

NEET Mock Test 1

Total Time: 3 Hour : 20 Minute

Total Marks: 720

Instructions

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1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Physics Section A

1. A series combination of n_1 capacitors, each of value C_1 , is charged by a source of potential difference $4V$. When another parallel combination of n_2 capacitors, each of value C_2 , is charged by a source of potential difference V , it has the same (total) energy stored in it, as the first combination has. The value of C_2 , in terms of C_1 , is then (+4, -1)
- a. $\frac{2C_1}{n_1n_2}$
- b. $16 \frac{n_2}{n_1} C_1$
- c. $2 \frac{n_2}{n_1} C_1$
- d. $\frac{16 C_1}{n_1n_2}$
-
2. A straight wire of diameter 0.5 mm carrying a current of 1 A is replaced by the another wire of 1 mm diameter carrying the same current. The strength of the magnetic field far away is (+4, -1)
- a. one-quarter of the earlier value
- b. one-half of the earlier value
- c. twice the earlier value
- d. same as the earlier value
-
3. If a body A of mass M is thrown with velocity v at an angle of 30° to the horizontal and another body B of the same mass is thrown with the same speed at an angle of 60° to the horizontal, the ratio of horizontal range of A to B will be (+4, -1)
- a. 1:3
- b. 1:1
- c. $1:\sqrt{3}$
- d. $\sqrt{3}:1$

-
4. If a car at rest accelerates uniformly to a speed of 144 km/hour in 20 second it covers a distance of (+4, -1)
- a. 400 m
 - b. 1440 m
 - c. 2880m
 - d. 25m
-
5. In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is (+4, -1)
- a. $\frac{27}{5}$
 - b. $\frac{5}{27}$
 - c. $\frac{4}{9}$
 - d. $\frac{9}{4}$
-
6. Ray optics is valid, when characteristic dimensions are (+4, -1)
- a. much smaller than the wavelength of light
 - b. of the same order as the wavelength of light
 - c. of the order of one millimetre
 - d. much larger than the wavelength of light.
-
7. For a p-type semiconductor, which of the following statements is true ? (+4, -1)
- a. Holes are the majority carriers and pentavalent atoms are the dopants.
 - b. Electrons are the majority carriers and pentavalent atoms are the dopants.

- c. Electrons are the majority carriers and trivalent atom are the dopants.
- d. Holes are the majority carriers and trivalent atoms are the dopants.

8. If the momentum of an electron is changed by P , then the de Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be (+4, -1)

- a. $200P$
- b. $400P$
- c. $\frac{P}{200}$
- d. $100P$

9. For a plane electromagnetic wave propagating in x-direction, which one of the following combination gives the correct possible directions for electric field (E) and magnetic field (B) respectively (+4, -1)

- a. $-\hat{j} + \hat{k}, -\hat{j} + \hat{k}$
- b. $\hat{j} + \hat{k}, \hat{j} + \hat{k}$
- c. $-\hat{j} + \hat{k}, -\hat{j} - \hat{k}$
- d. $\hat{j} + \hat{k}, -\hat{j} - \hat{k}$

10. A capacitor of capacitance 'C', is connected across an ac source of voltage V , given by $V = V_0 \sin \omega t$. The displacement current between the plates of the capacitor, would then be given by (+4, -1)

- a. $I_d = V_0 \omega C \sin \omega t$
- b. $I_d = V_0 \omega C \cos \omega t$
- c. $I_d = \frac{V_0}{\omega C} \cos \omega t$
- d. $I_d = \frac{V_0}{\omega C} \sin \omega t$

11. A series LCR circuit containing a 5.0 H inductor, 80 μF capacitor and 40 Ω resistor is connected to a 230 V variable frequency ac source. The angular frequencies of the source at which power transferred to the circuit is half the power at the resonant angular frequency are likely to be (+4, -1)

- a. 42 rad/s and 58 rad/s
- b. 25 rad/s and 75 rad/s
- c. 50 rad/s and 25 rad/s
- d. 46 rad/s and 54 rad/s

12. Unit of Stefan's constant is (+4, -1)

- a. Watt- $\text{m}^2\text{-K}$
- b. Watt- m^2/K^4
- c. Watt/ $\text{m}^2\text{-K}$
- d. Watt/ m^2K^4

13. The nuclei of which one of the following pairs of nuclei are isotones? (+4, -1)

- a. $_{34}\text{Se}^{74}$, $_{31}\text{Ga}^{71}$
- b. $_{42}\text{Mo}^{92}$, $_{40}\text{Zr}^{92}$
- c. $_{38}\text{Sr}^{84}$, $_{38}\text{Sr}^{86}$
- d. $_{20}\text{Ca}^{40}$, $_{16}\text{S}^{32}$

14. The temperature of inversion of a thermocouple is 620°C and the neutral temperature is 300°C. what is the temperature of cold junction? (+4, -1)

- a. 20°C

- b. 120°C
- c. -20°C
- d. -120°C

15. A Carnot engine whose sink is at 300 K has an efficiency of 40%. By how much should the temperature of source be increased so as to increase its efficiency by 50% of original efficiency? (+4, -1)

- a. 275 K
- b. 175 K
- c. 250 K
- d. 225 K

16. One coolie takes 1 minute to raise a suitcase through a height of 2 m but the second coolie takes 30 s to raise the same suitcase to the same height. The powers of two coolies are in the ratio (+4, -1)

- a. 1:3
- b. 2:1
- c. 3:1
- d. 1:2

17. A battery of e.m.f 10 V and internal resistance $0.5\ \Omega$ is connected across a variable resistance R. The value of R for which the power delivered in it is maximum is given by (+4, -1)

- a. $0.5\ \Omega$
- b. $1.0\ \Omega$
- c. $2.0\ \Omega$

d. 0.25Ω

18. The period of revolution of planet A around the sun is 8 times that of B. The distance of A from the sun is how many times greater than that of B from the sun? (+4, -1)

a. 4

b. 5

c. 2

d. 3

19. A car of mass m is moving on a level circular track of radius R . If μ_s represents the static friction between the road and tyres of the car, the maximum speed of the car in circular motion is given by (+4, -1)

a. $\sqrt{\mu_s m R g}$

b. 0

c. $\sqrt{\frac{m R g}{\mu_s}}$

d. $\sqrt{\mu_s R g}$

20. A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β . Then, its time period of vibration will be (+4, -1)

a. $\frac{\beta^2}{\alpha}$

b. $\frac{2\pi\beta}{\alpha}$

c. $\frac{\beta^2}{\alpha^2}$

d. $\frac{\alpha}{\beta}$

21. A round disc of moment of inertia I_2 about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia I_1 rotating with an angular velocity ω about the same axis. The final angular velocity of the combination of discs is (+4, -1)

- a. $\frac{I_2\omega}{I_1+I_2}$
- b. ω
- c. $\frac{I_1\omega}{I_1+I_2}$
- d. $\frac{(I_1+I_2)\omega}{I_1}$

22. A short electric dipole has a dipole moment of $16 \times 10^{-9} C m$. The electric potential due to the dipole at a point at a distance of $0.6 m$ from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is : (+4, -1)

$$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 N m^2 / C^2\right)$$

- a. $50 V$
- b. $200 V$
- c. $400 V$
- d. zero

23. A source of sound gives 5 beats per second, when sounded with another source of frequency 100 second^{-1} . The second harmonic of the source, together with a source of frequency 205 second^{-1} gives 5 beats per second. What is the frequency of the source? (+4, -1)

- a. 105 second^{-1}
 - b. 205 second^{-1}
 - c. 95 second^{-1}
 - d. 100 second^{-1}
-

24. A uniform magnetic field acts right angles to the direction of motion of electrons. As a result, the electron moves in a circular path of radius 2 cm. If the speed of electrons is doubled, then the radius of the circular path will be (+4, -1)
- a. 2.0 cm
 - b. 0.5 cm
 - c. 4.0 cm
 - d. 1.0 cm
-
25. If a unit vector is represented by $0.5\hat{i} - 0.8\hat{j} + c\hat{k}$ then the value of c is (+4, -1)
- a. $\sqrt{0.01}$
 - b. $\sqrt{0.11}$
 - c. 1
 - d. $\sqrt{0.39}$
-
26. The number of d-electrons in Fe^{2+} ($Z = 26$) is not equal to the number of electrons in which one of the following? (+4, -1)
- a. d-electrons in Fe ($Z=26$)
 - b. p-electrons in Ne ($Z=10$)
 - c. s-electrons in Mg ($Z=12$)
 - d. p-electrons in Cl ($Z=17$)
-
27. What will be the ratio of the distance moved by a freely falling body from rest in 4th and 5th seconds of journey? (+4, -1)
- a. 4 : 5
 - b. 7 : 9

c. 16 : 25

d. 1 : 1

28. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index (+4, -1)

a. equal to that of glass

b. less than one

c. greater than that of glass

d. less than that of glass

29. For CE transistor amplifier, the audio signal voltage across the collector resistance of $2k\Omega$ is $4V$. If the current amplification factor of the transistor is 100 and the base resistance is $1k\Omega$, then the input signal voltage is (+4, -1)

a. 10 mV

b. 20 mV

c. 30 mV

d. 15 mV

30. In photoelectric emission process from a metal of work function $1.8eV$, the kinetic energy of most energetic electrons is $0.5eV$. The corresponding stopping potential is (+4, -1)

a. 1.8V

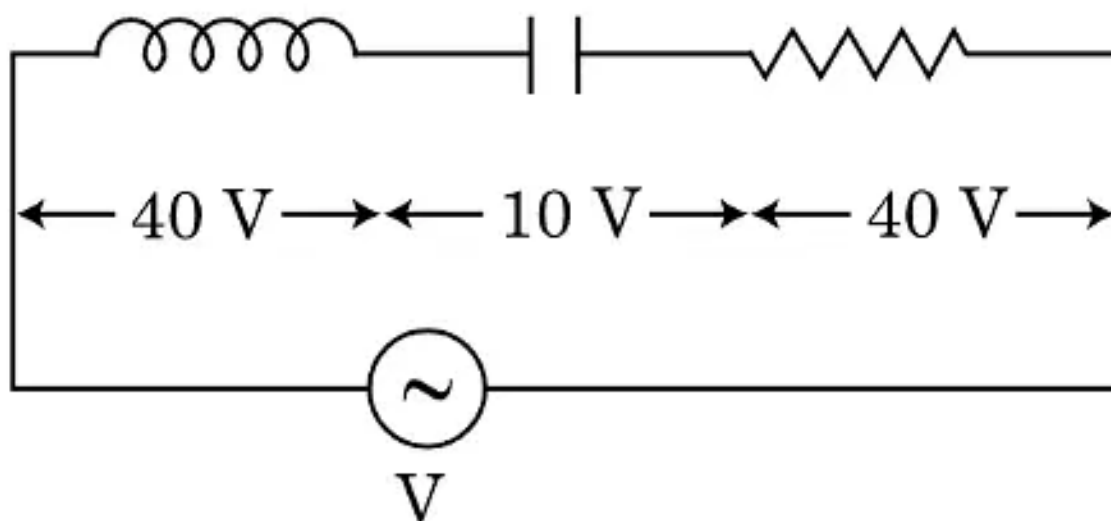
b. 1.3V

c. 0.5 V

d. 2.3 V

31. An inductor of inductance L , a capacitor of capacitance C and a resistor of resistance ' R ' are connected in series to an ac source of potential difference ' V ' volts as shown in the figure. The potential difference across L , C and R is 40 V, 10 V and 40 V, respectively. The amplitude of current flowing through LCR series circuit is $10\sqrt{2}$ A. The impedance of the course is

(+4, -1)



- a. 5Ω
- b. $4\sqrt{2} \Omega$
- c. $5\sqrt{2} \Omega$
- d. 4Ω
32. A uniform conducting wire of length $12a$ and resistance ' R ' is wound up as a current-carrying coil in the shape of,
- (i) an equilateral triangle of side ' a '.
- (ii) a square of side ' a '.
- The magnetic dipole moments of the coil in each case respectively are:

(+4, -1)

- a. $4Ia^2$ and $3Ia^2$
- b. $\sqrt{3}Ia^2$ and $3Ia^2$
- c. $3Ia^2$ and Ia^2
- d. $3Ia^2$ and $4Ia^2$

-
- 33.** A capacitor of capacity C and reactance X if capacitance and frequency become double then (+4, -1)
- a. $4X$
 - b. $X/2$
 - c. $X/4$
 - d. $2X$
-
- 34.** Fission of nuclei is possible because the binding energy per nucleon in them: (+4, -1)
- a. increases with mass number at high mass numbers
 - b. decreases with mass number at high mass numbers
 - c. increases with mass number at low mass numbers
 - d. decreases with mass number at low mass numbers
-
- 35.** The ratio of the dimensions of Planck's constant and that of the moment of inertia is the dimension of: (+4, -1)
- a. frequency
 - b. velocity
 - c. angular momentum
 - d. time

Physics Section B

36. A black body at 1227°C emits radiations with maximum intensity at a wavelength of $5000\text{ \AA}$. If the temperature of the body is increased by 1000°C , the maximum intensity will be observed at : (+4, -1)
- a. $7500\text{ \AA}$
 - b. $1500\text{ \AA}$
 - c. $6000\text{ \AA}$
 - d. $3000\text{ \AA}$
-
37. The potential energy of a system increases if work is done (+4, -1)
- a. upon the system by a nonconservative force
 - b. by the system against a conservative force
 - c. by the system against a non conservative force
 - d. upon the system by a conservative force
-
38. The velocity of charge carriers of current (about 1 ampere) in a metal under normal conditions is of the order of (+4, -1)
- a. a fraction of mm/sec
 - b. velocity of light
 - c. several thousand metres/second
 - d. a few hundred metres per second
-
39. For a planet having mass equal to mass of the earth but radius is one fourth of radius of the earth. Then escape velocity for this planet will be (+4, -1)
- a. 11.2 km/sec

b. 22.4 km/sec

c. 5.6 km/sec

d. 44.8 km/sec

40. A monkey of mass 20 kg is holding a vertical rope. The rope will not break when a mass of 25 kg is suspended from it but will break if the mass exceeds 25 kg . What is the maximum acceleration with which the monkey can climb up along the rope ? ($g = 10 \text{ m/s}^2$) (+4, -1)

a. 5 m/s^2

b. 10 m/s^2

c. 25 m/s^2

d. 2.5 m/s^2

41. A particle is executing SHM along a straight line. Its velocities at distances x_1 and x_2 mean position are V_1 and V_2 , respectively. Its time period is : (+4, -1)

a. $2\pi \sqrt{\frac{V_1^2 + V_2^2}{x_1^2 + x_2^2}}$

b. $2\pi \sqrt{\frac{V_1^2 - V_2^2}{x_1^2 - x_2^2}}$

c. $2\pi \sqrt{\frac{x_1^2 + x_2^2}{V_1^2 + V_2^2}}$

d. $2\pi \sqrt{\frac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$

42. A star, which is emitting radiation at a wavelength of $5000 \text{ \AA}$ is approaching the earth with a velocity of $1.5 \times 10^4 \text{ m/s}$. The change in wavelength of the radiation as received on the earth is (+4, -1)

a. $25 \text{ \AA}$

b. $100 \text{ \AA}$

c. zero

d. 2.5 

43. Two metallic spheres of radii 1 cm and 2 cm are given charges $10^{-2}C$ and $5 \times 10^{-2}C$ respectively. If they are connected by a conducting wire, the final charge on the smaller sphere is (+4, -1)

a. $3 \times 10^{-2} C$

b. $4 \times 10^{-2} C$

c. $1 \times 10^{-2} C$

d. $2 \times 10^{-2} C$

44. A small mass attached to a string rotates on a frictionless table top as shown. If the tension in the string is increased by pulling the string causing the radius of the circular motion to decrease by a factor of 2, the kinetic energy of the mass will (+4, -1)

a. decrease by a factor of 2

b. remain constant

c. increase by a factor of 2

d. increase by a factor of 4

45. A very long straight wire carries a current I . At the instant when a charge $+Q$ at point P has velocity $\vec{v}$, as shown, the force on the charge is (+4, -1)

a. along Oy

b. opposite to Oy

c. along Ox

d. opposite to Ox

46. If the angle between the vectors $\vec{A}$ and $\vec{B}$ is θ , the value of the product $(\vec{B} \times \vec{A}) \cdot \vec{A}$ is equal to (+4, -1)

- a. $B A^2 \sin \theta$
- b. $B A^2 \cos \theta$
- c. $B A^2 \sin \theta \cos \theta$
- d. zero

47. The number of protons, neutrons and electrons in ${}_{71}^{175}\text{Lu}$, respectively, are : (+4, -1)

- a. 71, 104 and 71
- b. 104, 71 and 71
- c. 71, 71 and 104
- d. 175, 104 and 71

48. Which colour of the light has the longest wavelength? (+4, -1)

- a. green
- b. violet
- c. red
- d. blue

49. For the given circuit of p-n junction diode which is correct :- (+4, -1)

- a. in forward bias the voltage across R is V
- b. in reverse bias the voltage across R is V
- c. in forward bias the voltage across R is 2V

d. in reverse bias the voltage across R is 2V.

50. In Thomson mass spectrograph $\vec{E} \perp \vec{B}$ then the velocity of electron beam will be (+4, -1)

a. $\frac{|\vec{E}|}{|\vec{B}|}$

b. $\vec{E} \times \vec{B}$

c. $\frac{|\vec{B}|}{|\vec{E}|}$

d. $\frac{|\vec{E}^2|}{|\vec{B}^2|}$

Chemistry Section A

51. The frequency of radiation emitted when the electron falls from $n = 4$ to $n = 1$ in a hydrogen atom will be (Given ionisation energy of $H = 2.18 \times 10^{18} \text{ J atom}^{-1}$ and $h = 6.625 \times 10^{-34} \text{ Js}$) (+4, -1)
- a. $1.54 \times 10^{15} \text{ s}^{-1}$
- b. $1.03 \times 10^{15} \text{ s}^{-1}$
- c. $3.08 \times 10^{15} \text{ s}^{-1}$
- d. $2.00 \times 10^{15} \text{ s}^{-1}$
-
52. Equal masses of H_2 , O_2 and methane have been taken in a container of volume V at temperature 27°C in identical conditions. The ratio of the volumes of gases $H_2 : O_2 : CH_4$ would be (+4, -1)
- a. 8 : 16 : 1
- b. 16 : 8 : 1
- c. 16 : 1 : 2
- d. 8 : 1 : 2
-
53. For a given exothermic reaction, K_p and K'_p are the equilibrium constants at temperatures T_1 and T_2 , respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2 , it is readily observed that :- (+4, -1)
- a. $K_p > K'_p$
- b. $K_p < K'_p$
- c. $K_p = K'_p$
- d. $K_p = \frac{1}{K'_p}$
-

54. Unit of entropy is : -

(+4, -1)

- a. $JK^{-1}mol^{-1}$
- b. $Jmol^{-1}$
- c. $J^{-1}K^{-1}mol^{-1}$
- d. $JKmol^{-1}$

55. What volume of oxygen gas (O_2) measured at $0^\circ C$ and 1 atm, is needed to burn completely 1L of propane gas (C_3H_8) measured under the same conditions?

(+4, -1)

- a. 7 L
- b. 6 L
- c. 5 L
- d. 10 L

56. When a biochemical reaction is carried out in laboratory from outside of human body in the absence of enzyme, the rate of reaction obtained is 10^{-6} times, then activation energy of the reaction in the presence of enzyme is

(+4, -1)

- a. $\frac{6}{RT}$
- b. P is required
- c. different from E_a obtained in laboratory
- d. cannot say any things

57. Which of the following aqueous solution has minimum freezing point?

(+4, -1)

- a. 0.01 M NaCl
- b. 0.005 M NaCl

c. 0.1 M NaCl

d. $0.01\text{ M Na}_2\text{SO}_4$

58. Zinc can be coated on iron to produce galvanized iron but the reverse is not possible. It is because (+4, -1)

a. zinc is lighter than iron

b. zinc has lower melting point than iron

c. zinc has lower negative electrode potential than iron

d. zinc has higher negative electrode potential than iron

59. In the Kjeldahl's method for estimation of nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralized 10 mL of $1\text{ M H}_2\text{SO}_4$. The percentage of nitrogen in the soil is : (+4, -1)

a. 37.33

b. 45.33

c. 35.33

d. 43.33

60. Magnetic moment 2.84 B.M. is given by (At. nos, Ni=28, Ti=22, Cr=24, Co=27) (+4, -1)

a. Cr^{2+}

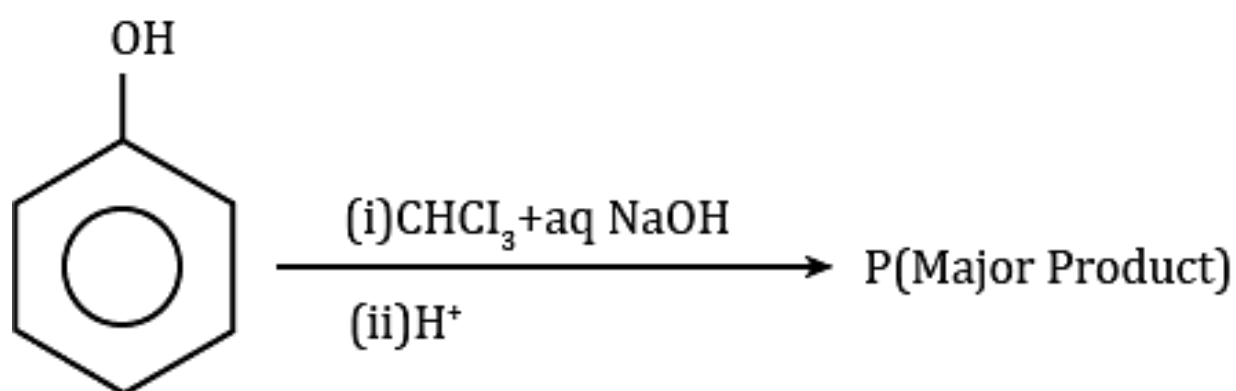
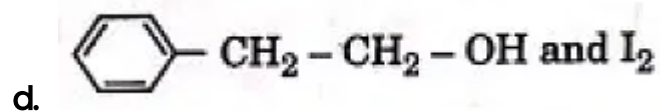
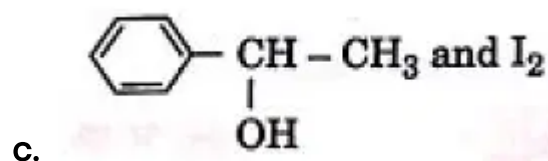
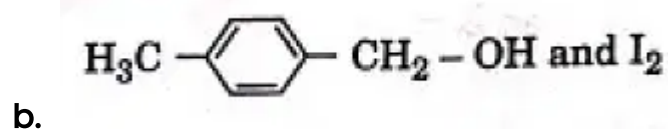
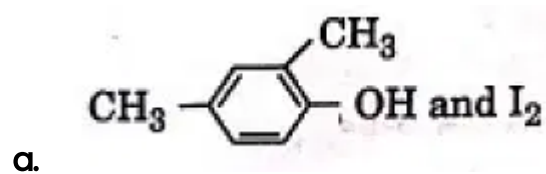
b. Co^{2+}

c. Ni^{2+}

d. Ti^{3+}

61. Compound A, $\text{C}_8\text{H}_{10}\text{O}$, is found to react with NaOI (produced by reacting Y with NaOH) and yields a yellow precipitate with characteristic smell. A and Y (+4, -1)

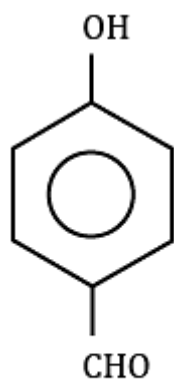
are respectively



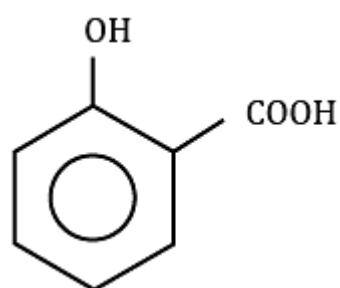
62.

(+4, -1)

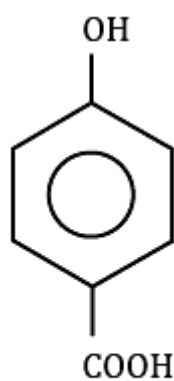
Consider the following reaction and identify the product (P).



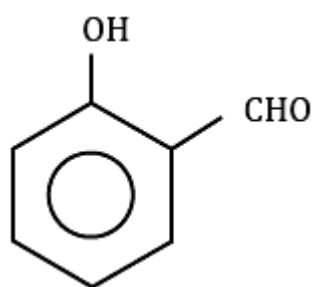
a.



b.



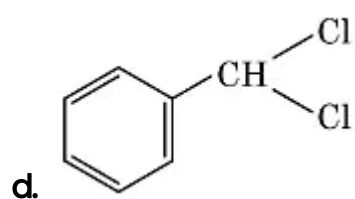
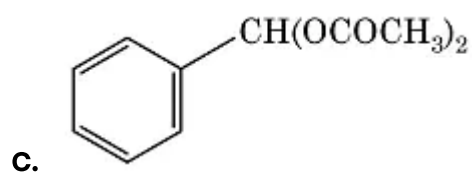
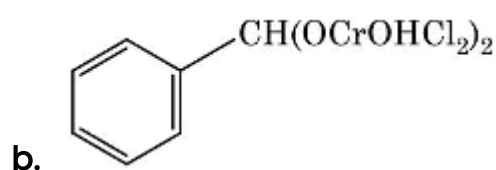
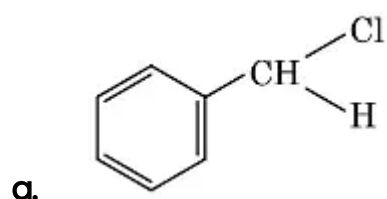
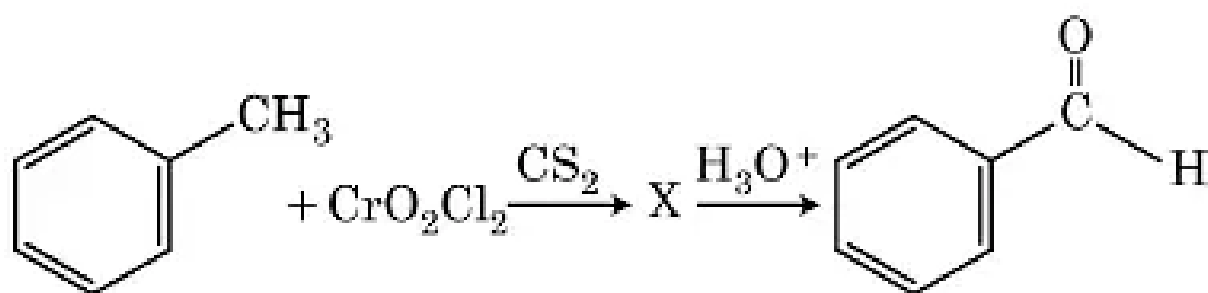
c.



d.

63. The intermediate compound 'X' in the following chemical reaction is

(+4, -1)



64. Geometrical isomers are differ in

(+4, -1)

- a. Poisition of functional group
- b. Position of atoms
- c. Spatial arrangement of atoms
- d. Length of carbon chain

65. Zn convert it's melted state to its solid state, it has HCP structure, then find out nearest no. of nearest atom (+4, -1)

- a. 6
- b. 8
- c. 12
- d. 4

66. Among the following which compound will show the highest lattice energy? (+4, -1)

- a. KF
- b. NaF
- c. CsF
- d. RbF

67. The d electron configuration of Cr^{2+} , Mn^{2+} , Fe^{2+} and Ni^{2+} are $3d^4$, $3d^5$, $3d^6$ and $3d^8$ respectively. Which one of the following aqua complex will exhibit the minimum paramagnetic behaviour? (At. Nos. $Cr = 24$, $Mn = 25$, $Fe = 26$, $Co = 27$) (+4, -1)

- a. $[Fe(H_2O)_6]^{2+}$
- b. $[Ni(H_2O)_6]^{2+}$
- c. $[Co(H_2O)_6]^{2+}$
- d. $[Mn(H_2O)_6]^{2+}$

68. Brown ring test is used to detect (+4, -1)

- a. Iodine
- b. Nitrate

- c. Iron
- d. Bromide

69. The correct statement in respect of protein haemoglobin is that it (+4, -1)

- a. functions as a catalyst for biological reactions
- b. maintains blood sugar level
- c. act as an oxygen carrier in the blood
- d. forms antibodies and offers resistance to diseases

70. Electronic configuration of calcium atom can be written as (+4, -1)

- a. $[Ne]4p^2$
- b. $[Ar]4s^2$
- c. $[Ne]4s^2$
- d. $[Kr]4P^2$

71. Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape ? (+4, -1)

- a. 44565
- b. 44628
- c. 44563
- d. 44569

72. For the reaction $CH_4(g) + 2O_2(g) \rightleftharpoons CO_2(g) + 2H_2O(l) \Delta H_r = -170.8 \text{ KJ mol}^{-1}$ (+4, -1)
Which of the following statements is not true:

- a. At equilibrium, the concentrations of $CO_2(g)$ and $H_2O(l)$ are not equal
- b. The equilibrium constant for the reaction is given by $K_p = \frac{[CO_2]}{[CH_4][O_2]}$
- c. Addition of $CH_4(g)$ or $O_2(g)$ at equilibrium will cause a shift to the right
- d. The reaction is exothermic

73. What is the entropy change (in $JK^{-1}mol^{-1}$) when one mole of ice is converted into water at $0^\circ C$? (The enthalpy change for the conversion of ice to liquid water is $6.0 kJ mol^{-1}$ at $0^\circ C$) (+4, -1)

- a. 21.98
- b. 20.13
- c. 2.013
- d. 2.198

74. When 22.4 L of $H_{2(g)}$ is mixed with 11.2 L of $Cl_{2(g)}$, each at STP, the moles of $HCl_{(g)}$ formed is equal to (+4, -1)

- a. 1 mole of $HCl_{(g)}$
- b. 2 moles of $HCl_{(g)}$
- c. 0.5 mole of $HCl_{(g)}$
- d. 1.5 moles of $HCl_{(g)}$

75. When initial concentration of the reactant is doubled, the half-life period of a zero order reaction (+4, -1)

- a. remains unchanged
- b. is halved
- c. is tripled

d. is doubled

76. Which one of the following is incorrect for ideal solution ? (+4, -1)

a. $\Delta H_{mix} = 0$

b. $\Delta U_{mix} = 0$

c. $\Delta P = P_{obs} - P_{calculated\ by\ Raoult's\ law} = 0$

d. $\Delta G_{mix} = 0$

77. Lassaigne's test is used in qualitative analysis to detect (+4, -1)

a. nitrogen

b. sulphur

c. chlorine

d. all of these

78. When $CuSO_4$ is electrolysed using platinum electrodes? (+4, -1)

a. Copper is liberated at cathode, sulphur at anode

b. Copper is liberated at cathode, oxygen at anode

c. Sulphur is liberated at cathode, oxygen at anode

d. Oxygen is liberated at cathode, copper at anode

79. On heating one end of a piece of a metal, the other end becomes hot because of (+4, -1)

a. energised electrons moving to the other end

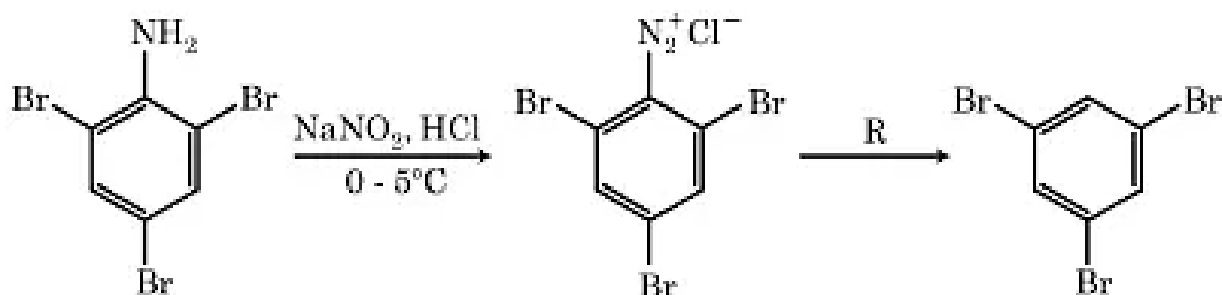
b. minor perturbation in the energy of atoms

- c. resistance of the metal
- d. mobility of atoms in the metal

80. Schotten-Baumann reaction is a reaction of phenols with (+4, -1)

- a. benzoyl chloride and NaOH
- b. acetyl chloride and NaOH
- c. salicylic acid and cone. H_2SO_4
- d. acetyl chloride and cone. H_2SO_4

81. The reagent 'R' in the given sequence of chemical reaction is (+4, -1)



- a. CuCN/KCN
- b. H_2O
- c. CH_3CH_2OH
- d. HI

82. In which of the following sets, all the given species are isostructural? (+4, -1)

- a. CO_2 , NO_2 , ClO_2 , SiO_2
- b. PCl_3 , $AlCl_3$, BCl_3 , $SbCl_3$

- c. $\text{BF}_3, \text{NF}_3, \text{PF}_3, \text{AlF}_3$
- d. $\text{BF}_4^-, \text{CCl}_4, \text{NH}_4^+, \text{PCl}_4^+$

83. When $\text{CH}_3\text{CH}_2\text{CHCl}_2$ is treated with NaNH_2 , the product formed is (+4, -1)

- a. $\text{CH}_3 - \text{CH} = \text{CH}_2$
- b. $\text{CH}_3 - \text{C} \equiv \text{CH}$
- c. $\text{CH}_3\text{CH}_2\text{CHNH}_2\text{NH}_2$
- d. $\text{CH}_3\text{CH}_2\text{CHCINH}_2$

84. In BCC, the distance between two nearest atoms will be (+4, -1)

- a. $\sqrt{3}a$
- b. $\frac{\sqrt{3}}{2}a$
- c. $\frac{\sqrt{3}}{4}a$
- d. $\frac{a}{2}$

85. Among the following, which one is a wrong statement? (+4, -1)

- a. PH_5 and BiCl_5 do not exist
- b. $p\pi - d\pi$ bonds are present in SO_2
- c. SeF_4 and CH_4 have same shape
- d. I_3^+ has bent geometry

Chemistry Section B

86. An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium(III) chloride. The number of moles of $AgCl$ precipitated would be : (+4, -1)
- a. 0.01
 - b. 0.001
 - c. 0.002
 - d. 0.003
-
87. The hormone that helps in the conversion of glucose to glycogen is (+4, -1)
- a. cortisone
 - b. bile acids
 - c. adrenaline
 - d. insulin
-
88. Equal volumes of two monoatomic gases, A and B, at same temperature and pressure are mixed. The ratio of specific heats (C_p/C_v) of the mixture will be - (+4, -1)
- a. 1.5
 - b. 3.3
 - c. 1.67
 - d. 0.83
-
89. Given the reaction between 2 gases represented by A_2 and B_2 to give the compound $AB_{(g)}$. $A_{2(g)} + B_{2(g)} \rightleftharpoons 2 AB_{(g)}$ At equilibrium, the concentration of $A_2 = 3.0 \times 10^{-3} M$ of $B_2 = 4.2 \times 10^{-3} M$ of $AB = 2.8 \times 10^{-3} M$ If the reaction takes place in a sealed vessel at $527^\circ C$, then the value of K_C will be : (+4, -1)

- a. 1.9
- b. 0.62
- c. 4.5
- d. 2

90. H_3PO_2 is the molecular formula of an acid of phosphorous. Its name and basicity respectively are (+4, -1)

- a. phosphorous acid and 2
- b. hypophosphorous acid and 2
- c. hypophosphorous acid and one
- d. hypophosphoric acid and two

91. How many electrons can fit in the orbital for which $n = 3$ and $l = 1$? (+4, -1)

- a. 2
- b. 6
- c. 10
- d. 14

92. Which has maximum number of molecules :- (+4, -1)

- a. 7 gm N_2
 - b. 2 gm H_2
 - c. 16 gm NO_2
 - d. 16 gm O_2
-

93. Which of the following are not state functions? (I) $q + W$ (II) q (III) w (IV) $H-TS$ (+4, -1)

- a. (II) and (III)
- b. (I) and (IV)
- c. (II), (III) and (IV)
- d. (I), (II) and (III)

94. Which of the following is dependent on temperature? (+4, -1)

- a. Molarity
- b. Mole fraction
- c. Weight percentage
- d. Molality

95. Liquid benzene (C_6H_6) burns in oxygen according to the equation, (+4, -1)

$2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(g)$ How many litres of O_2 at STP are needed to complete the combustion of 39 g of liquid benzene?

(Mol. weight of $O_2 = 32$, $C_6H_6 = 78$)

- a. 74 L
- b. 11.2 L
- c. 22.4 L
- d. 84 L

96. When neutral or faintly alkaline $KMnO_4$ is treated with potassium iodide, iodide ion is converted into 'X'. 'X' is - (+4, -1)

- a. IO_4^-
- b. IO_3^-

c. $I0^{-}$

97. The given reaction, $2FeCl_3 + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$ is an example of (+4, -1)

- a. third order reaction
- b. first order reaction
- c. second order reaction
- d. none of these

98. The reagents which can be used to distinguish acetophenone from benzophenone is (are) (+4, -1)

- a. 2,4-dinitrophenyl hydrazine
- b. aqueous solution of $NaHSO_3$
- c. Benedict reagent
- d. I_2 and Na_2CO_3

99. The specific conductance of a $N/10$ KCl at $25^\circ C$ is $0.0112 \text{ ohm}^{-1} \text{ cm}^{-1}$. The resistance of cell containing solution at the same temperature was found to be 55 ohm . The cell constant will be (+4, -1)

- a. 0.142 cm^{-1}
- b. 0.66 cm^{-1}
- c. 0.918 cm^{-1}
- d. 1.12 cm^{-1}

100. $CH_3-CH_2-\underset{\substack{| \\ Cl}}{CH}-CH_3$ obtained by chlorination of n-butane will be (+4, -1)

- a. Meso form
- b. Racemic mixture
- c. d-form
- d. *l*-form

Zoology Section A

101. Which of the following species does not have the ability to fix atmospheric nitrogen? (+4, -1)
- a. Azotobactor
 - b. Anabaena
 - c. Nostoc
 - d. Spirogyra.
-
102. A woman with normal vision, but whose father was colour blind, marries a colour blind man. Suppose that the fourth child of this couple was a boy. This boy (+4, -1)
- a. may be colourblind or may be of normal vision
 - b. must be colour blind
 - c. must have normal colour vision
 - d. will be partially colour blind since he is heterozygous for the colourblind mutant allele.
-
103. Which of the following is not a function of the skeletal system? (+4, -1)
- a. Production of body heat
 - b. Locomotion
 - c. Production of erythrocytes
 - d. Storage of minerals
-
104. During DNA replication, Okazaki fragments are used to elongate: (+4, -1)
- a. The lagging strand towards replication fork

- b. The leading strand away from replication fork
- c. The lagging strand away from the replication fork
- d. The leading strand towards replication fork

105. Match the columns and identity the correct option

(+4, -1)

	Column I	Column II
A.	Thylakoids	(i) Disc-shaped sacs in Golgi apparatus
B	Cristate	(ii) Condensed structure of DNA
C	Cisternae	(iii) Flat membranous sacs in stroma
D	Chomatin	(iv) Infolding in mitochondria

- a. A-(iii), B-(i), C-(iv), D-(ii)
- b. A-(iii), B-(iv), C-(ii), D-(i)
- c. A-(iv), B-(iii), C-(i), D-(ii)
- d. A-(iii), B-(iv), C-(i), D-(ii)

106. Mitotic anaphase differs from metaphase in possessing

(+4, -1)

- a. same number of chromosomes and same number of chromatids
- b. half number of chromosomes and half number of chromatids
- c. half number of chromosomes and same number of chromatids
- d. same number of chromosomes and half number of chromatids.

107. Third ventricle of brain is also known as

(+4, -1)

- a. metacoel

- b. rhinocoel
- c. paracoel
- d. diacoel.

108. Which of the following is not a desirable feature of a cloning vector? (+4, -1)

- a. Presence of origin of replication
- b. Presence of a marker gene
- c. Presence of single restriction enzyme site
- d. Presence of two or more recognition sites

109. Following are the statements about prostomium of earthworm. (+4, -1)

- (a) It serves as a covering for mouth.
- (b) It helps to open cracks in the soil into which it can crawl.
- (c) It is one of the sensory structures.
- (d) It is the first body segment.

Choose the correct answer from the options given below

- a. (b) and (c) are correct
- b. (a), (b) and (c) are correct
- c. (a), (b) and (d) are correct
- d. (a), (b), (c) and (d) are correct

110. MSH is secreted by: (+4, -1)

- a. Anterior lobe of pituitary
- b. Middle lobe of pituitary
- c. Posterior lobe of pituitary

d. Endostyle

111. Which of the following is the simplest amino acid

(+4, -1)

- a. Tyrosine
- b. Asparagine
- c. Glycine
- d. Alanine

112. Uricotelism is found in

(+4, -1)

- a. Fishes and Fresh water protozoans
- b. Birds, reptiles and insects
- c. Frogs and toads
- d. Mammals and birds

113. Given below are four matchings of an animal and its kind of respiratory organ:

(+4, -1)

- A. Silver fish – trachea
- B. Scorpion – book lung
- C. Sea squirt – pharyngeal gills
- D. Dolphin – skin

The correct matchings are:

- a. A and D
- b. A, B and C
- c. B and D
- d. C and D

- 114.** Radial symmetry is, usually, exhibited in animals which **(+4, -1)**
- a. are attached to the substratum
 - b. have one opening of alimentary canal
 - c. live in water
 - d. have ciliary mode of feeding.
-

- 115.** Earliest fossil form in phylogeny of horse is **(+4, -1)**
- a. Merychippus
 - b. Equus
 - c. Meshippus
 - d. Eohippus
-

- 116.** Identify the human developmental stage shown below as well as the related right place of its occurrence in a normal pregnant woman, select the right option for the two, together. Dev elopmental - Site of occurrence stage **(+4, -1)**
- a. Late morula - middle part of Fallopian tube
 - b. Blastula - end part of Fallopian tube
 - c. Blastocyst - uterine wall
 - d. 8-celled morula - starting point of Fallopian tube
-

- 117.** In five-kingdom classification system, the kingdom that includes the blue-green algae, nitrogen-fixing bacteria and methanogenic archaebacteria is **(+4, -1)**
- a. Plantae
 - b. Fungi

c. Protista

d. Monera

118. Lysozyme that is present in perspiration, saliva and tears, destroys (+4, -1)

a. All viruses

b. Certain types of bacteria

c. Most virus infected cells

d. Certain fungi

119. What is a keystone species? (+4, -1)

a. a species which makes up only a small proportion of the total biomass of a community, yet has a huge impact on the community's organization and survival

b. a common species that has plenty of biomass, yet has a fairly low impact on the community's organization

c. a rare species that has minimal impact on the biomass and on other species in the community

d. a dominant species that constitutes a large proportion of the biomass and which affects many other species.

120. What is common among amylase, rennin and trypsin? (+4, -1)

a. these are produced in stomach

b. these act at a pH lower than 7

c. these all are proteins

d. these all are proteolytic enzymes.

121. Which is the principal cation in the plasma of the blood? **(+4, -1)**

- a. potassium
- b. magnesium
- c. calcium
- d. sodium.

122. Which of the following is the pair of biofertilizers **(+4, -1)**

- a. Azolla and BGA
- b. Nos toe and legume
- c. Rhizobium and grasses
- d. Salmonella and E.coli.

123. A woman with two genes for haemophilia and one gene for colour blindness on one of the 'X' chromosomes marries a normal man. How will the progeny be? **(+4, -1)**

- a. 50% haemophilic colour-blind sons and 50% normal sons
- b. 50% haemophilic daughters (carrier) and 50% colour blind daughters (carrier)
- c. all sons and daughters haemophilic and colour-blind
- d. haemophilic and colour-blind daughters.

124. During DNA replication, the strands separate by **(+4, -1)**

- a. DNA polymerase
- b. topoisomerase

- c. unwindase/helicase
- d. gyrase

125. Experiments on *Acetabularia* by Hammerling proved the role of (+4, -1)

- a. cytoplasm in controlling differentiation
- b. nucleus in heredity
- c. chromosomes in heredity
- d. nucleo-cytoplasmic ratio.

126. The pivot joint between atlas and axis is a type of : (+4, -1)

- a. Cartilaginous joint
- b. Synovial joint
- c. Saddle joint
- d. Fibrous joint

127. Mitotic spindle is mainly composed of which protein :- (+4, -1)

- a. Actin
- b. Tubulin
- c. Actomyosin
- d. Myoglobin

128. Select the incorrect statement regarding synapses: (+4, -1)

- a. The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.

- b. Electrical current can flow directly from one neuron into the other across the electrical synapse.
 - c. Chemical synapse use neurotransmitters
 - d. Impulse transmission across a chemical synapse is always faster than that across an electrical synapse
-

129. During the purification process for recombinant DNA technology, addition of chilled ethanol precipitates out (+4, -1)

- a. DNA
 - b. Histones
 - c. Polysaccharides
 - d. RNA
-

130. Which cells do not form layer and remains structurally separate (+4, -1)

- a. Epithelial cells
 - b. Muscle cells
 - c. Nerve cells
 - d. Gland cells
-

131. Which gland secretes odorous secretion in mammals: (+4, -1)

- a. Bartholins
- b. Prostate
- c. Anal gland
- d. Liver-bile

132. In glycolysis, during oxidation electrons are removed by **(+4, -1)**

- a. Glyceraldehyde-3-phosphat
- b. NAD^+
- c. Molecular oxygen
- d. ATP

133. The majority of carbon dioxide produced by our body cells is transported to the lungs : **(+4, -1)**

- a. Dissolved in the blood
- b. As bicarbonates
- c. As carbonates
- d. Attached to hemoglobin

134. Bowman's glands are found in: **(+4, -1)**

- a. olfactory epithelium
- b. external auditory canal
- c. cortical nephrons only
- d. juxtamedullary nephrons

135. Which of the following is an example of platyhelminthes? **(+4, -1)**

- a. Plasmodium
- b. Schistosoma
- c. Trypanosoma

d. Wuchereria.

Zoology Section B

136. Embryological support for evolution was disapproved by (+4, -1)

- a. Karl Ernst von Baer
- b. Alfred Wallace
- c. Charles Darwin
- d. Oparin

137. In an egg, the type of cleavage is determined by (+4, -1)

- a. the amount and distribution of yolk
- b. the number of egg membranes
- c. the shape and size of the sperm
- d. the size and location of the nucleus.

138. In five kingdom system, the main basis of classification :- (+4, -1)

- a. Structure of nucleus
- b. Nutrition
- c. Structure of cell wall
- d. Asexual reproduction

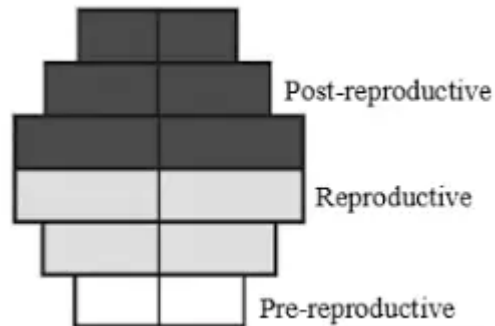
139. Use of anti-histamines and steroids give a quick relief from - (+4, -1)

- a. Headache
- b. Allergy
- c. Nausea

d. Cough

140. What type of human population is represented by the following age pyramid?

(+4, -1)



- a. vanishing population
- b. stable population
- c. declining population
- d. expanding population.

141. When breast feeding is replaced by less nutritive food low in proteins and calories; the infants below the age of one year are likely to suffer from

(+4, -1)

- a. Rickets
- b. Kwashiorkor
- c. Marasmus
- d. Pellagra

142. Which vertebrate organ receives only oxygenated blood?

(+4, -1)

- a. spleen
- b. liver

- c. gill
- d. lung.

143. Which of the following is not a biofertilizer ? (+4, -1)

- a. Nostoc
- b. Mycorrhiza
- c. Agrobacterium
- d. Rhizobium

144. ABO blood group system is due to (+4, -1)

- a. multifactor inheritance
- b. incomplete dominance
- c. multiple allelism
- d. epistasis

145. Each chromosome at the anaphase stage of a bone marrow cell in our body has (+4, -1)

- a. two chromatids
- b. several chromatids
- c. no chromatids
- d. only one chromatid.

146. Fluid mosaic model of cell membrane was put forward by (+4, -1)

- a. Danielli and Davson

- b. Singer and Nicolson
- c. Garner and Allard
- d. Watson and Crick.

147. Sliding filament theory can be best explained as (+4, -1)

- a. actin and myosin filaments do not shorten but rather slide pass each other
- b. when myofilaments slide pass each other, myosin filaments shorten while actin filaments do not shorten
- c. when myofilaments slide pass each other actin filaments shorten while myosin filaments do not shorten
- d. actin and myosin filaments shorten and slide pass each other.

148. Which one of the following never occurs during mitotic cell division? (+4, -1)

- a. Spindle fibres attach to kinetochores of chromosomes
- b. Movement of centrioles towards opposite poles
- c. Pairing of homologous chromosomes
- d. Coiling and condensation of the chromatids

149. In gene gun method used to introduce alien DNA into host cells, microparticles of _ _ _ _ _ metal are used. (+4, -1)

- a. Zinc
- b. Tungsten or gold
- c. Silver
- d. Copper

150. Match List I with List II with respect in human eye.

(+4, -1)

	List I		List II
A	Fovea	I	Visible coloured portion of eye that regulates diameter of pupil
B	Iris	II	External layer of eye formed of dense connective tissue.
C	Blind spot	III	Point of greatest visual acuity or resolution
D	Sclera	IV	Point where optic nerve leaves the eyeball and photoreceptor cells are absent

Choose the correct answer from the options given below:

- a. A-IV, B-III, C-II, D-I
- b. A-I, B-IV, C-III, D-II
- c. A-II, B-I, C-III, D-IV
- d. A-III, B-I, C-IV, D-II

Botany Section A

151. Even in absence of pollinating agents seed-setting is assured in (+4, -1)
- a. Commellina
 - b. Zostera
 - c. Salvia
 - d. Fig
-
152. Which of the following biomolecules is common to respiration-mediated breakdown of fats, carbohydrates and proteins ? (+4, -1)
- a. Glucose-6-phosphate
 - b. Fructose 1, 6-bisphosphate
 - c. Pyruvic acid
 - d. Acetyl CoA
-
153. Which one of the following is wrong in relation to photorespiration ? (+4, -1)
- a. It occurs in chloroplast
 - b. It occurs in day time only
 - c. It is a characteristic of C_4 plants
 - d. It is a characteristic of C_3 plants
-
154. Which one of the following have the highest number of species in nature ? (+4, -1)
- a. Birds
 - b. Angiosperms
 - c. Fungi

d. Insects

155. Which of the following is the most stable ecosystem? (+4, -1)

- a. mountain
- b. ocean
- c. forest
- d. desert.

156. Which of the following hormones can replace vernalisation? (+4, -1)

- a. auxin
- b. cytokinin
- c. gibberellins
- d. ethylene.

157. Companion cells are closely associated with (+4, -1)

- a. Sieve elements
- b. Vessel elements
- c. Trichomes
- d. Guard cells

158. Maximum application of animal cell culture technology today is in the production of (+4, -1)

- a. Insulin
- b. Interferons

- c. Vaccines
- d. Edible proteins.

159. Mycorrhiza is a symbiotic relationship between roots of higher plants and (+4, -1)

- a. virus
- b. fungi
- c. bacteria
- d. blue green algae

160. The translocation of organic solutes in sieve tube members is supported by- (+4, -1)

- a. Cytoplasmic streaming
- b. Root pressure and transpiration pull
- c. P-proteins
- d. Mass flow involving a carrier and ATP

161. Fluoride pollutions mainly affects: (+4, -1)

- a. Brain
- b. Heart
- c. Teeth
- d. Kidney

162. Pteridophytes differ from bryophytes and thallophytes in having (+4, -1)

- a. vascular tissues
- b. motile antherozoids

- c. archegonia
- d. alternation of generations.

163. An example of a seed with perisperm and caruncle is (+4, -1)

- a. Castor
- b. Coffee
- c. Lily
- d. Cotton

164. Formation of gametophyte directly from sporophyte without meiosis is (+4, -1)

- a. apospory
- b. apogamy
- c. parthenogenesis
- d. amphimixis.

165. Which statements is wrong for Krebs' cycle ? (+4, -1)

- a. There is one point in the cycle where FAD^+ is reduced to $FADH_2$
- b. During conversion of succinyl CoA to succinic acid, a molecule of GTP is synthesised
- c. The cycle starts with condensation of acetyl group (acetyl CoA) with pyruvic acid to yield citric acid
- d. There are three points in the cycle where NAD^+ is reduced to $NADH + H^+$

166. Which one of the following is essential for photolysis of water? (+4, -1)

- a. manganese
- b. zinc
- c. copper
- d. boron

167. Which one of the following has maximum genetic diversity in India ? (+4, -1)

- a. Tea
- b. Teak
- c. Wheat
- d. Mango

168. Cork cambium and vascular cambium are (+4, -1)

- a. parts of secondary xylem and phloem
- b. parts of pericycle
- c. lateral meristem
- d. apical meristem.

169. Most animals are tree dwellers in a (+4, -1)

- a. temperate deciduous forest
- b. tropical rainforest
- c. coniferous forest
- d. thorn woodland.

170. Opening of floral buds into flowers, is a type of (+4, -1)

- a. autonomic movement of variation
- b. paratonic movement of growth
- c. autonomic movement of growth
- d. autonomic movement of locomotion.

171. Passive absorption of minerals depends on

(+4, -1)

- a. temperature
- b. temperature and metabolic inhibitor
- c. metabolic inhibitor
- d. humidity.

172. Pebrine is a disease of

(+4, -1)

- a. silk worm
- b. lac insect
- c. honey bee
- d. fish.

173. Which of the following is not observed during an apoplastic pathway?

(+4, -1)

- a. Movement of water occurs through intercellular spaces and wall of the cells
- b. The movement does not involve crossing of cell membrane
- c. The movement is aided by cytoplasmic streaming
- d. Apoplast is continuous and does not provide any barrier to water movement

174. Which of the following is not used for disinfection of drinking water ? (+4, -1)

- a. Phenyl
- b. Chloramine
- c. Chlorine
- d. Ozone

175. Chloroplast of Chlamydomonas is (+4, -1)

- a. stellate
- b. cup-shaped
- c. collar-shaped
- d. spiral.

176. An example of axile placentation is (+4, -1)

- a. Dianthus
- b. Lemon
- c. Argemone
- d. Marigold

177. Function of filiform apparatus is to (+4, -1)

- a. recognize the suitable pollen at stigma
- b. stimulate division of generative cell
- c. produce nectar
- d. guide the entry of pollen tube.

178. Which one is a C₄-plant? (+4, -1)

- a. papaya
- b. pea
- c. potato
- d. maize/corn

179. Which of the following regions of the globe exhibits highest species diversity ? (+4, -1)

- a. Western Ghats of India
- b. Madagascar
- c. Himalayas
- d. Amazon forests

180. Cork is formed from (+4, -1)

- a. cork cambium (phellogen)
- b. vascular cambium
- c. phloem
- d. xylem.

181. Glycolysis takes place in (+4, -1)

- a. Mitochondria
- b. Cytoplasm
- c. Chloroplast

d. Lysosome

182. Phytochrome becomes active in (+4, -1)

- a. red light
- b. green light
- c. blue light
- d. none of these.

183. Pick up the correct food chain (+4, -1)

- a. grass >> chamelion >> insect >> bird
- b. grass >> fox >> rabbit >> bird
- c. phytoplankton >> zooplankton >> fish
- d. fallen leaves >> bacteria >> insect larvae.

184. The first domesticated animal by primitive man was (+4, -1)

- a. cat
- b. cow
- c. dog
- d. horse.

185. The function of leghaemoglobin in the root nodules of legumes is (+4, -1)

- a. inhibition of nitrogenase activity
- b. oxygen removal
- c. nodule differentiation

d. expression of nif gene

Botany Section B

186. Brown algae is characterised by the presence of (+4, -1)

- a. fucoxanthin
- b. haematochrome
- c. Citrus-adventive embryo
- d. phycoerythrin.

187. Among china rose, mustard, brinjal, potato, guava, cucumber, onion and tulip, (+4, -1)
how many plants have superior ovary?

- a. Three
- b. Four
- c. Five
- d. Six

188. Eight nucleated embryo sac is (+4, -1)

- a. only monosporic
- b. only bisporic
- c. only tetrasporic
- d. any of these

189. Where is respiratory electron transport system (ETS) located in plants ? (+4, -1)

- a. Mitochondrial matrix
- b. Outer mitochondrial membrane
- c. Inner mitochondrial membrane

d. Intermembrane space

190. Which pigment system is inactivated in red drop? (+4, -1)

- a. PS-I and PS-II
- b. PS-I
- c. PS-II
- d. none of the above.

191. Which one of the following is an example of ex-situ conservation ? (+4, -1)

- a. Seed bank
- b. Sacred groves
- c. National park
- d. Wildlife sanctuary

192. Which of the following pairs is a sedimentary type of biogeochemical cycle? (+4, -1)

- a. phosphorus and nitrogen
- b. phosphorus and sulphur
- c. oxygen and nitrogen
- d. phosphorus and carbon dioxide.

193. Which of the following is not an inhibitory substance governing seed dormancy ? (+4, -1)

- a. Gibberellic acid
- b. Absciscic acid

- c. Phenolic acid
- d. Para-ascorbic acid

194. Which of the following is generally used for induced mutagenesis in crop plants? (+4, -1)

- a. X-rays
- b. UV (260 nm)
- c. gamma rays (from cobalt 60)
- d. alpha particles.

195. Collenchyma occurs in the stem and petioles of (+4, -1)

- a. xerophytes
- b. monocots
- c. dicot herbs
- d. hydrophytes.

196. Match Column - I with Column - II. Choose the correct answer from options given below. (+4, -1)

- a. (a) - (ii) , (b) - (iv), (c) - (i), (d) - (iii)
- b. (a) - (i) , (b) - (ii), (c) - (iii), (d) - (iv)
- c. (a) - (iii) , (b) - (i), (c) - (iv), (d) - (ii)
- d. (a) - (iv) , (b) - (iii), (c) - (ii), (d) - (i)

197. Phenyl mercuric acetate (PMA) results in (+4, -1)

- a. reduced photosynthesis

- b. reduced transpiration
- c. reduced respiration
- d. killing of plants.

198. More than 70% of world's freshwater is contained in : (+4, -1)

- a. Antarctica
- b. Glaciers and Mountains
- c. Greenland
- d. Polar ice

199. A gymnospermic leaf carries 16 chromosomes. The number of chromosomes in its endosperm is (+4, -1)

- a. 8
- b. 12
- c. 16
- d. 24

200. Among flowers of Calotropis, tulip, Sesbania, Asparagus, Colchicum, sweet pea, Petunia, Indigofera, mustard, soybean, tobacco and groundnut, how many plants have corolla with valvate aestivation? (+4, -1)

- a. Six
- b. Seven
- c. Eight
- d. Five

Answers

1. Answer: d

Explanation:

A series combination of n_1 capacitors each of capacitance C_1 are connected to $4V$ source as shown in the figure.

Total capacitance of the series combination of the capacitors is

$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_1} + \frac{1}{C_1} + \dots \text{ upto } n_1 \text{ terms} = \frac{n_1}{C_1}$$

or $C_s = \frac{C_1}{n_1} \dots (i)$

Total energy stored in a series combination of the capacitors is

$$U_s = \frac{1}{2} C_s (4V)^2 = \frac{1}{2} \left(\frac{C_1}{n_1} \right) (4V)^2 \text{ (Using (i)) } \dots (ii)$$

A parallel combination of n_2 capacitors each of capacitance C_2 are connected to V source as shown in the figure.

Total capacitance of the parallel combination of capacitors is

$$C_p = C_2 + C_2 + \dots + \text{ upto } n_2 \text{ terms} = n_2 C_2$$

or $C_p = n_2 C_2 \dots (iii)$

Total energy stored in a parallel combination of capacitors is

$$U_p = \frac{1}{2} C_p V^2$$

$$= \frac{1}{2} (n_2 C_2) (V)^2 \text{ (Using (iii)) } \dots (iv)$$

According to the given problem,

$$U_s = U_p$$

Substituting the values of U_s and U_p from equations (ii) and (iv), we get

$$\frac{1}{2} \frac{C_1}{n_1} (4V)^2 = \frac{1}{2} (n_2 C_2) (V)^2$$

or $\frac{C_1 16}{n_1} = n_2 C_2$ or $C_2 = \frac{16 C_1}{n_1 n_2}$

Concepts:

1. Electrostatic Potential and Capacitance:

Electrostatic Potential

The potential of a point is defined as the **work done** per unit charge that results in bringing a charge from infinity to a certain point.

Some major things that we should know about electric potential:

- They are denoted by V and are a scalar quantity.
- It is measured in volts.

Capacitance

The ability of a **capacitor** of holding the energy in form of an **electric charge** is defined as capacitance. Similarly, we can also say that capacitance is the storing ability of capacitors, and the unit in which they are measured is "farads".

Read More: [Electrostatic Potential and Capacitance](#)

The capacitor is in Series and in Parallel as defined below;

In Series

Both the Capacitors C_1 and C_2 can easily get connected in series. When the **capacitors are connected in series** then the total capacitance that is C_{total} is less than any one of the capacitor's capacitance.

In Parallel

Both Capacitor C_1 and C_2 are connected in parallel. When the capacitors are connected parallelly then the total capacitance that is C_{total} is any one of the capacitor's capacitance.

2. Answer: d

Explanation:

Diameter of first wire (d_1) = 0.5 mm;

Current in first wire (I_1) = 1A; Diameter of second wire (d_2) = 1 mm and current in second wire (I_2) = 1A.

Strength of magnetic field due to current flowing

in a conductor, $(B) = \frac{\mu_0}{4\pi} \times \frac{2I}{a}$ or $B \propto I$

Since the current in both the wires is same,

therefore there is no change in the strength of the magnetic field.

Concepts:

1. Moving Charges and Magnetism:

Moving charges generate an electric field and the rate of flow of charge is known as **current**. This is the basic concept in **Electrostatics**. Another important concept related to moving **electric charges** is the magnetic effect of current. Magnetism is caused by the current.

Magnetism:

- The relationship between a [Moving Charge and Magnetism](#) is that Magnetism is produced by the movement of charges.
- And Magnetism is a property that is displayed by Magnets and produced by moving charges, which results in objects being attracted or pushed away.

Magnetic Field:

Region in space around a magnet where the Magnet has its Magnetic effect is called the Magnetic field of the Magnet. Let us suppose that there is a point charge q (moving with a velocity v and, located at r at a given time t) in presence of both the electric field $E(r)$ and the magnetic field $B(r)$. The force on an electric charge q due to both of them can be written as,

$$F = q [E(r) + v \times B(r)] \equiv F_{\text{Electric}} + F_{\text{magnetic}}$$

This force was based on the extensive experiments of Ampere and others. It is called the Lorentz force.

3. Answer: b

Explanation:

For the given velocity of projection u , the horizontal range is the same for the angle of projection θ and $90^\circ - \theta$

Horizontal range $R = \frac{u^2 \sin 2\theta}{g}$

$\therefore$ For body A $R_A = \frac{u^2 \sin(2 \times 30^\circ)}{g} = \frac{u^2 \sin 60^\circ}{g}$

For body B $R_B = \frac{u^2 \sin(2 \times 30^\circ)}{g} = \frac{u^2 \sin(2 \times 60^\circ)}{g}$

$R_B = \frac{u^2 \sin 120^\circ}{g} = \frac{u^2 \sin(180^\circ - 60^\circ)}{g} = \frac{u^2 \sin 60^\circ}{g}$

The range is the same whether the angle is θ or $90^\circ - \theta$.

$\therefore$ The ratio of ranges is 1 : 1

Concepts:

1. Motion in a Plane:

It is a vector quantity. A vector quantity is a quantity having both magnitude and direction. Speed is a scalar quantity and it is a quantity having a magnitude only. Motion in a plane is also known as motion in two dimensions.

Equations of Plane Motion

The equations of motion in a straight line are:

$$v = u + at$$

$$s = ut + \frac{1}{2} at^2$$

$$v^2 - u^2 = 2as$$

Where,

- v = final velocity of the particle
- u = initial velocity of the particle
- s = displacement of the particle
- a = acceleration of the particle
- t = the time interval in which the particle is in consideration

4. Answer: a

Explanation:

$$\begin{aligned} u &= 0, v = 144 \text{ km/hour} = 144 \times \frac{5}{18} \text{ m/sec} \\ &= 40 \text{ m/sec} \end{aligned}$$

$$v = u + at$$

$$\Rightarrow a = \frac{v-u}{t} = \frac{40-0}{20} = 2m/sec^2$$

$$\therefore s = ut + \frac{1}{2}at^2$$

$$= \frac{1}{2} \times 2 \times (20)^2 = 400m$$

Concepts:

1. Motion in a straight line:

The **motion in a straight line** is an object changes its position with respect to its surroundings with time, then it is called in motion. It is a change in the position of an object over time. It is nothing but linear motion.

Types of Linear Motion:

Linear motion is also known as the **Rectilinear Motion** which are of two types:

1. **Uniform linear motion with constant velocity or zero acceleration:** If a body travels in a straight line by covering an equal amount of distance in an equal interval of time then it is said to have uniform motion.
2. **Non-Uniform linear motion with variable velocity or non-zero acceleration:** Not like the uniform acceleration, the body is said to have a non-uniform motion when the velocity of a body changes by unequal amounts in equal intervals of time. The rate of change of its velocity changes at different points of time during its movement.

5. Answer: b

Explanation:

The wavelength of a spectral line in the Lyman series is

$$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right), n = 2, 3, 4, \dots$$

and that in the Balmer series is

$$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right), n = 3, 4, 5, \dots$$

For the longest wavelength in the Lyman series,

$$n = 2$$

$$\therefore \frac{1}{\lambda_L} = R \left(\frac{1}{1^2} - \frac{1}{2^2} \right) = R \left(\frac{1}{1} - \frac{1}{4} \right) = R \left(\frac{4-1}{4} \right) = \frac{3R}{4}$$

$$\text{or } \lambda_L = \frac{4}{3R}$$

For the longest wavelength in the Balmer series,

$$n=3$$

$$\therefore \frac{1}{\lambda_B} = R \left(\frac{1}{2^2} - \frac{1}{3^2} \right) = R \left(\frac{1}{4} - \frac{1}{9} \right) = R \left(\frac{9-4}{36} \right) = \frac{5R}{36}$$

$$\text{or } \lambda_B = \frac{36}{5R}$$

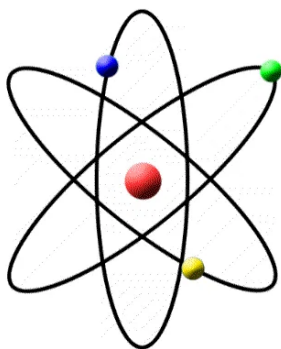
$$\text{Thus, } \frac{\lambda_L}{\lambda_B} = \frac{\frac{4}{3R}}{\frac{36}{5R}} = \frac{4}{3R} \times \frac{5R}{36} = \frac{5}{27}$$

Concepts:

1. Atoms:

- The smallest unit of matter indivisible by chemical means is known as an **atom**.
- The fundamental building block of a chemical **element**.
- The smallest possible unit of an element that still has all the chemical properties of that element.
- An atom is consisting of a nucleus surrounded by one or more shells of **electrons**.
- **Word origin:** from the Greek word *atomos*, which means uncuttable, something that cannot be divided further.

All matter we encounter in everyday life consists of smallest units called atoms – the air we breath consists of a wildly careening crowd of little groups of atoms, my computer's keyboard of a tangle of atom chains, the metal surface it rests on is a crystal lattice of atoms. All the variety of matter consists of less than hundred species of atoms (in other words: less than a hundred different chemical elements).



Atom

Every atom consists of an nucleus surrounded by a cloud of electrons. Nearly all of the atom's mass is concentrated in its nucleus, while the structure of the electron cloud determines how the atom can bind to other atoms (in other words: its chemical properties). Every chemical element can be defined via a characteristic number of protons in its nucleus. Atoms that have lost some of their usual number of electrons are called ions. Atoms are extremely small (typical diameters are in the region of tenths of a billionth of a metre = 10^{-10} metres), and to describe their properties and behaviour, one has to resort to quantum theory.

6. Answer: d

Explanation:

Answer (d) much larger than the wavelength of light.

Concepts:

1. Ray Optics and Optical Instruments:

Optics, deals with the determination of behaviour and the properties of light, along with its interactions with the matter and also with the instruments that are used to detect it.

Ray optics is also known as the geometrical optics and it is a branch of science which describes light propagation.

Reflection is the change in direction of light at an interface in-between two different media so that the wave-front returns into a medium from which it was originated.

Speed of light is the rate at which the light travels in free space.

A phenomenal change in image formed when the light is passed from one medium to another which is called [Refraction](#).

Total Internal Reflection is the reflection of light when the light ray enters into a rarer medium from a denser medium and the angle of incidence is higher than the critical angle of incidence then that light ray will be reflected back to the denser medium.

Read More: [Ray Optics and Optical Instruments](#)

7. Answer: d

Explanation:

In p-type semiconductor, an intrinsic semiconductor is doped with trivalent impurities, that creates deficiencies of valence electrons called holes which are majority charge carriers.

Concepts:

1. Semiconductors:

Semiconductors are a crystalline solid materials, whose electrical conductivity lies between a conductor and an insulator. Semiconductors are mainly used in the manufacturing of electronic devices like capacitors, transistors, diodes, Integrated circuits, etc.

Properties of Semiconductor:

1. Semiconductor acts like an insulator at Zero Kelvin. On increasing the temperature, it works as a conductor.
2. Due to their exceptional electrical properties, semiconductors can be modified by doping to make semiconductor devices suitable for energy conversion, switches, and amplifiers.
3. Lesser power losses.

Uses of Semiconductor:

1. Semiconductors are widely used in manufacturing electronics devices like transistors, diodes, sensors, integrated circuits.
2. Semiconductors are widely used in all electronic devices, like mobile phones, digital cameras, communication devices, trains, ATMs, etc.

8. Answer: a

Explanation:

de Broglie wavelength associated with an electron is

$$\lambda = \frac{h}{P} \text{ or } P = \frac{h}{\lambda}$$

$$\therefore \frac{\lambda}{P} = -\frac{\lambda}{P}$$

$$\frac{P}{P_{initial}} = \frac{0.5}{100}$$

$$P_{initial} = 200P$$

Concepts:

1. Dual Nature of Radiation and Matter:

The dual nature of matter and the dual nature of radiation were throughgoing concepts of physics. At the beginning of the 20th century, scientists untangled one of the best-kept secrets of nature – the wave-particle duplexity or the [dual nature of matter and radiation](#).

Electronic Emission

The least energy that is needed to emit an electron from the surface of a metal can be supplied to the loose electrons.

Photoelectric Effect

The photoelectric effect is a phenomenon that involves electrons getting away from the surface of materials.

Heisenberg's Uncertainty Principle

Heisenberg's Uncertainty Principle states that both the momentum and position of a particle cannot be determined simultaneously.

9. Answer: c

Explanation:

The correct answer is option (C): $-\hat{j} + \hat{k}, -\hat{j} - \hat{k}$

Concepts:

1. Electromagnetic waves:

The waves that are produced when an electric field comes into contact with a magnetic field are known as [Electromagnetic Waves](#) or EM waves. The constitution of an oscillating magnetic field and electric fields gives rise to electromagnetic waves.

Types of Electromagnetic Waves:

Electromagnetic waves can be grouped according to the direction of disturbance in them and according to the range of their frequency. Recall that a wave transfers energy from one point to another point in space. That means there are two things going on: the disturbance that defines a wave, and the propagation of wave. In this context the waves are grouped into the following two categories:

- **Longitudinal waves:** A wave is called a [longitudinal wave](#) when the disturbances in the wave are parallel to the direction of propagation of the wave. For example, sound waves are longitudinal waves because the change of pressure occurs parallel to the direction of wave propagation.
 - **Transverse waves:** A wave is called a [transverse wave](#) when the disturbances in the wave are perpendicular (at right angles) to the direction of propagation of the wave.
-

10. Answer: b

Explanation:

The correct answer is option (B): $I_d = V_0 \omega C \cos \omega t$

Concepts:

1. Displacement Current:

[Displacement current](#) is a quantity appearing in Maxwell's equations. Displacement current definition is defined in terms of the rate of change of the electric displacement field (D). It can be explained by the phenomenon observed in a capacitor.

$$\nabla \times H = J + J_D$$

Where,

- H is related to magnetic field B as
 $B = \mu H$
- μ
is the permeability of the medium in between the plates.
- J is the conducting current density.
- J_D is the displacement current density.

We know that

11. Answer: d

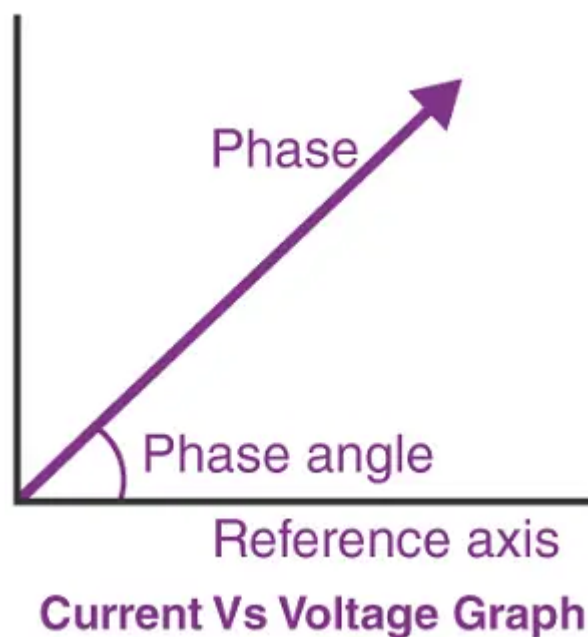
Explanation:

The correct answer is option (D) : 46 rad/s and 54 rad/s

Concepts:

1. LCR Circuit:

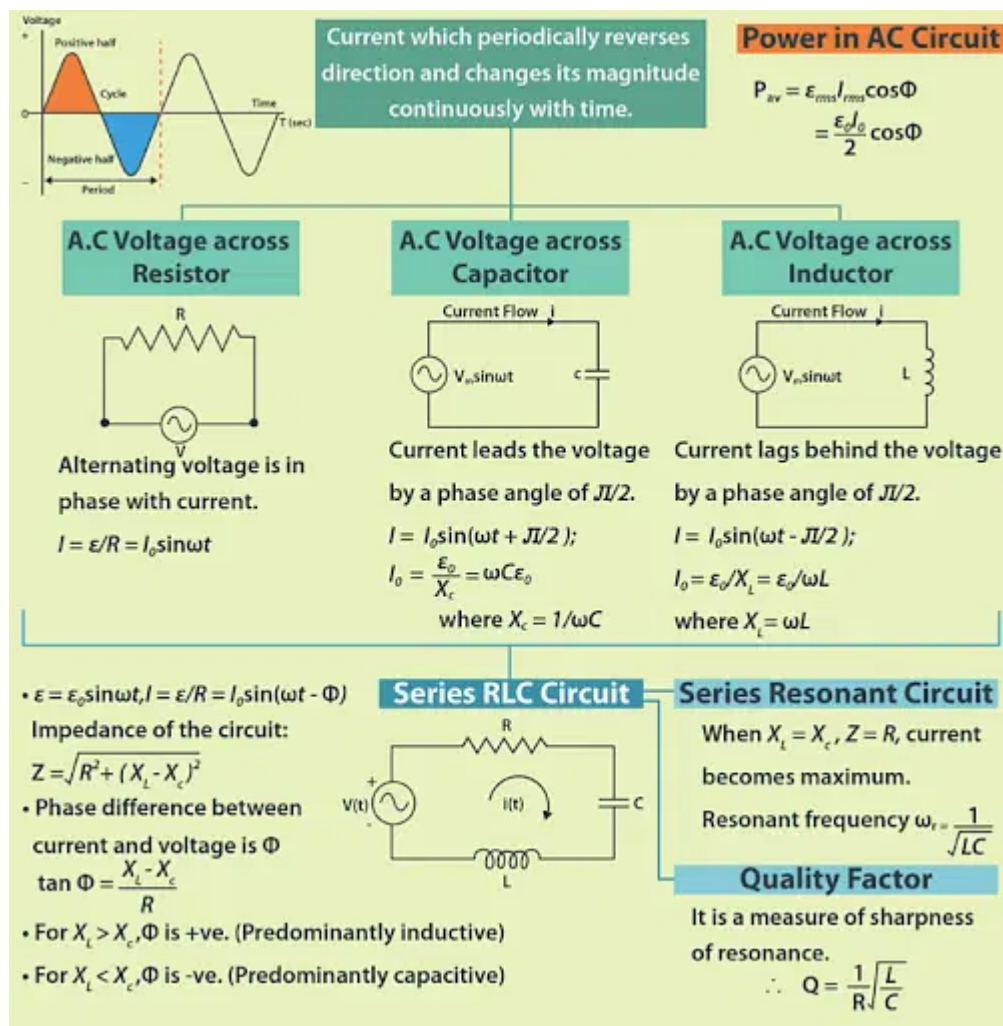
An LCR circuit, also known as a resonant circuit, or an RLC circuit, is an electrical circuit consist of an inductor (L), capacitor (C) and resistor (R) connected in series or parallel.



Series LCR circuit

When a constant voltage source is connected across a resistor a current is induced in it. This current has a unique direction and flows from the negative to positive terminal. Magnitude of current remains constant.

Alternating current is the current if the direction of current through this resistor changes periodically. An AC generator or AC dynamo can be used as AC voltage source.



12. Answer: d

Explanation:

The correct option is (D) : Watt/m²k⁴

Stefan's law is $E = \sigma(T^4)$

$$\Rightarrow \sigma = \frac{E}{T^4}$$

where, $E = \frac{\text{Energy}}{\text{Area} \times \text{Time}} = \text{Watt} / \text{m}^2$ $\sigma = \text{Watt} / \text{m}^2 \text{K}^4$

Concepts:

1. Units and Measurement:

Unit:

A unit of a physical quantity is an arbitrarily chosen standard that is broadly acknowledged by the society and in terms of which other quantities of similar nature may be measured.

Measurement:

The process of measurement is basically a comparison process. To measure a physical quantity, we have to find out how many times a standard amount of that physical quantity is present in the quantity being measured. The number thus obtained is known as the magnitude and the standard chosen is called the unit of the physical quantity.

Read More: [Fundamental and Derived Units of Measurement](#)

System of Units:

1. CGS system
2. FPS system
3. MKS system
4. SI units

Types of Units:

Fundamental Units –

The units defined for the fundamental quantities are called fundamental units.

Derived Units –

The units of all other physical quantities which are derived from the fundamental units are called the derived units.

13. Answer: a

Explanation:

The isotones have same number of neutrons (N) but difference proton number (Z) i.e., (A-Z) are equal

From the options ${}_{34}\text{Se}^{74}$, ${}_{31}\text{Ga}^{71}$ each one has same number of neutron i.e 40

Hence isotonic pair is of ${}_{34}\text{Se}^{74}$, ${}_{31}\text{Ga}^{71}$

Therefore, the correct option is (A): ${}_{34}\text{Se}^{74}$, ${}_{31}\text{Ga}^{71}$

Concepts:

1. Nuclear Physics:

Nuclear physics is the field of physics that studies atomic nuclei and their constituents and interactions, in addition to the study of other forms of nuclear matter. Nuclear physics should not be confused with atomic physics, which studies the atom as a whole, including its electrons

Radius of Nucleus

'R' represents the radius of the nucleus. $R = R_0 A^{1/3}$

Where,

- R_0 is the proportionality constant
- A is the **mass number** of the element

Total Number of Protons and Neutrons in a Nucleus

The mass number (A), also known as the nucleon number, is the total number of neutrons and protons in a nucleus.

$$A = Z + N$$

Where, N is the neutron number, A is the mass number, Z is the proton number

Mass Defect

Mass defect is the difference between the sum of masses of the nucleons (neutrons + protons) constituting a nucleus and the rest mass of the nucleus and is given as:

$$\Delta m = Zm_p + (A - Z) m_n - M$$

Where Z = atomic number, A = mass number, m_p = mass of 1 proton, m_n = mass of 1 neutron and M = mass of nucleus.

14. Answer: c

Explanation:

Similar to how the neutral temperature is greater than the temperature of the cold junction, the temperature of the inversion is higher than the neutral temperature.

In accordance with the key idea, $t_n - t_0 = t_i - t_n$

$$\Rightarrow t_0 = 2t_n - t_i$$

given, $t_i = 620^\circ \text{C}$, and $t_n = 300^\circ \text{C}$.

Consequently, t_0 = temperature of the cold junction

$$= 2 \times 300 - 620 = 600 - 620$$

$$= -20^\circ \text{C}$$

Therefore, the correct option is (C): -20°C

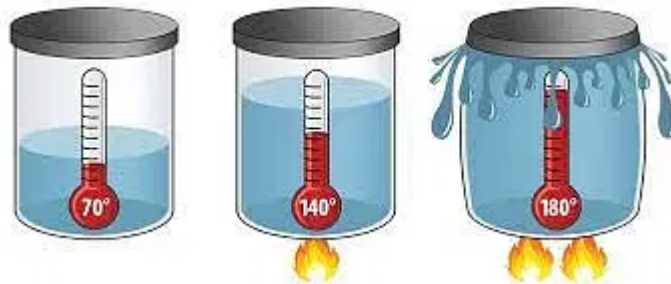
Concepts:

1. Thermal Expansion:

Thermal expansion is the tendency of matter to change its shape, area, and volume in response to a change in temperature. Temperature is a monotonic function of the average molecular kinetic energy of a substance.

The expansion of the solid material is taken to be the linear expansion coefficient, as the expansion takes place in terms of height, thickness and length. The gaseous and liquid expansion takes the volume expansion coefficient. Normally, if the material is fluid, we can explain the changes in terms of volume change.

The bonding force among the molecules and atoms differs from material to material. These characteristics of the compounds and elements are known as the expansion coefficient.



15. Answer: c

Explanation:

Temperature of sink $T_L = 300 \text{ K}$

Original efficiency $\eta = 40\% = 0.4$

Let the Initial temperature of the source be T_H

Using $\eta = 1 - T_H T_L$

$$\therefore 0.4 = 1 - T_H \times 300 \Rightarrow T_H = 500 \text{ K}$$

Now the efficiency of the engine is increased by 50% of original efficiency,

$$\therefore \text{New efficiency } \eta' = 40\% + 20\% = 60\%$$

$$\therefore \eta' = 1 - T_H' T_L$$

$$\text{OR } 0.6 = 1 - T_H' \times 300$$

$$\text{OR } T_H' \times 300 = 0.4 \Rightarrow T_H' = 750 \text{ K}$$

$$\text{Increase in source temperature } \Delta T_H = T_H' - T_H = 750 - 500 = 250 \text{ K}$$

so, the correct option is (C): 250 K

Concepts:

1. Carnot Engine:

The [Carnot engine](#) is a theoretical [heat engine](#) that operates on the principle of a reversible thermodynamic cycle. It was developed by French engineer Nicolas

Léonard Sadi Carnot in the early 19th century and is considered one of the most efficient heat engines that can be constructed.

The Carnot engine consists of four stages: isothermal expansion, adiabatic expansion, isothermal compression, and adiabatic compression. In the first stage, the working fluid in the engine is heated isothermally by a heat source, which provides the energy needed to expand the fluid and do work. In the second stage, the fluid expands adiabatically, meaning that there is no heat transfer between the fluid and its surroundings. In the third stage, the fluid is cooled isothermally by a heat sink, which removes energy from the fluid and allows it to contract and do work. In the fourth stage, the fluid is compressed adiabatically, returning it to its original state and completing the cycle.

Read More: [Carnot's Theorem](#)

The Carnot engine is the most efficient heat engine that can be constructed, as it operates at the maximum possible efficiency for a given temperature difference between the heat source and sink. The efficiency of the Carnot engine is given by the ratio of the temperature difference between the heat source and sink to the absolute temperature of the heat source, or 1 minus the ratio of the absolute temperature of the heat sink to the absolute temperature of the heat source.

Although the Carnot engine is a theoretical construct, it has important practical applications in the design and optimization of real-world heat engines, such as internal combustion engines and steam turbines.

16. Answer: d

Explanation:

$$\text{Power, } P = \frac{\text{Work done}}{\text{Time taken}}$$

Here work done (= mgh) is same in both cases.

$$\therefore \frac{P_1}{P_2} = \frac{t_2}{t_1} = \frac{30s}{1 \text{ min}} = \frac{30s}{60s} = \frac{1}{2}.$$

17. Answer: a

Explanation:

According to maximum power theorem, the power in the circuit is maximum if the value of external resistance is equal to the internal resistance of battery. So if the value of external resistance is equal to the internal resistance of battery. i.e , $R = r = 0.5 \Omega$

Concepts:

1. Current Electricity:

[Current electricity](#) is defined as the flow of [electrons](#) from one section of the circuit to another.

Types of Current Electricity

There are two [types of current](#) electricity as follows:

Direct Current

The current electricity whose direction remains the same is known as direct current. Direct current is defined by the constant flow of electrons from a region of high electron density to a region of low electron density. DC is used in many household appliances and applications that involve a battery.

Alternating Current

The current electricity that is bidirectional and keeps changing the direction of the charge flow is known as alternating current. The bi-directionality is caused by a sinusoidally varying current and voltage that reverses directions, creating a periodic back-and-forth motion for the current. The electrical outlets at our homes and industries are supplied with [alternating current](#).

18. Answer: a

Explanation:

Period of revolution of planet A $(T_A) = 8T_B$

According to Kepler's III law of planetary motion

$$T^2 \propto R^3.$$

Therefore $\left(\frac{r_A}{r_B}\right)^3 = \left(\frac{T_A}{T_B}\right)^2 = \left(\frac{8T_B}{T_B}\right)^2 = 64$
 or $\frac{r_A}{r_B} = 4$ or $r_A = 4r_B$.

Concepts:

1. Gravitation:

In mechanics, the universal force of attraction acting between all matter is known as **Gravity**, also called **gravitation**. It is the weakest known force in nature.

Newton's Law of Gravitation

According to Newton's law of gravitation, "Every particle in the universe attracts every other particle with a force whose magnitude is,

- $F \propto (M_1 M_2) \dots (1)$
- $(F \propto 1/r^2) \dots (2)$

On combining equations (1) and (2) we get,

$$F \propto M_1 M_2 / r^2$$

$$F = G \times [M_1 M_2] / r^2 \dots (7)$$

$$\text{Or, } f(r) = GM_1 M_2 / r^2$$

The dimension formula of G is $[M^{-1} L^3 T^{-2}]$.

19. Answer: d

Explanation:

Force of friction provides the necessary centripetal force.

$$f \leq \mu_s N = \frac{mv^2}{R}$$

$$v^2 \leq \frac{\mu_s R N}{m}$$

$$v^2 \leq \mu_s R g \quad [\text{because } N = mg]$$

$$\text{or } v \leq \sqrt{\mu_s R g}$$

∴ The maximum speed of the car in circular motion is

$$v^{max} = \sqrt{\mu_s R g}$$

Concepts:

1. Laws of Motion:

The [laws of motion](#), which are the keystone of classical mechanics, are three statements that defined the relationships between the forces acting on a body and its motion. They were first disclosed by English physicist and mathematician Isaac Newton.

Newton's First Law of Motion

[Newton's 1st law states](#) that a body at rest or uniform motion will continue to be at rest or uniform motion until and unless a net external force acts on it.

Newton's Second Law of Motion

[Newton's 2nd law of motion](#) deals with the relation between force and acceleration. According to the second law of motion, the acceleration of an object as built by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

Newton's Third Law of Motion

[Newton's 3rd law of motion](#) states when a body applies a force on another body that there is an equal and opposite reaction for every action.

20. Answer: b

Explanation:

If A and ω be amplitude and angular frequency of vibration, then

$$\alpha = \omega^2 A \quad \text{...(i)}$$

$$\text{and } \beta = \omega A \quad \text{...(ii)}$$

Dividing eqn. (i) by eqn. (ii), we get

$$\frac{\alpha}{\beta} = \frac{\omega^2 A}{\omega A} = \omega$$

∴ Time period of vibration is

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{(\alpha/\beta)} = \frac{2\pi\beta}{\alpha}$$

Concepts:

1. Oscillations:

Oscillation is a process of repeating variations of any quantity or measure from its **equilibrium** value in time. Another definition of oscillation is a periodic variation of a matter between two values or about its central value.

The term vibration is used to describe the mechanical oscillations of an object. However, oscillations also occur in dynamic systems or more accurately in every field of science. Even our heartbeats also create oscillations. Meanwhile, objects that move to and fro from its equilibrium position are known as oscillators.

Read More: [Simple Harmonic Motion](#)

Oscillation- Examples

The tides in the sea and the movement of a simple pendulum of the clock are some of the most common examples of oscillations. Some of the examples of oscillations are vibrations caused by the guitar strings or the other instruments having strings are also and etc. The movements caused by oscillations are known as oscillating movements. For example, oscillating movements in a sine wave or a spring when it moves up and down.

The maximum distance covered while taking oscillations is known as the amplitude. The time taken to complete one cycle is known as the time period of the oscillation. The number of oscillating cycles completed in one second is referred to as the frequency which is the reciprocal of the time period.

21. Answer: c

Explanation:

Applying conservation of angular momentum.

$$I_1\omega = (I_1 + I_2)\omega_1$$

$$\omega_1 = \frac{I_1 \omega}{(I_1 + I_2)}.$$

22. Answer: b

Explanation:

The correct answer is B:200V

The electric potential due to the dipole,

$$V = \frac{kp \cos \theta}{r^2}$$

$$\text{Here: } K = \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$$

$$r = 0.6\text{m}$$

$$P = 16 \times 10^{-9} \text{ Cm}$$

Putting these values in the formula we get;

$$V = \frac{9 \times 10^9 \times 16 \times 10^{-9}}{(0.6)^2} \times \frac{1}{2}$$

$$V = 200 \text{ V}$$

Concepts:

1. Electrostatic Potential and Capacitance:

Electrostatic Potential

The potential of a point is defined as the **work done** per unit charge that results in bringing a charge from infinity to a certain point.

Some major things that we should know about electric potential:

- They are denoted by V and are a scalar quantity.
- It is measured in volts.

Capacitance

The ability of a **capacitor** of holding the energy in form of an **electric charge** is defined as capacitance. Similarly, we can also say that capacitance is the storing ability of capacitors, and the unit in which they are measured is “farads”.

Read More: [Electrostatic Potential and Capacitance](#)

The capacitor is in Series and in Parallel as defined below;

In Series

Both the Capacitors C_1 and C_2 can easily get connected in series. When the **capacitors are connected in series** then the total capacitance that is C_{total} is less than any one of the capacitor's capacitance.

In Parallel

Both Capacitor C_1 and C_2 are connected in parallel. When the capacitors are connected parallelly then the total capacitance that is C_{total} is any one of the capacitor's capacitance.

23. Answer: a

Explanation:

Frequency of first source with 5 beats/sec = 100 and frequency of second source with 5 beats/sec = 205. The frequency of the first source = $100 \pm 5 = 105$ or 95 Hz. Therefore frequency of second harmonic source = 210 Hz or 190 Hz. As the second harmonic gives 5 beats/second with the sound of frequency 205 Hz, therefore frequency of second harmonic source should be 210 Hz. The frequency of source = 105 Hz.

Concepts:

1. Waves:

Waves are a disturbance through which the energy travels from one point to another. Most acquainted are surface waves that tour on the water, but sound, mild, and the movement of subatomic particles all exhibit wavelike properties. inside the most effective waves, the disturbance oscillates periodically (see periodic movement) with a set frequency and wavelength.

Types of Waves:

Transverse Waves –

Waves in which the medium moves at right angles to the direction of the wave.

Examples of transverse waves:

- Water waves (ripples of gravity waves, not sound through water)
- Light waves
- S-wave earthquake waves
- Stringed instruments
- Torsion wave

The high point of a transverse wave is a crest. The low part is a trough.

Longitudinal Wave -

A longitudinal wave has the movement of the particles in the medium in the same dimension as the direction of movement of the wave.

Examples of longitudinal waves:

- Sound waves
- P-type earthquake waves
- Compression wave

24. Answer: c

Explanation:

$$r = \frac{mv}{qB} \text{ or } r \propto v$$

As v is doubled, the radius also becomes doubled.

Hence radius = $2 \times 2 = 4$ cm.

Concepts:

1. Moving Charges and Magnetism:

Moving charges generate an electric field and the rate of flow of charge is known as [current](#). This is the basic concept in [Electrostatics](#). Another important concept related to moving [electric charges](#) is the magnetic effect of current. Magnetism is caused by the current.

Magnetism:

- The relationship between a [Moving Charge and Magnetism](#) is that Magnetism is produced by the movement of charges.
- And Magnetism is a property that is displayed by Magnets and produced by moving charges, which results in objects being attracted or pushed away.

Magnetic Field:

Region in space around a magnet where the Magnet has its Magnetic effect is called the Magnetic field of the Magnet. Let us suppose that there is a point charge q (moving with a velocity v and, located at r at a given time t) in presence of both the electric field $E(r)$ and the magnetic field $B(r)$. The force on an electric charge q due to both of them can be written as,

$$F = q [E(r) + v \times B(r)] \equiv F_{\text{Electric}} + F_{\text{magnetic}}$$

This force was based on the extensive experiments of Ampere and others. It is called the Lorentz force.

25. Answer: b

Explanation:

For a unit vector $\hat{n}$, $|\hat{n}| = 1$

$$|0.5\hat{i} - 0.8\hat{j} + c\hat{k}|^2 = 1^2 \Rightarrow 0.25 + 0.64 + c^2 = 1$$

$$\text{or } c = \sqrt{0.11}$$

Concepts:

1. Motion in a Plane:

It is a vector quantity. A vector quantity is a quantity having both magnitude and direction. Speed is a scalar quantity and it is a quantity having a magnitude only. Motion in a plane is also known as motion in two dimensions.

Equations of Plane Motion

The equations of motion in a straight line are:

$$v = u + at$$

$$s = ut + \frac{1}{2} at^2$$

$$v^2 - u^2 = 2as$$

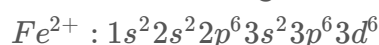
Where,

- v = final velocity of the particle
 - u = initial velocity of the particle
 - s = displacement of the particle
 - a = acceleration of the particle
 - t = the time interval in which the particle is in consideration
-

26. Answer: d

Explanation:

Electronic configuration of the elements are:



number of d-electrons = 6 $Fe^{2+} : 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$ -has 6 electrons in d-orbital i.e. same as in d-orbital of Fe^{2+}

$Ne : 1s^2 2s^2 2p^6$ -has 6 electrons in p-orbital i.e. same as in d-orbital of Fe^{2+}

$Mg : 1s^2 2s^2 2p^6 3s^2$ -has (2 + 2 + 2)6 electrons in s-orbital i.e. same as in d-orbital of Fe^{2+}

$Cl : 1s^2 2s^2 2p^6 3s^2 3p^5$ -has (6+5) 11 electrons in p-orbital and are not same as in d-orbital of

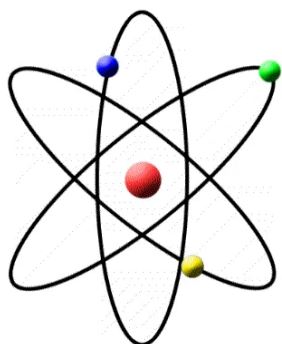


Concepts:

1. Atoms:

- The smallest unit of matter indivisible by chemical means is known as an **atom**.
- The fundamental building block of a chemical **element**.
- The smallest possible unit of an element that still has all the chemical properties of that element.
- An atom is consisting of a nucleus surrounded by one or more shells of **electrons**.
- **Word origin:** from the Greek word *atomos*, which means uncuttable, something that cannot be divided further.

All matter we encounter in everyday life consists of smallest units called atoms – the air we breath consists of a wildly careening crowd of little groups of atoms, my computer’s keyboard of a tangle of atom chains, the metal surface it rests on is a crystal lattice of atoms. All the variety of matter consists of less than hundred species of atoms (in other words: less than a hundred different chemical elements).



Atom

Every atom consists of an nucleus surrounded by a cloud of electrons. Nearly all of the atom’s mass is concentrated in its nucleus, while the structure of the electron cloud determines how the atom can bind to other atoms (in other words: its chemical properties). Every chemical element can be defined via a characteristic number of protons in its nucleus. Atoms that have lost some of their usual number of electrons are called ions. Atoms are extremely small (typical diameters are in the region of tenths of a billionth of a metre = 10^{-10} metres), and to describe their properties and behaviour, one has to resort to quantum theory.

27. Answer: b

Explanation:

Distance covered in n^{th} second is given by

$$s_n = u + \frac{a}{2}(2n - 1)$$

Given : $u = 0, a = g$

$$\therefore s_4 = \frac{g}{2}(2 \times 4 - 1) = \frac{7g}{2}$$

$$s_5 = \frac{g}{2}(2 \times 5 - 1) = \frac{9g}{2} \quad \therefore \frac{s_4}{s_5} = \frac{7}{9}$$

Concepts:

1. Motion in a straight line:

The **motion in a straight line** is an object changes its position with respect to its surroundings with time, then it is called in motion. It is a change in the position of an object over time. It is nothing but linear motion.

Types of Linear Motion:

Linear motion is also known as the **Rectilinear Motion** which are of two types:

1. **Uniform linear motion with constant velocity or zero acceleration:** If a body travels in a straight line by covering an equal amount of distance in an equal interval of time then it is said to have uniform motion.
2. **Non-Uniform linear motion with variable velocity or non-zero acceleration:** Not like the uniform acceleration, the body is said to have a non-uniform motion when the velocity of a body changes by unequal amounts in equal intervals of time. The rate of change of its velocity changes at different points of time during its movement.

28. Answer: a

Explanation:

$$\frac{1}{f} = \left(\frac{\mu_2}{\mu_1} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

For power = $\frac{1}{f} = 0$, $\mu_2 = \mu_1$

Concepts:

1. Ray Optics and Optical Instruments:

Optics, deals with the determination of behaviour and the properties of light, along with its interactions with the matter and also with the instruments that are used to detect it.

Ray optics is also known as the geometrical optics and it is a branch of science which describes light propagation.

Reflection is the change in direction of light at an interface in-between two different media so that the wave-front returns into a medium from which it was originated.

Speed of light is the rate at which the light travels in free space.

A phenomenal change in image formed when the light is passed from one medium to another which is called [Refraction](#).

Total Internal Reflection is the reflection of light when the light ray enters into a rarer medium from a denser medium and the angle of incidence is higher than the critical angle of incidence then that light ray will be reflected back to the denser medium.

Read More: [Ray Optics and Optical Instruments](#)

29. Answer: b

Explanation:

$$\beta = 100$$

$$R_C = 2k\Omega$$

$$v_0 = 4V$$

$$R_B = 1k\Omega$$

$$A = \frac{v_0}{v_i} = \beta \frac{R_C}{R_B}$$

$$v_i = \frac{v_0 \times R_B}{\beta R_C} = \frac{4 \times 10}{100 \times 2 \times 10^3} = 20 mV$$

Concepts:

1. Semiconductors:

Semiconductors are a crystalline solid materials, whose electrical conductivity lies between a conductor and an insulator. Semiconductors are mainly used in the manufacturing of electronic devices like capacitors, transistors, diodes, Integrated circuits, etc.

Properties of Semiconductor:

1. Semiconductor acts like an insulator at Zero Kelvin. On increasing the temperature, it works as a conductor.
2. Due to their exceptional electrical properties, semiconductors can be modified by doping to make semiconductor devices suitable for energy conversion, switches, and amplifiers.
3. Lesser power losses.

Uses of Semiconductor:

1. Semiconductors are widely used in manufacturing electronics devices like transistors, diodes, sensors, integrated circuits.
 2. Semiconductors are widely used in all electronic devices, like mobile phones, digital cameras, communication devices, trains, ATMs, etc.
-

30. Answer: c

Explanation:

$$\begin{aligned}K.E._{\max} &= eV_0 \\ V_0 &= \frac{K.E._{\max}}{e} = \frac{0.5 \text{ eV}}{e} \\ V_0 &= 0.5 \text{ volt}\end{aligned}$$

Concepts:

1. Dual Nature of Radiation and Matter:

The dual nature of matter and the dual nature of radiation were throughgoing concepts of physics. At the beginning of the 20th century, scientists untangled one of the best-kept secrets of nature – the wave-particle duality or the [dual nature of matter and radiation](#).

Electronic Emission

The least energy that is needed to emit an electron from the surface of a metal can be supplied to the loose electrons.

Photoelectric Effect

The photoelectric effect is a phenomenon that involves electrons getting away from the surface of materials.

Heisenberg's Uncertainty Principle

Heisenberg's Uncertainty Principle states that both the momentum and position of a particle cannot be determined simultaneously.

31. Answer: a

Explanation:

The correct answer is option (A): $5\ \Omega$

Concepts:

1. Alternating Current:

An [alternating current](#) can be defined as a current that changes its magnitude and polarity at regular intervals of time. It can also be defined as an electrical current that repeatedly changes or reverses its direction opposite to that of Direct Current or DC which always flows in a single direction as shown below.

Alternating Current Production

Alternating current can be produced or generated by using devices that are known as alternators. However, alternating current can also be produced by different methods where many circuits are used. One of the most common or simple ways of generating AC is by using a basic single coil AC generator which consists of two-pole magnets and a single loop of wire having a rectangular shape.

Application of Alternating Current

AC is the form of current that are mostly used in different appliances. Some of the examples of alternating current include audio signal, radio signal, etc. An alternating current has a wide advantage over DC as AC is able to transmit power over large distances without great loss of energy.

32. Answer: b

Explanation:

The correct answer is option (B): $\sqrt{3}la^2$ and $3la^2$

Concepts:

1. Electric Dipole:

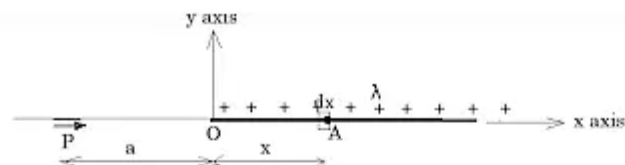
An **electric dipole** is a pair of equal and opposite point charges $-q$ and q , separated by a distance of $2a$. The direction from q to $-q$ is said to be the direction in space.

$$p = q \times 2a$$

where,

p denotes the electric dipole moment, pointing from the negative charge to the positive charge.

Force Applied on Electric Dipole



A small electric dipole having dipole moment p is placed along X-axis, as shown in the figure. A semi-infinite uniformly charged di-electric thin rod placed along x axis, with one end coinciding with origin. If linear charge density rod is $+\lambda$ and distance of dipole from rod is 'a', then calculate the electric force acting on dipole.

Electric field at A due to dipole, $E_A = \frac{2KP}{r^3}$ where $K = \frac{1}{4\pi\epsilon_0}$

$$E_A = \frac{2KP}{(x+a)^3}$$

Force at A due to dipole, $F_A = qE_A = (\lambda \cdot dx) \times \frac{2KP}{(x+a)^3}$

$$F_A = \frac{2\lambda KP}{(x+a)^3} dx$$

Total force exerted due to dipole on the rod, $F_D = \int_0^\infty \frac{2\lambda KP}{(x+a)^3} dx$

$$F_D = 2\lambda KP \times \left[\frac{1}{-2(x+a)^2} \right]_0^\infty$$

$$\Rightarrow F_D = \frac{\lambda KP}{a^2}$$

Now force exerted by rod on dipole is equal and opposite to F_D (Newton's law)

$$F_K = -F_D = -\frac{\lambda KP}{4\pi\epsilon_0 a^2}$$

33. Answer: c

Explanation:

The correct option is (C): $X/4$ The capacitive reactance is determined by the formula:
 $X = 1 / (\omega C) = 1 / (2\pi f C)$ Here, C represents the capacitance, f represents the frequency. Now, when both the frequency and capacitance are doubled: $X' = 1 / [2\pi(2f)(2C)] = 1 / (4\pi f C)$ This simplifies to: $X' = (1/4) * (1 / (2\pi f C)) = (1/4) * X = (X / 4)$

Concepts:**1. Electromagnetic Induction:**

Electromagnetic Induction is a current produced by the voltage production due to a changing [magnetic field](#). This happens in one of the two conditions:-

1. When we place the [conductor](#) in a changing magnetic field.
2. When the conductor constantly moves in a stationary field.

Formula:

The [electromagnetic induction](#) is mathematically represented as:-

$$e = N \times d\phi / dt$$

Where

- e = induced voltage
- N = number of turns in the coil
- ϕ = Magnetic flux (This is the amount of magnetic field present on the surface)
- t = time

Applications of Electromagnetic Induction

1. Electromagnetic induction in AC generator
2. Electrical Transformers
3. Magnetic Flow Meter

Explanation:



The graph shows that for high atomic mass nuclei, the binding energy per nucleon falls as the number of mass atoms increases.

Mass and number are reduced as a result of fission. Nuclei's stability will rise with a drop in mass number, allowing for the fission of heavier nuclei.

Therefore, the correct option is (B): decreases with mass number at high mass numbers

Concepts:

1. Nuclear Physics:

Nuclear physics is the field of physics that studies atomic nuclei and their constituents and interactions, in addition to the study of other forms of nuclear matter. Nuclear physics should not be confused with atomic physics, which studies the atom as a whole, including its electrons

Radius of Nucleus

'R' represents the radius of the nucleus. $R = R_0 A^{1/3}$

Where,

- R_0 is the proportionality constant
- A is the **mass number** of the element

Total Number of Protons and Neutrons in a Nucleus

The mass number (A), also known as the nucleon number, is the total number of neutrons and protons in a nucleus.

$$A = Z + N$$

Where, N is the neutron number, A is the mass number, Z is the proton number

Mass Defect

Mass defect is the difference between the sum of masses of the nucleons (neutrons + protons) constituting a nucleus and the rest mass of the nucleus and is given as:

$$\Delta m = Zm_p + (A - Z) m_n - M$$

Where Z = atomic number, A = mass number, m_p = mass of 1 proton, m_n = mass of 1 neutron and M = mass of nucleus.

35. Answer: a

Explanation:

$E = hv$, where h is the Planck constant, is a known equation.

h has a dimension of $\frac{E}{v} = \frac{[ML^2T^{-2}]}{[T^{-1}]} = [ML^2T^{-1}]$

The moment of inertia's dimension is $[ML^2]$.

The ratio is $\frac{[ML^2T^{-1}]}{[ML^2]} = [T^{-1}]$

dimension of Frequency = $[T^{-1}]$

Therefore, the correct option is (A): frequency.

Concepts:

1. Dimensional Analysis:

Dimensional Analysis is a process which helps verify any formula by the using the **principle of homogeneity**. Basically dimensions of each term of a dimensional equation on both sides should be the same.

Limitation of Dimensional Analysis: Dimensional analysis does not check for the correctness of value of constants in an equation.

Using Dimensional Analysis to check the correctness of the equation

Let us understand this with an example:

Suppose we don't know the correct formula relation between speed, distance and time,

We don't know whether

(i) Speed = Distance/Time is correct or

(ii) Speed = Time/Distance.

Now, we can use dimensional analysis to check whether this equation is correct or not.

By reducing both sides of the equation in its fundamental units form, we get

(i) $[L][T]^{-1} = [L] / [T]$ (Right)

(ii) $[L][T]^{-1} = [T] / [L]$ (Wrong)

From the above example it is evident that the dimensional formula establishes the correctness of an equation.

36. Answer: d

Explanation:

By using the Wiens displacement rule, $mT = b$,
we can calculate the following: $(5000)(1500)$
 $= (m)(1500+1000), =m = 2500(500)(1500) = 3000\text{\AA}$

Therefore, the correct option is (D): 3000 Å

Concepts:

1. Thermal Properties of Matter:

Anything that has mass or occupies space in the universe is commonly known as matter. There are five [properties of matters](#) namely chemical, mechanical, thermal, dimensional, and physical properties.

Read More: [Thermal Properties of Matter](#)

Heat Capacity:

The quantity of heat needed to change the temperature of the matter by 1° is known as the heat capacity of a material. The temperature is indicated in kelvin or Celsius and the amount of heat is shown in calories or joules. Specific heat capacity or molar heat capacity is used to calculate the heat capacity of the matter with the stated dimension.

Linear expansion is the situation when change takes place in one dimension or dimensional.

Thermal Expansion:

When heat is passed through the material, the change in the area, volume, and shape is recognized as the thermal expansion property of the material. The expansion of the railway tracks due to maximal heat which leads to accidents is an example of thermal expansion.

Thermal Conductivity:

This property is interconnected to the conductivity of heat. The amount of heat regulated by the material is directly proportional to the conductivity of the material. Not all objects have the capacity to conduct heat throughout their bodies. Insulators are such objects which do not have the property to conduct heat throughout their body.

Thermal Stress:

The stress due to thermal contraction or expansion of the body is known as thermal stress. The explosion of materials takes place due to thermal stress which is dangerous. The cracks on the truck tyres are caused by an outcome of thermal stress. Trucks at high speed generate heat which is caused by the friction of the truck tyres and the road surface.

37. Answer: b

Explanation:

The correct answer is Option B) by the system against a conservative force

Potential energy will increase when work is done by the system against a **conservative force**.

$$-U = W_{\text{conservative force}}$$

Discover More From Chapter: [Work, Energy and Power](#)

Concepts:

1. Work, Energy and Power:

Work

- Work is correlated to force and the displacement over which it acts. When an object is displaced parallel to the force's line of action, it is thought to be doing work. It is a force-driven action that includes movement in the force's direction.
- The work done by the force is described to be the product of the elements of the force in the direction of the displacement and the magnitude of this displacement.

Energy:

- A body's energy is its potential to do tasks. Anything that has the capability to work is said to have energy. The unit of energy is the same as the unit of work, i.e., the Joule.
- There are two types of mechanical energy such as; Kinetic and potential energy.

Read More: [Work and Energy](#)

Power:

- Power is the rate at which energy is transferred, conveyed, or converted or the rate of doing work. Technologically, it is the amount of work done per unit of time. The SI unit of power is Watt (W) which is joules per second (J/s).

Sometimes the power of motor vehicles and other machines is demonstrated in terms of Horsepower (hp), which is roughly equal to 745.7 watts.

- Power is a scalar quantity, which gives us a quantity or amount of energy consumed per unit of time but with no manifestation of direction.
-

38. Answer: a

Explanation:

The velocity of charge carriers of current (about 1 ampere) in a metal under normal conditions is of the order of a fraction of mm/sec .

So, the correct answer is (A): of a fraction of mm/sec

Concepts:

1. Current Electricity:

[Current electricity](#) is defined as the flow of [electrons](#) from one section of the circuit to another.

Types of Current Electricity

There are two [types of current](#) electricity as follows:

Direct Current

The current electricity whose direction remains the same is known as direct current. Direct current is defined by the constant flow of electrons from a region of high electron density to a region of low electron density. DC is used in many household appliances and applications that involve a battery.

Alternating Current

The current electricity that is bidirectional and keeps changing the direction of the charge flow is known as alternating current. The bi-directionality is caused by a sinusoidally varying current and voltage that reverses directions, creating a periodic back-and-forth motion for the current. The electrical outlets at our homes and industries are supplied with [alternating current](#).

39. Answer: b

Explanation:

$$v_e = \sqrt{2gR} = \sqrt{\frac{2GM}{R}}$$

if R is 1/4th then $v_e = 2v_{e-earth}$

$$= 2 \times 11.2 = 22.4 \text{ km/sec}$$

Concepts:

1. Gravitation:

In mechanics, the universal force of attraction acting between all matter is known as **Gravity**, also called **gravitation**. It is the weakest known force in nature.

Newton's Law of Gravitation

According to Newton's law of gravitation, "Every particle in the universe attracts every other particle with a force whose magnitude is,

- $F \propto (M_1 M_2) \dots (1)$
- $(F \propto 1/r^2) \dots (2)$

On combining equations (1) and (2) we get,

$$F \propto M_1 M_2 / r^2$$

$$F = G \times [M_1 M_2] / r^2 \dots (7)$$

$$\text{Or, } f(r) = GM_1 M_2 / r^2$$

The dimension formula of G is $[M^{-1}L^3T^{-2}]$.

40. Answer: d

Explanation:

$$T_{\max} = 25g; ma = T_{\max} - mg$$

$$\Rightarrow a = \frac{g}{4} = \frac{10}{4} = 2.5 \text{ m/s}^2$$

Concepts:

1. Laws of Motion:

The **laws of motion**, which are the keystone of classical mechanics, are three statements that defined the relationships between the forces acting on a body and its motion. They were first disclosed by English physicist and mathematician Isaac Newton.

Newton's First Law of Motion

Newton's 1st law states that a body at rest or uniform motion will continue to be at rest or uniform motion until and unless a net external force acts on it.

Newton's Second Law of Motion

Newton's 2nd law of motion deals with the relation between force and acceleration. According to the second law of motion, the acceleration of an object as built by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

Newton's Third Law of Motion

Newton's 3rd law of motion states when a body applies a force on another body that there is an equal and opposite reaction for every action.

41. Answer: d

Explanation:

For particle undergoing SHM

$$V = \omega \sqrt{A^2 - X^2}$$

$$\text{so } V_1 = \omega \sqrt{A^2 - x_1^2} \text{ \& } V_2 = \omega \sqrt{A^2 - x_2^2}$$

solving these two equation we get

$$\omega = \sqrt{\frac{V_1^2 - V_2^2}{x_2^2 - x_1^2}} = \frac{2\pi}{T}$$

$$\Rightarrow T = 2\pi \sqrt{\frac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$$

Concepts:

1. Oscillations:

Oscillation is a process of repeating variations of any quantity or measure from its **equilibrium** value in time. Another definition of oscillation is a periodic variation of a matter between two values or about its central value.

The term vibration is used to describe the mechanical oscillations of an object. However, oscillations also occur in dynamic systems or more accurately in every field of science. Even our heartbeats also creates oscillations. Meanwhile, objects that move to and fro from its equilibrium position are known as oscillators.

Read More: [Simple Harmonic Motion](#)

Oscillation- Examples

The tides in the sea and the movement of a simple pendulum of the clock are some of the most common examples of oscillations. Some of examples of oscillations are vibrations caused by the guitar strings or the other instruments having strings are also and etc. The movements caused by oscillations are known as oscillating movements. For example, oscillating movements in a sine wave or a spring when it moves up and down.

The maximum distance covered while taking oscillations is known as the amplitude. The time taken to complete one cycle is known as the time period of the oscillation. The number of oscillating cycles completed in one second is referred to as the frequency which is the reciprocal of the time period.

42. Answer: a

Explanation:

Wavelength (λ) = 5000 nm and velocity (v) = 1.5×10^4 m/s.

Wavelength of the approaching star, (λ') = $\lambda \frac{c-v_s}{c}$ or $\frac{\lambda'}{\lambda} = 1 - \frac{v}{c}$ or, $\frac{v}{c} = 1 - \frac{\lambda'}{\lambda} = \frac{\lambda - \lambda'}{\lambda} = \frac{\Delta\lambda}{\lambda}$

Therefore $\Delta\lambda = \lambda \times \frac{\Delta}{c} = 5000 \text{ nm} \times \frac{1.5 \times 10^6}{3 \times 10^8} = 25 \text{ nm}$.
(where $\Delta\lambda$ is the change in the wavelength)

Concepts:

1. Waves:

[Waves](#) are a disturbance through which the energy travels from one point to another. Most acquainted are surface waves that tour on the water, but sound, mild, and the movement of subatomic particles all exhibit wavelike properties. Inside the most effective waves, the disturbance oscillates periodically (see periodic movement) with a set [frequency and wavelength](#).

Types of Waves:

Transverse Waves –

Waves in which the medium moves at right angles to the direction of the wave.

Examples of transverse waves:

- Water waves (ripples of gravity waves, not sound through water)
- Light waves
- S-wave earthquake waves
- Stringed instruments
- Torsion wave

The high point of a transverse wave is a crest. The low part is a trough.

Longitudinal Wave –

A longitudinal wave has the movement of the particles in the medium in the same dimension as the direction of movement of the wave.

Examples of longitudinal waves:

- Sound waves
 - P-type earthquake waves
 - Compression wave
-

43. Answer: d**Explanation:**

The correct answer is D: $2 \times 10^{-2} \text{ C}$

Radii of sphere (R_1) = 1 cm = $1 \times 10^{-2} \text{ m}$;

(R_2) = 2 cm = $2 \times 10^{-2} \text{ m}$ and charges on sphere;

(Q_1) = 10^{-2} C and (Q_2) = $5 \times 10^{-2} \text{ C}$.

Common potential (V)

$$\begin{aligned} &= \frac{\text{Total charge}}{\text{Total capacity}} \\ &= \frac{Q_1 + Q_2}{C_1 + C_2} = \frac{(1 \times 10^{-2}) + (5 \times 10^{-2})}{4\pi\epsilon_0 10^{-2} + 4\pi\epsilon_0 (2 \times 10^{-2})} \\ &= \frac{6 \times 10^{-2}}{4\pi\epsilon_0 (3 \times 10^{-2})} \end{aligned}$$

Therefore final charge on smaller sphere ($C_1 V$)

$$= 4\pi\epsilon_0 \times 10^{-2} \times \frac{6 \times 10^{-2}}{4\pi\epsilon_0 \times 3 \times 10^{-2}} = 2 \times 10^{-2} \text{ C}.$$

Concepts:**1. Electrostatic Potential and Capacitance:****Electrostatic Potential**

The potential of a point is defined as the **work done** per unit charge that results in bringing a charge from infinity to a certain point.

Some major things that we should know about electric potential:

- They are denoted by V and are a scalar quantity.
- It is measured in volts.

Capacitance

The ability of a **capacitor** of holding the energy in form of an **electric charge** is defined as capacitance. Similarly, we can also say that capacitance is the storing ability of capacitors, and the unit in which they are measured is "farads".

Read More: [Electrostatic Potential and Capacitance](#)

The capacitor is in Series and in Parallel as defined below;

In Series

Both the Capacitors C_1 and C_2 can easily get connected in series. When the **capacitors are connected in series** then the total capacitance that is C_{total} is less than any one of the capacitor's capacitance.

In Parallel

Both Capacitor C_1 and C_2 are connected in parallel. When the capacitors are connected parallelly then the total capacitance that is C_{total} is any one of the capacitor's capacitance.

44. Answer: d

Explanation:

\$

$$K \cdot E = \frac{1}{2} I \omega^2$$

\$

$\therefore$ From angular momentum conservation about centre.

$$L \rightarrow \text{constant}$$

$$I = mr^2$$

$$K \cdot E = \frac{1}{2} I \omega^2$$

$$K \cdot E = 4K \cdot E$$

K.E. is increased by a factor of 4.

45. Answer: a

Explanation:

According to Fleming's left hand rule direction of force is along Oy axis which is perpendicular to wire.

$$\vec{F} = e(\vec{v} \times \vec{B})$$

B due to i is acting inwards i.e. into the paper.

v is along Ox.

$$\therefore \vec{F} = Q \begin{bmatrix} \hat{i} \\ \hat{j} \\ \hat{k} \end{bmatrix} \times \begin{bmatrix} 0 \\ 0 \\ -B \end{bmatrix} \Rightarrow \vec{F} = Q \left[-\hat{j}(-vB) + 0 \right]$$

$$\therefore \vec{F} = +QvB\hat{j}.$$
 i.e in Oy direction.

Concepts:

1. Moving Charges and Magnetism:

Moving charges generate an electric field and the rate of flow of charge is known as **current**. This is the basic concept in **Electrostatics**. Another important concept related to moving **electric charges** is the magnetic effect of current. Magnetism is caused by the current.

Magnetism:

- The relationship between a [Moving Charge and Magnetism](#) is that Magnetism is produced by the movement of charges.
- And Magnetism is a property that is displayed by Magnets and produced by moving charges, which results in objects being attracted or pushed away.

Magnetic Field:

Region in space around a magnet where the Magnet has its Magnetic effect is called the Magnetic field of the Magnet. Let us suppose that there is a point charge q (moving with a velocity v and, located at r at a given time t) in presence of both the electric field $E(r)$ and the magnetic field $B(r)$. The force on an electric charge q due to both of them can be written as,

$$\vec{F} = q \left[\vec{E}(r) + \vec{v} \times \vec{B}(r) \right] \equiv F_{\text{Electric}} + F_{\text{magnetic}}$$

This force was based on the extensive experiments of Ampere and others. It is called the Lorentz force.

Explanation:

Let $\vec{A} \times \vec{B} = \vec{C}$

The cross product of $\vec{B}$ and $\vec{A}$ is perpendicular to the plane containing $\vec{A}$ and $\vec{B}$

i.e perpendicular to $\vec{A}$. If a dot product of this cross product and $\vec{A}$ is taken, as the cross product is perpendicular to $\vec{A}$, $\vec{C} \cdot \vec{A} = 0$.

Therefore product of $(\vec{B} \times \vec{A}) \cdot \vec{A} = 0$.

Concepts:

1. Motion in a Plane:

It is a vector quantity. A vector quantity is a quantity having both magnitude and direction. Speed is a scalar quantity and it is a quantity having a magnitude only. Motion in a plane is also known as motion in two dimensions.

Equations of Plane Motion

The equations of motion in a straight line are:

$$v = u + at$$

$$s = ut + \frac{1}{2} at^2$$

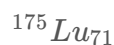
$$v^2 - u^2 = 2as$$

Where,

- v = final velocity of the particle
- u = initial velocity of the particle
- s = displacement of the particle
- a = acceleration of the particle
- t = the time interval in which the particle is in consideration

47. Answer: a

Explanation:



Number of electrons = 71

= Number of protons = 71

Number of protons + number of neutrons = mass number

71 + number of neutrons = 175.

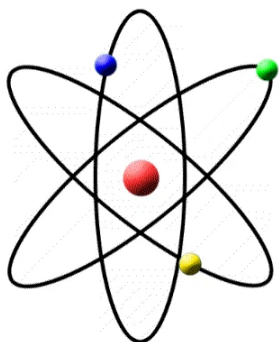
Number of neutrons = $175 - 71 = 104$

Concepts:

1. Atoms:

- The smallest unit of matter indivisible by chemical means is known as an **atom**.
- The fundamental building block of a chemical **element**.
- The smallest possible unit of an element that still has all the chemical properties of that element.
- An atom is consisting of a nucleus surrounded by one or more shells of **electron s**.
- **Word origin:** from the Greek word *atomos*, which means uncuttable, something that cannot be divided further.

All matter we encounter in everyday life consists of smallest units called atoms – the air we breath consists of a wildly careening crowd of little groups of atoms, my computer's keyboard of a tangle of atom chains, the metal surface it rests on is a crystal lattice of atoms. All the variety of matter consists of less than hundred species of atoms (in other words: less than a hundred different chemical elements).



Atom

Every atom consists of an nucleus surrounded by a cloud of electrons. Nearly all of the atom's mass is concentrated in its nucleus, while the structure of the electron cloud determines how the atom can bind to other atoms (in other words: its chemical properties). Every chemical element can be defined via a characteristic number of protons in its nucleus. Atoms that have lost some of their usual number of electrons are called ions. Atoms are extremely small (typical diameters are in the region of tenths of a billionth of a metre = 10^{-10} metres), and to describe their properties and behaviour, one has to resort to quantum theory.

48. Answer: c

Explanation:

Red has the longest **wavelength** among the given options. Red has the longest and violet has the shortest wavelength, this can be determined from the acronym VIBGYOR.

For frequency, it is inverse.

Therefore, option C) Red is the correct choice.

Concepts:

1. Ray Optics and Optical Instruments:

Optics, deals with the determination of behaviour and the properties of light, along with its interactions with the matter and also with the instruments that are used to detect it.

Ray optics is also known as the geometrical optics and it is a branch of science which describes light propagation.

Reflection is the change in direction of light at an interface in-between two different media so that the wave-front returns into a medium from which it was originated.

Speed of light is the rate at which the light travels in free space.

A phenomenal change in image formed when the light is passed from one medium to another which is called **Refraction**.

Total Internal Reflection is the reflection of light when the light ray enters into a rarer medium from a denser medium and the angle of incidence is higher than the critical angle of incidence then that light ray will be reflected back to the denser medium.

Read More: [Ray Optics and Optical Instruments](#)

49. Answer: a

Explanation:

In forward biasing, the resistance of p-n junction diode is very low to the flow of current.

So practically all the voltage will be dropped across the resistance p, i.e. voltage across R will be V.

In reverse biasing, the resistance of p-n junction diode is very high. So the voltage drop across R is zero

Concepts:

1. Semiconductors:

Semiconductors are a crystalline solid materials, whose electrical conductivity lies between a conductor and an insulator. Semiconductors are mainly used in the manufacturing of electronic devices like capacitors, transistors, diodes, Integrated circuits, etc.

Properties of Semiconductor:

1. Semiconductor acts like an insulator at Zero Kelvin. On increasing the temperature, it works as a conductor.
2. Due to their exceptional electrical properties, semiconductors can be modified by doping to make semiconductor devices suitable for energy conversion, switches, and amplifiers.
3. Lesser power losses.

Uses of Semiconductor:

1. Semiconductors are widely used in manufacturing electronics devices like transistors, diodes, sensors, integrated circuits.
 2. Semiconductors are widely used in all electronic devices, like mobile phones, digital cameras, communication devices, trains, ATMs, etc.
-

50. Answer: a

Explanation:

$$eE = evB \therefore v = \frac{|E|}{|B|}$$

Concepts:

1. Dual Nature of Radiation and Matter:

The dual nature of matter and the dual nature of radiation were throughgoing concepts of physics. At the beginning of the 20th century, scientists untangled one of the best-kept secrets of nature – the wave-particle duplexity or the [dual nature of matter and radiation](#).

Electronic Emission

The least energy that is needed to emit an electron from the surface of a metal can be supplied to the loose electrons.

Photoelectric Effect

The photoelectric effect is a phenomenon that involves electrons getting away from the surface of materials.

Heisenberg's Uncertainty Principle

Heisenberg's Uncertainty Principle states that both the momentum and position of a particle cannot be determined simultaneously.

51. Answer: c

Explanation:

The correct answer is C: $3.08 \times 10^{15} s^{-1}$

Ionisation energy of $H = 2.18 \times 10^{-18} J atom^{-1}$

$\therefore E_1$ (Energy of 1st orbit of H-atom)

$$= -2.18 \times 10^{-18} J atom^{-1}$$

$$\therefore E_n = \frac{-2.18 \times 10^{-18}}{n^2} J atom^{-1}$$

$Z = 1$ for $H - atom$

$$\Delta E = E_4 - E_1$$

$$= \frac{-2.18 \times 10^{-18}}{4^2} - \frac{-2.18 \times 10^{-18}}{1^2}$$

$$= -2.18 \times 10^{-18} \times \left[\frac{1}{4^2} - \frac{1}{1^2} \right]$$

$$\Delta E = -2.18 \times 10^{-18} \times -\frac{15}{16}$$

$$= +2.0437 \times 10^{-18} J atom^{-1}$$

$$\therefore v = \frac{\Delta E}{h}$$

$$= \frac{2.0437 \times 10^{-18} J atom^{-1}}{6.6256 \times 10^{-34} J s}$$

$$= 3.084 \times 10^{15} s^{-1} atom^{-1}$$

Concepts:

1. Structure of Atom:

Atomic Structure:

The atomic structure of an element refers to the constitution of its nucleus and the arrangement of the electrons around it. Primarily, the atomic structure of matter is made up of **protons**, electrons and neutrons.

Dalton's Atomic Theory

Dalton proposed that every matter is composed of atoms that are indivisible and indestructible.

The following are the postulates of his theory:

- Every matter is made up of atoms.
- Atoms are indivisible.
- Specific elements have only one type of atoms in them.
- Each atom has its own constant mass that varies from element to element.

- **Atoms** undergo rearrangement during a chemical reaction.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

Cons of Dalton's Atomic Theory

- The theory was unable to explain the existence of **isotopes**.
- Nothing about the structure of atom was appropriately explained.
- Later, the scientists discovered particles inside the atom that proved, the atoms are divisible.

Subatomic Particles

1. Protons – are positively charged subatomic particles.
2. Electron – are negatively charged subatomic particles.
3. Neutrons – are electrically neutral particles and carry no charge

Atomic Structure of Isotopes

Several atomic structures of an element can exist, which differ in the total number of nucleons. These variants of elements having a different nucleon number (also known as the mass number) are called isotopes of the element. Therefore, the isotopes of an element have the same number of protons but differ in the number of neutrons. For example, there exist three known naturally occurring isotopes of hydrogen, namely, protium, deuterium, and tritium.

52. Answer: c

Explanation:

According to Avogadro's hypothesis,

Volume of a gas (V) $\propto$ number of moles (n)

Therefore, the ratio of the volumes of gases can be determined in terms of their moles.

$\therefore$ The ratio of volumes of $H_2 : O_2$: methane (CH_4) is given by

$$V_{H_2} : V_{O_2} : V_{CH_4} = n_{H_2} : n_{O_2} : n_{CH_4}$$

$$\Rightarrow V_{H_2} : V_{O_2} : V_{CH_4} := \frac{m_{H_2}}{M_{H_2}} : \frac{m_{O_2}}{M_{O_2}} : \frac{m_{CH_4}}{M_{CH_4}}$$

Given, $m_{H_2} = m_{O_2} = m_{CH_4} = m$

$$\left[\because n = \frac{\text{mass}}{\text{molar mass}} \right]$$

$$\text{Thus, } V_{H_2} : V_{O_2} : V_{CH_4} := \frac{m}{2} : \frac{m}{32} : \frac{m}{16} \\ = 16:1:2$$

Concepts:

1. States of Matter:

The matter is made up of very tiny particles and these particles are so small that we cannot see them with naked eyes.

There are three States of Matter:

The [three states of matter](#) are as follows:

Solid State:

- The solid-state is one of the fundamental states of matter.
- Solids differ from liquids and gases by the characteristic of rigidity.
- The molecules of solids are tightly packed because of ***strong intermolecular forces***, they only oscillate about their mean positions.

Liquid State:

- The molecules in a liquid are closely packed due to ***weak intermolecular forces***.
- These forces are weaker than solids but stronger than that of gases.
- There is much space in between the molecules of liquids which makes their flowing ability easy.

Gaseous State:

- In this [state of matter](#), distances between the molecules are large (intermolecular distance is in the range of 10^{-7} – 10^{-5} cm).
 - The ***intermolecular forces experienced between them are negligible***.
 - Thus, translatory, rotatory and vibratory motions are observed prominently in gases.
-

53. Answer: a

Explanation:

For a given exothermic reaction, K_P and K'_P are the equilibrium constants at temperatures T_1 and T_2 respectively. Assuming that heat of reaction is constant in temperatures range between T_1 and T_2 , it is readily observation that $K_P > K'_P$.

$$\log \frac{K_2}{K_1} = \frac{\Delta H^\circ}{2.303R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$T_2 > T_1$ So, $K_P > K'_P$ (exothermic reaction)

(assuming $T_2 > T_1$, although it is not mentioned, which temperature is higher. If $T_1 > T_2$ then $K_P < K'_P$ then answer should be (2)).

Thus for an exothermic reaction, when the temperature is increased, the equilibrium will shift in the reverse direction and the value of the equilibrium constant will decrease. This is in accordance with Le-Chatelier principle.

Concepts:

1. Equilibrium:

An **equilibrium** represents a state in a process when the observable properties such as color, temperature, pressure, concentration etc do not show any change.

The word equilibrium means 'balance' which indicates that a **chemical reaction** represents a balance between the reactants and products taking part in the reaction. The equilibrium state is also noticed in certain physical processes such as the **melting point** of ice at 0°C , both ice and water are present at equilibrium.

In the case of physical processes such as the melting of solid, dissolution of salt in water etc., the equilibrium is called **physical equilibrium** while the equilibrium associated with chemical reaction is known as **chemical equilibrium**.

Equilibrium in Chemical changes

The chemical equilibrium in a reversible reaction is the state at which both forward and backward reactions occur at the same speed.

The stage of the reversible reaction at which the concentration of the reactants and products do not change with time is called the equilibrium state.

Read More: [Calculating Equilibrium Concentration](#)

Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

Homogenous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are all in the same phase. [Homogenous equilibrium](#) can be further divided into two types: Reactions in which the number of molecules of the products is equal to the number of molecules of the reactants. For example,

- $\text{H}_2 (\text{g}) + \text{I}_2 (\text{g}) \rightleftharpoons 2\text{HI} (\text{g})$
- $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO} (\text{g})$

Reactions in which the number of molecules of the products is not equal to the total number of reactant molecules. For example,

- $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{SO}_3 (\text{g})$
- $\text{COCl}_2 (\text{g}) \rightleftharpoons \text{CO} (\text{g}) + \text{Cl}_2 (\text{g})$

Heterogeneous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are present in different phases. A few examples of [heterogeneous equilibrium](#) are listed below.

- $\text{CO}_2 (\text{g}) + \text{C} (\text{s}) \rightleftharpoons 2\text{CO} (\text{g})$
- $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$

Thus, the different types of chemical equilibrium are based on the phase of the reactants and products.

Check Out: [Equilibrium Important Questions](#)

54. Answer: a

Explanation:

$$\Delta S = \frac{q}{T}$$

q = required heat per mol

T = constant absolute temperature.

Unit of entropy is $JK^{-1}mol^{-1}$

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System** – An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System** – Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System** – In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The [Zeroth law of thermodynamics](#) states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The [First law of thermodynamics](#) is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

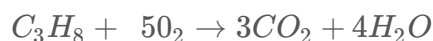
The [Second law of thermodynamics](#) is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

55. Answer: c**Explanation:**

The correct answer is C:5L



For the combustion of 22.4 L propane, oxygen required = $5 \times 22.4L$

For the combustion of 1 L of propane oxygen required $\frac{5 \times 22.4}{22.4} L$
 $= 5L$

Concepts:**1. Some Basic Concepts of Chemistry:**

Chemistry is a vast subject and for understanding its significance we can take help of following points:

- Chemistry plays an important role in understanding various subjects like physics, geology and biology.
- Chemistry is a core branch of science that explains us about the various compositional properties and interaction of **matter**. It also helps to understand various **chemical reactions**.
- Chemistry is important in order to understand the behaviour of **fertilizers**, alkenes, acids, salts, dyes, **polymers**, drugs, soaps and alloys in organic and **inorganic chemistry**.
- Chemistry plays an important role in various fields like healthcare, industrial, research, food, and farm activities.

Read More: [Some Basic Concepts of Chemistry](#)

Classification of Matter

There are two ways of classifying the matter:

(A) Physical Classification:

Matter can exist in three physical states:

1. **Solids** – have definite volume and definite shape

2. Liquids – have definite volume but not definite shape.
3. Gases – have neither definite volume nor definite shape.

(B) Chemical Classification:

Based upon the composition, matter can be divided into two main types:

1. **Pure Substances** are defined as a single substance (or matter) which cannot be separated by simple physical methods. Pure substances can be further classified as (i) Elements (ii) Compounds
 2. Mixtures are the combination of two or more elements or **compounds** which are not chemically combined together and may also be present in any proportion.
-

56. Answer: c

Explanation:

The correct answer is C: Different from E_a obtained in laboratory

In a laboratory setting, when a biochemical reaction is conducted outside the human body without the involvement of enzymes, the reaction rate is observed to be 10^{-6} times slower than the activation energy of the reaction. This differs from the activation energy obtained in the laboratory because, for a specific chemical reaction, there is a distinct difference in the activation energy when enzymes are present

compared to when they are absent. This variation in activation energy is described by the;

Arrhenius equation: $K = Ae^{(\frac{-E_a}{RT})}$.

It indicates that the activation energy takes on different values depending on whether enzymes are involved or not.

Concepts:

1. Chemical Kinetics:

Chemical kinetics is the description of the **rate of a chemical reaction**. This is the rate at which the reactants are transformed into products. This may take place by abiotic or by biological systems, such as microbial metabolism.

Rate of a Chemical Reaction:

The speed of a reaction or the rate of a reaction can be defined as the change in concentration of a reactant or product in unit time. To be more specific, it can be expressed in terms of: (i) the rate of decrease in the concentration of any one of the reactants, or (ii) the rate of increase in concentration of any one of the products. Consider a hypothetical reaction, assuming that the volume of the system remains constant. $R \rightarrow P$

Read More: [Chemical Kinetics MCQ](#)

Factors Affecting The Reaction Rate:

- **The concentration of Reactants** – According to [collision theory](#), which is discussed later, reactant molecules collide with each other to form products.
- **Nature of the Reactants** – The reaction rate also depends on the types of substances that are reacting.
- **Physical State of Reactants** – The physical state of a reactant whether it is solid, liquid, or gas can greatly affect the rate of change.
- **Surface Area of Reactants** – When two or more reactants are in the same phase of fluid, their particles collide more often than when either or both are in the solid phase or when they are in a heterogeneous mixture. In a heterogeneous medium, the collision between the particles occurs at an interface between phases. Compared to the homogeneous case, the number of collisions between reactants per unit time is significantly reduced, and so is the reaction rate.
- **Temperature** – If the temperature is increased, the number of collisions between reactant molecules per second. Increases, thereby increasing the rate of the reaction.
- **Effect Of Solvent** – The nature of the [solvent](#) also depends on the reaction rate of the solute particles.
- **Catalyst** – [Catalysts](#) alter the rate of the reaction by changing the reaction mechanism.

57. Answer: a

Explanation:

Solution will have highest freezing point if ΔT_f (depression in freezing point) value will be lowest $\Delta T_f = iK_f m$

where, i = van't Hoff's factor, K_f = molal depression constant, m = molality of solution As K_f is a constant quantity, so ΔT_f depends upon and only.

For $NaCl$, $NaCl \rightarrow Na^+ + Cl^-$ $i = 2$

For Na_2SO_4 , $i = 3$; For $C_{12}H_{22}O_{11}$, $i = 1$

ΔT_f value is lowest for $0.01 M NaCl$, hence, it has highest freezing point.

Concepts:

1. Solutions:

A [solution](#) is a homogeneous mixture of two or more components in which the particle size is smaller than 1 nm.

For example, salt and sugar is a good illustration of a solution. A solution can be categorized into several components.

Types of Solutions:

The solutions can be classified into three types:

- **Solid Solutions** – In these solutions, the [solvent](#) is in a Solid-state.
- **Liquid Solutions**– In these solutions, the solvent is in a Liquid state.
- **Gaseous Solutions** – In these solutions, the solvent is in a Gaseous state.

On the basis of the amount of solute dissolved in a solvent, solutions are divided into the following types:

1. **Unsaturated Solution**– A solution in which more solute can be dissolved without raising the temperature of the solution is known as an unsaturated solution.
2. **Saturated Solution**– A solution in which no solute can be dissolved after reaching a certain amount of temperature is known as an unsaturated saturated solution.
3. **Supersaturated Solution**– A solution that contains more solute than the maximum amount at a certain temperature is known as a supersaturated solution.

58. Answer: d**Explanation:**

$$E_{Zn^{+2}/Zn}^0 = -0.76 \text{ V}$$

$$E_{Fe^{+2}/Fe}^0 = -0.76 \text{ V}$$

Zn has higher negative SRP (Standard reduction potential) so it works as anode and protect iron to make iron as cathode.

Concepts:**1. Electrochemical Cells:**

An **electrochemical cell** is a device that is used to create electrical energy through the chemical reactions which are involved in it. The electrical energy supplied to electrochemical cells is used to smooth the chemical reactions. In the electrochemical cell, the involved devices have the ability to convert the chemical energy to electrical energy or vice-versa.

Classification of Electrochemical Cell:**Cathode**

- Denoted by a positive sign since electrons are consumed here
- A reduction reaction occurs in the cathode of an electrochemical cell
- Electrons move into the cathode

Anode

- Denoted by a negative sign since electrons are liberated here
- An oxidation reaction occurs here
- Electrons move out of the anode

Types of Electrochemical Cells:**Galvanic cells (also known as Voltaic cells)**

- Chemical energy is transformed into electrical energy.

- The redox reactions are spontaneous in nature.
- The anode is negatively charged and the cathode is positively charged.
- The electrons originate from the species that undergo oxidation.

Electrolytic cells

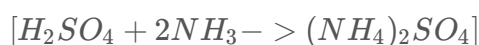
- Electrical energy is transformed into chemical energy.
 - The redox reactions are non-spontaneous.
 - These cells are positively charged anode and negatively charged cathode.
 - Electrons originate from an external source.
-

59. Answer: a

Explanation:

$$\therefore M \times V(ml) = m \text{ mol}$$

$$10 \text{ m mol } H_2SO_4 = 20 \text{ m mol of } NH_3$$



1 mol NH_3 contains 14 g nitrogen

$20 \times 10^{-3} \text{ mol } NH_3$ contains $14 \times 20 \times 10^{-3}$ nitrogen

0.75 g of sample contains

$$\% \text{ Nitrogen} = \frac{14 \times 20 \times 10^{-3}}{0.75} \times 100 = 37.33\%$$

60. Answer: c

Explanation:

$$\sqrt{n(n+2)} = 2.84$$

$$\Rightarrow n = 2$$



Concepts:

1. D and F Block Elements:

The d-block elements are placed in groups 3–12 and f-block elements with 4f and 5f orbital filled progressively. The general [electronic configuration](#) of [d block elements](#)

and [f- block elements](#) are $(n-1) d^{1-10} ns^{1-2}$ and $(n-2) f^{1-14} (n-1) d^1 ns^2$ respectively. They are commonly known as transition elements because they exhibit multiple oxidation states because of the d-d transition which is possible by the availability of vacant d orbitals in these elements.

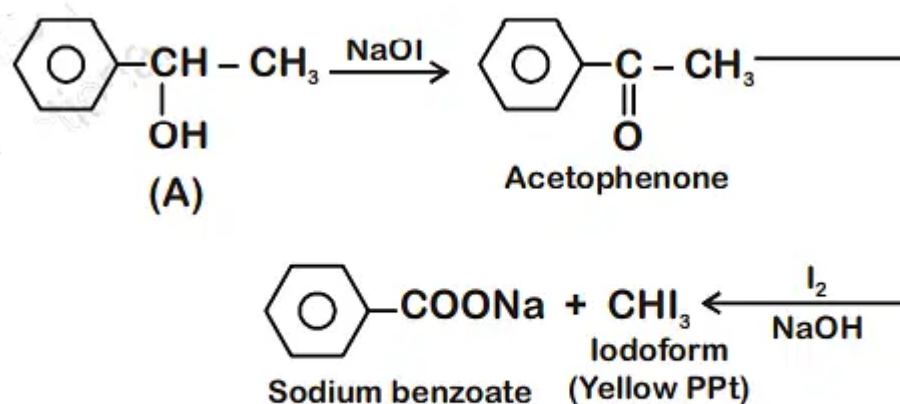
They have variable Oxidation States as well as are good catalysts because they provide a large surface area for the absorption of reaction. They show variable oxidation states to form intermediate with reactants easily. They are mostly lanthanoids and show lanthanoid contraction. Since differentiating electrons enter in an anti-penultimate f subshell. Therefore, these elements are also called inner transition elements.

Read More: [The d and f block elements](#)

61. Answer: c

Explanation:

Option (3) is secondary alcohol which on oxidation gives phenylmethyl ketone (Acetophenone). This on reaction with I_2 and $NaOH$ form iodoform and sodium benzoate. $2NaOH + I_2 \rightarrow NaOI + NaI + H_2O$



□

Concepts:

1. Aldehydes, Ketones, and Carboxylic Acids:

Aldehydes, Ketones, and Carboxylic Acids are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

Aldehydes:

Aldehydes are organic compounds that have the functional group -CHO .

Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

Ketones:

Ketones are organic compounds that have the functional group C=O and the structure R-(C=O)-R' .

Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

Carboxylic Acid:

Carboxylic acids are organic compounds that contain a $(\text{C=O})\text{OH}$ group attached to an R group (where R refers to the remaining part of the molecule).

Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

62. Answer: d

Explanation:

The correct option is (D)

Concepts:

1. Haloalkanes and Haloarenes:

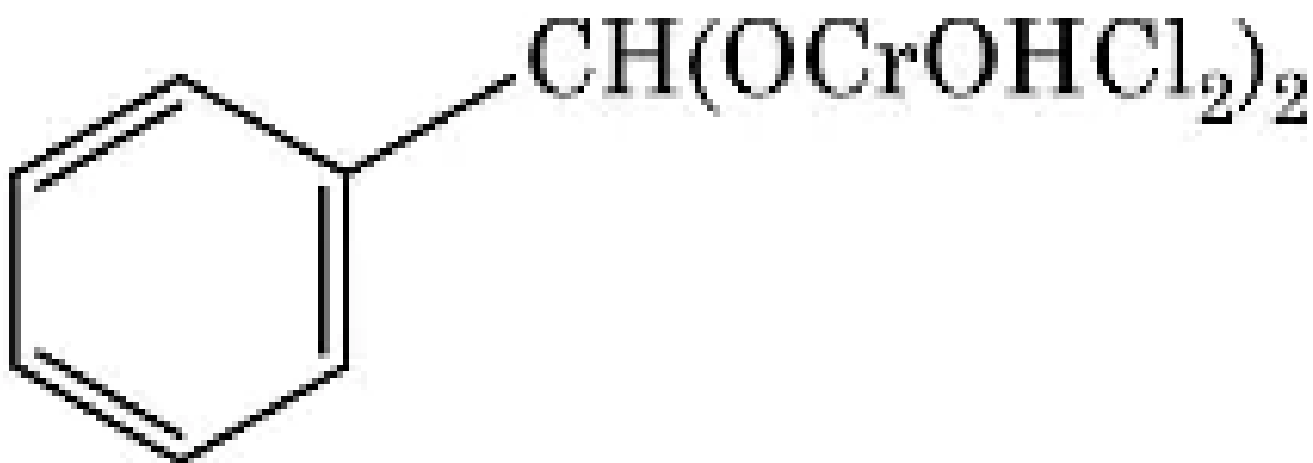
The hydrocarbons such as [Haloalkanes and Haloarenes](#) are the ones, in which one or more [hydrogen](#) atoms are replaced with halogen atoms. The main difference between Haloalkanes and Haloarenes is that Haloalkanes are derived from open chained hydrocarbons, also called alkanes, and Haloarenes are derived from aromatic hydrocarbons.

- Haloalkanes have hydrocarbons made up of aliphatic alkanes and one or more hydrogen atoms replaced by [halogens](#) (elements such as Chlorine, Bromine, Fluorine, Iodine, etc.) whereas, haloarenes consist of aromatic ring or rings and one or more hydrogen atoms replaced by halogens.
- In haloalkanes, the halogen atom is attached to the sp^3 hybridized carbon atom of the alkyl group whereas, in haloarenes, the halogen atom is attached to the sp^3 hybridized carbon atom of the alkyl group.
- Haloalkanes are saturated organic compounds where all the chemical bonds are attached to the carbon atom with single bonds and a single carbon atom is attached to the Halogen atom, whereas, the haloarenes differ from Haloalkanes by their method of preparation and properties.
- Haloalkanes are made by aliphatic alkanes by the process of free radical halogenation, whereas, haloarenes are made by direct halogenation of aromatic rings.
- Haloalkanes are odorless compounds, whereas, haloarenes have a sweet odor.
- Haloalkanes precipitate in SN^2 substitution reactions, whereas, haloarenes do not precipitate in SN^2 substitution reactions.
- Example of haloalkanes is CH_3Cl (Methyl Chloride) and CH_3CH_2Br (Ethyl Bromide) and the example of haloarenes is Chlorobenzene, Bromobenzene.

63. Answer: b

Explanation:

The correct answer is option (B) :



Concepts:

1. Alcohols, Phenols, and Ethers:

Alcohol is formed when a saturated carbon atom bonds to a hydroxyl ($-\text{OH}$) group. It is an organic compound that contains a hydroxyl functional group attached to a carbon atom.

Phenol is formed when the $-\text{OH}$ group replaces the hydrogen atom in benzene. It is an organic compound in which a hydroxyl group directly attaches to an aromatic hydrocarbon.

Ether is formed when oxygen atom bonds to two alkyl or aryl groups. It is an organic compound that has an oxygen atom that is connected to two aryl and alkyl groups.

Read More: [Alcohol, Phenol, and Ethers](#)

64. Answer: c

Explanation:

The correct option is (C) : Spatial arrangement of atoms

The isomers that differ from one another in terms of their geometry or atoms' spatial arrangement are known as geometric isomers, also known as cis-trans isomers or E-Z isomers. Double bonds and ring structures are the two primary sources of geometric isomers. In contrast to limited rotation about the double bond, which

emphasises the relative locations of the substituent groups above and below the double bond, the C-C single bond has unrestricted rotation.

Concepts:

1. Alkenes:

Alkenes

In organic chemistry, an **alkene** is a **hydrocarbon** containing a **carbon-carbon double bond**.^[1]

Alkene is often used as synonym of **olefin**, that is, any hydrocarbon containing one or more double bonds.

Read More: [Ozonolysis](#)

IUPAC Nomenclature of Alkenes

1. An alkene or cycloalkene is indicated by the suffix (ending) ene.
2. For the root name, the longest chain must include both carbon atoms of the double bond.
3. The root chain must be numbered beginning at the end closest to a double bond carbon atom. If the double bond is in the chain's centre, the nearest substituent rule is used to determine where the numbering begins.
4. If the compound contains more than one double bond, it is named with a diene, triene, or equivalent prefix indicating the number of double bonds, and each double bond is assigned a locator number.

Read More: [Unsaturated Hydrocarbon](#)

65. Answer: c

Explanation:

The correct option is (C): 12.

In the hexagonal close-packed (hcp) structure, the coordination number is 12. As

zinc (Zn) adopts the hcp structure, it has 12 nearest neighbors, with six located within the same plane, and three situated above and three below that plane.

66. Answer: b

Explanation:

NaF has high lattice energy because Na^+ is smallest in size and lattice energy increases as the size of cation decreases.

Concepts:

1. Chemical Bonding and Molecular Structure:

Such a group of atoms is called a **molecule**. Obviously, there must be some force that holds these constituent atoms together in the molecules. The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a **chemical bond**.

Types of Chemical Bonds:

There are 4 types of chemical bonds which are formed by atoms or molecules to yield compounds.

- **Ionic Bonds** – Ionic bonding is a type of chemical bonding which involves a transfer of electrons from one atom or molecule to another.
- **Covalent Bonds** – Compounds that contain carbon commonly exhibit this type of chemical bonding.
- **Hydrogen Bonds** – It is a type of polar covalent bonding between oxygen and hydrogen wherein the hydrogen develops a partial positive charge
- **Polar Bonds** – In Polar Covalent chemical bonding, electrons are shared unequally since the more electronegative atom pulls the electron pair closer to itself and away from the less electronegative atom.

Factors Affecting Bond Enthalpy in Chemical Bonding:

- Size of the Atom
- Multiplicity of Bonds

- Number of Lone Pair of Electrons Present
 - Bond Angle
-

67. Answer: c**Explanation:**

As magnetic moment is $\sqrt{n(n+2)}$ where n is no. of unpair electron.

So ion with minimum no. of unpair electron will have minimum paramagnetism.

$= [Co(H_2O)_6]^{2+}$ have minimum paramagnetic behaviour.

Concepts:**1. Coordination Compounds:**

A coordination compound holds a central metal atom or ion surrounded by various oppositely charged ions or neutral molecules. These molecules or ions are re-bonded to the metal atom or ion by a coordinate bond.

Coordination entity:

A coordination entity composes of a central metal atom or ion bonded to a fixed number of ions or molecules.

Ligands:

A molecule, ion, or group which is bonded to the metal atom or ion in a complex or coordination compound by a coordinate bond is commonly called a ligand. It may be either neutral, positively, or negatively charged.

68. Answer: b**Explanation:**

Ring test is used for confirming NO_3^- ion.

Concepts:

1. P-Block Elements:

- P block elements are those in which the last electron enters any of the three p-orbitals of their respective shells. Since a p-subshell has three degenerate p-orbitals each of which can accommodate two electrons, therefore in all there are six groups of p-block elements.
- P block elements are shiny and usually a good conductor of electricity and heat as they have a tendency to lose an electron. You will find some amazing properties of elements in a P-block element like gallium. It's a metal that can melt in the palm of your hand. Silicon is also one of the most important metalloids of the p-block group as it is an important component of glass.

P block elements consist of:

- [Group 13 Elements](#): Boron family
 - [Group 14 Elements](#): Carbon family
 - [Group 15 Elements](#): Nitrogen family
 - [Group 16 Elements](#): Oxygen family
 - [Group 17 Elements](#): Fluorine family
 - [Group 18 Elements](#): Neon family
-

69. Answer: c

Explanation:

Haemoglobin acts as oxygen carrier in the blood because four Fe^{2+} ions of each haemoglobin can bind with four molecules of O_2 and form oxyhaemoglobin $4Hb + 4O_2 \longrightarrow Hb_4O_8$

Oxy -haemoglobin

Concepts:

1. Biomolecules:

[Biomolecules](#) are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. These non-living

molecules are the actual foot-soldiers of the battle of sustenance of life.

There are four major classes of Biomolecules – Carbohydrates, Proteins, Nucleic acids and Lipids.

1. **Carbohydrates** are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
 2. **Proteins** are another class of indispensable biomolecules, which make up around 50 per cent of the cellular dry weight. Proteins are polymers of amino acids arranged in the form of polypeptide chains. The structure of proteins is classified as primary, secondary, tertiary and quaternary in some cases.
 3. **Nucleic acids** refer to the genetic material found in the cell that carries all the hereditary information from parents to progeny. There are two types of nucleic acids namely, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The main function of nucleic acid is the transfer of genetic information and synthesis of proteins by processes known as translation and transcription.
 4. **Lipids** are organic substances that are insoluble in water, soluble in organic solvents, are related to fatty acids and are utilized by the living cell.
-

70. Answer: b

Explanation:

To write the electronic configuration of an atom, it is better if we remember the atomic number of noble gases and the orbitals follow the noble gas. The atomic number of Ca is 20 and its nearest noble gas is argon (Ar = 18). Hence, the electronic configuration of Ca = [Ar] $4s^2$

Concepts:

1. **Structure of Atom:**

Atomic Structure:

The atomic structure of an element refers to the constitution of its nucleus and the arrangement of the electrons around it. Primarily, the atomic structure of matter is made up of [protons](#), electrons and neutrons.

Dalton's Atomic Theory

Dalton proposed that every matter is composed of atoms that are indivisible and indestructible.

The following are the postulates of his theory:

- Every matter is made up of atoms.
- Atoms are indivisible.
- Specific elements have only one type of atoms in them.
- Each atom has its own constant mass that varies from element to element.
- **Atoms** undergo rearrangement during a chemical reaction.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

Cons of Dalton's Atomic Theory

- The theory was unable to explain the existence of **isotopes**.
- Nothing about the structure of atom was appropriately explained.
- Later, the scientists discovered particles inside the atom that proved, the atoms are divisible.

Subatomic Particles

1. Protons - are positively charged subatomic particles.
2. Electron - are negatively charged subatomic particles.
3. Neutrons - are electrically neutral particles and carry no charge

Atomic Structure of Isotopes

Several atomic structures of an element can exist, which differ in the total number of nucleons. These variants of elements having a different nucleon number (also known as the mass number) are called isotopes of the element. Therefore, the isotopes of an element have the same number of protons but differ in the number of neutrons. For example, there exist three known naturally occurring isotopes of hydrogen, namely, protium, deuterium, and tritium.

Explanation:

$$\frac{r_{O_2}}{r_{H_2}} = \sqrt{\frac{M_{H_2}}{M_{O_2}}}$$
$$\frac{\frac{t}{n_{H_2}}}{\frac{t}{n_{O_2}}} = \sqrt{\frac{2}{32}} = \sqrt{\frac{1}{16}} = \frac{1}{4}$$
$$\therefore \frac{n_{O_2}}{n_{H_2}} = \frac{1}{4}$$

as $\frac{1}{2}$ moles of H_2 are diffused, moles of O_2 diffused in same time. $\frac{n_{O_2}}{1/2} = \frac{1}{4} \Rightarrow n_{O_2} = \frac{1}{8}$

Concepts:

1. States of Matter:

The matter is made up of very tiny particles and these particles are so small that we cannot see them with naked eyes.

There are three States of Matter:

The [three states of matter](#) are as follows:

Solid State:

- The solid-state is one of the fundamental states of matter.
- Solids differ from liquids and gases by the characteristic of rigidity.
- The molecules of solids are tightly packed because of ***strong intermolecular forces***; they only oscillate about their mean positions.

Liquid State:

- The molecules in a liquid are closely packed due to ***weak intermolecular forces***.
- These forces are weaker than solids but stronger than that of gases.
- There is much space in between the molecules of liquids which makes their flowing ability easy.

Gaseous State:

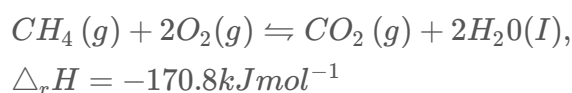
- In this [state of matter](#), distances between the molecules are large (intermolecular distance is in the range of 10^{-7} – 10^{-5} cm).
- The ***intermolecular forces experienced between them are negligible***.

- Thus, translatory, rotatory and vibratory motions are observed prominently in gases.

72. Answer: b

Explanation:

For the reaction,



This equilibrium is an example of heterogeneous chemical equilibrium. Hence, for it

$$K_c = \frac{[CO_2]}{[CH_4][O_2]^2} \quad 20 \text{ mm} \quad \dots (i)$$

(equilibrium constant on the basis of concentration)

$$\text{and } K_p = \frac{p_{CO_2}}{p_{CH_4} \times p_{O_2}^2} \quad 20 \text{ mm} \quad \dots (ii)$$

(equilibrium constant according to partial pressure)

Thus, in this concentration of $CO_2(g)$ and $H_2O(l)$ are not equal at equilibrium.

The equilibrium constant $(K_p) = \frac{[CO_2]}{[CH_4][O_2]}$ is not correct expression.

On adding $CH_4(g)$ or $O_2(g)$ at equilibrium, K_c will be decreased according to expression (i) but K_c remains constant at constant temperature for a reaction, so for maintaining the constant value of K_c , the concentration of CO_2 will increased in same order. Hence, on addition of CH_4 or O_2 equilibrium

will cause to the right.

Combustion reaction is an example of exothermic reaction

Concepts:

1. Equilibrium:

An **equilibrium** represents a state in a process when the observable properties such as color, temperature, pressure, concentration etc do not show any change.

The word equilibrium means 'balance' which indicates that a **chemical reaction** represents a balance between the reactants and products taking part in the reaction. The equilibrium state is also noticed in certain physical processes such as the **melting point** of ice at 0°C, both ice and water are present at equilibrium.

In the case of physical processes such as the melting of solid, dissolution of salt in water etc., the equilibrium is called **physical equilibrium** while the equilibrium associated with chemical reaction is known as **chemical equilibrium**.

Equilibrium in Chemical changes

The chemical equilibrium in a reversible reaction is the state at which both forward and backward reactions occur at the same speed.

The stage of the reversible reaction at which the concentration of the reactants and products do not change with time is called the equilibrium state.

Read More: [Calculating Equilibrium Concentration](#)

Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

Homogenous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are all in the same phase. **Homogenous equilibrium** can be further divided into two types:

Reactions in which the number of molecules of the products is equal to the number of molecules of the reactants. For example,

- $\text{H}_2 (\text{g}) + \text{I}_2 (\text{g}) \rightleftharpoons 2\text{HI} (\text{g})$
- $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO} (\text{g})$

Reactions in which the number of molecules of the products is not equal to the total number of reactant molecules. For example,

- $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{SO}_3 (\text{g})$
- $\text{COCl}_2 (\text{g}) \rightleftharpoons \text{CO} (\text{g}) + \text{Cl}_2 (\text{g})$

Heterogeneous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are present in different phases. A few examples of [heterogeneous equilibrium](#) are listed below.

- $\text{CO}_2 (\text{g}) + \text{C} (\text{s}) \rightleftharpoons 2\text{CO} (\text{g})$
- $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$

Thus, the different types of chemical equilibrium are based on the phase of the reactants and products.

Check Out: [Equilibrium Important Questions](#)

73. Answer: a

Explanation:

$$\Delta H = 6.0 \text{ kJ mol}^{-1} = 6 \times 10^3 \text{ J mol}^{-1}$$

$$T = 0^\circ \text{C} = 273 \text{ K}$$

$$\Delta S = \frac{\Delta H}{T} \text{ (For a reversible process)}$$

$$\Delta S = \frac{6 \times 10^3 \text{ J mol}^{-1}}{273 \text{ K}} = 21.98 \text{ J K}^{-1} \text{ mol}^{-1}$$

Concepts:

1. Thermodynamics:

[Thermodynamics](#) in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System** – An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System** – Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System** – In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The [Zeroth law of thermodynamics](#) states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The [First law of thermodynamics](#) is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The [Second law of thermodynamics](#) is a physical law of thermodynamics about heat and loss in its conversion.

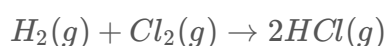
Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

74. Answer: a

Explanation:

The given problem is related to the concept of stoichiometry of chemical equations. Thus, we have to convert the given volumes into their moles and then, identify the limiting reagent [possessing minimum number of moles and gets completely used up in the reaction]. The limiting reagent gives the moles of product formed in the reaction.



Initial vol. 22.4L 11.2L 2mol

∴ 22.4 L volume at STP is occupied by

$$Cl_2 = 1 \text{ mole}$$

∴ 11.2 L volume will be occupied by

$$Cl_2 = \frac{1 \times 11.2}{22.4} \text{ mol} = 0.5 \text{ mol}$$

22.4 L volume at STP is occupied by $H_2 = 1 \text{ mol}$



$$1 \text{ mol} // 0.5 \text{ mol}$$

Since, Cl_2 possesses minimum number of moles, thus it is the limiting reagent.

As per equation,

1 mole of $Cl_2 = 2$ moles of HCl

$\therefore 0.5$ mole of $Cl_2 = 2 \times 0.5$ mole of HCl

$= 1.0$ mole of HCl

Hence, 1.0 mole of HCl (g) is produced by
0.5 mole of Cl_2 [or 11.2 L].

Concepts:

1. Some Basic Concepts of Chemistry:

Chemistry is a vast subject and for understanding its significance we can take help of following points:

- Chemistry plays an important role in understanding various subjects like physics, geology and biology.
- Chemistry is a core branch of science that explains us about the various compositional properties and interaction of **matter**. It also helps to understand various **chemical reactions**.
- Chemistry is important in order to understand the behaviour of **fertilizers**, alkenes, acids, salts, dyes, **polymers**, drugs, soaps and alloys in organic and **inorganic chemistry**.
- Chemistry plays an important role in various fields like healthcare, industrial, research, food, and farm activities.

Read More: [Some Basic Concepts of Chemistry](#)

Classification of Matter

There are two ways of classifying the matter:

(A) Physical Classification:

Matter can exist in three physical states:

1. **Solids** – have definite volume and definite shape
2. Liquids – have definite volume but not definite shape.
3. Gases – have neither definite volume nor definite shape.

(B) Chemical Classification:

Based upon the composition, matter can be divided into two main types:

1. **Pure Substances** are defined as a single substance (or matter) which cannot be separated by simple physical methods. Pure substances can be further classified as (i) Elements (ii) Compounds
 2. Mixtures are the combination of two or more elements or **compounds** which are not chemically combined together and may also be present in any proportion.
-

75. Answer: d

Explanation:

Half life of zero order

$$t_{1/2} = \frac{[A_0]}{2K}$$

$t_{1/2}$ will be doubled on doubling the initial concentration.

Concepts:

1. Chemical Kinetics:

Chemical kinetics is the description of the **rate of a chemical reaction**. This is the rate at which the reactants are transformed into products. This may take place by abiotic or by biological systems, such as microbial metabolism.

Rate of a Chemical Reaction:

The speed of a reaction or the rate of a reaction can be defined as the change in concentration of a reactant or product in unit time. To be more specific, it can be expressed in terms of: (i) the rate of decrease in the concentration of any one of the reactants, or (ii) the rate of increase in concentration of any one of the products. Consider a hypothetical reaction, assuming that the volume of the system remains constant. $R \rightarrow P$

Read More: [Chemical Kinetics MCQ](#)

Factors Affecting The Reaction Rate:

- **The concentration of Reactants** – According to [collision theory](#), which is discussed later, reactant molecules collide with each other to form products.
 - **Nature of the Reactants** – The reaction rate also depends on the types of substances that are reacting.
 - **Physical State of Reactants** – The physical state of a reactant whether it is solid, liquid, or gas can greatly affect the rate of change.
 - **Surface Area of Reactants** – When two or more reactants are in the same phase of fluid, their particles collide more often than when either or both are in the solid phase or when they are in a heterogeneous mixture. In a heterogeneous medium, the collision between the particles occurs at an interface between phases. Compared to the homogeneous case, the number of collisions between reactants per unit time is significantly reduced, and so is the reaction rate.
 - **Temperature** – If the temperature is increased, the number of collisions between reactant molecules per second increases, thereby increasing the rate of the reaction.
 - **Effect Of Solvent** – The nature of the [solvent](#) also depends on the reaction rate of the solute particles.
 - **Catalyst** – [Catalysts](#) alter the rate of the reaction by changing the reaction mechanism.
-

76. Answer: d

Explanation:

ΔG_{mix} should be less than zero

Concepts:

1. Solutions:

A [solution](#) is a homogeneous mixture of two or more components in which the particle size is smaller than 1 nm.

For example, salt and sugar is a good illustration of a solution. A solution can be categorized into several components.

Types of Solutions:

The solutions can be classified into three types:

- **Solid Solutions** – In these solutions, the **solvent** is in a Solid-state.
- **Liquid Solutions**– In these solutions, the solvent is in a Liquid state.
- **Gaseous Solutions** – In these solutions, the solvent is in a Gaseous state.

On the basis of the amount of solute dissolved in a solvent, solutions are divided into the following types:

1. **Unsaturated Solution**– A solution in which more solute can be dissolved without raising the temperature of the solution is known as an unsaturated solution.
2. **Saturated Solution**– A solution in which no solute can be dissolved after reaching a certain amount of temperature is known as an unsaturated saturated solution.
3. **Supersaturated Solution**– A solution that contains more solute than the maximum amount at a certain temperature is known as a supersaturated solution.

77. Answer: d

Explanation:

Lassaigne's test is used for the qualitative analysis of elements like Nitrogen Sulphur Chlorine etc. in the organic compound.

78. Answer: b

Explanation:

During electrolysis, copper is deposited at the cathode while oxygen is liberated at anode. The following reactions occur at the electrodes

At anode $2H_2O \rightarrow 4H^+ + O_2 + 4e^-$

\$\hspace{4mm}\$ (Oxidation) \$

At cathode $Cu^{2+} + 2e^- \rightarrow Cu(s)$ (*Reduction*)

Concepts:

1. D and F Block Elements:

The d-block elements are placed in groups 3-12 and F-block elements with 4f and 5f orbital filled progressively. The general [electronic configuration](#) of [d block elements](#) and [f- block elements](#) are $(n-1) d^{1-10} ns^{1-2}$ and $(n-2) f^{1-14} (n-1) d^1 ns^2$ respectively. They are commonly known as transition elements because they exhibit multiple oxidation states because of the d-d transition which is possible by the availability of vacant d orbitals in these elements.

They have variable Oxidation States as well as are good catalysts because they provide a large surface area for the absorption of reaction. They show variable oxidation states to form intermediate with reactants easily. They are mostly lanthanoids and show lanthanoid contraction. Since differentiating electrons enter in an anti-penultimate f subshell. Therefore, these elements are also called inner transition elements.

Read More: [The d and f block elements](#)

79. Answer: a

Explanation:

Conductivity of heat in metals is due to the presence of free electrons, which move due to increase in temperature.

Concepts:

1. Electrochemical Cells:

An [electrochemical cell](#) is a device that is used to create electrical energy through the chemical reactions which are involved in it. The electrical energy supplied to electrochemical cells is used to smooth the chemical reactions. In the electrochemical cell, the involved devices have the ability to convert the chemical energy to electrical energy or vice-versa.

Classification of Electrochemical Cell:

Cathode

- Denoted by a positive sign since electrons are consumed here
- A reduction reaction occurs in the cathode of an electrochemical cell
- Electrons move into the cathode

Anode

- Denoted by a negative sign since electrons are liberated here
- An oxidation reaction occurs here
- Electrons move out of the anode

Types of Electrochemical Cells:

Galvanic cells (also known as Voltaic cells)

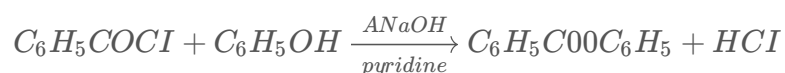
- Chemical energy is transformed into electrical energy.
- The redox reactions are spontaneous in nature.
- The anode is negatively charged and the cathode is positively charged.
- The electrons originate from the species that undergo oxidation.

Electrolytic cells

- Electrical energy is transformed into chemical energy.
- The redox reactions are non-spontaneous.
- These cells are positively charged anode and negatively charged cathode.
- Electrons originate from an external source.

80. Answer: a

Explanation:



Concepts:

1. Aldehydes, Ketones, and Carboxylic Acids:

Aldehydes, Ketones, and Carboxylic Acids are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

Aldehydes:

Aldehydes are organic compounds that have the functional group -CHO .

Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

Ketones:

Ketones are organic compounds that have the functional group C=O and the structure R-(C=O)-R' .

Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

Carboxylic Acid:

Carboxylic acids are organic compounds that contain a $(\text{C=O})\text{OH}$ group attached to an R group (where R refers to the remaining part of the molecule).

Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

81. Answer: c

Explanation:

The correct answer is option (C) : $\text{CH}_3\text{CH}_2\text{OH}$

Concepts:

1. Chemical Properties – Alcohols, Phenols and Ethers:

[Alcohols, phenols, and ethers](#) are organic compounds that have distinct chemical properties.

Alcohols are characterized by the presence of the hydroxyl ($-\text{OH}$) functional group, which makes them polar and capable of forming hydrogen bonds. They are typically classified as primary, secondary, or tertiary, depending on the number of alkyl groups attached to the carbon atom bearing the hydroxyl group. [Alcohols undergo various chemical reactions](#), including oxidation, dehydration, and esterification.

Phenols are organic compounds that contain an $-\text{OH}$ group attached to an aromatic ring. They are weaker acids than carboxylic acids but stronger acids than alcohols due to the resonance stabilization of the phenoxide ion. Phenols undergo various chemical reactions, including electrophilic substitution and oxidation.

Read More: [Classification of Alcohol, Phenols and Ethers](#)

Ethers are organic compounds that contain an oxygen atom bonded to two alkyl or aryl groups. They are characterized by their low boiling points and are often used as solvents. Ethers undergo various chemical reactions, including cleavage of the $\text{C}-\text{O}$ bond and oxidation.

In summary, alcohols, phenols, and ethers have distinct chemical properties due to the presence of the hydroxyl or ether functional group. Understanding these properties is important for understanding their reactivity and potential applications in various fields, including chemistry, biology, and industry.

82. Answer: d

Explanation:

Isostructural species are the molecules that have the same shape and also the same connectivity. In the question, BF_4^- , CCl_4 , NH_4^+ , PCl_4^+ are isostructural because they

have tetrahedral structure. The atoms occupy one of the vertices of the tetrahedron around the central atom.

83. Answer: b

Explanation:

The correct option is (B) : $\text{CH}_3 - \text{C} \equiv \text{CH}$

This is the process for making alkyne. In this reaction, reducing agents like alcohol KOH or sodamide are applied to the alkyl dihalide to produce alkyne as a byproduct.

Concepts:

1. Alkynes:

In [organic chemistry](#), an alkyne is an unsaturated hydrocarbon containing at least one carbon-carbon triple bond. Alkynes are an organic molecule that contains triple bonds between the carbon atoms. Its general formula is $\text{C}_n\text{H}_{2n-2}$. They are also known as acetylenes. In this article, we will deal with the structure of alkynes.

Isomerism in Alkynes:

Alkynes show three types of isomerism

1. **Chain isomerism** – Due to the different arrangement of carbon atoms in the chain that is straight chain or branched.
2. **Position isomerism** – Due to the difference in the location of the triple bond.
3. **Functional isomerism** – Isomeric with alkadienes both being represented by the general formula $\text{C}_n\text{H}_{2n-2}$.

Properties of Alkynes:

Physical Properties:

- Non-polar, unsaturated hydrocarbons.
- Highly soluble in organic and non-polar solvents and slightly soluble in polar solvents.
- High boiling point, in comparison to other hydrocarbons.

- Release a high amount of energy due to the repulsion of electrons in a reaction.
- More acidic than alkanes and alkenes due to SP hybridization.

Chemical Properties:

- Hydrogenation - Alkynes undergoes two types of hydrogenation reactions. Complete hydrogenation (in presence of Pd-C/ H₂) and partial hydrogenation (in presence of Linder's catalyst/H₂).
 - Act as a strong nucleophile by converting into acetylide.
 - React with BH₃ and undergo hydroboration reactions to form aldehydes and ketones.
 - Undergo halogenation reactions in the presence of different halogenating agents by different mechanisms and forms haloalkanes.
-

84. Answer: b

Explanation:

The correct option is (B): $\frac{\sqrt{3}}{2}a$

In BCC, there will be atoms at the body centre and at corners. So the distance between two nearest atoms is nothing but distance between point A and O

$$AO = \frac{AF}{2} = \frac{\sqrt{3}}{2}a.$$

Concepts:

1. Cell: The Unit of Life:

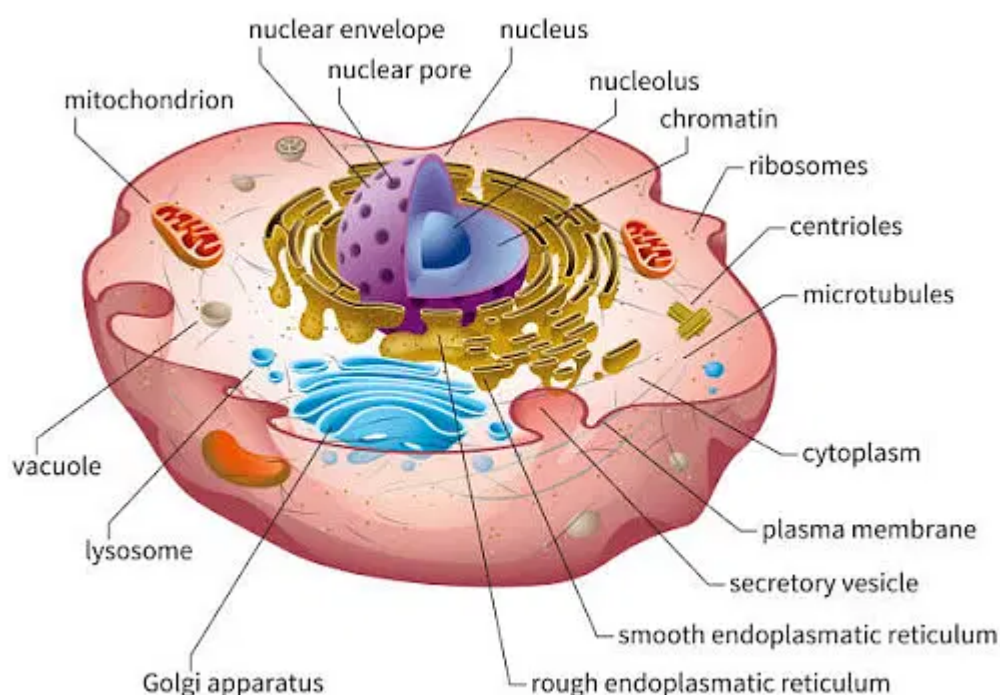
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus is present in the center of the cell, which includes all the hereditary information of an organism. Some of the molecules present in the cell are protein, carbohydrates, starch, and sugar.

Read More: [Fundamental Unit of Life: Cell](#)

Parts of Cell:

The different parts of a cell and their functions are as follows:

- Cell Membrane
- Cell Wall
- Nucleus
- Cytoplasm



85. Answer: c

Explanation:

Shape of SeF_4 would be see saw where as that of CH_4 would be tetrahedral

Concepts:

1. Chemical Bonding and Molecular Structure:

Such a group of atoms is called a [molecule](#). Obviously, there must be some force that holds these constituent atoms together in the molecules. The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a [chemical bond](#).

Types of Chemical Bonds:

There are 4 types of chemical bonds which are formed by atoms or molecules to yield compounds.

- **Ionic Bonds** – Ionic bonding is a type of chemical bonding which involves a transfer of electrons from one atom or molecule to another.
- **Covalent Bonds** – Compounds that contain carbon commonly exhibit this type of chemical bonding.
- **Hydrogen Bonds** – It is a type of polar covalent bonding between oxygen and hydrogen wherein the hydrogen develops a partial positive charge
- **Polar Bonds** – In Polar Covalent chemical bonding, electrons are shared unequally since the more electronegative atom pulls the electron pair closer to itself and away from the less electronegative atom.

Factors Affecting Bond Enthalpy in Chemical Bonding:

- Size of the Atom
- Multiplicity of Bonds
- Number of Lone Pair of Electrons Present
- Bond Angle

86. Answer: b

Explanation:



$$\text{Excess mole} = MV_{(ilt)}$$

$$= 0.01 \times \frac{100}{1000}$$

$$= 0.001$$

Concepts:

1. Coordination Compounds:

A coordination compound holds a central metal atom or ion surrounded by various oppositely charged ions or neutral molecules. These molecules or ions are re-bonded to the metal atom or ion by a coordinate bond.

Coordination entity:

A coordination entity composes of a central metal atom or ion bonded to a fixed number of ions or molecules.

Ligands:

A molecule, ion, or group which is bonded to the metal atom or ion in a complex or coordination compound by a coordinate bond is commonly called a ligand. It may be either neutral, positively, or negatively charged.

87. Answer: d

Explanation:

Insulin hormone helps in the conversion of glucose into glycogen by the liver and skeletal muscle. Insulin is secreted by pancreas that lower blood glucose level.

Concepts:

1. Biomolecules:

Biomolecules are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. These non-living molecules are the actual foot-soldiers of the battle of sustenance of life.

There are four major classes of Biomolecules – Carbohydrates, Proteins, Nucleic acids and Lipids.

1. **Carbohydrates** are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
2. **Proteins** are another class of indispensable biomolecules, which make up around 50per cent of the cellular dry weight. Proteins are polymers of amino acids arranged in the form of polypeptide chains. The structure of proteins is classified as primary, secondary, tertiary and quaternary in some cases.
3. **Nucleic acids** refer to the genetic material found in the cell that carries all the hereditary information from parents to progeny. There are two types of nucleic acids namely, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The main

function of nucleic acid is the transfer of genetic information and synthesis of proteins by processes known as translation and transcription.

4. **Lipids** are organic substances that are insoluble in water, soluble in organic solvents, are related to fatty acids and are utilized by the living cell.
-

88. Answer: c

Explanation:

For monoatomic

$$\frac{C_P}{C_V} = \gamma = 1.67$$

$\therefore$ Equal volume of two monoatomic gases so γ will remain same

Concepts:

1. States of Matter:

The matter is made up of very tiny particles and these particles are so small that we cannot see them with naked eyes.

There are three States of Matter:

The [three states of matter](#) are as follows:

Solid State:

- The solid-state is one of the fundamental states of matter.
- Solids differ from liquids and gases by the characteristic of rigidity.
- The molecules of solids are tightly packed because of ***strong intermolecular forces***, they only oscillate about their mean positions.

Liquid State:

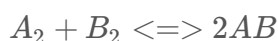
- The molecules in a liquid are closely packed due to ***weak intermolecular forces***.
- These forces are weaker than solids but stronger than that of gases.
- There is much space in between the molecules of liquids which makes their flowing ability easy.

Gaseous State:

- In this [state of matter](#), distances between the molecules are large (intermolecular distance is in the range of 10^{-7} – 10^{-5} cm).
 - The *intermolecular forces experienced between them are negligible*.
 - Thus, translatory, rotatory and vibratory motions are observed prominently in gases.
-

89. Answer: b

Explanation:



$$K_c = \frac{[AB]^2}{[A_2][B_2]} = \frac{2.8 \times 2.8 \times 10^{-6}}{3 \times 10^{-3} \times 4.2 \times 10^{-3}} = 0.62$$

Concepts:

1. Equilibrium:

An [equilibrium](#) represents a state in a process when the observable properties such as color, temperature, pressure, concentration etc do not show any change.

The word equilibrium means 'balance' which indicates that a [chemical reaction](#) represents a balance between the reactants and products taking part in the reaction. The equilibrium state is also noticed in certain physical processes such as the [melting point](#) of ice at 0°, both ice and water are present at equilibrium.

In the case of physical processes such as the melting of solid, dissolution of salt in water etc., the equilibrium is called **physical equilibrium** while the equilibrium associated with chemical reaction is known as [chemical equilibrium](#).

Equilibrium in Chemical changes

The chemical equilibrium in a reversible reaction is the state at which both forward and backward reactions occur at the same speed.

The stage of the reversible reaction at which the concentration of the reactants and products do not change with time is called the equilibrium state.

Read More: [Calculating Equilibrium Concentration](#)

Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

Homogenous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are all in the same phase. [Homogenous equilibrium](#) can be further divided into two types:

Reactions in which the number of molecules of the products is equal to the number of molecules of the reactants. For example,

- $\text{H}_2 (\text{g}) + \text{I}_2 (\text{g}) \rightleftharpoons 2\text{HI} (\text{g})$
- $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO} (\text{g})$

Reactions in which the number of molecules of the products is not equal to the total number of reactant molecules. For example,

- $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{SO}_3 (\text{g})$
- $\text{COCl}_2 (\text{g}) \rightleftharpoons \text{CO} (\text{g}) + \text{Cl}_2 (\text{g})$

Heterogeneous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are present in different phases. A few examples of [heterogeneous equilibrium](#) are listed below.

- $\text{CO}_2 (\text{g}) + \text{C} (\text{s}) \rightleftharpoons 2\text{CO} (\text{g})$
- $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$

Thus, the different types of chemical equilibrium are based on the phase of the reactants and products.

Check Out: [Equilibrium Important Questions](#)

90. Answer: c

Explanation:

The name of H_3PO_2 is hypophosphorous acid when dissolve in water, it gives only one H^+ , so its basicity is one.

Concepts:

1. P-Block Elements:

- P block elements are those in which the last electron enters any of the three p-orbitals of their respective shells. Since a p-subshell has three degenerate p-orbitals each of which can accommodate two electrons, therefore in all there are six groups of p-block elements.
- P block elements are shiny and usually a good conductor of electricity and heat as they have a tendency to lose an electron. You will find some amazing properties of elements in a P-block element like gallium. It's a metal that can melt in the palm of your hand. Silicon is also one of the most important metalloids of the p-block group as it is an important component of glass.

P block elements consist of:

- [Group 13 Elements](#): Boron family
- [Group 14 Elements](#): Carbon family
- [Group 15 Elements](#): Nitrogen family
- [Group 16 Elements](#): Oxygen family
- [Group 17 Elements](#): Fluorine family
- [Group 18 Elements](#): Neon family

91. Answer: b

Explanation:

```


$$\begin{array}{l} n=3 \text{ and } l=1 \\ \Rightarrow 3 \text{ p orbital so } 3 \text{ p orbital can accommodate } 6 \text{ electrons.} \end{array}$$


```

Concepts:

1. Structure of Atom:

Atomic Structure:

The atomic structure of an element refers to the constitution of its nucleus and the arrangement of the electrons around it. Primarily, the atomic structure of matter is made up of [protons](#), electrons and neutrons.

Dalton's Atomic Theory

Dalton proposed that every matter is composed of atoms that are indivisible and indestructible.

The following are the postulates of his theory:

- Every matter is made up of atoms.
- Atoms are indivisible.
- Specific elements have only one type of atoms in them.
- Each atom has its own constant mass that varies from element to element.
- [Atoms](#) undergo rearrangement during a chemical reaction.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

Cons of Dalton's Atomic Theory

- The theory was unable to explain the existence of [isotopes](#).
- Nothing about the structure of atom was appropriately explained.
- Later, the scientists discovered particles inside the atom that proved, the atoms are divisible.

Subatomic Particles

1. Protons – are positively charged subatomic particles.
2. Electron – are negatively charged subatomic particles.
3. Neutrons – are electrically neutral particles and carry no charge

Atomic Structure of Isotopes

Several atomic structures of an element can exist, which differ in the total number of nucleons. These variants of elements having a different nucleon number (also known as the mass number) are called isotopes of the element. Therefore, the isotopes of an element have the same number of protons but differ in the number of neutrons. For example, there exist three known naturally occurring isotopes of hydrogen, namely, protium, deuterium, and tritium.

92. Answer: b

Explanation:

In 7 g nitrogen, number of molecules = $\frac{7.0}{28} \text{ mol}$
 $= 0.25 \times N_A$ molecules

where, $N_A = \text{Avogadro number} = 6.023 \times 10^{23}$

In 2 g of $H_2 = \frac{2.0}{2} \text{ mol} = 1 \times N_A$ molecules

In 16 g of $\backslash$, $NO_2 = \frac{16.0}{46} \text{ mol}$
 $= 0.348 \times N_A$ molecules

In 16 g of $O_2 = \frac{16}{32} \text{ mol} = 0.5 \times N_A$ molecules

Hence, maximum number of molecules are present in 2 g of H_2 .

Concepts:

1. Some Basic Concepts of Chemistry:

Chemistry is a vast subject and for understanding its significance we can take help of following points:

- Chemistry plays an important role in understanding various subjects like physics, geology and biology.
- Chemistry is a core branch of science that explains us about the various compositional properties and interaction of **matter**. It also helps to understand various **chemical reactions**.
- Chemistry is important in order to understand the behaviour of **fertilizers**, alkenes, acids, salts, dyes, **polymers**, drugs, soaps and alloys in organic and **inorganic chemistry**.
- Chemistry plays an important role in various fields like healthcare, industrial, research, food, and farm activities.

Read More: [Some Basic Concepts of Chemistry](#)

Classification of Matter

There are two ways of classifying the matter:

(A) Physical Classification:

Matter can exist in three physical states:

1. **Solids** - have definite volume and definite shape
2. Liquids - have definite volume but not definite shape.
3. Gases - have neither definite volume nor definite shape.

(B) Chemical Classification:

Based upon the composition, matter can be divided into two main types:

1. **Pure Substances** are defined as a single substance (or matter) which cannot be separated by simple physical methods. Pure substances can be further classified as (i) Elements (ii) Compounds
2. Mixtures are the combination of two or more elements or **compounds** which are not chemically combined together and may also be present in any proportion.

93. Answer: a

Explanation:

$$\Delta U = q + w$$

$$\Delta G = \Delta H - T\Delta S$$

ΔU and ΔG are state functions but q and w are not state functions.

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System** – An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System** – Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System** – In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The [Zeroth law of thermodynamics](#) states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The [First law of thermodynamics](#) is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The [Second law of thermodynamics](#) is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

94. Answer: a

Explanation:

Molarity includes volume of solution which can change with change in temperature.

Concepts:

1. Solutions:

A [solution](#) is a homogeneous mixture of two or more components in which the particle size is smaller than 1 nm.

For example, salt and sugar is a good illustration of a solution. A solution can be categorized into several components.

Types of Solutions:

The solutions can be classified into three types:

- **Solid Solutions** – In these solutions, the **solvent** is in a Solid-state.
- **Liquid Solutions**– In these solutions, the solvent is in a Liquid state.
- **Gaseous Solutions** – In these solutions, the solvent is in a Gaseous state.

On the basis of the amount of solute dissolved in a solvent, solutions are divided into the following types:

1. **Unsaturated Solution**– A solution in which more solute can be dissolved without raising the temperature of the solution is known as an unsaturated solution.
2. **Saturated Solution**– A solution in which no solute can be dissolved after reaching a certain amount of temperature is known as an unsaturated saturated solution.
3. **Supersaturated Solution**– A solution that contains more solute than the maximum amount at a certain temperature is known as a supersaturated solution.

95. Answer: d

Explanation:



$$\frac{156}{156} \times 2 \times 78 \text{ g of } C_6H_6 \text{ requires } \frac{330}{156} \times 15 \times 32 \text{ g of } O_2$$

$$\therefore 156 \text{ g of benzene required oxygen} = 15 \times 22.4 \text{ L}$$

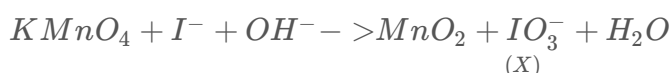
$$\therefore 1 \text{ g of benzene required oxygen} = \frac{15 \times 22.4}{156} \text{ L}$$

$$\therefore 39 \text{ g of benzene required oxygen} = \frac{15 \times 22.4 \times 39}{156}$$

$$= 84.0 \text{ L}$$

96. Answer: c

Explanation:



Concepts:

1. D and F Block Elements:

The d-block elements are placed in groups 3-12 and F-block elements with 4f and 5f orbital filled progressively. The general [electronic configuration](#) of [d block elements](#) and [f- block elements](#) are $(n-1) d^{1-10} ns^{1-2}$ and $(n-2) f^{1-14} (n-1) d^1 ns^2$ respectively. They are commonly known as transition elements because they exhibit multiple oxidation states because of the d-d transition which is possible by the availability of vacant d orbitals in these elements.

They have variable Oxidation States as well as are good catalysts because they provide a large surface area for the absorption of reaction. They show variable oxidation states to form intermediate with reactants easily. They are mostly lanthanoids and show lanthanoid contraction. Since differentiating electrons enter in an anti-penultimate f subshell. Therefore, these elements are also called inner transition elements.

Read More: [The d and f block elements](#)

97. Answer: a

Explanation:

Answer (a) third order reaction

Concepts:

1. Chemical Kinetics:

[Chemical kinetics](#) is the description of the [rate of a chemical reaction](#). This is the rate at which the reactants are transformed into products. This may take place by abiotic or by biological systems, such as microbial metabolism.

Rate of a Chemical Reaction:

The speed of a reaction or the rate of a reaction can be defined as the change in concentration of a reactant or product in unit time. To be more specific, it can be expressed in terms of: (i) the rate of decrease in the concentration of any one of the reactants, or (ii) the rate of increase in concentration of any one of the products.

Consider a hypothetical reaction, assuming that the volume of the system remains constant. $R \rightarrow P$

Read More: [Chemical Kinetics MCQ](#)

Factors Affecting The Reaction Rate:

- **The concentration of Reactants** – According to [collision theory](#), which is discussed later, reactant molecules collide with each other to form products.
- **Nature of the Reactants** – The reaction rate also depends on the types of substances that are reacting.
- **Physical State of Reactants** – The physical state of a reactant whether it is solid, liquid, or gas can greatly affect the rate of change.
- **Surface Area of Reactants** – When two or more reactants are in the same phase of fluid, their particles collide more often than when either or both are in the solid phase or when they are in a heterogeneous mixture. In a heterogeneous medium, the collision between the particles occurs at an interface between phases. Compared to the homogeneous case, the number of collisions between reactants per unit time is significantly reduced, and so is the reaction rate.
- **Temperature** – If the temperature is increased, the number of collisions between reactant molecules per second. Increases, thereby increasing the rate of the reaction.
- **Effect Of Solvent** – The nature of the [solvent](#) also depends on the reaction rate of the solute particles.
- **Catalyst** – [Catalysts](#) alter the rate of the reaction by changing the reaction mechanism.

98. Answer: d

Explanation:

The structures of acetophenone and benzophenone are . When acetophenone containing is treated with I_2 and Na_2CO_3 it forms yellow precipitate of CHI_3 whereas benzophenone does not give this test. Acetophenone gives iodoform test due to presence of $-COCH_3$ group.

Concepts:

1. Aldehydes, Ketones, and Carboxylic Acids:

Aldehydes, Ketones, and Carboxylic Acids are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

Aldehydes:

Aldehydes are organic compounds that have the functional group -CHO .

Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

Ketones:

Ketones are organic compounds that have the functional group C=O and the structure R-(C=O)-R' .

Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

Carboxylic Acid:

Carboxylic acids are organic compounds that contain a $(\text{C=O})\text{OH}$ group attached to an R group (where R refers to the remaining part of the molecule).

Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

99. Answer: b

Explanation:

We know that $\text{specific conductance} = \text{Cell constant} \times \text{conductance} \Rightarrow \text{Cell constant} = \text{Resistance} \times \text{sp. conductance} = 55 \times 0.0112 = 0.616 \text{ cm}^{-1}$

Concepts:

1. Electrochemical Cells:

An **electrochemical cell** is a device that is used to create electrical energy through the chemical reactions which are involved in it. The electrical energy supplied to electrochemical cells is used to smooth the chemical reactions. In the electrochemical cell, the involved devices have the ability to convert the chemical energy to electrical energy or vice-versa.

Classification of Electrochemical Cell:

Cathode

- Denoted by a positive sign since electrons are consumed here
- A reduction reaction occurs in the cathode of an electrochemical cell
- Electrons move into the cathode

Anode

- Denoted by a negative sign since electrons are liberated here
- An oxidation reaction occurs here
- Electrons move out of the anode

Types of Electrochemical Cells:

Galvanic cells (also known as Voltaic cells)

- Chemical energy is transformed into electrical energy.
- The redox reactions are spontaneous in nature.
- The anode is negatively charged and the cathode is positively charged.
- The electrons originate from the species that undergo oxidation.

Electrolytic cells

- Electrical energy is transformed into chemical energy.
- The redox reactions are non-spontaneous.

- These cells are positively charged anode and negatively charged cathode.
 - Electrons originate from an external source.
-

100. Answer: b

Explanation:

The correct option is (B): Racemic mixture.

$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3 \rightarrow \text{CH}_3\text{-CH}_2\text{CH-CH}_3$ intermediate Sp_2 hybrid planar shape $\rightarrow$ Cl
recemic mix.

Concepts:

1. Haloalkanes and Haloarenes:

The hydrocarbons such as [Haloalkanes and Haloarenes](#) are the ones, in which one or more [hydrogen](#) atoms are replaced with halogen atoms. The main difference between Haloalkanes and Haloarenes is that Haloalkanes are derived from open chained hydrocarbons, also called alkanes, and Haloarenes are derived from aromatic hydrocarbons.

- Haloalkanes have hydrocarbons made up of aliphatic alkanes and one or more hydrogen atoms replaced by [halogens](#) (elements such as Chlorine, Bromine, Fluorine, Iodine, etc.) whereas, haloarenes consist of aromatic ring or rings and one or more hydrogen atoms replaced by halogens.
- In haloalkanes, the halogen atom is attached to the sp^3 hybridized carbon atom of the alkyl group whereas, in haloarenes, the halogen atom is attached to the sp^2 hybridized carbon atom of the alkyl group.
- Haloalkanes are saturated organic compounds where all the chemical bonds are attached to the carbon atom with single bonds and a single carbon atom is attached to the Halogen atom, whereas, the haloarenes differ from Haloalkanes by their method of preparation and properties.
- Haloalkanes are made by aliphatic alkanes by the process of free radical halogenation, whereas, haloarenes are made by direct halogenation of aromatic rings.
- Haloalkanes are odorless compounds, whereas, haloarenes have a sweet odor.
- Haloalkanes precipitate in SN^2 substitution reactions, whereas, haloarenes do not precipitate in SN^2 substitution reactions.

- Example of haloalkanes is CH_3Cl (Methyl Chloride) and $\text{CH}_3\text{CH}_2\text{Br}$ (Ethyl Bromide) and the example of haloarenes is Chlorobenzene, Bromobenzene.
-

101. Answer: d

Explanation:

Members of kingdom monera - bacteria and cyanobacteria (blue green algae) have the ability to fix nitrogen. Azotobacter is a N_2 -fixing bacteria. Anabaena and Nostoc are heterocystous blue-green algae. The heterocysts are the sites of N_2 -fixation. Spirogyra is one of the commonest green algae. It has no function in nitrogen fixation.

Concepts:

1. Microbes in Human Welfare:

There are several valuable [microorganisms that are beneficial to humans](#) in various manners such as:

In Household Products

1. Fermentation of milk to produce yogurt.
2. Milk curdling to compose curd, cheese, and paneer.

In Industrial Products

1. Production of beverages such as wine, beer, whiskey, brandy, or rum.
2. Production of antibiotics such as Penicillin and other chemical substances to kill or retard the expansion of disease-causing microbes.

Fermented Beverages

1. A fermentor is used to produce microbes on a large scale for industrial purposes.
2. The brewer's yeast (*Saccharomyces cerevisiae*) is used to make ethanol. At this time, the yeast ferments malted cereals and fruit juices.

Antibiotics

1. The term antibiotic means “against life”. These materials can kill or destroy the growth of other microbes.

102. Answer: a

Explanation:

Colourblindness is a recessive sex-linked trait. Since the woman's father was colour blind. She should be carrier of the colour blind gene (XCX). When she marries to colour blind man their progeny could be

Concepts:

1. Principles of Inheritance and Variation – Mutation:

A **Mutation** is a change in the sequence of our DNA base pairs caused by numerous environmental stimuli such as UV light or mistakes during DNA replication. Germline mutations take place in the eggs and sperm and can be passed onto offspring, whereas somatic mutations take place in body cells and are not passed on.

Types of Mutations

There are three [types of mutations](#), which are as follows:

Silent mutation

It refers to any change in DNA sequence that has no effect on the amino acid sequence in a protein or the functions that a protein performs. There is no phenotypic indication that a mutation has occurred.

Nonsense mutation

When there is a change in the sequence of base pairs due to a point mutation, that results in a stop codon. This leads to a protein that is either shortened or non-functional.

Missense mutation

A missense mutation occurs when a point mutation causes a change in the codon, which then codes for another amino acid.

The mutation is caused by the following factors:

Internal Causes

When DNA copies incorrectly, the majority of mutations occur. Evolution occurs as a result of all of these mutations. DNA makes a copy of itself during cell division. When a copy of DNA isn't flawless, it's called a mutation since it differs somewhat from the original DNA.

External Causes

When certain chemicals or radiations are used to break down DNA, it causes the DNA to break down. The thymine dimers are broken by UV radiation, resulting in altered DNA.

103. **Answer: a**

Explanation:

Production of body heat

Concepts:

1. Locomotion and Movement:

Locomotion

The movement of a creature from one place to another is known as locomotion. During the process, there is the action of appendages such as wings, limbs, and flagella. In some animals, like fish, whales, and sharks, locomotion upshots from a wave-like series of muscle contractions. Locomotion helps an **organism** in finding their food, avoid harsh weather conditions, escape from their predators, etc.

Some examples of locomotion are walking, running, swimming, etc. Movement, on the other hand, refers to any type of motion that need not be localized.

Read More: [Locomotion and Movement](#)

Movement

Movement is generally described as a state of changing the position from rest to motion or vice-versa. Movement can be both voluntary movement and involuntary movement. Movement helps an organism perform essential functions, such as pumping [blood](#) to the different parts of the body, etc.

Read More: [Difference between Locomotion and Movement](#)

104. Answer: c

Explanation:

Two DNA polymerase molecules work simultaneous at the DNA fork, one on the leading strand and the other on the lagging strand.

Each Okazaki fragment is synthesized by DNA polymerase at lagging strand in $5' \rightarrow 3'$ direction. New Okazaki fragments appear as the replication fork opens further.

As the first Okazaki fragment appears away from the replication fork, the direction of elongation would be away from replication fork.

Concepts:

1. The Molecular Basis of Inheritance:

DNA Replication:

DNA synthesis is commenced at particular points within the DNA strand referred to as 'origins', which are certain coding regions. There are numerous origin sites, and when replication of DNA starts, these sites are mentioned as replication forks. Within the replication, the complex is the enzyme DNA Helicase, so that they can be utilized as a template for replication. DNA Primase is another enzyme that's essential in DNA replication.

RNA:

Ribonucleic acid (RNA) is an essential biological macromolecule that exists all together in biological cells. It is principally involved in the synthesis of proteins, that

carry the messenger instructions from DNA, which itself contains the genetic instructions needed for the event and maintenance of life. In some viruses, RNA, in spite of DNA, carries genetic information.

Genetic Code:

Genetic code is the term we use in the manner that the four bases of DNA--the A, C, G, and Ts--are strung together in a way that the ribosome, the cellular machinery, can read them and switch them into a protein. In the ordering, every three nucleotides during a row count as a triplet and code for one amino alkanoic acid.

Read More: [Molecular Basis of Inheritance](#)

105. Answer: d

Explanation:

A-(iii), B-(iv), C-(i), D-(ii)

Concepts:

1. Cell: The Unit of Life:

- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus is present in the center of the cell, which includes all the hereditary information of an organism. Some of the molecules present in the cell are protein, carbohydrates, starch, and sugar.

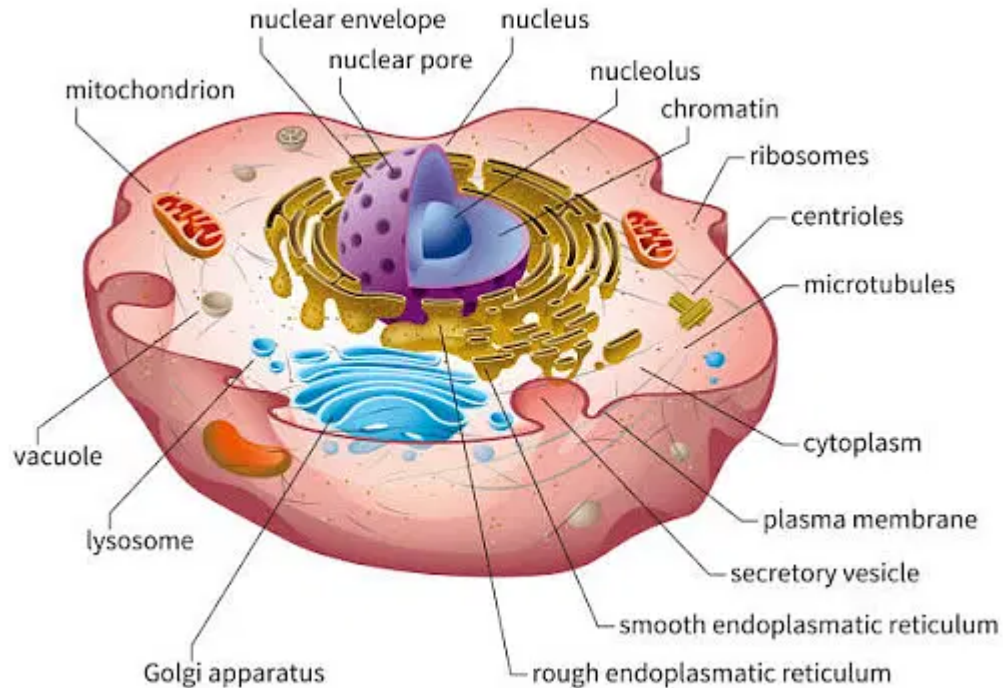
Read More: [Fundamental Unit of Life: Cell](#)

Parts of Cell:

The different parts of a cell and their functions are as follows:

- Cell Membrane

- Cell Wall
- Nucleus
- Cytoplasm



106. Answer: d

Explanation:

Mitotic anaphase differs from metaphase in possessing same number of chromosomes and half number of chromatids. During anaphase of mitosis, chromosomes divide at the point of centromere or kinetochore and thus two sister chromatids are formed which are called as chromosomes. While during metaphase, chromosomes become maximally distinct due to further contraction and thus size of chromosomes is measured at mitotic metaphase.

Concepts:

1. Cell Cycle and Cell Division:

Cell Cycle:

The sequence of events by which a cell copies itself synthesizes other constituents of the cell and eventually splits into two daughter cells is termed the cell cycle. The cell synthesizes all its constituents in a sequential pattern to make sure the proper division and distribution of components that occurs between the two daughter cells. Therefore, we can say that the cell cycle is the period of time between the development of new daughter cells and their further division.

Stages of Cell Cycle:

The cell cycle can be sub-divided into an additional category of Interphase. Meanwhile, the Interphase can be branched into 3 further stages, such as:

1. G1 Phase - "Gap 1 Phase"
2. S Phase - "Synthesis Phase"
3. G2 Phase - "Gap 2 Phase"

Read More: [Cell Cycle and Cell Division](#)

Cell Division:

The division of the parent cells into two or more cells is called daughter cell, [cell division](#) takes place. In general, it occurs as a part of a larger cell cycle. All the cell reproduces by dividing into two, wherein each parental cell produces two daughter cells.

Stages of Cell Division:

Cell division can be widely divided into several sub-segments that result from Mitosis and Meiosis.

1. Mitosis or (M Phase)
2. Meiosis

107. Answer: d

Explanation:

The ventricles consist of four hollow, fluid filled spaces inside the brain. The third ventricle is also known as diacoel. The third ventricle consists of a narrow channel

between the hemispheres through the area of the thalamus. It is connected by the cerebral aqueduct or aqueduct of Sylvius or iter in the midbrain portion of the brainstem to the fourth ventricle in the pons and medulla. Metacoel is the IV ventricle, rhinocoel is the I ventricle and paracoel are the II ventricles.

Concepts:

1. Neural Control and Coordination:

Neural System:

Neurons are the most specialised cells in the nervous system of all animals, and they are responsible for detecting, accepting, and conveying numerous types of motives. The neurological system of low-spinal animals like Hydra is incredibly simple, consisting of a network of neurons. When the brain of an insect comprises a vast number of ganglia and neural tissues, it is optimally structured.

Coordination System:

Coordination is the process by which two or more organs work together to accomplish each other's duties. Increased muscle activity increases the supply of oxygen and the demand for energy while we exercise. When we cease exercising, our nerves, heart, lungs, and kidneys all return to normal. As a result, all of the organs' functions are properly integrated in order to conduct the exercise and supply the appropriate conditions while exercising. Similarly, in the human body, the neurological and endocrine systems work together to coordinate all of the organ activities.

108. Answer: d

Explanation:

In order to link the alien DNA, the cloning vector needs to have very few, preferably single recognition sites for the commonly used restriction enzymes. Presence of more than one recognition sites within the vector will generate several fragments, which will complicate the gene cloning.

Concepts:

1. Biotechnology:

[Biotechnology](#) is a vast field of biology that involves the creation, production, and modification of useful products for human welfare using both the technology and the execution of living organisms and their components. An agricultural engineer, Karoly Ereky, coined the word "biotechnology" in 1919, achieving him the title of "Father of Biotechnology."

Principles of Biotechnology:

Among many, the two core techniques that entitled the birth of modern biotechnology are :

1. **Genetic Engineering** is one of the methods of direct modifications of an organism's genome (i.e., DNA and RNA). It requires the introduction of new genes into host species to escalate function or trait, hence altering the host organism's phenotype.
2. **Bioprocess Engineering** is one of the methods of maintaining sterile conditions to facilitate the growth of large quantities of desired microbes and other eukaryotic cells for the development of new or modified biotechnological products such as enzymes, vaccines, antibiotics, and other biotechnological products.

109. Answer: b

Explanation:

The correct answer is option (B): (a), (b) and (c) are correct

Concepts:

1. Earthworm:

An [earthworm](#) is a terrestrial invertebrate that is to the phylum Annelida. They display a tube-within-a-tube body plan; they are externally subdivided with corresponding internal subdivision, and they usually have setae on all divisions. They arise worldwide where soil, water, and temperature allow.

Generally, earthworms are found in soil, eating a wide variety of organic matter. This organic matter incorporates plant matter, rotifers, nematodes, bacteria, living protozoa, fungi, and other microorganisms. An [earthworm's digestive system](#) runs the expanse of its body. An [earthworm respire](#)s throughout its skin. It has a double transport system made up of coelomic fluid that goes within the fluid-filled coelom and a simple, closed circulatory system.

It has a nervous system – “central and peripheral”. Its central nervous system comprises two ganglia above the mouth, one on either side, connected to a nerve running along its length to motor neurons and sensory cells in each segment. Large numbers of chemoreceptors concentrate close to its mouth.

Read More: [Reproductive System of Earthworm](#)

110. Answer: b

Explanation:

The pituitary gland consists of distinct sections, each responsible for producing specific hormones:

- The middle lobe, known as the pars intermedia, releases melanocyte-stimulating hormone (MSH), which influences skin pigmentation by acting on melanin-containing cells.
- The anterior lobe of the pituitary gland produces a range of hormones, including prolactin, growth hormone, FSH, LH, TSH, and ACTH.
- The posterior lobe of the pituitary gland secretes oxytocin and vasopressin.
- The pineal gland, a separate structure, produces melatonin, a hormone that plays a role in regulating sleep-wake cycles.

So, the correct option is (B): Middle lobe of pituitary

Concepts:

1. Chemical Coordination and Integration:

The [chemical coordination and integration](#) of all physiological functions in the animal body are jointly synchronized by the neural and endocrine systems. The [control and coordination](#) of body functions are executed by the [endocrine glands](#). They are

ductless glands that secrete several hormones to control and coordinate body functions.

Human Endocrine System:

The human body has several endocrine glands located in different parts. They cover the pituitary gland, thymus, thyroid gland, pineal gland, parathyroid, pancreas (dual gland), adrenal gland, and gonads (testes and ovaries). The liver, kidney, heart, and gastrointestinal tract also produce hormones in small traces to harmonize the functioning of these organs.

The [Hypothalamus](#) comprises groups of secretory cells called nuclei which secrete various hormones. These hormones released by the hypothalamus are important in regulating the synthesis and secretion of pituitary hormones.

Functions of Endocrine Glands:

- Pituitary Gland
- Pineal Gland
- Thyroid Gland
- Parathyroid Gland
- Thymus
- Adrenal Gland
- Pancreas
- Testes
- Ovary
- Hormones of Kidney, Heart, and Gastrointestinal Tract

111. Answer: c

Explanation:

Glycine is the simplest amino acid because it has a hydrogen atom as its side chain (R-group), making it the smallest and simplest in terms of chemical structure.

So, the correct answer is (C): Glycine

Concepts:

1. Proteins:

An essential part of every cell in our body, [protein](#) is one of the three macronutrients which is required by our body in larger amounts. Proteins are made up of linear chains of smaller units called [amino acids](#). Every biochemical process that takes place inside our bodies is possible because of these proteins. Proteins are 3-dimensional structures that are assembled with different amino acid sequences.

Functions of Protein

Proteins are used in many ways. Some of their functions are:

- **Enzymes:** Most of the important chemical reactions which take place inside a cell are mostly carried out by enzymes. They also play a role in regenerating and creating DNA molecules and carrying out complex processes.
- **Hormonal Regulation:** Proteins create various types of hormones that help in balancing the components of the body. For example, hormones like insulin help in regulating blood sugar and secretin. The formation of digestive juices essential for the whole digestion process is also possible because of hormones.
- **Protection:** Being the main constituent of antibodies, proteins protect our body against antigens and pathogens thus preventing infections.
- **Energy:** Proteins are one the most essential sources of energy required for our body movements. The right amount of proteins should be consumed so that they can be turned into energy.
- **Structural functions:** Proteins are the building blocks of the body. They are required for the growth, development, healing, and repair of tissues. Proteins are essential in order to strengthen various structures like hair, skin, and muscles. It is also present in the outer membrane of all cells in the human body.

Classification of Protein

Proteins are classified on the basis of:

1. Shape
2. Constitution
3. Nature of Molecules

Protein Structure

A protein [molecule](#) is made from a long chain of amino acids, each linked to its neighbor through a covalent peptide bond. The structure of proteins are divided into four types:

1. Primary Structure
 2. Secondary Structure
 3. Tertiary Sector
 4. Quaternary Structure
-

112. Answer: b

Explanation:

Uricotelism is the excretion process where uric acid serves as the primary nitrogenous waste substance that gets expelled. This phenomenon is observed in various creatures including insects, certain terrestrial crustaceans, land-dwelling snails, reptiles inhabiting land, and birds. These animals employ uricotelism as a means to conserve water, which is crucial for their survival.

Concepts:

1. Excretory products and their elimination:

The physiological process of the elimination of metabolic waste from the body is called [excretion](#). The excretory products comprise amino acids, carbon dioxide, urea, uric acid, water, and ammonia. Some of the Molluscs and Echinoderms excrete waste products from the body in the form of amino acids. Ammonia is the foremost excretory product in animals, it is derived from the proteins exists in the food we eat.

Excretory Products in Different Organisms:

Organisms	Excretory Products	Excretory Organs
Paramecium,	Ammonia	Contractile vacuole
Amoeba	Ammonia	Contractile vacuole
Hydra	Ammonia	General body surface
Ascaris	Ammonia	Renette cells
Periplaneta	Uric acid	Malpighian tubule
Palaemon	Uric acid	Antennary gland
Pheretima	Ammonia	Nephridial system
Spider	Uric acid	Coxal glands, Malpighian tubule
Taenia	Ammonia	Protonephridia
Leucon	Ammonia	General body surface

Read More: [Excretion in Human Beings](#)

113. Answer: b

Explanation:

The correct matchings are:

- A. Trachea is the respiratory organ of Silver fish.
- B. Book lung is the respiratory organ of Scorpion.
- C. Pharyngeal gills is the respiratory organ of Sea squirt.

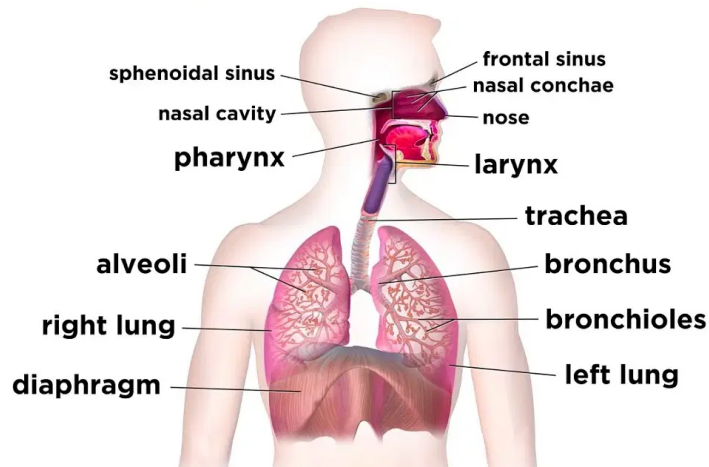
So, the correct answer is (B): A, B, and C

Concepts:

1. The Respiratory System:

[Human Respiratory System](#) is a compound biological system of organs and tissues that helps in gaseous exchange. The system includes airways, lungs, and [blood vessel](#) s. Its core function is to introduce oxygen and expel carbon dioxide from the body. The atmospheric air is continuously pumped in and out through a system of pipes which are called the conducting airways. There are a great number of muscles and blood vessels involved in the whole process of respiration.

The Respiratory System



Features of Human Respiratory System:

- The respiratory system is essential for inhalation of oxygen and transportation of the same to the different parts of the body where it is used for cellular respiration.
- The design of the lungs is created in a manner that helps in gaseous exchange in an efficient manner. The other parts of the respiratory system such as the nose, pharynx, larynx, trachea, and bronchi help in the process of bringing in oxygen to the lungs and taking carbon dioxide out of it.
- There is an arrangement of muscles such as the diaphragm and intercostal muscles that aid in the process of human respiration.

114. Answer: a

Explanation:

The organisms attached to the substratum possess radial symmetry in all vertical planes. All the animals belonging to cnidaria (e.g. jellyfish) and echinodermata (e.g. starfish) are radially symmetrical and typically sessile in their adult form. In radial symmetry the parts in an organ or organism when cut through the centre in any direction produces two halves that are mirror images of each other.

Concepts:

1. Animal Kingdom:

Animals are eukaryotic, multicellular species that belong to the [Kingdom Animalia](#). Every animal has a distinct characteristic. They get energy either by feeding on plants or on other animals. There are millions of species that have been recognized, few shares similar characteristics while others vary drastically.

Kingdom Animalia comprises all animals. In the midst of the five kingdoms, the largest kingdom is the animal kingdom. Animals are multicellular eukaryotes. Though, like plants, they do not possess chlorophyll or a cell wall. Therefore, members of the animal kingdom indicate a heterotrophic mode of nutrition. Kingdom Animalia is further classified into ten different subphyla based on their body designs or differentiations.

The different phyla of the Kingdom Animalia are as follows:

1. Porifera
2. Coelenterata (Cnidaria)
3. Platyhelminthes
4. Nematoda
5. Annelida
6. Arthropoda
7. Mollusca
8. Echinodermata
9. Hemichordata
10. Chordata

Read More: [Classification of Animal Kingdom](#)

115. Answer: d

Explanation:

According to fossils, the evolution of modern horse began in the eocene epoch in North America with a foxsized species originally named Eohippus. But later on, it was renamed Hyracotherium. After its origin, Hyracotherium spread throughout Europe and Asia.

Concepts:

1. Evolution:

Evolution is a process that occurs in changes in the genetic content of a population over time. Evolutionary change is generally classified into two: microevolution and macroevolution. The process of changes in allele frequencies in a population over time is a microevolutionary process. Three main mechanisms that cause allele frequency change are natural selection, genetic drift, and gene flow. On the other hand, macroevolution refers to change at or above the level of the species.

116. Answer: c

Explanation:

After fertilization, zygote undergoes rapid mitotic divisions, called cleavage, which is characterized by absence of growth of daughter cells. This leads to the conversion of single celled zygote into a multicellular structure called blastocyst or blastula. Implantation or embedding of zygote into endometrium of uterus occurs in blastocyst stage. The various stages in the journey of a fertilized egg from fertilization in the Fallopian tube to the implantation site in the uterus is illustrated in the given figure. Blastocyst comes in contact with the endometrium in the region of embryonal knob or embryonic disc. It adheres to the same. The surface cells of trophoblast secrete lytic enzymes which cause corrosion of endometrial lining. They also give rise to finger-like outgrowths called chorionic villi. Chorionic villi and uterine tissue become interdigitated. Villi not only help in fixation but also absorption of nourishment.

Concepts:

1. Human Reproduction:

Reproduction in human beings involves the fusion of male and female gametes that produces in their **reproductive system**.

Male Reproductive System:

The male reproductive system comprises:

- **Testicles (testes):** A pair of oval-shaped organs masked in a pouch known as the scrotum. They manage the production of sperms and the male hormone testosterone.
- **Scrotum:** It is a sac-like organ that hangs under the penis and behind it. It is the house of the testes, or testicles, and maintains a temperature that is needed for the production of sperm by it.
- **Vas deferens:** The sperms produced in testes are stored in a tube known as the epididymis. Here the sperms get matured and pass to the urethra via the muscular tube known as vas deferens.
- **Accessory glands:** This includes three glands, namely the prostate gland, seminal vesicles, and Cowper's gland. The secretions from the mentioned three glands mix to form a fluid known as semen. Semen nourishes the sperm, raises the volume, and helps in lubrication.
- **Penis:** The penis is a cylindrical tube that serves as both an excretory organ, and a reproductive organ. It transfers sperms into the vagina during sexual intercourse.

Female Reproductive System:

The **female reproductive system** is active before, during, and after fertilization as well. It comprises the following parts:

- **A pair of ovaries:** A pair of ovaries produce and stores ovum in them. They also produce a female hormone known to be estrogen.
- **Fallopian tubes (Oviducts):** They are the area of fertilization. They connect both the ovaries with the uterus.
- **Uterus:** Uterus is the place of development for the embryo.
- **Vagina:** The part that connects the cervix to the external female body parts is called a vagina. It is the passage for the penis during coitus as well as a fetus during transfer.

117. Answer: d

Explanation:

Kingdom Monera includes prokaryotes – mycoplasma, bacteria, actinomycetes and cyanobacteria or blue green algae.

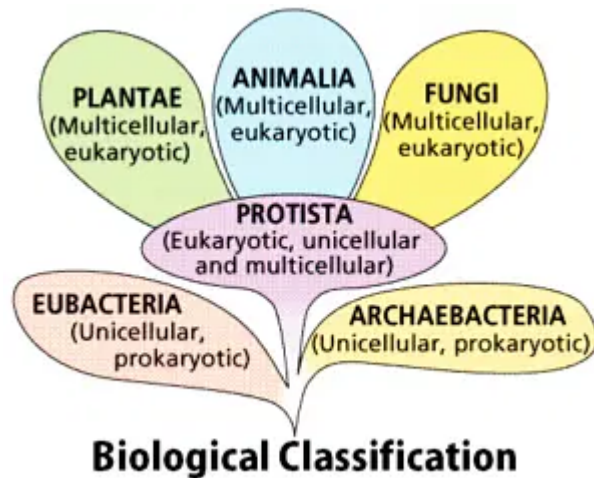


Concepts:

1. Biological Classification:

The process of grouping living organisms into categories is called [biological classification](#). The most modern 5-kingdom classification was put ahead by an eminent scientist R.H. Whittaker. The [five-kingdom classification](#) is based on the criteria like [cell structure](#), mode of nutrition, body form, and [reproduction](#). One of the most important characteristics of this system is that it follows the evolutionary sequence of living organisms. The organisms are classified into distinct taxa or levels like Kingdom, Phylum, Division, Class, Order, Family, [Genus](#), and [Species](#). The 5 kingdoms are as follows:

- [Kingdom Monera](#)
- [Kingdom Protista](#)
- [Kingdom Fungi](#)
- [Kingdom Plantae](#)
- [Kingdom Animalia](#)



118. Answer: b

Explanation:

Lysozyme is an antibacterial enzyme with natural antibiotic properties. Normally excreted in the tears, nasal mucus, milk, and saliva in most animals, lysozyme is part of the body's first natural defence against bacteria and viruses. Lysozyme is an enzyme that degrades the polysaccharide protective coating on the surface of many bacteria and viruses (glycoprotein covering) to allow other enzymes and antibodies to find their appropriate attachment site. Most of the bacteria affected by lysozyme are not pathogenic. Lysozyme serves as a non-specific innate opsonin by binding to the bacterial surface, reducing the negative charge and facilitating phagocytosis of the bacterium before opsonins from the acquired immune system arrive at the scene. In other words, lysozyme makes it easier for phagocytic white blood cells to engulf bacteria.

Concepts:

1. Human Health and Disease:

Health is described as a state of complete physical, mental and social well-being.

The **disease** is a circumstance where malfunctioning of the body organs occurs leading to uneasiness and discomfort.

Differences between Infectious Diseases and Non-Infectious Diseases:

Infectious diseases	Non-infectious diseases
•These diseases are easily transmitted from one person to another. •Examples: AIDS, Typhoid	•These diseases remain restricted to the person and are not easily transmitted from one person to another. •Examples: Diabetes, Cancer

Common Diseases in Humans:

Diseases	Pathogen	Signs and Symptoms
Typhoid	<i>Salmonella typhi</i>	High fever, low pulse rate, abdominal pain, frequent stools
Pneumonia	<i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i>	Lymph and mucus collect in the alveoli and bronchioles
Common cold	<i>Viruses like Rhino viruses</i>	Nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness
Malaria	<i>Plasmodium</i>	Fever, restlessness, less appetite, slight sleeplessness, muscular pains, headache and feeling of chilliness
Amoebiasis	<i>Entamoeba histolytica</i>	Blood along with faeces and abdominal pain
Ascariasis	<i>Ascaris</i>	Obstruction of intestinal passage, abdominal discomfort
Elephantiasis	<i>Wuchereria bancrofti</i>	Inflammation of lymphatic vessels of the lower limbs
Ringworms	<i>Microsporum</i> , <i>Trichophyton</i> , <i>Epidermophyton</i>	Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp

Read More: [Human Health and Disease](#)

119. Answer: a

Explanation:

Keystone species are those species which has significant and disproportionately large influence on the community structure and characteristics. It has often considerably low abundance and biomass as compared to dominant species. Removal of such species causes serious disruption in structure and function of community.

120. Answer: c

Explanation:

Amylase, rennin and trypsin are enzymes and as all enzymes are proteins so these three are also proteins.

Concepts:

1. Digestion and Absorption – Alimentary Canal:

Digestion can be defined as the process of breakdown of large, insoluble and complex food molecules into smaller ones for its absorption and circulation in the body. This process involves the usage of a variety of digestive fluids and [enzymes](#), including saliva, mucus, bile and hydrochloric acid, among others.

Read More: [Digestion and Absorption](#)

The alimentary canal is mainly referred to as **the pathway by which food enters our body and moves out through the anus after digestion**. It is a tube-like structure that starts from the mouth and ends in the anus. The alimentary canal plays a primary role in human digestion and is also termed as the digestive tract.

Peristalsis is a series of wave-like muscle contractions that move food through the digestive tract.

121. Answer: d

Explanation:

Blood consists of a watery fluid called plasma. Plasma is a faint yellow, slightly alkaline, viscous fluid. It consists of 90% water, 1% inorganic salts, 7% or 8% proteins and 1% of other substances. The inorganic salts in plasma occur as ions. Sodium is the main cation of plasma and chloride, the main anion. Potassium, calcium and magnesium occur in small amount.

Concepts:

1. Body Fluids and Circulation:

Liquid substances in the animal or human body are known as **body fluids**. The human body consists of about 60–67% body fluids. The chief components of the human body fluids are blood and lymph. **Blood** comprises a matrix called plasma with blood corpuscles floating in it. The blood cells are white blood cells, red blood cells, and platelets. **Lymph** consists of lymph cells.

Read More: [Body Fluids and Circulation](#)

Types of Body Fluids:

The different types of body fluids:

Blood

The main components of blood involve;

1. Plasma
2. Red Blood Cells
3. White Blood Cells
4. Platelets

Lymph

A colorless fluid present in the interstitial tissues is **lymph**. It circulates all over the lymphatic system. It can be described as blood without the RBCs. The exchange of hormones, nutrients, and gases occurs via this fluid. It contains lymphocytes that play a major function in the immune responses of the body.

The movement of blood across the vessels of the body that carries nutrients and gases along with it and removes waste from the different parts of the body is

circulation.

Types of Circulatory Systems:

There are two types of circulatory systems:

- Open Circulatory system
 - Closed circulatory system
-

122. Answer: a

Explanation:

Azolla plays a very important role in rice production. Azolla and its nitrogen-fixing partner, Anabaena, have been used as green manure to fertilize rice paddies and increase production. With the help of Azolla, rice can be grown year after year, several crops a year, with little or no decline in productivity; hence no rotation of crops is necessary.

Concepts:

1. Microbes in Human Welfare:

There are several valuable [microorganisms that are beneficial to humans](#) in various manners such as:

In Household Products

1. Fermentation of milk to produce yogurt.
2. Milk curdling to compose curd, cheese, and paneer.

In Industrial Products

1. Production of beverages such as wine, beer, whiskey, brandy, or rum.
2. Production of antibiotics such as Penicillin and other chemical substances to kill or retard the expansion of disease-causing microbes.

Fermented Beverages

1. A fermentor is used to produce microbes on a large scale for industrial purposes.
2. The brewer's yeast (*Saccharomyces cerevisiae*) is used to make ethanol. At this time, the yeast ferments malted cereals and fruit juices.

Antibiotics

1. The term antibiotic means "against life". These materials can kill or destroy the growth of other microbes.
-

123. Answer: b

Explanation:

Haemophilia is a defect of blood which prevents its clotting. Colour blindness is the inability of certain human beings to distinguish red from green colour. Both these diseases are produced by a recessive gene which lies on the X-chromosomes. A woman having both gene for haemophilia on one X-chromosome and gene for colour blindness on another X-chromosome will have genotype X^hX^c . Thus, progeny includes 50% haemophilic daughters (carrier) and 50% colour blind daughters (carrier).

Concepts:

1. Principles of Inheritance and Variation – Mutation:

A **Mutation** is a change in the sequence of our DNA base pairs caused by numerous environmental stimuli such as UV light or mistakes during DNA replication. Germline mutations take place in the eggs and sperm and can be passed onto offspring, whereas somatic mutations take place in body cells and are not passed on.

Types of Mutations

There are three [types of mutations](#), which are as follows:

Silent mutation

It refers to any change in DNA sequence that has no effect on the amino acid sequence in a protein or the functions that a protein performs. There is no phenotypic indication that a mutation has occurred.

Nonsense mutation

When there is a change in the sequence of base pairs due to a point mutation, that results in a stop codon. This leads to a protein that is either shortened or non-functional.

Missense mutation

A missense mutation occurs when a point mutation causes a change in the codon, which then codes for another amino acid.

The mutation is caused by the following factors:

Internal Causes

When DNA copies incorrectly, the majority of mutations occur. Evolution occurs as a result of all of these mutations. DNA makes a copy of itself during cell division. When a copy of DNA isn't flawless, it's called a mutation since it differs somewhat from the original DNA.

External Causes

When certain chemicals or radiations are used to break down DNA, it causes the DNA to break down. The thymine dimers are broken by UV radiation, resulting in altered DNA.

124. Answer: c

Explanation:

During DNA replication, the **DNA** opens up, and strands separate by unwindase/helicase. This is done to allow for **transcription** as well as **replication of our DNA**.

- The molecule is unwound by DNA unwinding **proteins** known as helicases.

- A DNA helicase or 'Unwindase' is an **enzyme** that melts the hydrogen bonds to hold the DNA in the double helix structure.
- The helicases II and III get attached to the lagging strand and protein is attached to the leading strand.
- The formation of bands is avoided by SSB or single stranded DNA binding proteins.

So, the correct option is 'unwindase/Helicase'.

Concepts:

1. The Molecular Basis of Inheritance:

DNA Replication:

DNA synthesis is commenced at particular points within the DNA strand referred to as 'origins', which are certain coding regions. There are numerous origin sites, and when replication of DNA starts, these sites are mentioned as replication forks. Within the replication, the complex is the enzyme DNA Helicase, so that they can be utilized as a template for replication. DNA Primase is another enzyme that's essential in DNA replication.

RNA:

Ribonucleic acid (RNA) is an essential biological macromolecule that exists all together in biological cells. It is principally involved in the synthesis of proteins, that carry the messenger instructions from DNA, which itself contains the genetic instructions needed for the event and maintenance of life. In some viruses, RNA, in spite of DNA, carries genetic information.

Genetic Code:

Genetic code is the term we use in the manner that the four bases of DNA--the A, C, G, and Ts--are strung together in a way that the ribosome, the cellular machinery, can read them and switch them into a protein. In the ordering, every three nucleotides during a row count as a triplet and code for one amino alkanoic acid.

Read More: [Molecular Basis of Inheritance](#)

125. Answer: b

Explanation:

Acetabularia used in Hammerling's nucleocytoplasmic experiment is unicellular uninucleate green algae. Hammerling's experiment of Acetabularia involved exchanging rhizoid and stalk. Presence of hereditary information in the nucleus was proved by the work of Hammerling on single celled alga Acetabularia.

Concepts:

1. Cell: The Unit of Life:

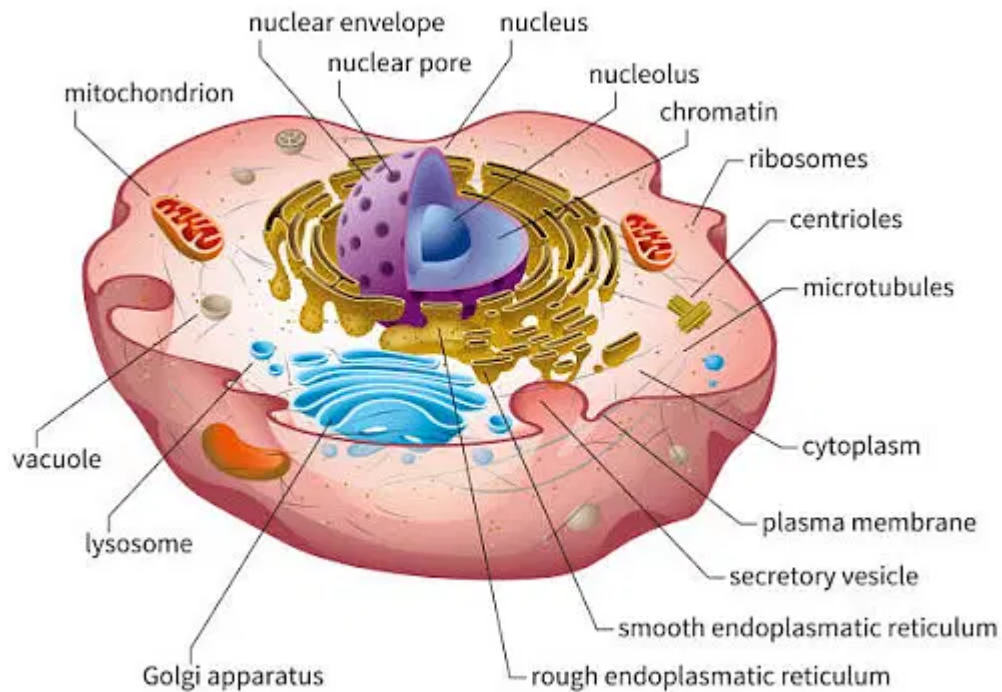
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus is present in the center of the cell, which includes all the hereditary information of an organism. Some of the molecules present in the cell are protein, carbohydrates, starch, and sugar.

Read More: [Fundamental Unit of Life: Cell](#)

Parts of Cell:

The different parts of a cell and their functions are as follows:

- Cell Membrane
- Cell Wall
- Nucleus
- Cytoplasm



126. Answer: b

Explanation:

Synovial joints are freely movable joint which allow considerable movements. Pivot joint is a type of synovial joint which provide rotational movement as in between atlas and axis vertebrae of vertebral column.

127. Answer: b

Explanation:

A spindle of fine fibres begins to develop during prophase. It consists of microtubules which are made of protein called tubulin and certain other associated proteins. These delicate fibres radiate from the centriole and constitute aster. This option was not given in the entrance paper. As actin and myosin are involved as contractile machinery in many nonmuscle cells so it can be considered as the correct answer. Myoglobin is present in muscles which can bind to oxygen.

Concepts:

1. Cell Cycle and Cell Division:

Cell Cycle:

The sequence of events by which a cell copies itself synthesizes other constituents of the cell and eventually splits into two daughter cells is termed the cell cycle. The cell synthesizes all its constituents in a sequential pattern to make sure the proper division and distribution of components that occurs between the two daughter cells. Therefore, we can say that the cell cycle is the period of time between the development of new daughter cells and their further division.

Stages of Cell Cycle:

The cell cycle can be sub-divided into an additional category of Interphase. Meanwhile, the Interphase can be branched into 3 further stages, such as:

1. G1 Phase - "Gap 1 Phase"
2. S Phase - "Synthesis Phase"
3. G2 Phase - "Gap 2 Phase"

Read More: [Cell Cycle and Cell Division](#)

Cell Division:

The division of the parent cells into two or more cells is called daughter cell, [cell division](#) takes place. In general, it occurs as a part of a larger cell cycle. All the cell reproduces by dividing into two, wherein each parental cell produces two daughter cells.

Stages of Cell Division:

Cell division can be widely divided into several sub-segments that result from Mitosis and Meiosis.

1. Mitosis or (M Phase)
2. Meiosis

Explanation:

A nerve impulse is transmitted from one neuron to another through junctions called synapses. There are two types of synapses, namely, electrical synapses and chemical synapses. Transmission of an impulse across electrical synapses is very similar to impulse conduction along a single axon. Impulse transmission across an electrical synapse is always faster than that across a chemical synapse.

Concepts:

1. Neural Control and Coordination:

Neural System:

Neurons are the most specialised cells in the nervous system of all animals, and they are responsible for detecting, accepting, and conveying numerous types of motives. The neurological system of low-spinal animals like Hydra is incredibly simple, consisting of a network of neurons. When the brain of an insect comprises a vast number of ganglia and neural tissues, it is optimally structured.

Coordination System:

Coordination is the process by which two or more organs work together to accomplish each other's duties. Increased muscle activity increases the supply of oxygen and the demand for energy while we exercise. When we cease exercising, our nerves, heart, lungs, and kidneys all return to normal. As a result, all of the organs' functions are properly integrated in order to conduct the exercise and supply the appropriate conditions while exercising. Similarly, in the human body, the neurological and endocrine systems work together to coordinate all of the organ activities.

129. Answer: a

Explanation:

In recombinant DNA technology, when chilled ethanol is added to the solution containing the DNA of interest, the DNA molecules become insoluble and form a

visible white precipitate. This occurs because DNA is not soluble in cold ethanol. This precipitation step allows the separation and purification of DNA from other cellular components and contaminants in the sample.

Therefore, The correct option is (A): DNA

Concepts:

1. Biotechnology:

[Biotechnology](#) is a vast field of biology that involves the creation, production, and modification of useful products for human welfare using both the technology and the execution of living organisms and their components. An agricultural engineer, Karoly Ereky, coined the word "biotechnology" in 1919, achieving him the title of "Father of Biotechnology."

Principles of Biotechnology:

Among many, the two core techniques that entitled the birth of modern biotechnology are :

1. **Genetic Engineering** is one of the methods of direct modifications of an organism's genome (i.e., DNA and RNA). It requires the introduction of new genes into host species to escalate function or trait, hence altering the host organism's phenotype.
2. **Bioprocess Engineering** is one of the methods of maintaining sterile conditions to facilitate the growth of large quantities of desired microbes and other eukaryotic cells for the development of new or modified biotechnological products such as enzymes, vaccines, antibiotics, and other biotechnological products.

130. Answer: c

Explanation:

Nerve cells, or neurons, have a unique structure where they do not typically form layers or stack together like epithelial cells. Instead, neurons are specialized for transmitting electrical signals throughout the nervous system and have long

processes called axons and dendrites that extend from their cell bodies, allowing them to communicate with other neurons without forming distinct layers or sheets. So, the correct option (C): Nerve cells

Concepts:

1. Animal Tissues:

Human bodies, like most animal bodies, are made up of four different types of tissue:

Epithelial Tissue:

This tissue forms the outer layer of the body and also lines many of the body's cavities where it has a protective function.

General functions of epithelial tissue:-

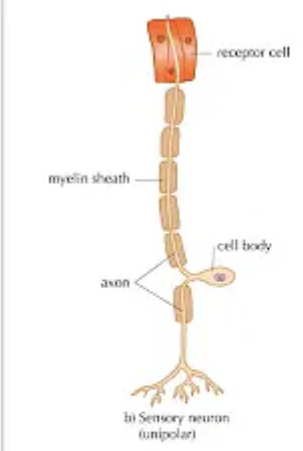
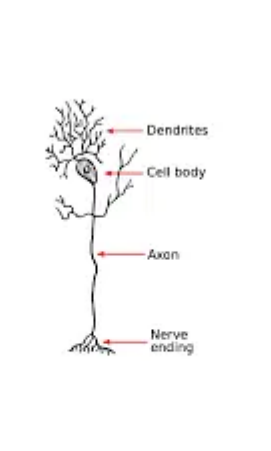
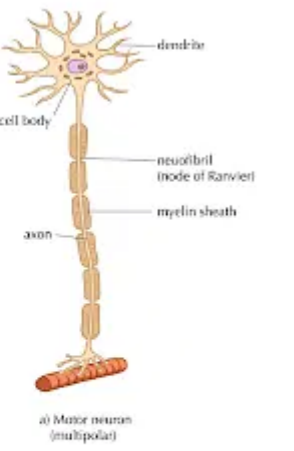
1. Provides a barrier between the external environment and the organ that it is covering.
2. Specialized to function in secretion and absorption.
3. Protects organisms from microorganisms, injury, and fluid loss.

Connective Tissue:

This tissue assists in the support and protection of organs and limbs and depending on the location in the body it may join or separate organs or parts of the body.

Muscle Tissue:

This tissue enables various forms of movement, both voluntary and involuntary.

Sensory neuron	Motor neuron	Interneuron
 Diagram of a sensory neuron (unipolar). Labels: receptor cell, myelin sheath, cell body, axon. b) Sensory neuron (unipolar)	 Diagram of a motor neuron. Labels: Dendrites, Cell body, Axon, Nerve ending.	 Diagram of an interneuron (multipolar). Labels: dendrite, cell body, neurofibril (node of Ranvier), myelin sheath, axon. a) Motor neuron (multipolar)
Sensory neurons are responsible for sending information about the environment (called stimuli) to the central nervous system. They are activated by touch, light, temperature, pressure, hearing etc. Sensory nerve cells (or sensory neurons) carry impulses (electrical signals) from a receptor to the central nervous system (CNS).	These neurons are very short compared to the sensory and motor neurons. The connectors or interneurons connect a sensory neuron with a motor neuron. The impulse travels from the cell body at the head end along the short axon to the dendrites.	Motor neurons carry impulses from the CNS to muscles or glands. In most cases the motor neuron causes muscle contraction (movement), but motor neurons can also cause secretion of substances by glands. The motor neuron causes a response via chemicals known as neurotransmitters.

Nerve Tissue:

This tissue is responsible for the carrying of electrical and chemical signals and impulses from the brain and central nervous system to the periphery, and vice versa.

131. Answer: c

Explanation:

The gland that secretes odorous secretion in mammals is the Anal gland. Anal glands, also known as anal sacs, are found near the anus and contain a foul-smelling secretion that can be used for scent marking, communication, and defense in some mammals.

So, the correct option is (C): Anal gland

Concepts:

1. Chemical Coordination and Integration – Hormones:

Hormones are chemical messengers that are released directly into the bloodstream, where they are carried to organs and tissues throughout the body to perform their tasks. Hormones are released by the body's endocrine glands.

Functions of Hormones

Following are some important functions of hormones:

- Food metabolism.
- Growth and development.
- Controlling thirst and hunger.
- Maintaining body temperature.
- Regulating mood and cognitive functions.
- Initiating and maintaining sexual development and reproduction.

Types of Hormones

To regulate various functions, different types of hormones are produced in the body. They are classified as follows:

- **Peptide Hormones:** Peptide hormones are composed of [amino acids](#) and are soluble in water.
- **Steroid Hormones:** Unlike peptide hormones, steroid hormones are fat-soluble and are able to pass through a cell membrane.

List of Important Hormones

1. Cortisol
2. Estrogen
3. Melatonin
4. Progesterone
5. Testosterone

132. Answer: b

Explanation:

Glycolysis is the mechanism through which energy is generated by breaking down glucose. Within glycolysis, NAD^+ functions as the electron carrier, and it can convert into NADH by acquiring a proton. This conversion of NAD^+ to NADH occurs as a consequence of the oxidation of carbohydrates and fats.

Concepts:

1. Biomolecules:

Biomolecules are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. These non-living molecules are the actual foot-soldiers of the battle of sustenance of life.

There are four major classes of Biomolecules – Carbohydrates, Proteins, Nucleic acids and Lipids.

1. **Carbohydrates** are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
2. **Proteins** are another class of indispensable biomolecules, which make up around 50 per cent of the cellular dry weight. Proteins are polymers of amino acids arranged in the form of polypeptide chains. The structure of proteins is classified as primary, secondary, tertiary and quaternary in some cases.
3. **Nucleic acids** refer to the genetic material found in the cell that carries all the hereditary information from parents to progeny. There are two types of nucleic acids namely, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The main function of nucleic acid is the transfer of genetic information and synthesis of proteins by processes known as translation and transcription.
4. **Lipids** are organic substances that are insoluble in water, soluble in organic solvents, are related to fatty acids and are utilized by the living cell.

133. Answer: b

Explanation:

The majority of carbon dioxide produced by our body cells is transported to the lungs dissolved in the blood as bicarbonates. This is part of the bicarbonate buffer system that helps regulate blood pH.

Therefore, the correct option is (B): As bicarbonates

Concepts:

1. Human Endocrine System:

The **human endocrine system** is a messenger system that balances or controls distant target organs through feedback loops of hormones released by the internal glands of an organism right into the circulatory system. The hypothalamus is the neural control node for all endocrine systems, in invertebrates.

Functions of the Human Endocrine System are:

The endocrine system controls a variety of body functions through hormone release. Hormones are built by the endocrine system's glands and pass throughout the bloodstream to various organs and tissues in the body. Hormones then command these organs and tissues about how to act.

The Endocrine System is in charge of the following bodily functions:

1. Metabolic rate
2. Development and growth of a human being
3. Reproduction and sexual function
4. Heart Rate
5. Blood pressure
6. The appetite is the need to eat
7. Controls cycles of sleep and wakefulness
8. Controls the temperature of the body

134. Answer: a

Explanation:

Bowman's glands, also known as olfactory glands or serous glands, are located in the olfactory epithelium of the nasal cavity. These glands secrete mucus, which helps trap odorant molecules and facilitates the detection of scents by olfactory receptors.

So, the correct option is (A): olfactory epithelium

Concepts:

1. Mechanism Human Excretory System:

Excretory System Organs

Kidneys– Kidneys are bean-shaped structures located on either side of the backbone. In human each adult kidney size is 10–12 cm with a width of 5–7 cm and weighs around 120–170g and it have an inner concave structure.

Ureter – A pair of thin muscular tubes called the ureter. Ureter comes out of each kidney extending from the renal pelvis and it carries urine from the kidney to the urinary bladder.

Urinary Bladder – muscular sac-like structure which stores urine. The urinary bladder is emptied by the process of micturition.

Urethra– This tube comes out from the urinary bladder and helps to expel urine out of the body. It acts as the common route for sperms and urine in males.

135. Answer: b

Explanation:

Platyhelminthes have a soft and dorsoventrally flattened body with bilateral symmetry.

- Plasmodium and Trypanosoma belong to the phylum **protozoa**. Hence options **A and C are incorrect**
- Wuchereria belongs to the phylum **Aschelminthes**. Hence option D is incorrect

Therefore, the correct answer is option B) Schistosoma

Concepts:

1. Animal Kingdom:

Animals are eukaryotic, multicellular species that belong to the **Kingdom Animalia**. Every animal has a distinct characteristic. They get energy either by feeding on plants or on other animals. There are millions of species that have been recognized, few shares similar characteristics while others vary drastically.

Kingdom Animalia comprises all animals. In the midst of the five kingdoms, the largest kingdom is the animal kingdom. Animals are multicellular eukaryotes. Though, like plants, they do not possess chlorophyll or a cell wall. Therefore, members of the animal kingdom indicate a heterotrophic mode of nutrition. Kingdom Animalia is further classified into ten different subphyla based on their body designs or differentiations.

The different phyla of the Kingdom Animalia are as follows:

1. Porifera
2. Coelenterata (Cnidaria)
3. Platyhelminthes
4. Nematoda
5. Annelida
6. Arthropoda
7. Mollusca
8. Echinodermata
9. Hemichordata
10. Chordata

Read More: [Classification of Animal Kingdom](#)

136. Answer: a

Explanation:

Embryological support for evolution was proposed by Ernst Haeckel.

- Embryological support for evolution was disapproved by Karl Ernst von Baer.

Concepts:

1. Evolution:

Evolution is a process that occurs in changes in the genetic content of a population over time. Evolutionary change is generally classified into two: microevolution and macroevolution. The process of changes in allele frequencies in a population over time is a microevolutionary process. Three main mechanisms that cause allele frequency change are natural selection, genetic drift, and gene flow. On the other hand, macroevolution refers to change at or above the level of the species.

137. Answer: a**Explanation:**

The amount of yolk and how it is distributed determines the type of cleavage. On this basis cleavage is of two types: (a) Holoblastic – where the segmentation line passes through the entire egg. It occurs in alecithal (without yolk), microlecithal (with very little amount of yolk) and mesolecithal (little amount of yolk) egg. (b) Meroblastic – where segmentation line does not pass through the egg and remained confined to a part of the egg. It occurs in megalecithal (large amount of yolk) egg.

Concepts:**1. Human Reproduction:**

[Reproduction in human](#) beings involves the fusion of male and female gametes that produces in their [reproductive system](#).

Male Reproductive System:

The male reproductive system comprises:

- **Testicles (testes):** A pair of oval-shaped organs masked in a pouch known as the scrotum. They manage the production of sperms and the male hormone testosterone.
- **Scrotum:** It is a sac-like organ that hangs under the penis and behind it. It is the house of the testes, or testicles, and maintains a temperature that is needed for the production of sperm by it.
- **Vas deferens:** The sperms produced in testes are stored in a tube known as the epididymis. Here the sperms get matured and pass to the urethra via the muscular tube known as vas deferens.
- **Accessory glands:** This includes three glands, namely the prostate gland, seminal vesicles, and Cowper's gland. The secretions from the mentioned three glands mix to form a fluid known as semen. Semen nourishes the sperm, raises the volume, and helps in lubrication.
- **Penis:** The penis is a cylindrical tube that serves as both an excretory organ, and a reproductive organ. It transfers sperms into the vagina during sexual intercourse.

Female Reproductive System:

The **female reproductive system** is active before, during, and after fertilization as well. It comprises the following parts:

- **A pair of ovaries:** A pair of ovaries produce and stores ovum in them. They also produce a female hormone known to be estrogen.
 - **Fallopian tubes (Oviducts):** They are the area of fertilization. They connect both the ovaries with the uterus.
 - **Uterus:** Uterus is the place of development for the embryo.
 - **Vagina:** The part that connects the cervix to the external female body parts is called a vagina. It is the passage for the penis during coitus as well as a fetus during transfer.
-

138. Answer: b

Explanation:

The correct answer is Option B) Nutrition

In the five kingdom system, the main classification is done on the basis of the modes of nutrition. The other basis of classification is done on, organism cellular organization and other structural and functional attributes. The five kingdoms are as follows:

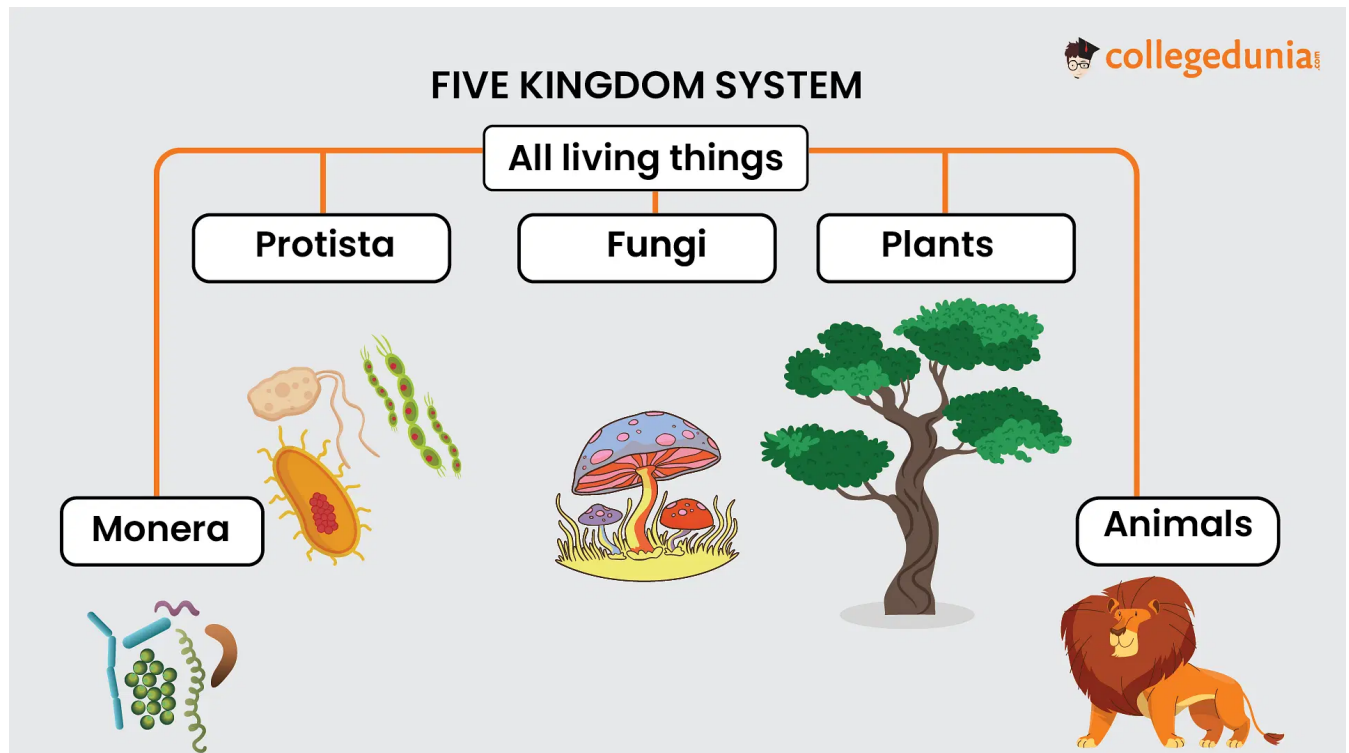
Monera: This includes prokaryotes, they are unicellular and lack a true nucleus and also the membrane bound organelles. They obtain their nutrients through absorption and photosynthesis.

Protista: They include eukaryotic organisms. They are generally unicellular; they have a variety of modes of nutrients like absorption, ingestion and photosynthesis.

Fungi: They are eukaryotes that have a cell wall made of chitin. They are multicellular except for the yeast. Their mode of nutrition is absorption and they are fungal organisms.

Plantae: They are multicellular eukaryotes. They have a cell wall of cellulose. They are autotrophs, that is they perform photosynthesis. They are terrestrial organisms that play a role in the food chain.

Animals: Animalia comprises eukaryotic, multicellular organisms with no cell walls. Their mode of nutrition is ingestion and digestion.



Read more from chapter: [Biological Classification](#)

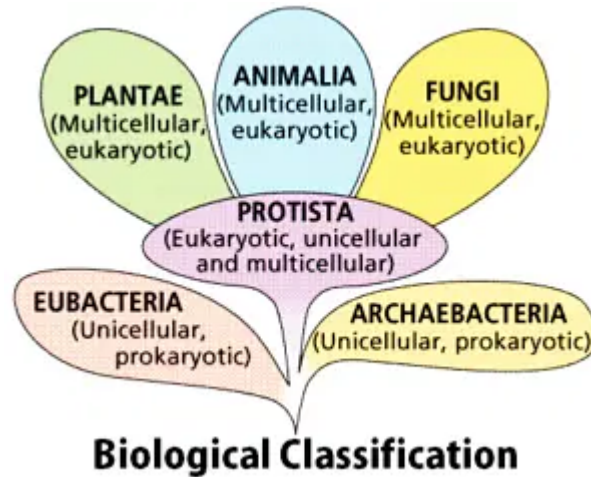
Concepts:

1. Biological Classification:

The process of grouping living organisms into categories is called [biological classification](#). The most modern 5-kingdom classification was put ahead by an eminent scientist R.H. Whittaker. The [five-kingdom classification](#) is based on the criteria like [cell structure](#), mode of nutrition, body form, and [reproduction](#). One of the most important characteristics of this system is that it follows the evolutionary sequence of living organisms. The organisms are classified into distinct taxa or levels like Kingdom, Phylum, Division, Class, Order, Family, [Genus](#), and [Species](#). The 5 kingdoms are as follows:

- [Kingdom Monera](#)
- [Kingdom Protista](#)
- [Kingdom Fungi](#)
- [Kingdom Plantae](#)

- [Kingdom Animalia](#)



139. Answer: b

Explanation:

Allergy is the hypersensitiveness of a person to some foreign substances coming in contact with or entering the body. The common allergens are dust, pollen mould, spores, fabricates, bacteria, etc. During an allergic reaction, there is increased the release of histamine from mast cells. Use of antihistamines and from mast cells. Use of antihistamine and steroids give a quick relief from allergy.

Concepts:

1. Human Health and Disease:

Health is described as a state of complete physical, mental and social well-being.

The **disease** is a circumstance where malfunctioning of the body organs occurs leading to uneasiness and discomfort.

Differences between Infectious Diseases and Non-Infectious Diseases:

Infectious diseases	Non-infectious diseases
•These diseases are easily transmitted from one person to another. •Examples: AIDS, Typhoid	•These diseases remain restricted to the person and are not easily transmitted from one person to another. •Examples: Diabetes, Cancer

Common Diseases in Humans:

Diseases	Pathogen	Signs and Symptoms
Typhoid	<i>Salmonella typhi</i>	High fever, low pulse rate, abdominal pain, frequent stools
Pneumonia	<i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i>	Lymph and mucus collect in the alveoli and bronchioles
Common cold	<i>Viruses like Rhino viruses</i>	Nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness
Malaria	<i>Plasmodium</i>	Fever, restlessness, less appetite, slight sleeplessness, muscular pains, headache and feeling of chilliness
Amoebiasis	<i>Entamoeba histolytica</i>	Blood along with faeces and abdominal pain
Ascariasis	<i>Ascaris</i>	Obstruction of intestinal passage, abdominal discomfort
Elephantiasis	<i>Wuchereria bancrofti</i>	Inflammation of lymphatic vessels of the lower limbs
Ringworms	<i>Microsporum</i> , <i>Trichophyton</i> , <i>Epidermophyton</i>	Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp

Read More: [Human Health and Disease](#)

140. Answer: c

Explanation:

The age pyramid is a graphic representation of the abundance of individuals of various age groups with –

Pre-reproductive individuals at the base.

Reproductive individuals in the middle.

Post-reproductive individuals at the top.

- The triangular age pyramid has a high proportion of pre-reproductive individuals, fewer post-reproductive individuals, and a moderate number of reproductive individuals. It represents a rapidly growing population.
- In a bell-shaped age pyramid, the number of pre-reproductive and reproductive individuals is almost equal while the post-reproductive individuals are comparatively fewer. It represents a stationary population where the growth rate is nearly zero.
- In an urn-shaped age pyramid, the number of reproductive individuals is higher than the number of pre-reproductive individuals. It represents a declining or diminishing **population**.

Hence, option C) is the correct answer.

141. Answer: c

Explanation:

Marasmus is common in infants under one year of age. It develops due to deficiency of proteins and calories. It can be cured by providing adequate proteins, fats and carbohydrates.

Concepts:

1. Digestion and Absorption – Alimentary Canal:

Digestion can be defined as the process of breakdown of large, insoluble and complex food molecules into smaller ones for its absorption and circulation in the body. This process involves the usage of a variety of digestive fluids and **enzymes**, including saliva, mucus, bile and hydrochloric acid, among others.

Read More: [Digestion and Absorption](#)

The alimentary canal is mainly referred to as **the pathway by which food enters our body and moves out through the anus after digestion**. It is a tube-like structure that starts from the mouth and ends in the anus. The alimentary canal plays a primary role in human digestion and is also termed as the digestive tract.

Peristalsis is a series of wave-like muscle contractions that move food through the digestive tract.

142. **Answer: a**

Explanation:

Spleen receives only oxygenated blood from the heart through splenic artery. The liver receives a blood supply from two sources. The first is the hepatic artery which delivers oxygenated blood from the general circulation. The second is the hepatic portal vein delivering deoxygenated blood from the small intestine containing nutrients. The blood flows through the liver tissue to the hepatic cells where many metabolic functions take place. The blood drains out of the liver via the hepatic vein. Gill and Lung receive deoxygenated blood as these are the organs where oxygenation of blood takes place.

Concepts:

1. Body Fluids and Circulation:

Liquid substances in the animal or human body are known as **body fluids**. The human body consists of about 60–67% body fluids. The chief components of the human body fluids are blood and lymph. **Blood** comprises a matrix called plasma with blood corpuscles floating in it. The blood cells are white blood cells, red blood cells, and platelets. **Lymph** consists of lymph cells.

Read More: [Body Fluids and Circulation](#)

Types of Body Fluids:

The different types of body fluids:

Blood

The main components of blood involve;

1. Plasma
2. Red Blood Cells
3. White Blood Cells
4. Platelets

Lymph

A colorless fluid present in the interstitial tissues is **lymph**. It circulates all over the lymphatic system. It can be described as blood without the RBCs. The exchange of hormones, nutrients, and gases occurs via this fluid. It contains lymphocytes that play a major function in the immune responses of the body.

The movement of blood across the vessels of the body that carries nutrients and gases along with it and removes waste from the different parts of the body is **circulation**.

Types of Circulatory Systems:

There are two types of circulatory systems:

- Open Circulatory system
- Closed circulatory system

143. Answer: c

Explanation:

Biofertilizers are organisms that enrich the nutrient quality of the soil. The main sources of biofertilizers are bacteria, fungi and cyanobacteria. Rhizobium bacteria is found in the nodules on the roots of leguminous plants by symbiotic association. These bacteria fix atmospheric nitrogen into organic forms, which is used by the plants as nutrient. Fungi are also known to form symbiotic associations with plants called mycorrhiza. Cyanobacteria are autotrophic microbes widely distributed in an aquatic and terrestrial environments. Many of which can fix atmospheric nitrogen,

e.g., Anabaena, Nostoc, Oscillatoria etc. But Agrobacterium tumefaciens is a pathogen of several dicot plants. It causes gall tumor in the plants.

Concepts:

1. Microbes in Human Welfare:

There are several valuable [microorganisms that are beneficial to humans](#) in various manners such as:

In Household Products

1. Fermentation of milk to produce yogurt.
2. Milk curdling to produce curd, cheese, and paneer.

In Industrial Products

1. Production of beverages such as wine, beer, whiskey, brandy, or rum.
2. Production of antibiotics such as Penicillin and other chemical substances to kill or retard the expansion of disease-causing microbes.

Fermented Beverages

1. A fermentor is used to produce microbes on a large scale for industrial purposes.
2. The brewer's yeast (*Saccharomyces cerevisiae*) is used to make ethanol. At this time, the yeast ferments malted cereals and fruit juices.

Antibiotics

1. The term antibiotic means "against life". These materials can kill or destroy the growth of other microbes.

144. Answer: c

Explanation:

Some genes can have more than two alleles. **When a trait is controlled by more than two alleles, it is called multiple allelism.** In humans, the **blood group is determined by three alleles** (I^A , I^B and I^O) of a gene I . A person can only have two of the three alleles, determining his blood group. Person with both I^A alleles belongs to A blood group, $I^A I^B$ to AB blood group and B group for both I^B alleles. Similarly, persons with O blood group have both alleles I^O .

The other three options are incorrect as they do not account for the blood group in humans.

- **Multifactor Inheritance** – It refers to the trait or disease caused by more than one factor like birth defect, chronic illness etc.
- **Incomplete Dominance** – The condition in which the two alleles of a gene are partially expressed resulting in a different phenotype not seen in parents, is called **incomplete dominance**.
- **Epistasis** – It is a condition in which the expression of a gene is inhibited due to the presence of another gene.

Concepts:

1. Principles of Inheritance and Variation – Mutation:

A **Mutation** is a change in the sequence of our DNA base pairs caused by numerous environmental stimuli such as UV light or mistakes during DNA replication. Germline mutations take place in the eggs and sperm and can be passed onto offspring, whereas somatic mutations take place in body cells and are not passed on.

Types of Mutations

There are three **types of mutations**, which are as follows:

Silent mutation

It refers to any change in DNA sequence that has no effect on the amino acid sequence in a protein or the functions that a protein performs. There is no phenotypic indication that a mutation has occurred.

Nonsense mutation

When there is a change in the sequence of base pairs due to a point mutation, that results in a stop codon. This leads to a protein that is either shortened or non-functional.

Missense mutation

A missense mutation occurs when a point mutation causes a change in the codon, which then codes for another amino acid.

The mutation is caused by the following factors:

Internal Causes

When DNA copies incorrectly, the majority of mutations occur. Evolution occurs as a result of all of these mutations. DNA makes a copy of itself during cell division. When a copy of DNA isn't flawless, it's called a mutation since it differs somewhat from the original DNA.

External Causes

When certain chemicals or radiations are used to break down DNA, it causes the DNA to break down. The thymine dimers are broken by UV radiation, resulting in altered DNA.

145. Answer: d

Explanation:

A bone marrow cell is a somatic cell and therefore mitosis takes place in it. During mitosis anaphase chromosomes split at centromere. Sister chromatids separate from each other, so that the two sister chromatids are separate structures and can now be called as chromosomes.

Concepts:

1. The Molecular Basis of Inheritance:

DNA Replication:

DNA synthesis is commenced at particular points within the DNA strand referred to as 'origins', which are certain coding regions. There are numerous origin sites, and when replication of DNA starts, these sites are mentioned as replication forks. Within the replication, the complex is the enzyme DNA Helicase, so that they can be utilized as a template for replication. DNA Primase is another enzyme that's essential in DNA replication.

RNA:

Ribonucleic acid (RNA) is an essential biological macromolecule that exists all together in biological cells. It is principally involved in the synthesis of proteins, that carry the messenger instructions from DNA, which itself contains the genetic instructions needed for the event and maintenance of life. In some viruses, RNA, in spite of DNA, carries genetic information.

Genetic Code:

Genetic code is the term we use in the manner that the four bases of DNA--the A, C, G, and Ts--are strung together in a way that the ribosome, the cellular machinery, can read them and switch them into a protein. In the ordering, every three nucleotides during a row count as a triplet and code for one amino alkanoic acid.

Read More: [Molecular Basis of Inheritance](#)

146. Answer: b

Explanation:

According to the fluid mosaic model of cell membrane structure proposed by Singer and Nicolson (1972) plasma membrane contains about 50-60% proteins and 50^0% lipids. Lipids form a bilayer with hydrophilic heads pointing outwards. Cell membrane allows transport of some molecules by passive transport e.g., water, neutral solutes while some are transported actively e.g., Na⁺/K⁺ pump.

Concepts:

1. Cell: The Unit of Life:

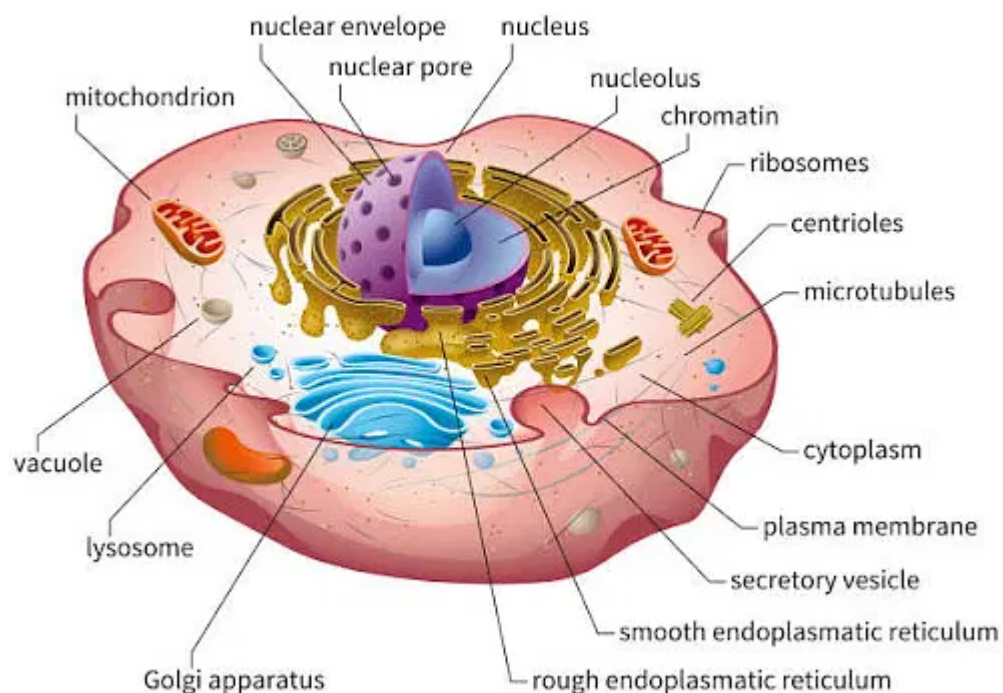
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus is present in the center of the cell, which includes all the hereditary information of an organism. Some of the molecules present in the cell are protein, carbohydrates, starch, and sugar.

Read More: [Fundamental Unit of Life: Cell](#)

Parts of Cell:

The different parts of a cell and their functions are as follows:

- Cell Membrane
- Cell Wall
- Nucleus
- Cytoplasm



Explanation:

According to sliding filament theory, muscle contraction is brought about by sarcomere contraction. This is result of sliding of actin and myosin filaments past each other leading to shortening of I band and disappearance of the H zone. Options B, C and D are incorrect as the sarcomere shortens while both the filaments remain the same length.

Concepts:

1. Locomotion and Movement:

Locomotion

The movement of a creature from one place to another is known as locomotion. During the process, there is the action of appendages such as wings, limbs, and flagella. In some animals, like fish, whales, and sharks, locomotion upshots from a wave-like series of muscle contractions. Locomotion helps an **organism** in finding their food, avoid harsh weather conditions, escape from their predators, etc.

Some examples of locomotion are walking, running, swimming, etc. Movement, on the other hand, refers to any type of motion that need not be localized.

Read More: [Locomotion and Movement](#)

Movement

Movement is generally described as a state of changing the position from rest to motion or vice-versa. Movement can be both voluntary movement and involuntary movement. Movement helps an organism perform essential functions, such as pumping **blood** to the different parts of the body, etc.

Read More: [Difference between Locomotion and Movement](#)

148. Answer: c

Explanation:

During mitosis, homologous chromosomes do not form pairs. Instead, they align end-to-end, allowing each daughter cell to inherit one sister chromatid from both members of the homologous pair upon division.

Concepts:

1. Cell Cycle and Cell Division:

Cell Cycle:

The sequence of events by which a cell copies itself synthesizes other constituents of the cell and eventually splits into two daughter cells is termed the cell cycle. The cell synthesizes all its constituents in a sequential pattern to make sure the proper division and distribution of components that occurs between the two daughter cells. Therefore, we can say that the cell cycle is the period of time between the development of new daughter cells and their further division.

Stages of Cell Cycle:

The cell cycle can be sub-divided into an additional category of Interphase. Meanwhile, the Interphase can be branched into 3 further stages, such as:

1. G1 Phase – "Gap 1 Phase"
2. S Phase – "Synthesis Phase"
3. G2 Phase – "Gap 2 Phase"

Read More: [Cell Cycle and Cell Division](#)

Cell Division:

The division of the parent cells into two or more cells is called daughter cell, [cell division](#) takes place. In general, it occurs as a part of a larger cell cycle. All the cell reproduces by dividing into two, wherein each parental cell produces two daughter cells.

Stages of Cell Division:

Cell division can be widely divided into several sub-segments that result from Mitosis and Meiosis.

1. Mitosis or (M Phase)
 2. Meiosis
-

149. Answer: b

Explanation:

Tungsten or gold microparticles are commonly used in the gene gun method for gene transfer. The microparticles are coated with the foreign DNA of interest and are then propelled into the target cells using a biolistic device (gene gun). The high velocity of the microparticles enables them to penetrate the cell membranes and deliver the foreign DNA into the host cells, allowing for genetic transformation or transfection.

Therefore, The correct option is (B): Tungsten or gold

Concepts:

1. Biotechnology:

[Biotechnology](#) is a vast field of biology that involves the creation, production, and modification of useful products for human welfare using both the technology and the execution of living organisms and their components. An agricultural engineer, Karoly Ereky, coined the word "biotechnology" in 1919, achieving him the title of "Father of Biotechnology."

Principles of Biotechnology:

Among many, the two core techniques that entitled the birth of modern biotechnology are :

1. **Genetic Engineering** is one of the methods of direct modifications of an organism's genome (i.e., DNA and RNA). It requires the introduction of new genes into host species to escalate function or trait, hence altering the host organism's phenotype.
2. **Bioprocess Engineering** is one of the methods of maintaining sterile conditions to facilitate the growth of large quantities of desired microbes and other eukaryotic cells for the development of new or modified biotechnological

products such as enzymes, vaccines, antibiotics, and other biotechnological products.

150. Answer: d

Explanation:

The correct match between List I and List II is:

- A. Fovea – III. Point of greatest visual acuity or resolution
- B. Iris – I. Visible coloured portion of the eye that regulates diameter of the pupil
- C. Blind spot – IV. Point where the optic nerve leaves the eyeball and photoreceptor cells are absent
- D. Sclera – II. External layer of the eye formed of dense connective tissue

The correct option is (D): A–III, B–I, C–IV, D–II

151. Answer: a

Explanation:

Some plants such as Viola (common pansy), Oxalis, and Commelina produce two types of flowers– chasmogamous flowers which are similar to flowers of other species with exposed anthers and stigma, and cleistogamous flowers which do not open at all. In such flowers, the anthers and stigma lie close to each other. When anthers dehisce in the flower buds, pollen grains come in contact with the stigma to effect pollination. Thus, cleistogamous flowers are invariably autogamous as there is no chance of cross-pollen landing on the stigma. Cleistogamous flowers produce assured seed-set even in the absence of pollinators.

Concepts:

1. Sexual Reproduction in Flowering Plants:

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all

flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

An individual flower comprises the following parts –

- Pedicle
 - Calyx
 - Petals
 - Sepals
 - Stamen
 - Pistil
 - Receptacle
-

152. Answer: d

Explanation:

Carbohydrates are usually first converted into glucose before they are used for respiration. Fats are broken down into glycerol and fatty acids first. If fatty acids were to be respired they would first be degraded to acetyl CoA and enter the pathway. Glycerol would enter the pathway after being converted to 3-phosphoglycerdehyde (PGAL). The proteins are degraded by proteases to individual amino acids (after deamination) and depending on their structure enter the pathway within the Krebs??cycle or as pyruvate or acetyl CoA. Thus, acetyl CoA is the common metabolite of all the three (carbohydrates, proteins and fats).

The given flow chart shows these interrelationships:

Concepts:

1. Respiration in Plants:

[Respiration in plants](#) is a process that entails the production of energy in [plants](#). This process can simply be described as the intake of Oxygen and the release of Carbon Dioxide as an outcome of the oxidation of complex organic compounds. Though plants do not have any specific organ to balance the process of respiration, their stems, roots, and leaves do this work at a very low rate than other living beings. The

process of respiration is very crucial for the plants to sustain the growth of the plant tissues.

This process can be stated as-



153. Answer: c

Explanation:

Photorespiration is a type of respiration which occurs in green cells in presence of light. It involves three organelles - chloroplast, peroxisomes and mitochondria. Respiratory substrate in photorespiration is a 2-carbon compound glycolic acid (2C), hence called C2 cycle. RuBP-carboxylase in normal O₂/CO₂ conc, acts as 'carboxylase'. It is the key enzyme of photosynthesis in C₃ plants.

Concepts:

1. Photosynthesis in Higher Plants:

Processes Of Photosynthesis in Higher Plants:

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C3 Cycle)
 2. C4 Cycle (Hatch and Slack Pathway)
-

154. Answer: d

Explanation:

Insects have highest number of species found in nature. The insecta is the largest class of animals. It has over 7,00,000 species. The insects are the most successful land invertebrates and the only major competitors with humans for dominance in the world.

Concepts:

1. Biodiversity and Conservation:

The term 'biodiversity' is derived from the two words- 'bios' which means life and 'diversity' i.e, differentiation or variation. Edward Wilson, the sociobiologist was the first to popularise the term 'biodiversity' in the year 1992. The term implies the occurrence of various plants and animals along with their variants such as biotypes, ecotypes and genes on earth. In our biosphere, the immense diversity or heterogeneity remains not only at the species level but also, at every level of biological organization that ranges from macromolecules in the cells to biomes.

[Biodiversity and Conservation](#) is a topic covered under the fifteenth chapter and Unit 5 of NCERT class 12 biology.

155. Answer: b

Explanation:

Of all the ecosystems, ocean is the largest and most stable ecosystem. Aquatic life is protected from vigorous climates and weather that are climatic conditions, problem of water supply, food, fire and artificial forces such as industrialization, farming and grazing are lacking in the oceans. The sea is continuous and not separated as land and freshwater habitats.

Concepts:

1. Ecosystem:

An **ecosystem** is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

Structure of the Ecosystem:

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

156. Answer: c

Explanation:

Gibberellin is a hormone that replaces vernalisation. Vernalization is a period of cold treatment for plants, usually perennials or trees. Some plants won't bloom without it. In vernalization plants are exposed to low temperature in order to stimulate flowering or to enhance seed production. The biennials form their vegetative body in the first year. Then they pass through a winter season and then produce flowers and fruits in the second year. By exogenous application of gibberellins many biennials can be induced to behave as annuals and they no more require the natural chilling treatment for their flowering.

157. Answer: a

Explanation:

Companion cell is a thin walled elongated cell which is associated with sieve tube. The sieve tube elements lack nucleus, they remain living, being dependents upon the adjacent companion cell nucleus.

Phloem is the food conducting tissue of plants, it consists of four type of cell.

- (i) Phloem parenchyma
 - (ii) Phloem fibre
 - (iii) Sieve tube elements
 - (iv) Companion cell.
-

158. Answer: c

Explanation:

Maximum application of animal cell culture technology is in the production of vaccines. Vaccines are chemical substances prepared from the proteins of other animals which confer immunity to a particular virus. Some of the vaccines synthesized biologically, through genetic engineering are vaccines for hepatitis B virus, vaccines for rabies virus, vaccines for poliovirus and vaccines for small pox virus, etc.

Concepts:

1. Strategies For Enhancement in Food Production:

Animal Husbandry

The raising and breeding of livestock are known as animal husbandry. Dairy farm management and fisheries are also included under animal husbandry and responsible for the selection of good breeds for better yield, maintaining a well-ventilated house and proper cleanliness and hygiene, and regulating proper [disposal of waste](#).

Read More: [Strategies for Enhancement in Food Production](#)

Animal Breeding

The practice of raising a group of animals belonging to a common species. Inbreeding and outbreeding are the two types of animal breeding.

1. Animals of superior male and female breed are made to mate for 4 to 6 generations. According to Mendel's experiment, true-breeding species or pure lines are created by [Inbreeding](#) which results in homozygosity.
2. The breeding involving animals that are not related is known as [outbreeding](#).
3. [Bee-keeping](#): The rearing of bees for the production of honey and beeswax is known as apiculture. One of the most common species of the honey bee is *Apis indica*. Beeswax is used to prepare polish, cosmetics, etc.
4. [Fisheries](#): Cultivation or breeding of aquatic flora and fauna for a commercial purpose is known as aquaculture. Fish and fish products for consumption are known as pisciculture.

Plant Breeding

In order to get rid of [nutrient deficiency diseases](#), crops need to have a specific nutrient value besides disease resistance, pest resistance, and high yield capacity. There are many strategies for enhancing food production through plant breeding.

1. [Somatic Hybrids](#)
2. [Totipotency](#)
3. [Biofortification](#)

Plant Breeding for Disease Resistance

Plant Breeding for Pest Resistance

Plant Breeding for Improved Food Quality

Single-Cell Protein

One of the ways to meet the growing demand of nutrients in plants and animals is a single-cell protein which is biomass that is rich in protein. microbes are produced on an industrial scale to get single-cell protein.

159. Answer: b

Explanation:

Symbiotic relationship between roots of higher plants and fungi is called mycorrhiza, e.g. Pinus roots are associated with fungal hyphae.

Concepts:

1. Mineral Nutrition:

The naturally occurring inorganic nutrient found in the soil and food that is necessary for the proper functioning of animal and plant bodies is defined as nutrition. [Minerals](#) are vital elements essential for the body.

Read More: [Mineral Nutrition](#)

Role of Nutrients:

1. Balancing function
2. Maintenance of osmotic pressure
3. Influencing the pH of the cell sap
4. Construction of the plant body
5. Catalysis of the biochemical reaction
6. Effects of Toxicity

160. Answer: d

Explanation:

P-proteins (Phloem proteins) are components found in large amounts in phloem sieve tubes. The main function of these bodies is to seal off the sieve tube element or sieve cell by bringing about the blockage of sieve plate. These bodies perform this function when ; the sieve element is injured. These bodies and callose together block the pores of sieve tube elements. P-Protein bodies and callose form blocking plugs. These bodies remain along the walls of sieve tube elements. P-Protein bodies

are assigned some in the translocation of food material in the sieve tubes but is not universally accepted.

Concepts:

1. Transport in Plants:

The two types of conducting tissues that are used to transport the water and minerals in plants such as:

Xylem:

Xylem is a long, non-living tube running from the roots to the leaves via the stem. The water is absorbed by the root hair and goes through cell-to-cell movement by osmosis until it reaches the xylem. This water is then transported throughout the xylem vessels to the leaves and is evaporated by the process of transpiration.

The xylem is also composed of lengthened cells like the phloem. However, the xylem is mainly accountable for transporting water to all plant parts from the roots. Since they serve such a vital function, a single tree would have a lot of xylem tissues.

Phloem:

The phloem is accountable for the translocation of nutrients and sugar like carbohydrates, produced by the leaves to areas of the plant that are metabolically in force. It is powered by living cells. The cell walls of these cells structure small holes at the ends of the cells known as sieve plates.

Means of Transportation in Plants:

[Transportation in plants](#) is by 3 means, they are as follows:

- Diffusion
- Facilitated diffusion
- Active Transport

161. Answer: c

Explanation:

Excessive exposure to fluoride, typically through drinking water with high fluoride levels, can lead to dental fluorosis, which is a condition that affects the appearance and health of teeth. It can cause staining and pitting of the enamel. In severe cases, fluoride toxicity can affect other parts of the body, including bones and the nervous system, but its primary impact is on dental health.

So, the correct option is (C): Teeth

Concepts:

1. Environmental Pollution:

When there is an unpleasant change in the surrounding that has harmful effects on plants and animals, it leads to [environmental pollution](#). Pollution is the root cause of a substance – “pollutant”. We can have pollutants in solid, liquid, or gaseous forms. A substance becomes a pollutant when its concentration is greater than the natural abundance and this increase in concentration is either because of human activities or natural phenomena.

Effects of Environmental Pollution:

Some pollutants are scraped into the soil by human beings. This leads to air, water, and soil pollution. If the soil is polluted, the helpful or functional microorganisms in it will die and the fertility of the soil will vanish. The production of crops will diminish. If the soil is not fertile; it will have a harmful consequence on human society.

162. Answer: a

Explanation:

Pteridophytes differs from bryophytes and thallophytes in having well developed vascular tissue system. Vascular tissues plays an important role in conducting water and food materials to the plants. Whereas these are absent in bryophytes and thallophytes.

Concepts:

1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They store their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

163. Answer: a

Explanation:

In castor seed testa and tegmen are united together. Seed coat is tough and bright due to scleroprotein. Over narrower end a brownish pad is found which is called caruncle. Caruncle is carbohydrate in nature. This protects micropyle and develops as an integumental outgrowth after fertilization. Below seed coat a very thin membrane is found over kernel and called perisperm (the persistent

nucellus). Below perisperm there is a large, white, swollen and oily mass called endosperm.

Concepts:

1. Morphology of Flowering Plants:

Morphology in flowering plants tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

Root System

The descending part of the plant grows under the soil roots. During the germination process, the radicle from the seed grows earthward and branches out. The branches along with the primary root are called the root system. Roots lack chlorophyll and therefore they are not green in color. Roots are positively geotropic and hydrotropic, that is, they grow downwards ground and water, and negatively phototropic, which is growing away from light.

There are three types of root systems found in plants are as follows:

1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

Shoot System

The stem is also an essential element of the plant. It is the ascending portion of the plant axis that bears branches, flowers, leaves, and fruits, as well as aiding in water and mineral conduction. It is the plant's aerial portion, brought about from an embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

164. **Answer: a**

Explanation:

Formation of gametophyte directly from sporophyte without meiosis and spore formation is apospory. The gametophyte thus has diploid number of chromosomes. Such gametophyte may form viable gametes which fuse to form tetraploid sporophyte. Apogamy is development of sporophyte directly from gametophytic tissue without fusion of gametes. Amphimixis is normal sexual reproduction. Parthenogenesis is development of embryo from egg without fertilization.

Concepts:

1. Sexual Reproduction in Flowering Plants:

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

An individual flower comprises the following parts –

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

165. Answer: c

Explanation:

Krebs cycle starts with condensation of acetyl CoA ($2C$) with oxaloacetic acid ($4C$) to form citric acid ($6C$).

Concepts:

1. Respiration in Plants:

Respiration in plants is a process that entails the production of energy in **plants**. This process can simply be described as the intake of Oxygen and the release of Carbon Dioxide as an outcome of the oxidation of complex organic compounds. Though plants do not have any specific organ to balance the process of respiration, their stems, roots, and leaves do this work at a very low rate than other living beings. The process of respiration is very crucial for the plants to sustain the growth of the plant tissues.

This process can be stated as-



166. Answer: a

Explanation:

Manganese (Mn^{2+}) is used for photolysis of water to produce oxygen and electrons during light reaction of photosynthesis. It is the phenomenon of breaking up of water into hydrogen and oxygen in the illuminated chloroplast. It acts as an essential cofactor.

Concepts:

1. Photosynthesis in Higher Plants:

Processes Of Photosynthesis in Higher Plants:

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C3 Cycle)
 2. C4 Cycle (Hatch and Slack Pathway)
-

167. **Answer: d**

Explanation:

Genetic diversity is the diversity in the number and types of genes as well as chromosomes present in different species and the variation in the genes and their alleles in the same species. India has more than 50,000 genetically diverse varieties of rice and 1000 varieties of mango.

Concepts:

1. Biodiversity and Conservation:

The term 'biodiversity' is derived from the two words- 'bios' which means life and 'diversity' i.e, differentiation or variation. Edward Wilson, the sociobiologist was the first to popularise the term 'biodiversity' in the year 1992. The term implies the occurrence of various plants and animals along with their variants such as biotypes, ecotypes and genes on earth. In our biosphere, the immense diversity or heterogeneity remains not only at the species level but also, at every level of biological organization that ranges from macromolecules in the cells to biomes.

[Biodiversity and Conservation](#) is a topic covered under the fifteenth chapter and Unit 5 of NCERT class 12 biology.

168. **Answer: c**

Explanation:

Cork cambium and vascular cambium are lateral meristems. Both are responsible for the secondary growth of stem. It also increases the girth of stem.

169. Answer: b

Explanation:

Tropical rainforests have a very dense plant cover. They also experience a large amount of precipitation, thus the forest floor is always damp. Thus, the conditions there have led animals to get adapted to arboreal habitats. Most animals found there are tree dwellers as almost every space on the forest floor is occupied by the vegetation.

Concepts:

1. Ecosystem:

An **ecosystem** is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

Structure of the Ecosystem:

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

170. Answer: c

Explanation:

Movement may be of two types, movement of locomotion and movement of curvature. Movement of curvature is movement of individual parts in relation to other parts. Curvature movement may be growth movements and turgor movements. Growth movements are caused by differential growth in different part of an organ. Opening of floral buds into flowers is such a type of growth movement. Mostly floral bud opening shows thermonastic movement i.e. opening and closing are controlled by temperature. Sometimes movements are controlled by presence or absence of light, eg. Oxalis.

Concepts:

1. Plant Growth and Development:

Growth in Plants:

Plants have the distinctive ability to grow throughout their life. The meristem cells present there in the [roots](#) and shoot apical lead to the primary growth of the plant. The primary growth which happens or takes place at the tips of the stem and roots of the plant contributes to the elongation of the plant along its axis.

In the later stages of growth in plants, the growth in dicotyledonous, [vascular cambium](#), [gymnosperms](#), and cork-cambium are also caused by the existence of meristems in them. These intercalary meristems are put up to increase the girth of the organs of the plant in which they are active. Such type of growth is commonly known as secondary growth.

Many parameters such as area, volume, fresh weight, cell number, dry weight, length, etc are utilized to measure the growth in plants as increase in the amount of protoplasm is responsible for the growth in plants.

Read More: [Plant Growth and Development](#)

171. Answer: a

Explanation:

Rate of salt absorption increases when temperature increases but to a certain limit as salt absorption is inhibited at higher temperature because certain enzymes are

not active at higher temperature and carriers are not synthesised. These carriers are required for active transport of salts from outer space in inner space. Rate of diffusion of ions and molecules increases at enhanced temperature due to their increased kinetic activity. Thus passive salt absorption will increase.

Concepts:

1. Mineral Nutrition:

The naturally occurring inorganic nutrient found in the soil and food that is necessary for the proper functioning of animal and plant bodies is defined as nutrition. [Minerals](#) are vital elements essential for the body.

Read More: [Mineral Nutrition](#)

Role of Nutrients:

1. Balancing function
2. Maintenance of osmotic pressure
3. Influencing the pH of the cell sap
4. Construction of the plant body
5. Catalysis of the biochemical reaction
6. Effects of Toxicity

172. Answer: a

Explanation:

Pebrine is a disease of silkworm caused by a small parasite *Nosema* which has a devastating effect on silk industry.

Concepts:

1. Strategies For Enhancement in Food Production:

Animal Husbandry

The raising and breeding of livestock are known as animal husbandry. Dairy farm management and fisheries are also included under animal husbandry and responsible for the selection of good breeds for better yield, maintaining a well-ventilated house and proper cleanliness and hygiene, and regulating proper [disposal of waste](#).

Read More: [Strategies for Enhancement in Food Production](#)

Animal Breeding

The practice of raising a group of animals belonging to a common species. Inbreeding and outbreeding are the two types of animal breeding.

1. Animals of superior male and female breed are made to mate for 4 to 6 generations. According to Mendel's experiment, true-breeding species or pure lines are created by [Inbreeding](#) which results in homozygosity.
2. The breeding involving animals that are not related is known as [outbreeding](#).
3. [Bee-keeping](#): The rearing of bees for the production of honey and beeswax is known as apiculture. One of the most common species of the honey bee is *Apis indica*. Beeswax is used to prepare polish, cosmetics, etc.
4. [Fisheries](#): Cultivation or breeding of aquatic flora and fauna for a commercial purpose is known as aquaculture. Fish and fish products for consumption are known as pisciculture.

Plant Breeding

In order to get rid of [nutrient deficiency diseases](#), crops need to have a specific nutrient value besides disease resistance, pest resistance, and high yield capacity. There are many strategies for enhancing food production through plant breeding.

1. [Somatic Hybrids](#)
2. [Totipotency](#)
3. [Biofortification](#)

Plant Breeding for Disease Resistance

Plant Breeding for Pest Resistance

Plant Breeding for Improved Food Quality

Single-Cell Protein

One of the ways to meet the growing demand of nutrients in plants and animals is a single-cell protein which is biomass that is rich in protein. microbes are produced on an industrial scale to get single-cell protein.

173. Answer: c

Explanation:

The apoplast refers to the interconnected system of cell walls that runs throughout the plant body, with the exception of certain regions such as the Casparian strips in roots. As a result of this separation, the apoplast cannot rely on cytoplasmic streaming for its transport mechanisms nor can it utilize plasmodesmata for movement between cells.

Concepts:

1. Transport in Plants:

The two types of conducting tissues that are used to transport the water and minerals in plants such as:

Xylem:

Xylem is a long, non-living tube running from the roots to the leaves via the stem. The water is absorbed by the root hair and goes through cell-to-cell movement by osmosis until it reaches the xylem. This water is then transported throughout the xylem vessels to the leaves and is evaporated by the process of transpiration.

The xylem is also composed of lengthened cells like the phloem. However, the xylem is mainly accountable for transporting water to all plant parts from the roots. Since they serve such a vital function, a single tree would have a lot of xylem tissues.

Phloem:

The phloem is accountable for the translocation of nutrients and sugar like carbohydrates, produced by the leaves to areas of the plant that are metabolically

in force. It is powered by living cells. The cell walls of these cells structurize small holes at the ends of the cells known as sieve plates.

Means of Transportation in Plants:

[Transportation in plants](#) is by 3 means, they are as follows:

- Diffusion
 - Facilitated diffusion
 - Active Transport
-

174. Answer: a

Explanation:

Phenyl is not typically used for the disinfection of drinking water. The other options (Chloramine, Chlorine, and Ozone) are commonly used methods for disinfecting drinking water to make it safe for consumption. Phenyl is more commonly used as a disinfectant for surfaces and in other applications, but it is not a standard choice for water treatment.

So, the correct option is (A): Phenyl

Concepts:

1. Environmental Issues:

[Environmental issues](#) refer to problems that arise from human activities that negatively impact the natural environment. These issues have far-reaching consequences on the earth and its inhabitants, including plants, animals, and humans.

Some of the major environmental issues include climate change, pollution, deforestation, and [loss of biodiversity](#). Climate change is caused by the accumulation of greenhouse gases in the atmosphere, leading to global warming and changes in weather patterns. Pollution is the release of harmful substances into the environment, such as air pollution from vehicle exhausts and industrial emissions or water pollution from oil spills and agricultural runoff.

[Deforestation](#) is the clearing of forests for human activities such as agriculture and logging, leading to habitat destruction and loss of biodiversity. Biodiversity is the variety of plant and animal species in an ecosystem, and its loss can lead to ecological imbalances, reduced food security, and the spread of diseases.

Other environmental issues include land degradation, resource depletion, and waste management. Land degradation is the deterioration of soil quality due to activities such as overgrazing, overuse of fertilizers, and deforestation. Resource depletion refers to the depletion of natural resources such as water, fossil fuels, and minerals. Waste management refers to the proper disposal and treatment of waste, which can cause health and environmental problems if not handled correctly.

Overall, environmental issues require collective action and effective policies to reduce their impact and preserve the natural world for future generations.

175. Answer: b

Explanation:

Chloroplast in Chlamydomonas is cup- shaped. It is one celled structure. Whereas stellate, spiral and collar shaped chloroplasts are present in Zygnema, Spirogyra and Ulothrix respectively.

Concepts:

1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are [bacteria](#) (prokaryotes), photosynthetic plants, [fungi](#), and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of [chlorophyll](#).

- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They store their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

176. Answer: b

Explanation:

In marigold of asteraceae the ovary is superior, 2 or 3 locular, placentation is axile, ovules 1 to many per locule, style 1, stigma 2 or 3 lobed.

Concepts:

1. Morphology of Flowering Plants:

Morphology in flowering plants tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

Root System

The descending part of the plant grows under the soil roots. During the germination process, the radicle from the seed grows earthward and branches out. The branches along with the primary root are called the root system. Roots lack chlorophyll and therefore they are not green in color. Roots are positively geotropic

and hydrotropic, that is, they grow downwards ground and water, and negatively phototropic, which is growing away from light.

There are three types of root systems found in plants are as follows:

1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

Shoot System

The stem is also an essential element of the plant. It is the ascending portion of the plant axis that bears branches, flowers, leaves, and fruits, as well as aiding in water and mineral conduction. It is the plant's aerial portion, brought about from an embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

177. Answer: d

Explanation:

In the ovule, the pollen tube is attracted by secretions of synergids. Usually the pollen tube enters the embryo sac by passing into one of the two synergids and is guided by the filiform apparatus of the synergids in their movement. Pollen tube then breaks open and releases its contents in the embryo sac. Antipodals and synergids later degenerate.

Concepts:

1. Sexual Reproduction in Flowering Plants:

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

An individual flower comprises the following parts –

- Pedicle
 - Calyx
 - Petals
 - Sepals
 - Stamen
 - Pistil
 - Receptacle
-

178. Answer: d

Explanation:

For a long time, Calvin cycle (C₃ cycle) was considered to be the only photosynthetic pathway for reduction of CO₂, into carbohydrates. M.D. Hatch and Slack reported that a 4-C compound oxaloacetic acid (OAA) is the first stable product in CO₂, reduction process. This led to an alternative pathway of CO₂, fixation which is known as Hatch and Slack's cycle or C₄ cycle. It occurs in sugarcane, maize etc. These C₄ plants have a characteristic leaf anatomy called Kranz anatomy.

Concepts:

1. Photosynthesis in Higher Plants:

Processes Of Photosynthesis in Higher Plants:

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C3 Cycle)
 2. C4 Cycle (Hatch and Slack Pathway)
-

179. Answer: d

Explanation:

Highest species diversity occurs in Amazon Rainforest.

Concepts:

1. Biodiversity and Conservation:

The term 'biodiversity' is derived from the two words- 'bios' which means life and 'diversity' i.e, differentiation or variation. Edward Wilson, the sociobiologist was the first to popularise the term 'biodiversity' in the year 1992. The term implies the occurrence of various plants and animals along with their variants such as biotypes, ecotypes and genes on earth. In our biosphere, the immense diversity or heterogeneity remains not only at the species level but also, at every level of biological organization that ranges from macromolecules in the cells to biomes.

[Biodiversity and Conservation](#) is a topic covered under the fifteenth chapter and Unit 5 of NCERT class 12 biology.

180. Answer: a

Explanation:

In hypodermis or outer cortical cells, a layer becomes meristematic which is known as cork cambium or phellogen. This phellogen also cuts off cells both on its outer side and inner side. The cells cut off on outer side are phellem or cork cells and cells cut off on inner side are phelloderm or secondary cortex. The phellem or cork cells

are dead and have deposition of a fatty substance called suberin (i.e., cork cells are suberized). Suberin is impervious to water and thus cork cells are buoyant (i.e., float on water). Phellem, phellogen and phelloderm collectively constitute periderm.

181. Answer: b

Explanation:

The correct answer is B) Glycolysis takes place in cytoplasm.

Glycolysis is the process of breaking down glucose into pyruvic acid leading to the production of ATP. The entire process of glycolysis takes place in the cytoplasm of the cell.

- Glycolysis is the common pathway for aerobic and anaerobic respiration.
- It is a ten-step reaction that converts a molecule of glucose into 2 molecules of pyruvic acid.
- The net gain of energy in the whole process is 2 molecules of ATP.
- Glycolysis is also termed an EMP pathway named after scientists Embden, Meyerhoff, and Parnas.

Concepts:

1. Respiration in Plants:

Respiration in plants is a process that entails the production of energy in plants. This process can simply be described as the intake of Oxygen and the release of Carbon Dioxide as an outcome of the oxidation of complex organic compounds. Though plants do not have any specific organ to balance the process of respiration, their stems, roots, and leaves do this work at a very low rate than other living beings. The process of respiration is very crucial for the plants to sustain the growth of the plant tissues.

This process can be stated as–



182. Answer: d

Explanation:

Phytochrome is a bright blue or bluish green pigment which was first of all isolated from plasma membrane of alga *Mougeotias*. It is a photoreceptive pigment. Phytochrome has a light absorbing or light detecting portion (the chromophore) attached to small protein of about 1,24,000 daltons. Phytochrome occurs in 2 forms, i.e., PR and Pfr (i.e., red light and far red light absorbing forms) and these 2 forms are interconvertible. It is involved in the perception of photoperiodic stimuli controlling flowering and other morphogenetic phenomenon in plants.

Concepts:

1. Plant Growth and Development:

Growth in Plants:

Plants have the distinctive ability to grow throughout their life. The meristem cells present there in the [roots](#) and shoot apical lead to the primary growth of the plant. The primary growth which happens or takes place at the tips of the stem and roots of the plant contributes to the elongation of the plant along its axis.

In the later stages of growth in plants, the growth in dicotyledonous, [vascular cambium](#), [gymnosperms](#), and cork-cambium are also caused by the existence of meristems in them. These intercalary meristems are put up to increase the girth of the organs of the plant in which they are active. Such type of growth is commonly known as secondary growth.

Many parameters such as area, volume, fresh weight, cell number, dry weight, length, etc are utilized to measure the growth in plants as increase in the amount of protoplasm is responsible for the growth in plants.

Read More: [Plant Growth and Development](#)

183. Answer: c

Explanation:

The process of transfer of energy from producers through a series of organisms, i.e., from primary consumers to secondary consumers and from secondary consumers to tertiary consumers by process of eating and being eaten constitute a food chain. The correct food chain is phytoplankton >> zooplankton >> fish.

Concepts:

1. Ecosystem:

An **ecosystem** is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

Structure of the Ecosystem:

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

184. Answer: c

Explanation:

The first domesticated animal by primitive man was dog. Cro-magnon man used to carry domesticated dogs while going for hunting.

Concepts:

1. Strategies For Enhancement in Food Production:

Animal Husbandry

The raising and breeding of livestock are known as animal husbandry. Dairy farm management and fisheries are also included under animal husbandry and responsible for the selection of good breeds for better yield, maintaining a well-ventilated house and proper cleanliness and hygiene, and regulating proper [disposal of waste](#).

Read More: [Strategies for Enhancement in Food Production](#)

Animal Breeding

The practice of raising a group of animals belonging to a common species. Inbreeding and outbreeding are the two types of animal breeding.

1. Animals of superior male and female breed are made to mate for 4 to 6 generations. According to Mendel's experiment, true-breeding species or pure lines are created by [Inbreeding](#) which results in homozygosity.
2. The breeding involving animals that are not related is known as [outbreeding](#).
3. [Bee-keeping](#): The rearing of bees for the production of honey and beeswax is known as apiculture. One of the most common species of the honey bee is *Apis indica*. Beeswax is used to prepare polish, cosmetics, etc.
4. [Fisheries](#): Cultivation or breeding of aquatic flora and fauna for a commercial purpose is known as aquaculture. Fish and fish products for consumption are known as pisciculture.

Plant Breeding

In order to get rid of [nutrient deficiency diseases](#), crops need to have a specific nutrient value besides disease resistance, pest resistance, and high yield capacity. There are many strategies for enhancing food production through plant breeding.

1. [Somatic Hybrids](#)
2. [Totipotency](#)
3. [Biofortification](#)

Plant Breeding for Disease Resistance

Plant Breeding for Pest Resistance

Plant Breeding for Improved Food Quality

Single-Cell Protein

One of the ways to meet the growing demand of nutrients in plants and animals is a single-cell protein which is biomass that is rich in protein. microbes are produced on an industrial scale to get single-cell protein.

185. Answer: b

Explanation:

The root nodule of legume contains enzyme 1 nitrogenase and leg haemoglobin. Nitrogenase catalyses the conversion of atmospheric nitrogen to ammonia. It is highly sensitive to the molecular oxygen and requires anaerobic conditions. The nodules have adaptations that ensure that the enzyme is protected from oxygen. To protect these enzymes, the nodule contains an oxygen scavenger called leg haemoglobin.

Concepts:

1. Mineral Nutrition:

The naturally occurring inorganic nutrient found in the soil and food that is necessary for the proper functioning of animal and plant bodies is defined as nutrition. [Minerals](#) are vital elements essential for the body.

Read More: [Mineral Nutrition](#)

Role of Nutrients:

1. Balancing function
 2. Maintenance of osmotic pressure
 3. Influencing the pH of the cell sap
 4. Construction of the plant body
 5. Catalysis of the biochemical reaction
 6. Effects of Toxicity
-

186. Answer: a

Explanation:

Brown algae are the members of the class phaeophyceae. Their chromatophores are ellipsoidal or discoid. They contain chlorophyll a, chlorophyll b, (α- and β- carotenes and xanthophyll pigments (e.g., lutein, flavoxanthin, violaxanthin). They also contain large amount of a brown pigment - fucoxanthin which masks the green colour of chlorophyll pigment. This gives characteristic brown colour to these plants, hence the name brown algae. The non-motile resting spores of Chlamydomonas contain a red pigment called hematochrome. phycocyanin and phycoerythrin are water soluble pigments found in red and blue-green algae.

Concepts:

1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They store their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.

- The non-photosynthetic plants acquire their food through **parasitism**, i.e through their host like Indian pipe.

Read More: [Classification of Plants](#)

187. Answer: d

Explanation:

China rose, mustard, brinjal, potato, onion and tulip are the plants that have superior ovary whereas in guava and cucumber, ovary is inferior.

Concepts:

1. Morphology of Flowering Plants:

Morphology in flowering plants tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

Root System

The descending part of the plant grows under the soil roots. During the germination process, the radicle from the seed grows earthward and branches out. The branches along with the primary root are called the root system. Roots lack chlorophyll and therefore they are not green in color. Roots are positively geotropic and hydrotropic, that is, they grow downwards ground and water, and negatively phototropic, which is growing away from light.

There are three types of root systems found in plants are as follows:

1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

Shoot System

The stem is also an essential element of the plant. It is the ascending portion of the plant axis that bears branches, flowers, leaves, and fruits, as well as aiding in water and mineral conduction. It is the plant's aerial portion, brought about from an embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

188. Answer: d

Explanation:

On the basis of number of megaspore nuclei taking part in development of female gametophyte or embryo sac, there are 3 types of embryo sacs- (i) Monosporic type - In this type the single nucleus of functional megaspore undergoes 3 mitotic divisions to form 8 nuclei, 7 cells. (ii) Bisporic type - Here embryo sac develops from 2 megaspore nuclei out of 4 nuclei formed after reduction division of MMC. It is also 8 nucleated. (iii) Tetrasporic type - Here all the 4 megaspore nuclei formed after reduction division of megaspore mother cell are functional and take part in development of embryo sac. It is further of different types. Fritillaria type, Plumbago type and Adoxa type are 8 nucleated.

Concepts:

1. Sexual Reproduction in Flowering Plants:

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

An individual flower comprises the following parts -

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen

- Pistil
 - Receptacle
-

189. Answer: c

Explanation:

An electron transport system (*ETS*) or electron transport chain (*ETC*) is a series of coenzymes and cytochromes that take part in the passage of electrons from one carrier to another and to its ultimate acceptor. The various components of *ETS* are arranged in five kinds of complexes, arranged in a definite sequence in the inner mitochondrial membrane.

Concepts:

1. Respiration in Plants:

Respiration in plants is a process that entails the production of energy in plants. This process can simply be described as the intake of Oxygen and the release of Carbon Dioxide as an outcome of the oxidation of complex organic compounds. Though plants do not have any specific organ to balance the process of respiration, their stems, roots, and leaves do this work at a very low rate than other living beings. The process of respiration is very crucial for the plants to sustain the growth of the plant tissues.

This process can be stated as–



190. Answer: c

Explanation:

Emerson and Lewis worked on Chlorel/a and Calculated the quantum yield for different wavelengths. Emerson observed that rate of photosynthesis declines in the red region of the spectrum. This decline in 1 photosynthesis is called 'Red drop'. It was observed that the quantum yield falls when the light of wavelengths more than 680

or 690 nm are supplied. As the PS-II (P-680) is driven by red light, so it remains ; inactive during red drop.

Concepts:

1. Photosynthesis in Higher Plants:

Processes Of Photosynthesis in Higher Plants:

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C₃ Cycle)
2. C₄ Cycle (Hatch and Slack Pathway)

191. **Answer: a**

Explanation:

Ex situ conservation is conservation of selected rare plants/animals in places outside their natural homes. It includes botanical gardens or zoological parts, seed banks, cryopreservation, field gene banks and sacred plants. Many wild and domesticated species are well managed and collected in botanical gardens, zoological parks, wild life safari parks, arboreta etc. Most of these have capture breeding programmes to

restore the decreasing number of animals and helping the survival of existing individuals of the species. Gene banks are institutes that maintain stocks of viable seeds (seed banks), live plants (orchards), tissue culture and frozen germplasm with the whole range of genetic viability.

Concepts:

1. Biodiversity and Conservation:

The term 'biodiversity' is derived from the two words- 'bios' which means life and 'diversity' i.e, differentiation or variation. Edward Wilson, the sociobiologist was the first to popularise the term 'biodiversity' in the year 1992. The term implies the occurrence of various plants and animals along with their variants such as biotypes, ecotypes and genes on earth. In our biosphere, the immense diversity or heterogeneity remains not only at the species level but also, at every level of biological organization that ranges from macromolecules in the cells to biomes.

[Biodiversity and Conservation](#) is a topic covered under the fifteenth chapter and Unit 5 of NCERT class 12 biology.

192. Answer: b

Explanation:

The term biogeochemical cycling is used for exchanges/circulation of biogeochemical nutrients between living and nonliving components of biosphere. In sedimentary cycle of matter, materials involved in circulation between biotic and abiotic components of biosphere are nongaseous and the reservoir pool is lithosphere, e.g., phosphorus, calcium, magnesium. Sulphur has both sedimentary and gaseous phase. O_2 , N_2 and CO_2 do not have sedimentary phase but are gaseous cycle.

Concepts:

1. Ecosystem:

An **ecosystem** is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

Structure of the Ecosystem:

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

193. **Answer: a**

Explanation:

Abscisic acid (ABA), phenolic acid and para-ascorbic acid are inhibitory substances that cause seed dormancy.

??Effect of inhibitory substance can be removed by application of certain chemicals like gibberellic acid and nitrates.

194. **Answer: c**

Explanation:

Among the physical mutagens, X and γ rays are the most commonly used mutagens in mutation breeding. Over the past 40 years use of γ rays in mutation induction has become particularly prevalent, while the use of X-rays has significantly reduced. The preference for γ rays is probably on account of both its wide availability and versatility of use. The naturally occurring isotope K40 is one source of γ rays in the environment. For practical purposes, Co60 and Cs137 are used as their physical

parameters like half life, energy of rays produced etc. make them suitable as gamma source.

Concepts:

1. Strategies For Enhancement in Food Production:

Animal Husbandry

The raising and breeding of livestock are known as animal husbandry. Dairy farm management and fisheries are also included under animal husbandry and responsible for the selection of good breeds for better yield, maintaining a well-ventilated house and proper cleanliness and hygiene, and regulating proper [disposal of waste](#).

Read More: [Strategies for Enhancement in Food Production](#)

Animal Breeding

The practice of raising a group of animals belonging to a common species. Inbreeding and outbreeding are the two types of animal breeding.

1. Animals of superior male and female breed are made to mate for 4 to 6 generations. According to Mendel's experiment, true-breeding species or pure lines are created by [Inbreeding](#) which results in homozygosity.
2. The breeding involving animals that are not related is known as [outbreeding](#).
3. [Bee-keeping](#): The rearing of bees for the production of honey and beeswax is known as apiculture. One of the most common species of the honey bee is *Apis indica*. Beeswax is used to prepare polish, cosmetics, etc.
4. [Fisheries](#): Cultivation or breeding of aquatic flora and fauna for a commercial purpose is known as aquaculture. Fish and fish products for consumption are known as pisciculture.

Plant Breeding

In order to get rid of [nutrient deficiency diseases](#), crops need to have a specific nutrient value besides disease resistance, pest resistance, and high yield capacity. There are many strategies for enhancing food production through plant breeding.

1. [Somatic Hybrids](#)

2. Totipotency

3. Biofortification

Plant Breeding for Disease Resistance

Plant Breeding for Pest Resistance

Plant Breeding for Improved Food Quality

Single-Cell Protein

One of the ways to meet the growing demand of nutrients in plants and animals is a single-cell protein which is biomass that is rich in protein. microbes are produced on an industrial scale to get single-cell protein.

195. Answer: c

Explanation:

Collenchyma occurs in climbing stems. Collenchyma occurs in the stem and petioles of dicot herbs. Due to deposition of pectin, it has high water retaining capacity. Since pectin appears at the angles, it becomes a spongy tissues. The collenchyma is a mechanical tissue which gives tensile strength to the plant.

196. Answer: a

Explanation:

Nitrococcus – Conversion of ammonia to nitrite Rhizobium – Conversion of atmospheric nitrogen to ammonia Thiobacillus – Denitrification Nitrobacter – Conversion of Nitrite to Nitrate

Concepts:

1. Mineral Nutrition:

The naturally occurring inorganic nutrient found in the soil and food that is necessary for the proper functioning of animal and plant bodies is defined as nutrition. [Minerals](#) are vital elements essential for the body.

Read More: [Mineral Nutrition](#)

Role of Nutrients:

1. Balancing function
 2. Maintenance of osmotic pressure
 3. Influencing the pH of the cell sap
 4. Construction of the plant body
 5. Catalysis of the biochemical reaction
 6. Effects of Toxicity
-

197. Answer: b

Explanation:

Phenyl mercuric acetate (PMA) results in reduced transpiration. PMA is an antitranspirant. These are some chemicals whose limited application on the leaf surface reduces or checks transpiration. A good antitranspirant increases leaf resistance but does not affect the mesophyll resistance.

Concepts:

1. Transport in Plants:

The two types of conducting tissues that are used to transport the water and minerals in plants such as:

Xylem:

Xylem is a long, non-living tube running from the roots to the leaves via the stem. The water is absorbed by the root hair and goes through cell-to-cell movement by osmosis until it reaches the xylem. This water is then transported throughout the xylem vessels to the leaves and is evaporated by the process of transpiration.

The xylem is also composed of lengthened cells like the phloem. However, the xylem is mainly accountable for transporting water to all plant parts from the roots. Since they serve such a vital function, a single tree would have a lot of xylem tissues.

Phloem:

The phloem is accountable for the translocation of nutrients and sugar like carbohydrates, produced by the leaves to areas of the plant that are metabolically in force. It is powered by living cells. The cell walls of these cells structurize small holes at the ends of the cells known as sieve plates.

Means of Transportation in Plants:

[Transportation in plants](#) is by 3 means, they are as follows:

- Diffusion
 - Facilitated diffusion
 - Active Transport
-

198. Answer: d

Explanation:

In the hydrosphere, approximately 2.5% of the total water is freshwater, with polar ice and glaciers containing around 70% of this freshwater, while groundwater holds approximately 30%. The remaining 98.5% of water in the hydrosphere is composed of saltwater.

So, the correct option is (D): Polar ice

Concepts:

1. Environmental Issues:

[Environmental issues](#) refer to problems that arise from human activities that negatively impact the natural environment. These issues have far-reaching consequences on the earth and its inhabitants, including plants, animals, and humans.

Some of the major environmental issues include climate change, pollution, deforestation, and [loss of biodiversity](#). Climate change is caused by the accumulation of greenhouse gases in the atmosphere, leading to global warming and changes in weather patterns. Pollution is the release of harmful substances into the environment, such as air pollution from vehicle exhausts and industrial emissions or water pollution from oil spills and agricultural runoff.

[Deforestation](#) is the clearing of forests for human activities such as agriculture and logging, leading to habitat destruction and loss of biodiversity. Biodiversity is the variety of plant and animal species in an ecosystem, and its loss can lead to ecological imbalances, reduced food security, and the spread of diseases.

Other environmental issues include land degradation, resource depletion, and waste management. Land degradation is the deterioration of soil quality due to activities such as overgrazing, overuse of fertilizers, and deforestation. Resource depletion refers to the depletion of natural resources such as water, fossil fuels, and minerals. Waste management refers to the proper disposal and treatment of waste, which can cause health and environmental problems if not handled correctly.

Overall, environmental issues require collective action and effective policies to reduce their impact and preserve the natural world for future generations.

199. Answer: a

Explanation:

Endosperm in a gymnospermic plant is a haploid structure, which is formed without fusion of gametes and represent female gametophyte. Leaf of gymnosperm belongs to diploid generation.

$$2n = 16$$

$$n = 8$$

So, number of chromosomes in endosperm of gymnosperm is 8 .

Concepts:

1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are [bacteria](#) (prokaryotes), photosynthetic plants, [fungi](#), and several non-

photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They store their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

200. Answer: b

Explanation:

The mode of arrangement of the sepals or petals with respect to one another in the floral bud is termed as aestivation. Aestivation is of different types - valvate, twisted or contorted, imbricate, quincuncial, vexillary, convolute, and plicate. In valvate aestivation, sepals or petals or tepals just touch each other without any overlapping. Calotropis, tulip, Asparagus, Colchicum, Petunia, mustard and tobacco have valvate aestivation.

Concepts:

1. Morphology of Flowering Plants:

Morphology in flowering plants tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

Root System

The descending part of the plant grows under the soil roots. During the germination process, the radicle from the seed grows earthward and branches out. The branches along with the primary root are called the root system. Roots lack chlorophyll and therefore they are not green in color. Roots are positively geotropic and hydrotropic, that is, they grow downwards ground and water, and negatively phototropic, which is growing away from light.

There are three types of root systems found in plants are as follows:

1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

Shoot System

The stem is also an essential element of the plant. It is the ascending portion of the plant axis that bears branches, flowers, leaves, and fruits, as well as aiding in water and mineral conduction. It is the plant's aerial portion, brought about from an embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.