

NEET Mock Test 3

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. Which of the following processes is reversible? (+4, -1)
 - a. Transfer of heat by radiation
 - b. Electrical heating of a nichrome wire
 - c. Transfer of heat by conduction
 - d. Isothermal compression

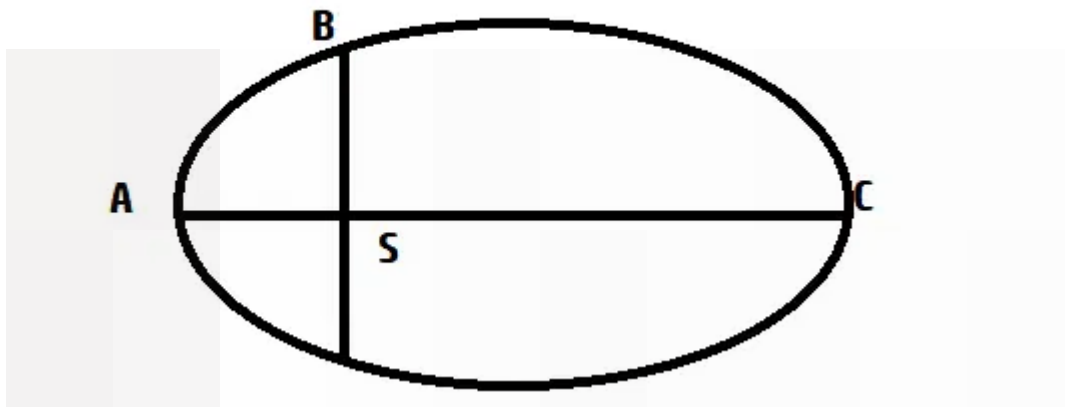
2. An electron is moving around the nucleus of a hydrogen atom in a circular orbit of radius r . The coulomb force $\vec{F}$ between the two is- (where $K = \frac{1}{4\pi\epsilon_0}$) (+4, -1)
 - a. $K \frac{e^2}{r^2} \hat{r}$
 - b. $-K \frac{e^2}{r^3} \hat{r}$
 - c. $K \frac{e^2}{r^3} \vec{r}$
 - d. $-K \frac{e^2}{r^3} \vec{r}$

3. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of (+4, -1)
 - a. $\sqrt{2} : 1$
 - b. $1 : 4$
 - c. $1 : 2$
 - d. $1 : \sqrt{2}$

4. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is $0.5\ \Omega$. The power loss in the wire is (+4, -1)

- a. 19.2 W
- b. 19.2 kW
- c. 19.2 J
- d. 12.2 kW

5. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A , K_B and K_C , respectively. AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then (+4, -1)



- a. $K_B > K_A > K_C$
 - b. $K_A < K_B < K_C$
 - c. $K_B < K_A < K_C$
 - d. $K_A > K_B > K_C$
6. When an oscillator completes 100 oscillations its amplitude reduced to $\frac{1}{3}$ of initial value. What will be its amplitude, when it completes 200 oscillations? (+4, -1)
- a. $\frac{1}{8}$
 - b. $\frac{2}{3}$
 - c. $\frac{1}{6}$

d. $\frac{1}{9}$

7. A lift of mass 1000 kg which is moving with acceleration of 1 m/s^2 in upward direction, then the tension developed in string which is connected to lift is :- (+4, -1)

- a. 9800 N
- b. 10,800 N
- c. 11,000 N
- d. 10,000 N

8. Two sound waves with wavelengths 5.0 m and 5.5. m respectively, each propagate in a gas with velocity 330 m/s. We expect the following number of beats per second :- (+4, -1)

- a. 6
- b. 12
- c. 0
- d. 1

9. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect? (+4, -1)

- a. The change in energy stored is $\frac{1}{2}CV^2 \left(\frac{1}{K} - 1\right)$
 - b. The charge on the capacitor is not conserved
 - c. The potential difference between the plates decreases K times
 - d. The energy stored in the capacitor decreases K times
-

10. A particle moving along x -axis has acceleration f , at time t , given by $f = f_0 \left(1 - \frac{t}{T}\right)$, where f_0 and T are constants. The particle at $t = 0$ has zero velocity. In the time interval between $t = 0$ and the instant when $f = 0$, the particle's velocity (v_x) is: (+4, -1)
- a. $\frac{1}{2}f_0T^2$
 - b. f_0T^2
 - c. $\frac{1}{2}f_0T$
 - d. f_0T
-
11. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection, is (+4, -1)
- a. 45°
 - b. 60°
 - c. $\tan^{-1} \frac{1}{2}$
 - d. $\tan^{-1} \left(\frac{\sqrt{3}}{2}\right)$
-
12. A proton and an alpha particle both enter a region of uniform magnetic field B , moving at right angles to the field B . If the radius of circular orbits for both the particles is equal and the kinetic energy acquired by proton is 1 MeV , the energy acquired by the alpha particle will be (+4, -1)
- a. 1.5 MeV
 - b. 1 MeV
 - c. 4 MeV
 - d. 0.5 MeV
-

13. A ring of mass m and radius r rotates about an axis passing through its centre and perpendicular to its plane with angular velocity ω . Its kinetic energy is (+4, -1)

- a. $\frac{1}{2}mr^2\omega^2$
- b. $mr\omega^2$
- c. $mr^2\omega^2$
- d. $\frac{1}{2}mr\omega^2$

14. For a normal eye, the cornea of eye provides a converging power of $40 D$ and the least converging power of the eye lens behind the cornea is $20 D$. Using this information, the distance between the retina and the cornea - eye lens can be estimated to be - (+4, -1)

- a. 1.5 cm
- b. 5 cm
- c. 2.5 cm
- d. 1.67 cm

15. In any fission process the ratio $\frac{\text{mass of fission products}}{\text{mass of parent nucleus}}$ is (+4, -1)

- a. equal to 1
- b. greater than 1
- c. less than 1
- d. depends on the mass of the parent nucleus.

16. What is the cause of "Green house effect" :- (+4, -1)

- a. infra-red rays
- b. ultra violet rays

- c. X-rays
- d. radio waves.

17. By photoelectric effect, Einstein proved

(+4, -1)

- a. $E = h\nu$
- b. $K.E. = \frac{1}{2}mv^2$
- c. $E = mc^2$
- d. $E = \frac{-Rhc^2}{n^2}$

18. *C* and *Si* both have same lattice structure; having 4 bonding electrons in each. However, *C* is insulator where as *Si* is intrinsic semiconductor. This is because

(+4, -1)

- a. In case of C the valence band is not completely filled at absolute zero temperature
- b. In case of C the conduction band is partly filled even at absolute zero temperature
- c. The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third
- d. The four bonding electron s in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit

19. If θ_1 and θ_2 be the apparent angles of dip observed in two vertical planes at right angles to each other, then the true angle of dip θ is given by :

(+4, -1)

- a. $\tan^2 \theta = \tan^2 \theta_1 + \tan^2 \theta_2$
- b. $\cot^2 \theta = \cot^2 \theta_1 - \cot^2 \theta_2$
- c. $\tan^2 \theta = \tan^2 \theta_1 - \tan^2 \theta_2$

d. $\cot^2 \theta = \cot^2 \theta_1 + \cot^2 \theta_2$

20. An ac source is connected to a capacitor C. Due to decrease in its operating frequency: (+4, -1)

- a. capacitive reactance remains constant
- b. capacitive reactance decreases
- c. displacement current increases
- d. displacement current decreases

21. The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are: (+4, -1)

- a. Random errors
- b. Instrumental errors
- c. Personal errors
- d. Least count errors

22. Two conducting circular loops of radii R_1 and R_2 are placed in the same plane with their centers coinciding. If $R_1 \gg R_2$, the mutual inductance M between them will be directly proportional to (+4, -1)

- a. $\frac{R_2^2}{R_1}$
- b. $\frac{R_1}{R_2}$
- c. $\frac{R_2}{R_1}$
- d. $\frac{R_1^2}{R_2}$

23. A cylindrical rod having temperature T_1 and T_2 at its end. The rate of flow of heat Q_1 cal/sec. If all the linear dimension are doubled keeping temperature (+4, -1)

remain const. then rate of flow of heat Q_2 will be

- a. $4Q_1$
- b. $2Q_1$
- c. $Q_1/4$
- d. $Q_1/2$

24. Which of the following are suitable for the fusion process

(+4, -1)

- a. Light nuclei
- b. heavy nuclei
- c. Element must be lying in the middle of the periodic table
- d. Middle elements, which are lying on binding energy curve

25. An ideal gas heat engine operates in Carnot cycle between 227°C and 127°C .

(+4, -1)

It absorbs 6×10^4 cal of heat at higher temperature. Amount of heat converted to work is:

- a. 2.4×10^4 cal
- b. 3.6×10^4 ca
- c. 1.2×10^4 cal
- d. 6.4×10^4 cal

26. A body, constrained to move in y-direction, is subjected to a force given by

(+4, -1)

$\vec{F} = (-2\hat{i} + 15\hat{j} + 6\hat{k})\text{N}$ The work done by this force in moving the body through a distance of $10\hat{j}$ m along y-axis, is

- a. 150 J

- b. 20 J
- c. 190 J
- d. 160 J

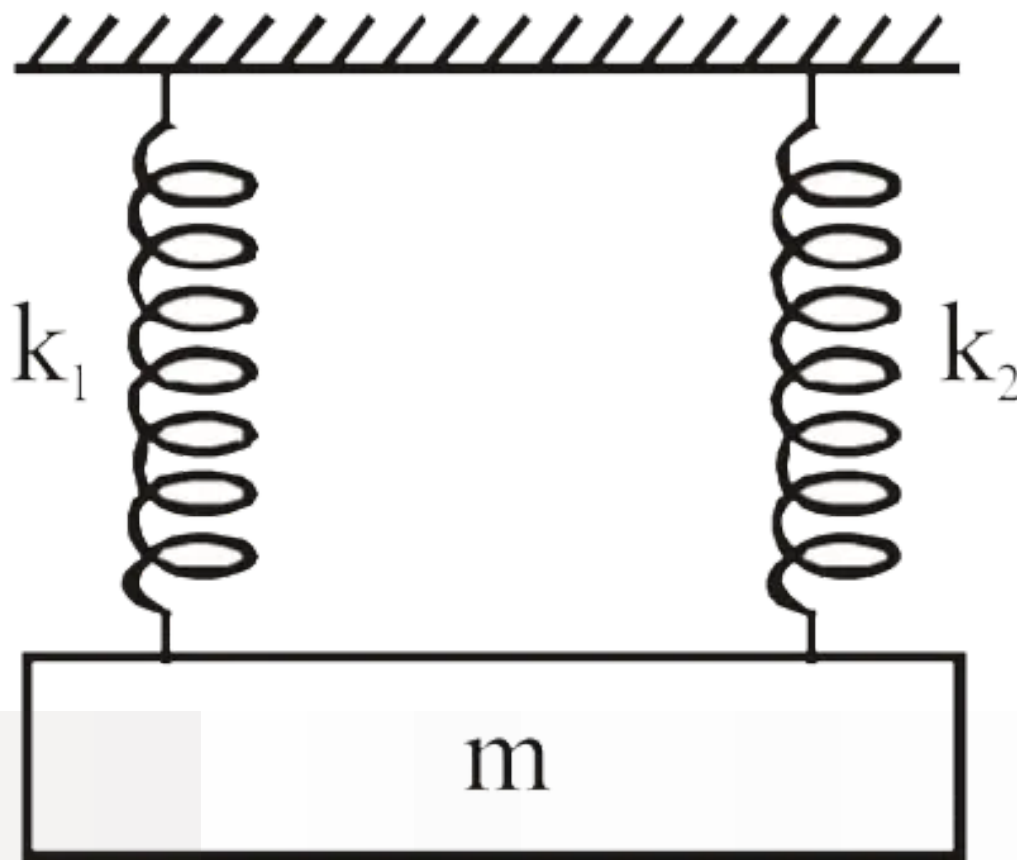
27. In the circuit shown in the figure, if the potential at point A is taken to be zero, the potential at point B is (+4, -1)

- a. +1 V
- b. -1 V
- c. +2 V
- d. -2 V

28. A particle of mass m is thrown upwards from the surface of the earth, with a velocity u . The mass and the radius of the earth are, respectively, M and R . G is gravitational constant and g is acceleration due to gravity on the surface of the earth. The minimum value of u so that the particle does not return back to earth, is (+4, -1)

- a. $\sqrt{\frac{2GM}{R^2}}$
- b. $\sqrt{\frac{2GM}{R}}$
- c. $\sqrt{\frac{2gM}{R^2}}$
- d. $\sqrt{2gR^2}$

29. A mass is suspended separately by two different springs in successive order then time periods is t_1 and t_2 respectively. If it is connected by both spring as shown in figure then time period is t_0 , the correct relation is (+4, -1)



- a. $t_0^2 = t_1^2 + t_2^2$
- b. $t_0^{-2} = t_1^{-2} + t_2^{-2}$
- c. $t_0^{-1} = t_1^{-1} + t_2^{-1}$
- d. $t_0 = t_1 + t_2$

30. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - (2 \times 10^5)t$ where, F is in newton and t in seconds. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet? (+4, -1)
- a. 9 Ns
 - b. zero
 - c. 1.8 Ns

d. 0.9 Ns

31. A transverse wave propagating along x-axis is represented by $y(x, t) = 8.0 \sin(0.5\pi x - 4\pi t - \pi/4)$ where x is in metres and t is in seconds. The speed of the wave is :- (+4, -1)

a. 8 m/s

b. $4\pi \text{ m/s}$

c. $0.5\pi \text{ m/s}$

d. $\pi/4 \text{ m/s}$

32. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the eneigy stored in the capacitor is (+4, -1)

a. $\frac{1}{2}\epsilon_0 E^2$

b. $\frac{E^2 Ad}{\epsilon_0}$

c. $\frac{1}{2}\epsilon_0 E^2 Ad$

d. $\epsilon_0 EAd$

33. A particle of unit mass undergoes one dimensional motion such that its velocity varies according to $v(x) = \beta x^{-2n}$, where β and n are constants and x is the position of the particle. The acceleration of the particle as a function of x , is given by (+4, -1)

a. $-2\beta^2 x^{-2n+1}$

b. $-2n\beta^2 e^{-4n+1}$

c. $-2n\beta^2 x^{-2n-1}$

d. $-2n\beta^2 x^{-4n-1}$

34. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an α -particle to describe a circle of same radius in the same field? (+4, -1)

- a. 2 MeV
- b. 1 MeV
- c. 0.5 MeV
- d. 4 MeV

35. A rod of length is 3 m and its mass acting per unit length is directly proportional to distance x from one of its end then its centre of gravity from that end will be at :- (+4, -1)

- a. 1.5 m
- b. 2 m
- c. 2.5 m
- d. 3.0 m

Physics Section B

36. A ship A is moving Westwards with a speed of 10 km h^{-1} and a ship B 100 km South of A, is moving Northwards with a speed of 10 km h^{-1} . The time after which the distance between them becomes shortest, is (+4, -1)
- a. $5\sqrt{2} \text{ h}$
 - b. $10\sqrt{2} \text{ h}$
 - c. 0 h
 - d. 5 h
-
37. If the focal length of objective lens is increased then magnifying power of (+4, -1)
- a. microscope will increase but that of telescope decrease
 - b. microscope and telescope both will increase.
 - c. microscope and telescope both will decrease
 - d. microscope will decrease but that of telescope will increase.
-
38. In terms of Bohr radius a_0 , the radius of the second Bohr orbit of a hydrogen atom is given by (+4, -1)
- a. $4a_0$
 - b. $8a_0$
 - c. $\sqrt{2}a_0$
 - d. $2a_0$
-
39. Which of the following statement is false for the properties of electromagnetic waves? (+4, -1)

- a. Both electric and magnetic field vectors attain the maxima and minima at the same place and same time.
- b. The energy in electromagnetic wave is divided equally between electric and magnetic vectors.
- c. Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave.
- d. These waves do not require any material medium for propagation

40. Consider the junction diode as ideal. The value of current flowing through AB is : (+4, -1)

- a. $10^{-2} A$
- b. $10^{-1} A$
- c. $10^{-3} A$
- d. $0 A$

41. Electrons used in an electron microscope are accelerated by a voltage of 25 kV . If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would (+4, -1)

- a. increase by 2 times
- b. decrease by 2 times
- c. decrease by 4 times
- d. increase by 4 times

42. If θ_1 and θ_2 be the apparent angles of dip observed in two vertical planes at right angles to each other, then the true angle of dip θ is given by : (+4, -1)

- a. $\tan^2 \theta = \tan^2 \theta_1 + \tan^2 \theta_2$

b. $\cot^2 \theta = \cot^2 \theta_1 - \cot^2 \theta_2$

c. $\tan^2 \theta = \tan^2 \theta_1 - \tan^2 \theta_2$

d. $\cot^2 \theta = \cot^2 \theta_1 + \cot^2 \theta_2$

43. In a series LCR circuit, the inductance L is 10 mH, Capacitance C is $1\mu\text{F}$ and resistance R is 100Ω . The frequency at which resonance occurs is (+4, -1)

a. 1.59 kHz

b. 15.9 rad/s

c. 15.9 kHz

d. 1.59 rad/s

44. A screw gauge gives the following readings when used to measure the diameter of a wire Main scale reading : 0 mm Circular scale reading: 52 divisions Given that 1 mm on the main scale corresponds to 100 divisions on the circular scale. The diameter of the wire from the above data is (+4, -1)

a. 0.052 cm

b. 0.52 cm

c. 0.026 cm

d. 0.26 cm

45. What is the cause of "Green house effect" (+4, -1)

a. Infra-red rays

b. Ultra violet rays

c. X-rays

d. Radio waves

46. A sample of radioactive element containing 4×10^{16} active nuclei. Half-life of the element is 10 days, then the number of decayed nuclei after 30 days (+4, -1)

- a. 0.5×10^{16}
- b. 2×10^{16}
- c. 3.5×10^{16}
- d. 1×10^{16}

47. A galvanometer acting as a voltmeter will have (+4, -1)

- a. a high resistance in series with its coil
- b. a low resistance in parallel with its coil
- c. a low resistance in series with its coil
- d. a high resistance in parallel with its coil

48. The equation of state for 5g of oxygen at a pressure P and temperature T, when occupying a volume V, will be :- (+4, -1)

- a. $PV = 5 RT$
- b. $PV = \left(\frac{5}{2}\right) RT$
- c. $PV = \left(\frac{5}{16}\right) RT$
- d. $PV = \left(\frac{5}{32}\right) RT$

49. The kinetic energy acquired by a mass m in travelling distance d, starting from rest, under the action of a constant force is directly proportional to (+4, -1)

- a. m
- b. m^0

c. $\sqrt{m}$

d. $l\sqrt{m}$

50. A student measures the terminal potential difference (V) of a cell (of emf ε and internal resistance r) as a function of the current (I) flowing through it. The slope, and intercept, of the graph between V and I , then, respectively, equal (+4, -1)

a. $-r$ and ε

b. r and $-\varepsilon$

c. $-\varepsilon$ and r

d. ε and $-r$

Chemistry Section A

51. For a cell involving one electron $E_{cell}^{\circ} = 0.59 \text{ V}$ at 298 K, the equilibrium constant for the cell reaction is : [Given that $\frac{2.303 RT}{F} = 0.059 \text{ V}$ at $T = 298$] (+4, -1)
- a. 1.0×10^{10}
- b. 1.0×10^{30}
- c. 1.0×10^2
- d. 1.0×10^5
-
52. For the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$ rate and rate constant are $1.02 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ and $3.4 \times 10^{-5} \text{ s}^{-1}$ respectively. The concentration of N_2O_5 in mol L^{-1} will be (+4, -1)
- a. 3.4×10^{-4}
- b. 3.0
- c. 5.2
- d. 3.2×10^{-5}
-
53. How many g of dibasic acid (mol. wt. 200) should be present in 100 mL of the aqueous solution to give 0.1 normality ? (+4, -1)
- a. 1 g
- b. 2 g
- c. 10 g
- d. 20 g
-
54. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl? (+4, -1)

- a. 0.339
- b. 0.011
- c. 0.029
- d. 0.044

55. Identify the correct statement for change of Gibbs energy for a system (ΔG_{system}) at constant temperature and pressure : (+4, -1)

- a. If $\Delta G_{system} > 0$, the process is spontaneous
- b. If $\Delta G_{system} = 0$, the system has attained equilibrium
- c. If $\Delta G_{system} = 0$, the system is still moving in a particular direction
- d. If $\Delta G_{system} < 0$, the process is spontaneous

56. Which of the following is an optically active compound? (+4, -1)

- a. 1-Butanol
- b. 1-Propanol
- c. 2-Chlorobutane
- d. 4-Hydroxyheptane

57. At 25° , the dissociation constant of a base, BOH is 1.0×10^{-12} . The concentration of hydroxyl ions in 0.01 M aqueous solution of the base would be (+4, -1)

- a. $2.0 \times 10^{-6} \text{ mol L}^{-1}$
- b. $1.0 \times 10^{-5} \text{ mol L}^{-1}$
- c. $1.0 \times 10^{-6} \text{ mol L}^{-1}$

d. $1.0 \times 10^{-7} \text{ mol L}^{-1}$

58. Arrange the following in increasing order of stability:- (a) $(\text{CH}_3)_2 \text{C}^+ - \text{CH}_2 - \text{CH}_3$ (b) $(\text{CH}_3)_3 \text{C}^+$ (c) $(\text{CH}_3)_2 \text{C}^+ \text{H}$ (d) $\text{CH}_3 \text{C}^+ \text{H}_2$ (e) $\text{C}^+ \text{H}_3$ (+4, -1)

a. $e < d < c < a < b$

b. $d < e < c < a < b$

c. $a < e < d < c < b$

d. $e < d < c < b < a$

59. Cinnabar is an ore of (+4, -1)

a. Hg

b. Cu

c. Pb

d. Zn

60. Consider the reactions :- Identify A, X, Y and Z (+4, -1)

a. A-Methoxymethane, X-Ethanol, Y-Ethanoic acid, Z-Semicarbazide

b. A - Ethanal , X - Ethanol , Y - But - 2 - enal , Z - Semicarbazone

c. A- Ethanol, X- Acet aldehyde, Y- Butanone, Z- Hydrazone

d. A-Methoxymethane, X-Ethanoic acid, Y-Acetate ion, Z-hydrazine

61. In the reaction the electrophile involved is (+4, -1)

a. dichlorocarbene ($:\text{CCl}_2$)

b. dichloromethyl cation (CHCl_2^+)

c. dichloromethyl anion ($\overset{\ominus}{C}HCl_2$)

d. formyl cation ($\overset{\oplus}{C}HO$)

62. On doping Ge metal with a little of In or Ga, one gets (+4, -1)

a. p-type semiconductor

b. insulator

c. n-type semiconductor

d. rectifier

63. The IUPAC name of an element with atomic number 119 is (+4, -1)

a. ununennium

b. unnilennium

c. unununnium

d. ununoctium

64. Match List-I with List-II. (+4, -1)

	List - I		List - II
(a)	Li	(i)	Absorbent for carbon dioxide
(b)	Na	(ii)	Electrochemical cells
(c)	KOH	(iii)	Coolant in fast breeder reactors
(d)	Cs	(iv)	Photoelectric cell

Choose the correct answer from the options given below:

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

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

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

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

65. Oxidation numbers of A , B and C are $+2$, $+5$ and -2 respectively possible formula of compound is: (+4, -1)

a. $A_2(BC_2)_2$

b. $A_3(BC_4)_2$

c. $A_2(BC_3)_2$

d. $A_3(B_2C)_2$

66. Predict the correct order among the following: (+4, -1)

a. lone pair-lone pair > bond pair-bond pair > lone pair - bond pair

b. bond pair - bond pair > lone pair - bond pair > lone pair - lone pair

c. lone pair - bond pair > bond pair - bond pair > lone pair - lone pair

d. lone pair - lone pair > lone pair - bond pair > bond pair - bond pair

67. Each of the following is true for white and red phosphorus except that they (+4, -1)

a. both are soluble in CS_2

b. can be oxidised by heating in air

c. consist of the same kind of atoms

d. can be converted into one another

68. If uncertainty in position and momentum are equal, then uncertainty in velocity is (+4, -1)

a. $\frac{1}{2m} \sqrt{\frac{h}{\pi}}$

b. $\sqrt{\frac{h}{2\pi}}$

c. $\frac{1}{m} \sqrt{\frac{h}{\pi}}$

d. $\sqrt{\frac{h}{\pi}}$

69. According to IUPAC nomenclature sodium nitroprusside is named as (+4, -1)

- a. sodium pentacyanonitrosyl ferrate (II)
- b. sodium pentacyanonitrosyl ferrate (III)
- c. sodium nitroferricyanide
- d. sodium nitroferrocyanide

70. Glycolysis is (+4, -1)

- a. oxidation of glucose to pyruvate
- b. conversion of glucose to haem
- c. oxidation of glucose to glutamate
- d. conversion of pyruvate to citrate

71. Buffer solutions have constant acidity and alkalinity because (+4, -1)

- a. these give unionised acid or base on reaction with added acid or alkali
 - b. acids and alkalies in these solutions are shielded from attack by other ions
 - c. they have large excess of H^+ or OH^- ions
 - d. they have fixed value of pH
-

72. By what factor does the average velocity of a gaseous molecule increase when the temperature (in kelvin) is doubled? (+4, -1)

- a. 2.8
- b. 4
- c. 1.4
- d. 2

73. For the reduction of silver ions with copper metal, the standard cell potential was found to be $+0.46\text{ V}$ at 25°C . The value of standard Gibbs energy, ΔG^0 will be ($F = 96500\text{ C mol}^{-1}$) (+4, -1)

- a. -89.0 kJ
- b. -89.0 J
- c. -44.5 kJ
- d. -98.0 kJ

74. Half-life period of a first order reaction is 1386 s . The specific rate constant of the reaction is (+4, -1)

- a. $5.0 \times 10^{-3}\text{ s}^{-1}$
- b. $0.5 \times 10^{-2}\text{ s}^{-1}$
- c. $0.5 \times 10^{-3}\text{ s}^{-1}$
- d. $5.0 \times 10^{-2}\text{ s}^{-1}$

75. If avogadro number N_A , is changed from $6.022 \times 10^{23}\text{ mol}^{-1}$ to $6.022 \times 10^{20}\text{ mol}^{-1}$, this would change : (+4, -1)

- a. the ratio of chemical species to each other in a balanced equation

- b. the ratio of elements to each other in a compound
- c. the definition of mass in units of grams
- d. the mass of one mole of carbon

76. If ΔH is the change in enthalpy and ΔE , the change in internal energy accompanying a gaseous reaction, then (+4, -1)

- a. ΔH is always greater than ΔE
- b. $\Delta H < \Delta E$ only if the number of moles of the products is greater than the number of moles of the reactants
- c. ΔH is always less than ΔE
- d. $\Delta H < \Delta E$ only if the number of moles of products is less than the number of moles of the reactants

77. In water saturated air, the mole fraction of water vapour is 0.02. If the total pressure of the saturated air is 1.2 atm , the partial pressure of dry air is : (+4, -1)

- a. 1.18 atm
- b. 1.76 atm
- c. 1.176 atm
- d. 0.98 atm

78. Base strength of (i) $\text{H}_3\text{C}-\text{C}^\ominus\text{H}_2$ (ii) $\text{H}_2\text{C}=\text{C}^\ominus\text{H}$ (iii) $\text{H}-\text{C}\equiv\text{C}^\ominus$ is in the order of (+4, -1)

- a. (ii) > (i) > (iii)
- b. (iii) > (ii) > (i)
- c. (i) > (iii) > (ii)
- d. (i) > (ii) > (iii)

79. Copper sulphate dissolves in excess of KCN to give

(+4, -1)

- a. $CuCN$
- b. $[Cu(CN)_4]^{3-}$
- c. $[Cu(CN)_4]^{2-}$
- d. $Cu(CN)_2$

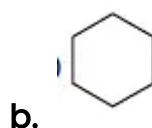
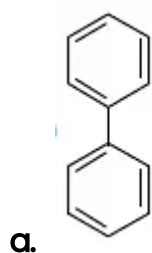
80. Following compounds are given : (a) CH_3CH_2OH (b) CH_3COCH_3 (c) $CH_3 - C(H)(OH)CH_3$ (d) CH_3OH Which of the above compounds(s), on being warmed with iodine solution and $NaOH$, will give iodoform ?

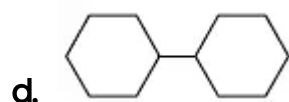
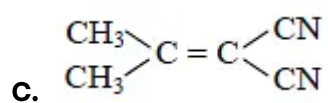
(+4, -1)

- a. Only (b)
- b. (a), (b) and (c)
- c. (a) and (b)
- d. (a), (c) and (d)

81. In which of the following molecules, all atoms are coplanar ?

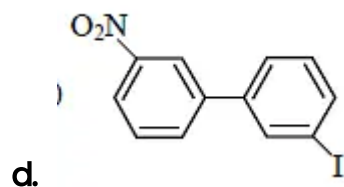
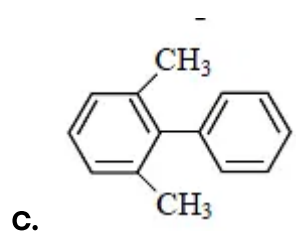
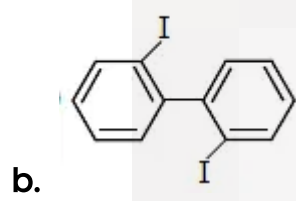
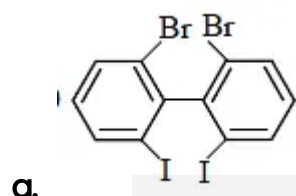
(+4, -1)





82. Which of the following biphenyls is optically active ?

(+4, -1)



83. Phenol, p-Methylphenol, m-Nitrophenol and p-Nitrophenol follows order of increasing acidic strength

(+4, -1)

- a. Phenol, p-Methylphenol, p-Nitrophenol, m-Nitrophenol
- b. p-Methylphenol, Phenol, m-Nitrophenol, p-Nitrophenol
- c. p-Methylphenol, m-Nitrophenol, Phenol, p-Nitrophenol
- d. m-Nitrophenol, p-Nitrophenol, Phenol and p-Methylphenol

84. The second order Bragg diffraction of X-rays with $\lambda = 1.0\text{\AA}$ from a set of parallel planes in a metal occurs at an angle 60° . The distance between the scattering planes in the crystals is (+4, -1)

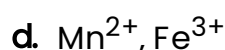
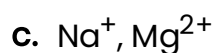
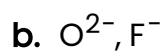
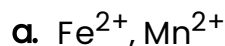
- a. $0.575\text{\AA}$
- b. $1.00\text{\AA}$
- c. $2.00\text{\AA}$
- d. $1.17\text{\AA}$

85. Among the following alkaline earth metal halides, one which is covalent and soluble in organic solvents is (+4, -1)

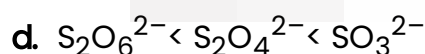
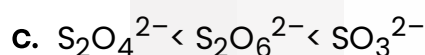
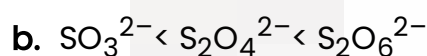
- a. Beryllium chloride
- b. Calcium chloride
- c. Strontium chloride
- d. Magnesium chloride

Chemistry Section B

86. From the following pairs of ions which one is not an iso-electronic pair? (+4, -1)



87. The oxidation states of sulphur in the anions SO_3^{2-} , $\text{S}_2\text{O}_4^{2-}$ and $\text{S}_2\text{O}_6^{2-}$ follow the order- (+4, -1)



88. Which of the following statements is true:- (+4, -1)

a. Silicon exhibits 4 coordination number in its compounds

b. Bond energy of F_2 is less than Cl_2

c. Mn(III) oxidation state is more stable than Mn(II) in aqueous state

d. Elements of 15th group shows only +3 and +5 oxidation states

89. Linear combination of two hybridised orbitals belonging to the two atoms, each having one electron leads to a (+4, -1)

a. sigma bond

- b. double bond
- c. coordinate bond
- d. pi-bond

90. Phospholipids are esters of glycerol with (+4, -1)

- a. one carboxylic acid residue and two phosphate groups
- b. three phosphate groups
- c. three carboxylic acid residues
- d. two carboxylic acid residues and one phosphate groups

91. The value of Planck's constant is $6.63 \times 10^{-34} \text{ Js}$. The velocity of light is $3.0 \times 10^8 \text{ ms}^{-1}$. Which value is closest to the wavelength in nanometers of a quantum of light with frequency of $8 \times 10^{15} \text{ s}^{-1}$? (+4, -1)

- a. 4×10^1
- b. 3×10^7
- c. 2×10^{25}
- d. 5×10^{-18}

92. Aluminium chloride in acidified aqueous solution forms a complex 'A', in which hybridisation state of Al is 'B'. What are 'A' and 'B', respectively? (+4, -1)

- a. $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$, sp^3d^2
 - b. $[\text{Al}(\text{H}_2\text{O})_4]^{3+}$, sp^3
 - c. $[\text{Al}(\text{H}_2\text{O})_4]^{3+}$, dsp^2
 - d. $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$, d^2sp^3
-

93. Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is $2.2 \times 10^{-4} \text{ mol L}^{-1}$ Solubility product of $Ag_2C_2O_4$ is :- (+4, -1)

- a. 2.66×10^{-12}
- b. 4.5×10^{-11}
- c. 5.3×10^{-12}
- d. 2.42×10^{-8}

94. Correct gas equation is (+4, -1)

- a. $\frac{V_1 T_2}{p_1} = \frac{V_2 T_1}{p_2}$
- b. $\frac{p_1 T_2}{V_1} = \frac{p_2 T_1}{V_2}$
- c. $\frac{p_1 V_1}{p_2 V_2} = \frac{T_1}{T_2}$
- d. $\frac{V_1 V_2}{T_1 T_2} = p_1 p_2$

95. How enzymes increases the rate of reactions? (+4, -1)

- a. By lowering activation energy
- b. By increasing activation energy
- c. By changing equilibrium constant
- d. By forming enzyme substrate complex

96. In a closed insulated container a liquid is stirred with a paddle to increase the temperature which of the following is true : - (+4, -1)

- a. $\Delta E = W \neq 0, q = 0$
- b. $\Delta E = W = q \neq 0$
- c. $\Delta E = 0, W = q \neq 0$

d. $W = 0 \Delta E = q \neq 0$

97. In electrolysis of NaCl when Pt electrode is taken then H_2 is liberated at cathode while with Hg cathode it forms sodium amalgam :- (+4, -1)

- a. Hg is more inert than Pt
- b. More voltage is required to reduce H^+ at Hg than at Pt
- c. Na is dissolved in Hg while it does not dissolve in Pt
- d. Conc, of H^+ ions is larger when Pt electrode is taken

98. In the reaction, $4NH_3(g) + 5O_2 \rightarrow 4NO(g) + 6H_2O(l)$ When 1 mole of ammonia and 1 mole of O_2 are made to react to completion, then (+4, -1)

- a. 1.0 mole of H_2O is produced
- b. 1.0 mole of NO will be produced
- c. all the oxygen will be consumed
- d. all the ammonia will be consumed

99. Vapour pressure of chloroform ($CHCl_3$) and dichloromethane (CH_2Cl_2) at $25^\circ C$ are 200 mmHg and 41.5 mm Hg respectively. Vapour pressure of the solution obtained by mixing 25.5 g of $CHCl_3$ and 40 g of CH_2Cl_2 at the same temperature will be: (Molecular mass of $CHCl_3 = 119.5$ u and molecular mass of $CH_2Cl_2 = 85$ u) (+4, -1)

- a. 615.0 mm Hg
 - b. 347.9 mm Hg
 - c. 285.5 mm Hg
 - d. 90.38 mm Hg
-

100. Consider the following compounds:

(+4, -1)

- a. III only
- b. I and III
- c. I only
- d. II only



Zoology Section A

101. Correct order is (+4, -1)
- a. palaeozoic > archaeozoic > coenozoic
 - b. archaeozoic > palaeozoic > proterozoic
 - c. palaeozoic > mesozoic > coenozoic
 - d. mesozoic > archaeozoic > proterozoic.
-
102. Fertilization in humans is practically feasible only if – (+4, -1)
- a. The ovum and sperms are transported simultaneously to ampullary-isthmic junction of the fallopian tube
 - b. The ovum and sperms are transported simultaneously to ampullary-isthmic junction of the cervix
 - c. The sperm are transported into cervix within 48 hrs of release of ovum in uterus
 - d. The sperm are transported into vagina just after the release of ovum in fallopian tube
-
103. Genophore/bacterial genome or nucleoid is made of (+4, -1)
- a. histones and nonhistones
 - b. RNA and histones
 - c. a single double stranded DNA
 - d. a single stranded DNA.
-
104. HIV that causes AIDS, first starts destroying (+4, -1)
- a. Helper T-lymphocytes

- b. Thrombocytes
- c. B-lymphocytes
- d. Leucocytes.

105. If '+' sign is assigned to beneficial interaction, '-' sign to detrimental and '0' sign to neutral interaction, then the population interaction represented by '+' '-' refers to (+4, -1)

- a. mutualism
- b. amensalism
- c. commensalism
- d. parasitism

106. In mammals, which blood vessel would normally carry largest amount of urea? (+4, -1)

- a. Dorsal Aorta
- b. Hepatic Vein
- c. Hepatic Portal Vein
- d. Renal Vein

107. Kupffer's cells occur in (+4, -1)

- a. spleen
 - b. kidney
 - c. brain
 - d. liver.
-

108. Which aquatic fern is used to increase the yield in paddy crop? (+4, -1)

- a. Azolla
- b. Salvinia
- c. Marsilea
- d. Isoetes.

109. During regeneration, modification of an organ to other organ is known as (+4, -1)

- a. Morphallogenesis
- b. Epimorphosis
- c. Morphallaxis
- d. Accretionary growth

110. A pleiotropic gene (+4, -1)

- a. controls a trait only in combination with another gene
- b. controls multiple traits in an individual
- c. is expressed only in primitive plants
- d. is a gene evolved during Pliocene.

111. Which of the following pairs is correctly matched? (+4, -1)

- a. hinge joint - between vertebrae
- b. gliding joint - between zygapophyses of the successive vertebrae
- c. cartilaginous joint - skull bones
- d. fibrous joint - between phalanges.

112. Which of the following options gives the correct sequence of events during mitosis ? **(+4, -1)**

- a. Condensation → nuclear membrane disassembly → arrangement at equator → centromere division → segregation → telophase
- b. Condensation → crossing over → nuclear membrane disassembly → segregation → telophase
- c. Condensation → arrangement at equator → centromere division → segregation → telophase
- d. Condensation → nuclear membrane disassembly → crossing over → segregation → telophase

113. Which of the following is an accumulation and release centre of neurohormones ? **(+4, -1)**

- a. Anterior pituitary lobe
- b. Posterior pituitary lobe
- c. Intermediate lobe of the pituitary
- d. Hypothalamus

114. Cellular totipotency is demonstrated by **(+4, -1)**

- a. Only gymnosperm cells
- b. All plant cells
- c. All eukaryotic cells
- d. Only bacterial cells

115. Diploid chromosome number in human is **(+4, -1)**

- a. 46

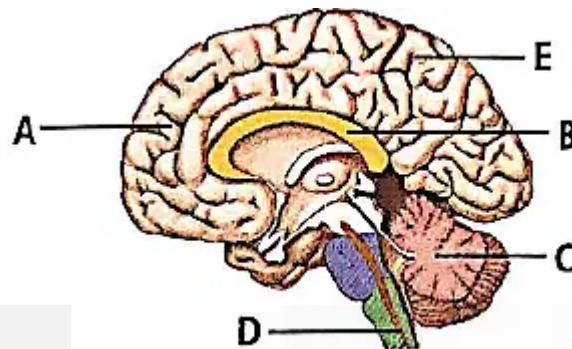
b. 44

c. 48

d. 42

116. The given figure shown lateral view of the human brain. identify the parts labelled as *A* to *E* and select the correct option

(+4, -1)



a. a

b. b

c. c

d. d

117. Which one of the following is one of the paths followed by air or O during respiration in the adult male *Periplaneta americana* as it enters the animal body?

(+4, -1)

a. Spiracle in metathorax, trachea, tracheloes, oxygen diffuses into cells

b. Mouth, bronchial tube, trachea, oxygen enters cells

c. Spiracles in prothorax, tracheole, trachea, oxygen diffuses into cells.

d. Hypopharynx, mouth, pharynx, trachea, tissues

118. In the following palindromic base sequence of DNA, which one can be cut easily by a particular restriction enzyme?

(+4, -1)

- a. 5' GATACT 3' ; 3' CTATGA 5'
- b. 5' GAATTC 3' ; 3' CTTAAG 5'
- c. 5' CTCAGT 3' ; 3' GAGTCA 5'
- d. 5' GTATTC 3' ; 3' CATAAG 5'

119. The partial pressures (in mm Hg) of oxygen (O₂) and carbon dioxide (CO₂) at alveoli (the site of diffusion) are (+4, -1)

- a. pO₂=159 and pCO₂=0.3
- b. pO₂=104 and pCO₂=40
- c. pO₂=40 and pCO₂=45
- d. pO₂=95 and pCO₂=40

120. *Bacillus thuringiensis* (Bt) strains have been used for designing novel: (+4, -1)

- a. Bio-metallurgical technique
- b. Bio-mineralization processes
- c. Bio-insecticidal plants
- d. Bio-fertilizers

121. Carbohydrates most abundant biomolecules on earth, are produced by : (+4, -1)

- a. All bacteria, fungi and algae
 - b. Fungi, algae and green plant cells
 - c. Some bacteria, algae and green plant cells
 - d. Viruses, fungi and bacteria
-

122. What is the role of RNA polymerase III in the process of transcription in eukaryotes (+4, -1)

- a. Transcribes only snRNAs
- b. Transcribes rRNAs (28S, 18S and 5.8S)
- c. Transcribes tRNA, 5s rRNA and snRNA
- d. Transcribes precursor of mRNA

123. Besides annelida and arthropoda, the metamerism is exhibited by (+4, -1)

- a. mollusca
- b. acanthocephala
- c. cestoda
- d. chordata.

124. Darwin's finches are a good example of (+4, -1)

- a. industrial melanism
- b. connecting link
- c. adaptive radiation
- d. convergent evolution.

125. Fertilizin is a chemical substance produced from (+4, -1)

- a. polar bodies
- b. middle piece of sperm
- c. mature eggs
- d. acrosome.

126. Give below is the diagram of a bacteriophage. In which one of the options all the four parts *A, B, C* and *D* are correct? (+4, -1)

- a. tail fibres , head, sheath, collar
- b. sheath ,collar, head ,tail , fibres
- c. head , sheath, collar, tail, fibres
- d. collar, tail fibres, head, sheath

127. Human immuno deficiency virus (HIV) has a protein coat and a genetic material which is (+4, -1)

- a. double stranded RNA
- b. double stranded DNA
- c. single stranded DNA
- d. single stranded RNA.

128. In a growing population of a country, (+4, -1)

- a. pre-reproductive individuals are less than the reproductive individuals.
- b. pre-reproductive individuals are more than the reproductive individuals.
- c. reproductive and pre-reproductive individuals are equal in number.
- d. reproductive individuals are less than the post-reproductive individuals.

129. In veins, valves are present to check backward flow of blood flowing at (+4, -1)

- a. atmospheric pressure
- b. high pressure

- c. low pressure
- d. all of these.

130. The proteolytic enzyme rennin is found in : (+4, -1)

- a. Intestinal juice
- b. Bile juice
- c. Gastric juice
- d. Pancreatic juice

131. Which bacteria is utilized in Gobar gas plant:- (+4, -1)

- a. Methanogens
- b. Nitrifying bacteria
- c. Ammonifying bacteria
- d. Denitrifying bacteria.

132. What is the work of progesterone which is present in oral contraceptive pills: (+4, -1)

- a. To inhibit ovulation
- b. To check oogenesis
- c. To check entry of sperms in to cervix to make them inactive
- d. To check sexual behaviour

133. A self-fertilizing trihybrid plant forms :- (+4, -1)

- a. 4 different gametes and 16 different zygotes
- b. 8 different gametes and 16 different zygotes

- c. 8 different gametes and 32 different zygotes
- d. 8 different gametes and 64 different zygotes

134. Which of the following muscular disorders is inherited ?

(+4, -1)

- a. Myasthenia gravis
- b. Botulism
- c. Tetany
- d. Muscular dystrophy

135. In Ornithine cycle, which of the following wastes are removed from the blood ?

(+4, -1)

- a. Urea and urine
- b. Ammonia and urea
- c. CO₂ and ammonia
- d. CO₂ and urea

Zoology Section B

136. Chlorophyll in chloroplast is located in (+4, -1)
- a. Grana
 - b. Pyrenoid
 - c. Stroma
 - d. Both grana and stroma
-
137. DNA-dependent RNA polymerase catalyzes transcription on one strand of the DNA which is called the (+4, -1)
- a. template strand
 - b. coding strand
 - c. alpha strand
 - d. antistrand
-
138. Match the following with respect to meiosis: Select the correct option from the following : (+4, -1)
- a. (a) → (iii), (b) → (iv), (c) → (i), (d) → (ii)
 - b. (a) → (iv), (b) → (iii), (c) → (ii), (d) → (i)
 - c. (a) → (i), (b) → (ii), (c) → (iv), (d) → (iii)
 - d. (a) → (ii), (b) → (iv), (c) → (iii), (d) → (i)
-
139. Retina is most sensitive at (+4, -1)
- a. optic disc
 - b. periphery

- c. macula lutea
- d. fovea centralis.

140. The hormone that stimulates the stomach to secrete gastric juice is (+4, -1)

- a. enterokinase
- b. enterogastrone
- c. gastrin
- d. renin.

141. The supportive skeletal structures in the human external ears and in the nose tip are examples of (+4, -1)

- a. Ligament
- b. Areolar tissue
- c. Bone
- d. Cartilage

142. In gene therapy of Adenosine Deaminase (ADA) deficiency, the patient requires periodic infusion of genetically engineered lymphocytes because: (+4, -1)

- a. Retroviral vector is introduced into these lymphocytes
 - b. Gene isolated from marrow cells producing ADA is introduced into cells at embryonic stages
 - c. Lymphocytes from patient's blood are grown in culture, outside the body
 - d. Genetically engineered lymphocytes are not immortal cells.
-

143. The net pressure gradient that causes the fluid to filter out of the glomeruli into the capsule is: **(+4, -1)**

- a. 20 mm Hg
- b. 75 mm Hg
- c. 30 mm Hg
- d. 50 mm Hg

144. Enzymes, vitamins and hormones can be classified into a single category of biological chemicals, because all of these: **(+4, -1)**

- a. enhance oxidative metabolism
- b. are conjugated proteins
- c. are exclusively synthesized in the body of a living organism as at present
- d. help in regulating metabolism

145. In the resting state of the neural membrane, diffusion due to concentration gradients, if allowed, would drive **(+4, -1)**

- a. K^+ and Na^+ out of the cell
- b. Na^+ into the cell
- c. Na^+ out of the cell
- d. K^+ into the cell

146. In order to obtain virus-free plants through tissue culture the best method is : **(+4, -1)**

- a. protoplast culture

- b. embryo rescue
- c. anther culture
- d. meristem culture

147. One gene-one enzyme hypothesis was postulated by: (+4, -1)

- a. R.Franklin
- b. Hershey and Chase
- c. A.Garrod
- d. Beadle and Tatum

148. The function of contractile vacuule, in protozoa, is (+4, -1)

- a. osmoregulation
- b. reproduction
- c. locomotion
- d. digestion of food.

149. Darwin's theory of pangenesis shows similarity with theory of inheritance of acquired characters then what shall be correct according to it (+4, -1)

- a. useful organs becomes strong and developed while useless organs become extinct
- b. size of organs increase with aging
- c. development of organs is due to will power
- d. there should be some physical basis of inheritance.

150. Freshly released human egg has (+4, -1)

- a.** one Y-chromosome
- b.** one X-chromosome
- c.** two X-chromosome
- d.** one X-chromosome and one Y-chromosome



Botany Section A

151. Identify the correct set of statements:

(+4, -1)

- a. The leaflets are modified into pointed hard thorns in Citrus and Bougainvillea
- b. Axillary buds form slender and spirally coiled tendrils in cucumber and pumpkin
- c. Stem is flattened and fleshy on Opuntia and modified to perform the function of leaves
- d. Rhizophora shows vertically upward growing roots that help to get oxygen for respiration
- e. Subaerially growing stems in grasses and strawberry help in vegetative propagation

Choose the correct answer from the options given below:

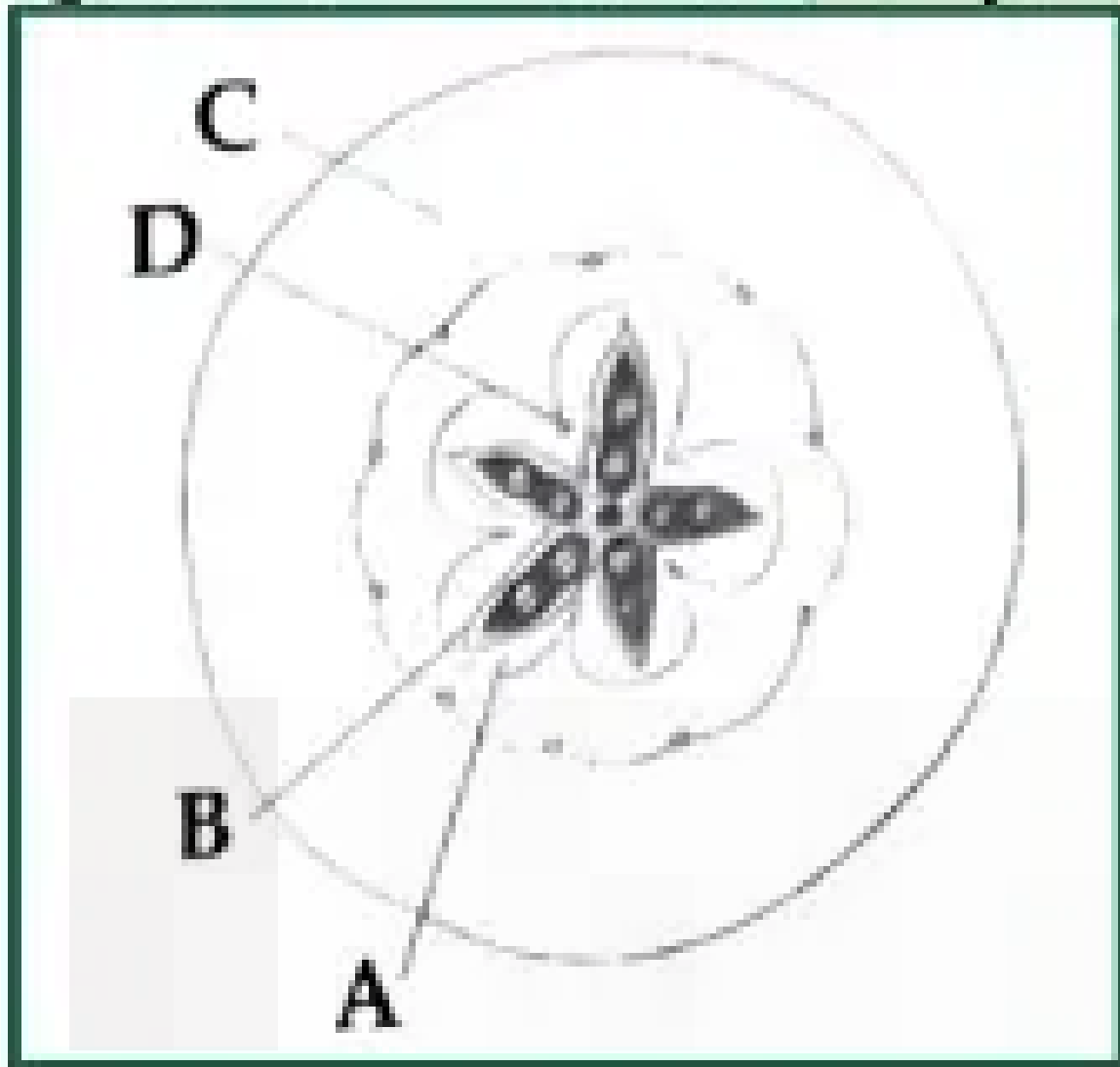
- a. (b) and (c) only
- b. (a) and (d) only
- c. (b), (c), (d) and (e) only
- d. (a), (b), (d) and (e) only

152. Peat moss is used as a packing material for sending flowers and live plants to distant places because (+4, -1)

- a. It serves as a disinfectant
- b. It is easily available
- c. It is hygroscopic
- d. It reduces transpiration

153.

(+4, -1)



Which part of the fruit, labelled in the given figure makes it a false fruit?

- a. A - Mesocarp
- b. B - Endocarp
- c. C - Thalamus
- d. D - Seed

154. Select the wrong statement :

(+4, -1)

- a. Chlamydomonas exhibits both isogamy and anisogamy and Fucus shows oogamy

- b. Isogametes are similar in structure, function and behaviour
- c. Anisogametes differ either in structure, function or behaviour
- d. In Oomycetes female gamete is smaller and motile, while male gamete is larger and non-motile

155. Axile placentation is observed in (+4, -1)

- a. China rose, Beans and Lupin
- b. Tomato, Dianthus and Pea
- c. China rose, Petunia and Lemon
- d. Mustard, Cucumber and Primrose

156. Hydrocolloid carrageen is obtained from (+4, -1)

- a. Chlorophyceae and Phaeophyceae
- b. Phaeophyceae and Rhodophyceae
- c. Rhodophyceae only
- d. Phaeophyceae only

157. Given below are two statements: One labelled as Assertion A and the other labelled as Reason R: (+4, -1)

Assertion A: In gymnosperms the pollen grains are released from the microsporangium and carried by air currents.

Reason R: Air currents carry the pollen grains to the mouth of the archegonia where the male gametes are discharged and pollen tube is not formed.

In the light of the above statements, choose the correct answer from the options given below:

- a. Both A and R are true but R is NOT the current explanation of A

- b. A is true but R is false
- c. A is false but R is true
- d. Both A and R are true and R is the correct explanation of A

158. Match the plant with the kind of life cycle it exhibits. Choose the correct answer from the options given below:

(+4, -1)

	List - I		List - II
(a)	Spirogyra	(i)	Dominant diploid sporophyte vascular plant, with highly reduced male or female gametophyte
(b)	Fern	(ii)	Dominant haploid free-living gametophyte
(c)	Funaria	(iii)	Dominant diploid sporophyte alternating with reduced gametophyte called prothallus
(d)	Cycas	(iv)	Dominant haploid leafy gametophyte alternating with partially dependent multicellular sporophyte

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

159. Family Fabaceae differs from Solanaceae and Liliaceae. With respect to the stamens, pick out the characteristics specific to family Fabaceae but not found in Solanaceae or Liliaceae.

(+4, -1)

- a. Polyadelphous and epipetalous stamens
- b. Monadelphous and Monothealous anthers
- c. Epiphyllous and Dithealous anthers

d. Diadelphous and Ditheous anthers

160. Identify the pair of heterosporous pteridophytes among the following: (+4, -1)

- a. Selaginella and Salvinia
 - b. Psilotum and Salvinia
 - c. Equisetum and Salvinia
 - d. Lycopodium and Selaginella
-

161. The site of perception of light in plants during photoperiodism is (+4, -1)

- a. Leaf
 - b. Shoot apex
 - c. Stem
 - d. Axillary bud
-

162. Genera like Selaginella and Salvinia produce two kinds of spores. Such plants are known as (+4, -1)

- a. Heterosporous
 - b. Homosorus
 - c. Heterosorus
 - d. Homosporous
-

163. Choose the correct match Bladderwort, sundew, venus flytrap (+4, -1)

- a. Nepenthes, Dionaea, Drosera

- b. Nepenthes, Utricularia, Vanda
 - c. Utricularia, Drosera, Dionaea
 - d. Dionaea, Trapa, Vanda
-

164. Diadelphous stamens are found in : (+4, -1)

- a. China rose and citrus
 - b. China rose
 - c. Citrus
 - d. Pea
-

165. Which is expressing right appropriate pairing: (+4, -1)

- a. Brassicaceae - Sunflower
 - b. Malvaceae - Cotton
 - c. Papilionaceae - Catechu
 - d. Liliaceae - Wheat
-

166. Which of the following plants is monoecious? (+4, -1)

- a. Cycas circinalis
 - b. Carica papaya
 - c. Chara
 - d. Marchantia polymorpha
-

167. Hair are found in the inflorescences of Zea mays are the modification of: (+4, -1)

- a. Style
 - b. Stigma
 - c. Spathe
 - d. Filaments
-

168. Which of the following algae produce Carrageen? (+4, -1)

- a. Blue-green algae
 - b. Green algae
 - c. Brown algae
 - d. Red algae
-

169. Juicy hair-like structures observed in the lemon fruit develop from: (+4, -1)

- a. Exocarp
 - b. Mesocarp
 - c. Endocarp
 - d. Mesocarp and endocarp
-

170. Glycolate induces opening of stomata in (+4, -1)

- a. Presence of oxygen
 - b. Low CO₂ conc.
 - c. High CO
 - d. CO₂ absent
-

171. In some members of which of the following pairs of families, pollen grains retain their viability for months after release (+4, -1)

- a. Rosaceae ; Leguminosae
- b. Poaceae ; Rosaceae
- c. Poaceae ; Leguminosae
- d. Poaceae ; Solanaceae

172. Cycas have two cotyledons but not included in angiosperms because of (+4, -1)

- a. Naked ovules
- b. Seems like monocot
- c. Circinate ptyxis
- d. Compound leaves

173. What type of placentation is seen in sweet pea? (+4, -1)

- a. Basal
- b. Axile
- c. Free central
- d. Marginal

174. Which aquatic fern performs nitrogen fixation (+4, -1)

- a. Azolla
- b. Nostoc
- c. Salvia
- d. Salvinia

175. Long filamentous threads protruding at the end of a young cob of maize are: (+4, -1)

- a. anthers
- b. styles
- c. ovaries
- d. hairs

176. Match items in column-I with those in column-II. (+4, -1)

	Column-I		Column-II
A	Peritrichous flagellation	1	Ginkgo
B	Living fossil	2	Macrocystes
C	Rhizophore	3	Escherichia coli
D	Smallest flowering plant	4	Selaginella
E	Largest perennial alga	5	Wolffia

Select the correct answer from the following : Codes :

- a. A-2, B-1, C-3, D-4, E-5
- b. A-5, B-3, C-2, D-5, E-1
- c. A-1, B-2 C-5, D-3, E-2
- d. A-3, B-1, C-4, D-5, E-2

177. Pentamerous, actinomorphic flowers, bicarpellary ovary with oblique septa, and fruit a capsule or berry, are characteristic features of: (+4, -1)

- a. Asteraceae
- b. Brassicaceae

c. Solanaceae

d. Liliaceae

178. Auxospores and hormocysts are formed, respectively, by : (+4, -1)

- a. several diatoms and a few cyanobacteria
- b. several cyanobacteria and several diatoms
- c. some diatoms and several cyanobacteria
- d. some cyanobacteria and many diatoms

179. An enzyme that can stimulate germination of barley seeds is: (+4, -1)

- a. α -amylase
- b. lipase
- c. protease
- d. invertase

180. Top-shaped multiciliate male gametes and the mature seed which bears only one embryo with two cotyledons, are characteristic features of : (+4, -1)

- a. polypetalous angiosperms
- b. gamopetalous angiosperms
- c. conifers
- d. cycads

181. Match Column - I with Column - II. (+4, -1)

Column - I

$$(a) \% \begin{array}{c} \nearrow \\ \oplus \\ \text{K}_{(5)} \end{array} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$$

$$(b) \oplus \begin{array}{c} \nearrow \\ \text{K}_{(5)} \end{array} \widehat{C_{(5)} A_5} \underline{G}_2$$

$$(c) \oplus \begin{array}{c} \nearrow \\ \text{P}_{(3+3)} \end{array} \widehat{A_{3+3} G_{(3)}}$$

$$(d) \oplus \begin{array}{c} \nearrow \\ \text{K}_{2+2} \end{array} C_4 A_{2-4} \underline{G}_{(2)}$$

Column - II

(i) Brassicaceae

(ii) Liliaceae

(iii) Fabaceae

(iv) Solanaceae

Select the correct answer from the options given below.

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

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

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

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

182. Which one pair of examples will correctly represent the grouping Spermatophyta according to one of the schemes of classifying plants:

(+4, -1)

a. Acacia, Sugarcane

b. Pinus, Cycas

c. Rhizopus, Triticum

d. Ginkgo, Pisum

183. Which one of the following is categorised under living fossils:

(+4, -1)

a. Pinus

- b. Cycas
- c. Selaginella
- d. Metasequoia

184. Select the correct pair

(+4, -1)

- a. Loose parenchyma cells rupturing the epidermis and forming a lens shaped opening in bark – Spongy parenchyma
- b. parenchyma cells in the epidermis of grass leaves – Subsidiary cells
- c. In dicot leaves, vascular bundles are surrounded by large thick-walled cells – Conjunctive tissue
- d. Cells of medullary rays that form part of cambial ring – Interfascicular cambium

185. Moss peat is used as a packing material for sending flowers and live plants to distant places because:

(+4, -1)

- a. it is easily available
- b. it is hygroscopic
- c. it reduces transpiration
- d. it serves as a disinfectant

Botany Section B

186. One of the synthetic auxin is

(+4, -1)

- a. IAA
- b. NAA
- c. IBA
- d. both B and C

187. Oxidative phosphorylation is

(+4, -1)

- a. formation of ATP by transfer of phosphate group from a substrate to ADP
- b. oxidation of phosphate group in ATP
- c. addition of phosphate group to ATP
- d. formation of ATP by energy released from electrons removed during substrate oxidation

188. Plants having little or no secondary growth are

(+4, -1)

- a. Cycads
- b. Grasses
- c. Conifers
- d. Deciduous angiosperms

189. Which one of the following belongs to the family Muscidae ?

(+4, -1)

- a. Fire fly
- b. Grasshopper

c. Cockroach

d. House fly

190. The historic Convention on Biological Diversity, 'The Earth Summit' was held in Rio de Janeiro in the year (+4, -1)

a. 1992

b. 1986

c. 2002

d. 1985

191. Which of the following is absent in polluted water (+4, -1)

a. Hydrilla

b. Water hyacinth

c. Larva of stone fly

d. Blue green

192. What happens in light reaction (Photo chemical reaction): (+4, -1)

a. Formation of ATP and NADPH₂

b. Formation of ATP

c. Formation of sugar

d. Breakdown of sugar

193. In 1984, the Bhopal gas tragedy took place because methyl isocyanate (+4, -1)

- a. Reacted with ammonia
- b. Reacted with CO₂
- c. Reacted with water
- d. Reacted with DDT

194. Which one of the following is not correctly matched (+4, -1)

- a. *Culex pipiens* – Filariasis
- b. *Aedes aegypti* – Yellow fever
- c. *Anopheles culifaciens* – Leishmaniasis
- d. *Glossina palpalis* – Sleeping sickness

195. Tetradynamous conditions occur in (+4, -1)

- a. cruciferae
- b. malvaceae
- c. solanaceae
- d. liliaceae.

196. *Ulothrix* can be described as a (+4, -1)

- a. filamentous alga lacking flagellated reproductive stages
- b. membranous alga producing zoospores
- c. filamentous alga with flagellated reproductive stages
- d. non-motile colonial alga lacking zoospores.

197. Which of the following statements is not correct ? (+4, -1)

- a. Insects that consume pollen or nectar without bringing about pollination are called pollen / nectar robbers.
- b. Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil
- c. Some reptiles have also been reported as pollinators in some plant species
- d. Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style

198. Fermentation is anaerobic production of (+4, -1)

- a. protein and acetic acid
- b. alcohol, lactic acid or similar compounds
- c. ethers and acetones
- d. alcohol and lipoproteins

199. The first step for initiation of photosynthesis will be (+4, -1)

- a. photolysis of water
- b. excitement of chlorophyll molecules due to absorption of light
- c. ATP formation
- d. glucose formation.

200. A plant requires magnesium for (+4, -1)

- a. protein synthesis
- b. chlorophyll synthesis
- c. cell wall development

d. holding cells together.



Answers

1. Answer: d

Explanation:

While the other processes are irreversible in nature, slow isothermal expansion or compression of an ideal gas is a reversible process.

Therefore, the correct option is (D): Isothermal compression

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

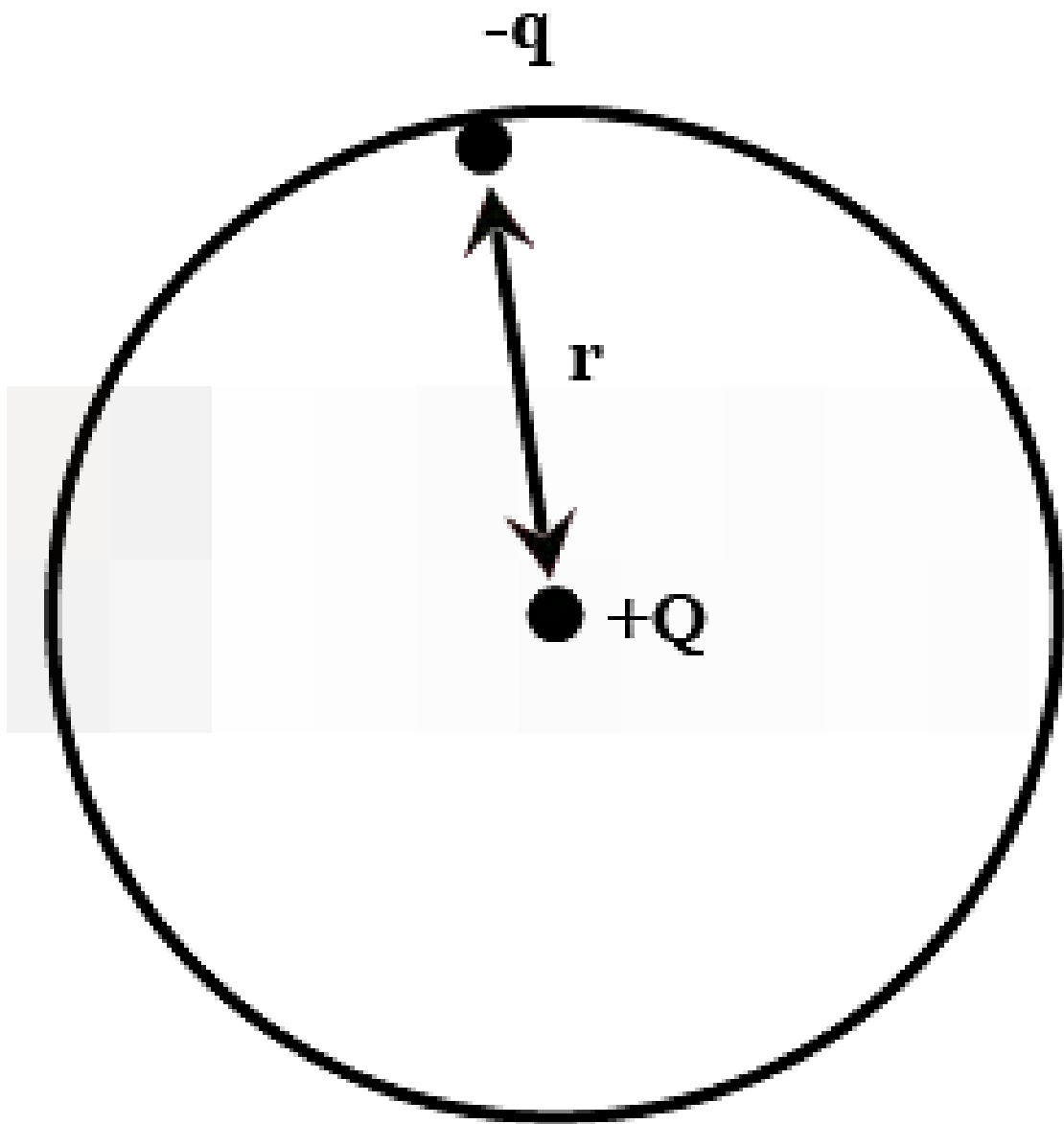
The [Second law of thermodynamics](#) is a physical law of thermodynamics about heat and loss in its conversion.

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.

2. Answer: d

Explanation:



$$\begin{aligned}\text{Coulomb force} &= K \frac{e^2}{r^2} (-\hat{r}) \\ &= K \frac{e^2}{r^3} \vec{r}\end{aligned}$$

Concepts:

1. Coulomb's Law:

In 1785, french physicist Charles Augustin de Coulomb coined a tangible relationship in mathematical form between two bodies that have been electrically charged. He represented an equation for the force causing the bodies to attract or repel each other which is commonly known as Coulomb's law or Coulomb's inverse-square law.

As per [Coulomb's law](#), the force of attraction or repulsion between two charged bodies is directly proportional to the product of their charges and inversely proportional to the square of the distance between them. It acts along the line joining the two charges regarded to be point charges.

Coulomb's Law has an abundant application to modern life, from Xerox machines to laser printers, to powder coating.

3. Answer: c

Explanation:

$$\begin{aligned} \text{Here } V_1 &= V_2 = \sqrt{2gh} \\ \frac{KE_1}{KE_2} &= \frac{\frac{1}{2}m_1v_1^2}{\frac{1}{2}m_2v_2^2} \\ &= \frac{m_1}{m_2} = \frac{2}{4} = \frac{1}{2} \end{aligned}$$

4. Answer: b

Explanation:

Here,

Distance between two cities = 150 km

Resistance of the wire, $R = (0.5 \Omega \text{ km}^{-1})(150 \text{ km})$
 $= 75 \Omega$

Voltage drop across the wire,

$$V = (8 \text{ V km}^{-1})(150 \text{ km}) = 1200 \text{ V}$$

Power loss in the wire is

$$P = \frac{V^2}{R} = \frac{(1200 \text{ V})^2}{75 \Omega} = 19200 \text{ W} = 19.2 \text{ KW}$$

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](#).

5. Answer: d

Explanation:

As per, Kepler's Law - $\frac{dA}{dt} = \text{constant}$

As dA/dt is constant, point A is perihelion and C is aphelion.

So, $K_A > K_B > K_C$

Read More: [Gravitation](#)

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,

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

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

$$\text{Or, } f(r) = G M_1 M_2 / r^2$$

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

6. Answer: d

Explanation:

For damped oscillation amplitude $A = A_0 e^{-bt}$

$$\frac{A_0}{3} = A_0 e^{-b(100T)} \Rightarrow e^{-100bT} = \frac{1}{3}$$

$$\text{at } t = 200T, A = A_0 e^{-b(200T)} = A_0 (e^{-100bT})^2$$

$$\Rightarrow A = A_0 \left(\frac{1}{3}\right)^2$$

$$= \frac{A_0}{9}$$

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.

7. Answer: b

Explanation:

$$\begin{aligned} T &= m(g + a) = 1000(9.8 + 1) \\ &= 10,800 \text{ N} \end{aligned}$$

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.

8. Answer: a

Explanation:

$$\begin{aligned} &\text{Number of beats per second} \\ &= \frac{v}{\lambda_1} - \frac{v}{\lambda_2} = 330 \left(\frac{1}{5} - \frac{1}{5.5} \right) \\ &= 66 - 60 = 6 \end{aligned}$$

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

9. Answer: b

Explanation:

$$q = CV \Rightarrow V = q/c$$

Due to dielectric insertion, new capacitance $C_2 = CK$

Initial energy stored in capacitor, $U_1 = \frac{q^2}{2C}$

Final energy stored in capacitor, $U_2 = \frac{q^2}{2KC}$

Change in energy stored, $\Delta U = U_2 - U_1$

$$\Delta U = \frac{q^2}{2C} \left(\frac{1}{K} - 1 \right) = \frac{1}{2} CV^2 \left(\frac{1}{K} - 1 \right)$$

New potential difference between plates

$$V' = \frac{q}{CK} = \frac{V}{K}$$

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.

10. Answer: c

Explanation:

$$\begin{aligned}\text{Acceleration } \frac{dv}{dt} &= f = f_0 \left(1 - \frac{t}{T}\right) \\ \Rightarrow \int_0^v dv &= f_0 \int_0^T \left(1 - \frac{t}{T}\right) dt\end{aligned}$$

$$\Rightarrow v = f_0 \left(t - \frac{t^2}{2T} \right)_0^T = f_0 \left(T - \frac{T^2}{2T} \right) = \frac{1}{2} f_0 T$$

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.

11. Answer: c

Explanation:

REF. Image. $\theta = 45^\circ$ projection speed = u

horizontal velocity $u_x = u \cos 45^\circ = \frac{u}{\sqrt{2}}$

initial vertical velocity $u_y = u \sin 45^\circ = \frac{u}{\sqrt{2}}$

height $_{\max}$ attained $H = \frac{u^2 \sin^2 \theta}{2g} = \frac{u^2/2}{2g}$

$$H = \frac{u^2}{4g}$$

half of the range = $\frac{R}{2} = \frac{u^2 \sin 2\theta}{2g} = \frac{u^2 \sin 90^\circ}{2g}$

$$\frac{R}{2} = \frac{u^2}{2g}$$

elevation $\phi = \tan^{-1} \frac{H}{R/2}$

$$\phi = \tan^{-1} \frac{u^2/4g}{u^2/2g}$$

$$\text{Or } \phi = \tan^{-1} 0.5$$

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

12. Answer: b

Explanation:

The kinetic energy acquired by a charged particle in a uniform magnetic field B is

$$K = \frac{q^2 B^2 R^2}{2m} \quad \text{where } R = \frac{mv}{qB}$$

where q and m are the charge and mass of the particle and R is the radius of circular orbit.

$\therefore$ The kinetic energy acquired by proton is

$$K_p = \frac{q_p^2 B^2 R_p^2}{2m_p}$$

and that by the alpha particle is

$$K_{\alpha} = \frac{q_{\alpha}^2 B^2 R_{\alpha}^2}{2m_{\alpha}}$$

$$\text{Thus, } \frac{K_{\alpha}}{K_p} = \left(\frac{q_{\alpha}}{q_p}\right)^2 \left(\frac{m_p}{m_{\alpha}}\right) \left(\frac{R_{\alpha}}{R_p}\right)^2$$

$$\text{or } K_{\alpha} = K_p \left(\frac{q_{\alpha}}{q_p}\right)^2 \left(\frac{m_p}{m_{\alpha}}\right) \left(\frac{R_{\alpha}}{R_p}\right)^2$$

$$\text{Here, } K_p = 1 \text{ MeV, } \frac{q_{\alpha}}{q_p} = 2, \frac{m_p}{m_{\alpha}} = \frac{1}{4}$$

$$\text{and } \frac{R_{\alpha}}{R_p} = 1$$

$$\therefore K_{\alpha} = (1 \text{ MeV})(2)^2 \left(\frac{1}{4}\right)(1)^2 = 1 \text{ MeV}$$

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.

13. Answer: a**Explanation:**

Kinetic energy $= \frac{1}{2}I\omega^2$, and for ring $I = mr^2$

Hence $KE = \frac{1}{2}mr^2\omega^2$

14. Answer: d**Explanation:**

For a normal eye, rays coming from infinity should go to the retina without effort when we look at infinity, lens offers minimum power and hence combination gives $40D + 20D = 60D$.

Distance between the retina and the cornea eye has must be equal to focal length.

$$f = \frac{1}{60}m = 1.67cm$$

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](#)

15. Answer: c

Explanation:

In fission process, when a parent nucleus breaks into daughter products, then some mass is lost in the form of energy. Thus, mass of fission products < mass of parent nucleus

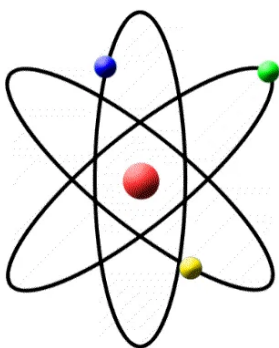
$$\frac{\text{Mass of fission products}}{\text{Mass of parent nucleus}}$$

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.

16. Answer: a

Explanation:

As the electro-magnetic radiations from Sun pass through the atmosphere, some of them are absorbed by it while other reach the surface of earth. The range of wavelength which reaches earth lies in infrared region. This part of the radiation from the sun has shorter wavelength and can penetrate through the layer of gases like CO_2 and reach earth surface. But the radiation from the earth being of longer wavelength can escape through this layer. As a result the earth surface gets warm. This is known as green house effect.

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.
-

17. Answer: a

Explanation:

In 1905, Einstein realized that the photoelectric effect could be understood if the energy in light is not spread out over wave fronts but is concentrated in small packets, or photons. Each photon of light of frequency ν has the energy $h\nu$. Thus, Einstein's work on photoelectric effect gives support to $E = h\nu$.

The energy carried by each particle of light (called quanta or photon) is dependent on the light's frequency (ν) as shown:

$$E = h\nu$$

Where h = Planck's constant = 6.6261×10^{-34} Js.

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.

18. Answer: c

Explanation:

The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third.

Concepts:

1. Semiconductors:

Semiconductors are 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.

19. Answer: d

Explanation:

$$\begin{aligned}\tan \theta_1 &= \frac{\tan \theta}{\cos \alpha} \\ \Rightarrow \tan \theta_2 &= \frac{\tan \theta}{\cos(90-\alpha)} = \frac{\tan \theta}{\sin \alpha} \\ \Rightarrow \sin^2 \alpha + \cos^2 \alpha &= 1 \\ \Rightarrow \cot^2 \theta_2 + \cot^2 \theta_1 &= \cot^2 \theta\end{aligned}$$

Concepts:

1. Magnetism & Matter:

Magnets are used in many devices like electric bells, telephones, radio, loudspeakers, motors, fans, screwdrivers, lifting heavy iron loads, super-fast trains, especially in foreign countries, **refrigerators**, etc.

Magnetite is the world's first magnet. This is also called a **natural magnet**. Though magnets occur naturally, we can also impart magnetic properties to a substance. It would be an artificial magnet in that case.

Read More: [Magnetism and Matter](#)

Some of the properties of the magnetic field lines are:

- The lines are continuous and outside the magnet, the field lines originate from the North pole and terminate at the South pole
- They form closed loops traversing inside the magnet.
- But here the lines seem to originate from the South pole and terminate at the North pole to form closed loops.
- More number of close lines indicate a stronger **magnetic field**
- The lines do not intersect each other
- The tangent drawn at the field line gives the direction of the field at that point.

20. Answer: d**Explanation:**

The correct option is (D): displacement current decreases When an AC source is connected to a capacitor, the capacitive reactance (X_c) is given by:

$$X_c = \frac{1}{(2 \times \pi \times f \times C)}$$

where: f is the frequency of the AC source C is the capacitance of the capacitor

As we can see from the above equation, the capacitive reactance is inversely proportional to the frequency of the AC source.

So, if the frequency of the AC source decreases, the capacitive reactance will increase.

Therefore, the statement "capacitive reactance remains constant" is not correct.

The statement "capacitive reactance decreases" is also not correct.

The statement "displacement current increases" is also not correct because the displacement current in a capacitor is directly proportional to the rate of change of the electric field, which is not affected by the frequency of the AC source.

Therefore, the correct answer is: "displacement current decreases". The displacement current in a capacitor is given by:

$$I_d = C \times \frac{dV}{dt}$$

where: I_d is the displacement current C is the capacitance of the capacitor $\frac{dV}{dt}$ is the rate of change of the voltage across the capacitor

As the frequency of the AC source decreases, the rate of change of voltage across the capacitor decreases, which in turn decreases the displacement current.

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.

21. Answer: a

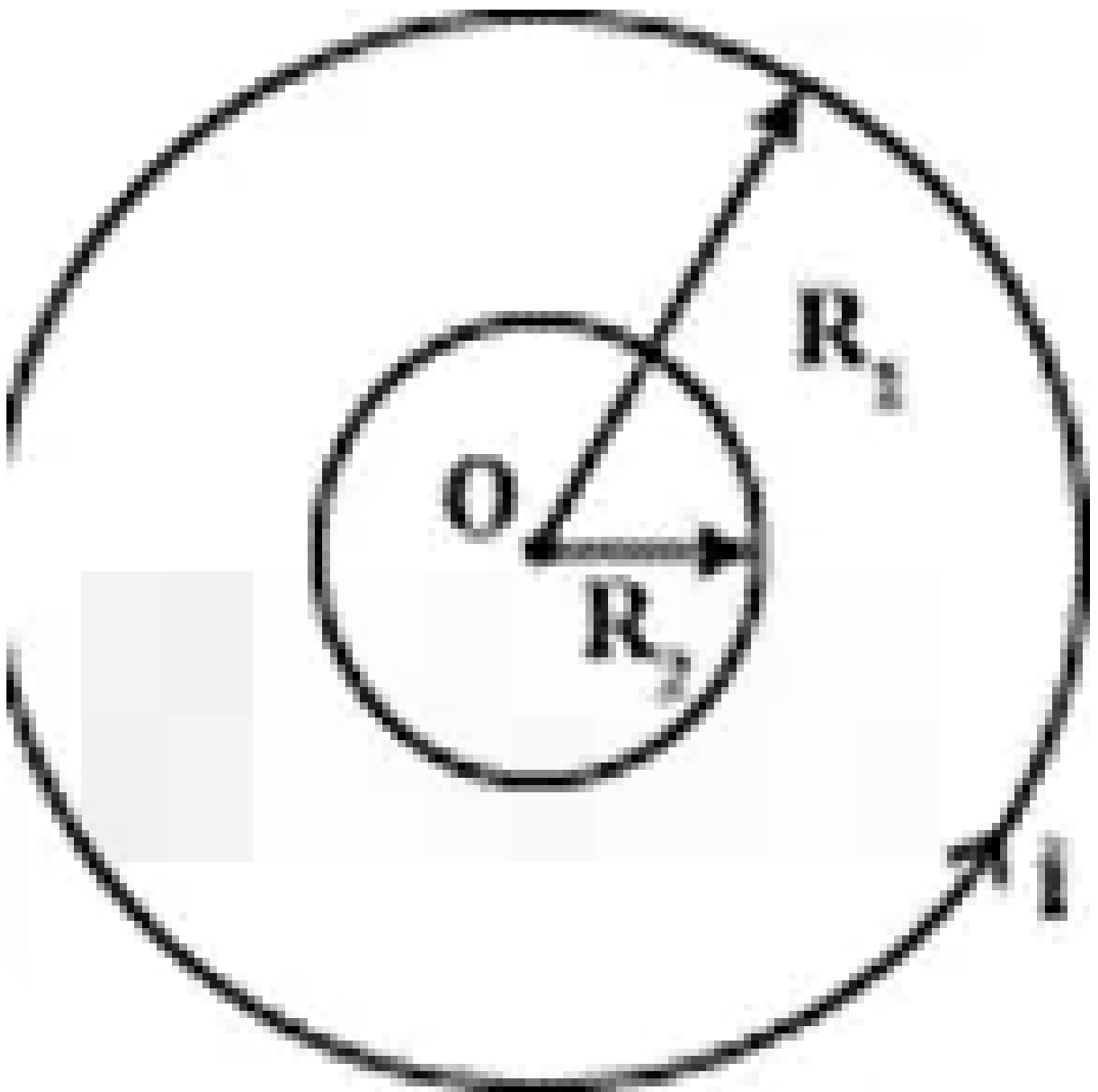
Explanation:

The correct option is (A): Random errors

Errors arise due to unpredictable fluctuations in temperature and voltage supply: random errors.

22. Answer: a

Explanation:



Magnetic field at the center of primary coil

$$B = \frac{\mu_0 i_1}{2R_1}$$

Now, considering it to be uniform, magnetic flux passing through secondary coil is

$$\phi_2 = BA = \frac{\mu_0 i_1}{2R_1} (\pi R_2^2)$$

$$\text{Now, } M = \frac{\phi_2}{i_1}$$

$$= \frac{\mu_0 \pi R_2^2}{2R_1}$$

$$\therefore M \propto \frac{R_2^2}{R_1}$$

Therefore, the correct option is (A) : $\frac{R_2^2}{R_1}$.

Concepts:

1. Inductance:

Inductance is a key parameter in electrical and electronic circuit designs. Like resistance and capacitance, it is a basic electrical measurement that affects all circuits to some degree.

Inductance is used in many areas of electrical and electronic systems and circuits. The electronic components can be in a variety of forms and may be called by a variety of names: coils, inductors, chokes, transformers, . . . Each of these may also have a variety of different variants: with and without cores and the core materials may be of different types.

There are two ways in which inductance is used:

- **Self-inductance:** Self-inductance is the property of a circuit, often a coil, whereby a change in current causes a change in voltage in that circuit due to the magnetic effect of caused by the current flow. It can be seen that self-inductance applies to a single circuit – in other words it is an inductance, typically within a single coil. This effect is used in single coils or chokes.
- **Mutual-inductance:** Mutual inductance is an inductive effect where a change in current in one circuit causes a change in voltage across a second circuit as a result of a magnetic field that links both circuits. This effect is used in transformers.

23. Answer: b

Explanation:

The correct option is (B) $2Q_1$ Heat flow rate $= KA(T_1 - T_2)/L = Q$ when linear dimensions are doubled $A_1 \propto r_1^2$, $L_1 = L$, $A_2 \propto 4r_1^2$, $L_1 = 2L$ so $Q_2 = 2Q_1$

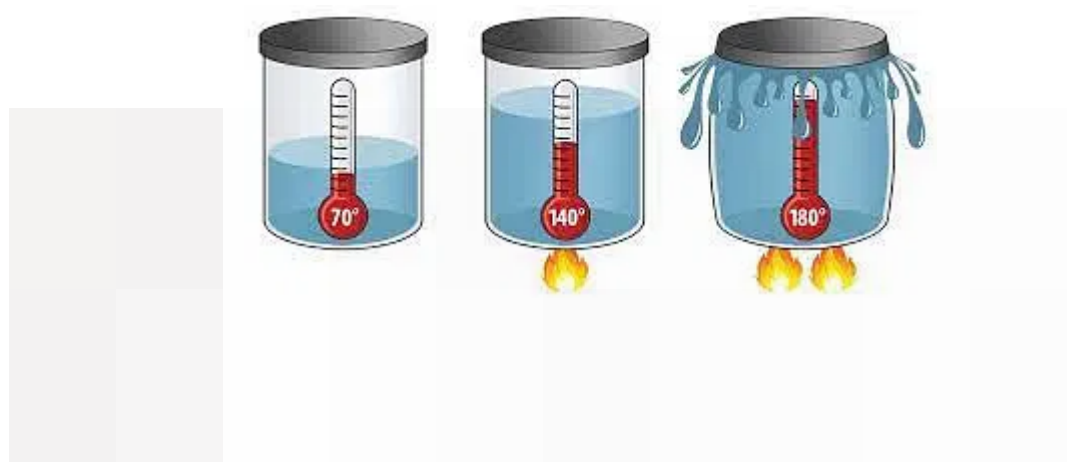
Concepts:

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.



24. Answer: a

Explanation:

The correct option is (A) : Light nuclei

As the atomic number of the reacting elements grows, so does the temperature needed to start the fusion process. Therefore, lighter nuclei are suited for the nuclear fusion process.

Concepts:

1. Nuclei:

In the year 1911, Rutherford discovered the atomic nucleus along with his associates. It is already known that every atom is manufactured of positive charge and mass in the

form of a nucleus that is concentrated at the center of the atom. More than 99.9% of the mass of an atom is located in the nucleus. Additionally, the size of the atom is of the order of 10^{-10} m and that of the nucleus is of the order of 10^{-15} m.

Read More: [Nuclei](#)

Following are the terms related to nucleus:

1. Atomic Number
 2. Mass Number
 3. Nuclear Size
 4. Nuclear Density
 5. Atomic Mass Unit
-

25. Answer: c

Explanation:

Efficiency for a Carnot engine is $e = 1 - \frac{T_2}{T_1} = \frac{1127+273}{227+273} = \frac{1400}{500} = \frac{1}{5}$.

$e = \frac{\text{Workoutput}}{\text{Heatinput}}$ is now equal to $\frac{W}{6 \times 10^4}$

$$W = e \times 6 \times 10^4 = \frac{1}{5} \times 6 \times 10^4 = 1.2 \times 10^4 \text{ cal.}$$

Therefore, the correct option is (C): 1.2×10^4 cal

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.

26. Answer: a

Explanation:

The correct option is (A): 150 J.

$$\vec{F} = (-2\hat{i} + 15\hat{j} + 6\hat{k})\text{N and distance } (d) = 10\hat{j}\text{ m.}$$

Work done

$$W = \vec{F} \cdot \vec{d} = (-2\hat{i} + 15\hat{j} + 6\hat{k}) \cdot (10\hat{j}) = 150\text{N} \cdot \text{m} = 150\text{ J.}$$

27. Answer: a

Explanation:

By KVL along path ACDB

$$V_A + 1 + (1)(2) - 2 = V_B$$

$$0 + 1 = V_B$$

$$\Rightarrow V_B = 1\text{ volt}$$

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](#).

28. Answer: b

Explanation:

$$v_{\text{escape}} = \sqrt{\frac{2GM}{R}}$$

Escape velocity from earth surface.

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,

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

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

$$\text{Or, } f(r) = G M_1 M_2 / r^2$$

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

29. Answer: b

Explanation:

$$\because T = 2\pi \sqrt{\frac{m}{K}}$$

$$\Rightarrow K \propto \frac{1}{T^2}$$

In this case $K = K_1 + K_2$

$$\frac{1}{t_0^2} = \frac{1}{t_1^2} + \frac{1}{t_2^2}$$

$$\Rightarrow t_0^{-2} = t_1^{-2} + t_2^{-2}$$

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.

30. Answer: d

Explanation:

When $F = 0$, $600 - 2 \times 10^5 t = 0$

$$\therefore t = \frac{600}{2 \times 10^5} = 3 \times 10^{-3} s.$$

Now, impulse, $I = \int_0^t F dt = \int_0^t (600 - 2 \times 10^5 t) dt$

$$600t - 2 \times 10^5 \frac{t^2}{2} = 600 \times 3 \times 10^{-3} - 10^5 \times (3 \times 10^{-3})^2$$

$$\text{or, } I = 1.8 - 0.9 = 0.9 \text{ N s.}$$

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.

31. Answer: a

Explanation:

$$V = \frac{\omega}{k} = \frac{4\pi}{0.5\pi} = 8ms^{-1}$$

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

32. Answer: c

Explanation:

Capacitance of a parallel plate capacitor is

$$C = \frac{\epsilon_0 A}{d} \dots (i)$$

Potential difference between the plates is

$$V = Ed \dots (ii)$$

The energy stored in the capacitor is

$$\begin{aligned} U &= \frac{1}{2} CV^2 = \frac{1}{2} \left(\frac{\epsilon_0 A}{d} \right) (Ed)^2 \text{ (Using (i) and (ii))} \\ &= \frac{1}{2} \epsilon_0 E^2 Ad \end{aligned}$$

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.

33. Answer: d

Explanation:

According to question, velocity of unit mass varies as

$$v(x) = \beta x^{-2n} \quad 50mm \quad \dots (i)$$

$$\frac{dv}{dx} = -2n\beta x^{-2n-1} \quad 40mm \quad \dots (ii)$$

Acceleration of the particle is given by

$$a = \frac{dv}{dt} = \frac{dv}{dx} \times \frac{dx}{dt} = \frac{dv}{dx} \times v$$

Using equation (i) and (ii), we get

$$\begin{aligned} a &= (-2n\beta x^{-2n-1}) \times (\beta x^{-2n}) \\ &= -2n\beta^2 x^{-4n-1} \end{aligned}$$

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.

34. Answer: b

Explanation:

Kinetic energy of a charged particle,

$$K = \frac{1}{2}mv^2 \text{ or } v = \sqrt{\frac{2K}{m}}$$

Radius of the circular path of a charged particle in uniform magnetic field is given by

$$R = \frac{mv}{Bq} = \frac{m}{Bq} \sqrt{\frac{2K}{m}} = \frac{\sqrt{2mK}}{Bq}$$

Mass of a proton, $m_p = m$

Mass of an α -particle, $m_\alpha = 4m$

Charge of a proton, $q_p = e$

Charge of an α -particle, $q_\alpha = 2e$

$$\therefore R_p = \frac{\sqrt{2m_p K_p}}{Bq_p} = \frac{\sqrt{2m K_p}}{Be}$$

$$\text{and } R_\alpha = \frac{\sqrt{2m_\alpha K_\alpha}}{Bq_\alpha}$$

$$= \frac{\sqrt{2(4m)K_\alpha}}{B(2e)} = \frac{\sqrt{2m K_\alpha}}{Be}$$

$$\therefore \frac{R_p}{R_\alpha} = \sqrt{\frac{K_p}{K_\alpha}}$$

As $R_p = R_\alpha$ (given)

$$\therefore K_\alpha = K_p = 1 \text{ MeV}$$

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.

35. Answer: b

Explanation:

Here $\rho = kx$ where k is a constant mass of small element of dx length is

$$dm = kx \cdot dx$$

$$x_{cm} = \frac{\int x \cdot dm}{\int dm} = \frac{\int_0^3 x(x dx)}{\int_0^3 x \cdot dx} = \frac{\left[\frac{x^3}{3}\right]_0^3}{\left[\frac{x^2}{2}\right]_0^3} = \frac{\frac{27}{3}}{\frac{9}{2}} = 2$$

36. Answer: d

Explanation:

Given situation is shown in the figure.

Velocity of ship A

$$v_A = 10 \text{ km h}^{-1} \text{ towards west}$$

Velocity of ship B

$$v_B = 10 \text{ km h}^{-1} \text{ towards north}$$

$$OS = 100 \text{ km}$$

OP = shortest distance

Relative velocity between A and B is

$$v_{AB} = \sqrt{v_A^2 + v_B^2} = 10\sqrt{2} \text{ km h}^{-1}$$

$$\cos 45^\circ = \frac{OP}{OS}; \frac{1}{\sqrt{2}} = \frac{OP}{100}$$

$$OP = \frac{100}{\sqrt{2}} = \frac{100\sqrt{2}}{2} = 50\sqrt{2} \text{ km}$$

The time after which distance between them equals to OP is given by

$$t = \frac{OP}{v_{AB}} = \frac{50\sqrt{2}}{10\sqrt{2}} \Rightarrow t = 5 \text{ h}$$

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

37. Answer: d

Explanation:

Magnifying power of a microscope.

$$m = \left(\frac{L}{f_o} \right) \left(\frac{D}{f_e} \right)$$

where f_o and f_e are the focal lengths of the objective and eyepiece respectively and L is the distance between their focal points and D is the least distance of distinct vision.

If f_o increases, then m will decrease.

Magnifying power of a telescope, $m = \frac{f_o}{f_e}$

where f_o and f_e are the focal lengths of the objective .
and eyepiece respectively.

If f_o increases, then m will increase.

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](#)

38. Answer: a

Explanation:

As $r \propto n^2$, therefore, radius of 2^{nd}
Bohr's orbit = $4a_0$

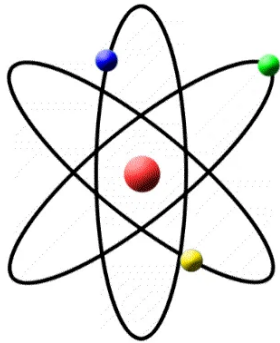
Concepts:

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.

39. Answer: c

Explanation:

In an electromagnetic wave both electric and magnetic vectors are perpendicular to each other as well as perpendicular to the direction of propagation of wave.

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.

40. Answer: a

Explanation:

Since diode is in forward bias $i = \frac{\Delta V}{R} = \frac{4 - (-6)}{1 \times 10^3} = \frac{10}{10^3} = 10^{-2} A$

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.

41. Answer: b

Explanation:

$$\lambda = \frac{h}{\sqrt{2mq\Delta V}} \propto \frac{1}{\sqrt{\Delta V}}$$

$$\frac{\lambda_2}{\lambda_1} = \sqrt{\frac{\Delta V_1}{\Delta V_2}} = \sqrt{\frac{25}{100}} = \frac{1}{2}$$

$$\lambda_2 = \frac{\lambda_1}{2}$$

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.

42. Answer: d

Explanation:

$$\tan \theta_1 = \frac{\tan \theta}{\cos \alpha} \Rightarrow \tan \theta_2 = \frac{\tan \theta}{\cos(90-\alpha)} = \frac{\tan \theta}{\sin \alpha} \Rightarrow \sin^2 \alpha + \cos^2 \alpha = 1 \Rightarrow \cot^2 \theta_2 + \cot^2 \theta_1 = \cot^2 \theta$$

Concepts:

1. Magnetism & Matter:

Magnets are used in many devices like electric bells, telephones, radio, loudspeakers, motors, fans, screwdrivers, lifting heavy iron loads, super-fast trains, especially in foreign countries, **refrigerators**, etc.

Magnetite is the world's first magnet. This is also called a **natural magnet**. Though magnets occur naturally, we can also impart magnetic properties to a substance. It would be an artificial magnet in that case.

Read More: [Magnetism and Matter](#)

Some of the properties of the magnetic field lines are:

- The lines are continuous and outside the magnet, the field lines originate from the North pole and terminate at the South pole
 - They form closed loops traversing inside the magnet.
 - But here the lines seem to originate from the South pole and terminate at the North pole to form closed loops.
 - More number of close lines indicate a stronger **magnetic field**
 - The lines do not intersect each other
 - The tangent drawn at the field line gives the direction of the field at that point.
-

43. Answer: a

Explanation:

The correct option is (A): 1.59 kHz

The resonant frequency (f_r) of a series LCR circuit is given by the formula:

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

where L is the inductance in Henries, C is the capacitance in farads, and π is the mathematical constant pi (approximately equal to 3.14).

Substituting the given values, we get:

$$\begin{aligned} f_r &= \frac{1}{2\pi\sqrt{10\text{ mH} \times 1\text{ }\mu\text{F}}} \\ &= \frac{1}{(2\pi\sqrt{(10 \times 10^{-3}\text{ H} \times 10^{-6}\text{ F}))}} \\ &= \frac{1}{(2\pi\sqrt{(10^{-8}))}} \\ &= \frac{1}{(2\pi \times 10^{-4})} \\ &= \frac{1}{(6.28 \times 10^{-5})} \\ &= 1591.5\text{ Hz (approx)} \end{aligned}$$

Therefore, the resonant frequency of the series LCR circuit is approximately 1591.5 Hz,
= 1.59K Hz

Concepts:

1. Inductance:

Inductance is a key parameter in electrical and electronic circuit designs. Like resistance and capacitance, it is a basic electrical measurement that affects all circuits to some degree.

Inductance is used in many areas of electrical and electronic systems and circuits. The electronic components can be in a variety of forms and may be called by a variety of names: coils, inductors, chokes, transformers, . . . Each of these may also have a variety of different variants: with and without cores and the core materials may be of different types.

There are two ways in which inductance is used:

- **Self-inductance:** Self-inductance is the property of a circuit, often a coil, whereby a change in current causes a change in voltage in that circuit due to the magnetic effect of caused by the current flow. It can be seen that self-inductance applies to a single circuit – in other words it is an inductance, typically within a single coil. This effect is used in single coils or chokes.

- **Mutual-inductance:** Mutual inductance is an inductive effect where a change in current in one circuit causes a change in voltage across a second circuit as a result of a magnetic field that links both circuits. This effect is used in transformers.
-

44. Answer: a

Explanation:

The correct answer is option (A): 0.052 cm

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.

45. Answer: a

Explanation:

The earth receives the UV, infrared, and visible light that the sun emits. A portion of the solar energy is absorbed by the atmosphere and clouds, while the remainder is sent back towards space by the atmosphere and clouds. The remainder of the energy is then absorbed by the Earth's surface, warming it. The energy is subsequently transformed into heat. Now that this heat has been absorbed by the earth's surface, it is retained in the atmosphere and contributes to the planet's warming. We refer to this impact as the "Greenhouse Effect." Thus, the Greenhouse effect is brought on by infrared radiation.

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.

46. Answer: c

Explanation:

The correct option is (C) : 3.5×10^{16}

$t = nT$, $X = \frac{X_0}{2^n} n = \frac{t}{T} = \frac{30}{10} = 3$, Active nuclei $X = \frac{4 \times 10^{16}}{(2)^3}$ and decayed nuclei $X = (X_0 - X) = 3.5 \times 10^{16}$

Concepts:

1. Nuclei:

In the year 1911, Rutherford discovered the atomic nucleus along with his associates. It is already known that every atom is manufactured of positive charge and mass in the form of a nucleus that is concentrated at the center of the atom. More than 99.9% of the mass of an atom is located in the nucleus. Additionally, the size of the atom is of the order of 10^{-10} m and that of the nucleus is of the order of 10^{-15} m.

Read More: [Nuclei](#)

Following are the terms related to nucleus:

1. Atomic Number
2. Mass Number
3. Nuclear Size
4. Nuclear Density
5. Atomic Mass Unit

47. Answer: a

Explanation:

A galvanometer acting as a voltmeter will have a high resistance in series with its coil.

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
-

48. Answer: d

Explanation:

The equation of state for 5g of oxygen at a pressure P and temperature T , when occupying a volume V , is $PV = 5 RT$.

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.

49. Answer: b

Explanation:

$$v^2 = u^2 + 2as \text{ or } v^2 - u^2 = 2as$$

$$\text{or } v^2 - (0)^2 = 2 \times \frac{F}{m} \times s \text{ or } v^2 = \frac{2Fs}{m} \text{ and}$$

$$\text{K.E} = \frac{1}{2}mv^2 = \frac{1}{2}m \times \frac{2Fs}{m} = Fs.$$

Thus K.E. is independent of m or directly proportional to m^0 .

50. Answer: a

Explanation:

According to Ohm's law, $\frac{dV}{dt} = -r$

and $\varepsilon \int I = 0$ [As $V = Ir = e$]

$\therefore$ Slope of the graph = $-r$ intercept = ε

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](#).

51. Answer: a

Explanation:

$$E_{cell} = E_{cell}^{\circ} - \frac{0.059}{n} \log Q$$

(At equilibrium, $Q = K_{eq}$ and $E_{cell} = 0$)

$$0 = E_{cell}^{\circ} - \frac{0.059}{1} \log K_{eq} \quad (\text{from equation (i)})$$

$$\log K_{eq} = \frac{E_{cell}^{\circ}}{0.059} = \frac{0.59}{0.059} = 10$$

$$K_{eq} = 10^{10} = 1 \times 10^{10}$$

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.

52. Answer: b

Explanation:

The correct answer is B:3.0

$$[N_2O_5] = \frac{Rate}{k} = \frac{1.02 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}}{3.4 \times 10^{-5} \text{ s}^{-1}} \\ = 3 \text{ mol L}^{-1}$$

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.
-

53. Answer: a**Explanation:**

Equivalent weight of dibasic acid

$$= \frac{\text{mol. wt.}}{2} = \frac{200}{2} = 100$$

Strength = 0.1 N , $m = ?$, $V = 100\text{ ml}$.

$$\text{From, } m = \frac{EVN}{1000}$$

$$= \frac{100 \times 100 \times 0.1}{1000} = 1\text{ g}$$

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.
-

54. Answer: c**Explanation:**

The reaction equation is



Molar mass of $PbO = 223 \text{ g mol}^{-1}$.

Now, moles of $PbO = \frac{6.5}{223} = 0.029 \text{ mol}$

and moles of $HCl = \frac{3.2}{36.5} = 0.088 \text{ mol}$

1 mol of PbO reacts with 2 moles of HCl .

Therefore, PbO is a limiting reagent.

0.029 mol of PbO will produce $PbCl_2 = 0.029 \text{ mol}$

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.

55. Answer: b

Explanation:

If ΔG system < 0 , the process is spontaneous

If ΔG system > 0 , the process is nonspontaneous

If ΔG system $= 0$, the process is in equilibrium

Concepts:

1. Thermodynamics:

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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.

56. Answer: c

Explanation:

2-Chlorobutane contains a chiral carbon atom and hence is optically active compound.

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.

57. Answer: d

Explanation:

Base, BOH is dissociated as follows



So, the dissociation constant of BOH base

$$K_b = \frac{[B^+][OH^-]}{[BOH]} \quad \dots\dots(i)$$

At equilibrium $[B^+] = [OH^-]$

$$K_b = \frac{[OH^-]^2}{[BOH]}$$

Given that $K_b = 1.0 \times 10^{-12}$

and $[BOH] = 0.01 \text{ M}$

$$1.0 \times 10^{-12} = \frac{[OH^-]^2}{0.01}$$

$$[OH^-]^2 = 1 \times 10^{-14}$$

$$[OH^-] = 1.0 \times 10^{-7} \text{ mol L}^{-1}$$

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](#)

58. Answer: a

Explanation:

Answer (a) $e < d < c < a < b$

59. Answer: a

Explanation:

Cinnabar is an ore of mercury which have formula HgS .

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](#)

60. Answer: b

Explanation:

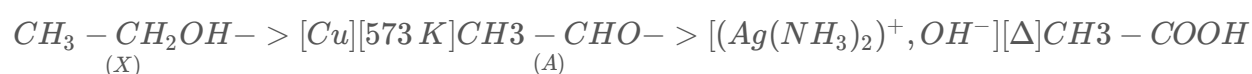
Since 'A' gives positive silver mirror test therefore, it must be an aldehyde or α

Hydroxyketone.

Reaction with semicarbazide indicates that A can be an aldehyde or ketone.

Reaction with OH^- i.e., aldol condensation (by assuming alkali to be dilute) indicates that A is aldehyde as aldol reaction of ketones is reversible and carried out in special apparatus.

These indicates option (2).



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 $(C=O)OH$ group attached to an R group (where R refers to the remaining part of the molecule).

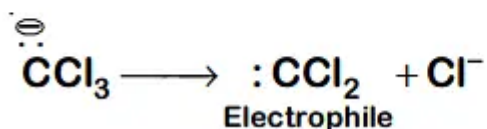
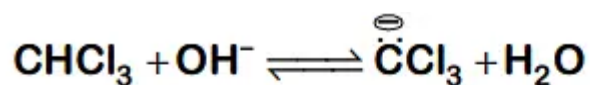
Preparation of Carboxylic Acids

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.

61. Answer: a

Explanation:

It is Reimer-Tiemann reaction. The electrophile formed is : CCl_2 (Dichlorocarbene) according to the following reaction



Concepts:

1. Alcohols, Phenols, and Ethers:

Alcohol is formed when a saturated carbon atom bonds to a hydroxyl (-OH) group. It is an organic compound that contains a hydroxyl functional group attached to a carbon atom.

Phenol is formed when the -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](#)

62. Answer: a

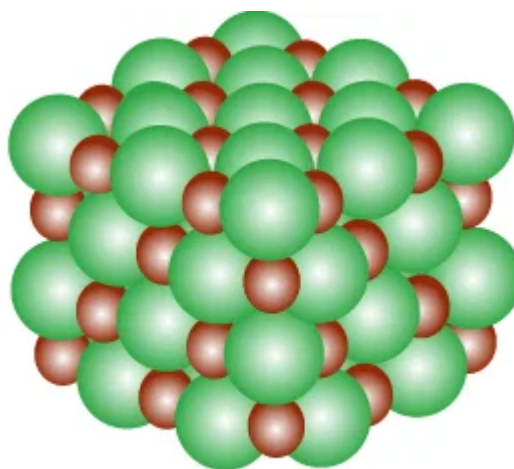
Explanation:

When we add some of In or Ga (group 13 element) into Ge (group number 14 element), then electron vacancy is created which is called holes. In this type of semiconductor the charge carrier are holes (positive), so it is called p-type semiconductor.

Concepts:

1. Solid State:

[Solids](#) are substances that are featured by a definite shape, volume, and high density. In the solid-state, the composed particles are arranged in several manners. Solid-state, in simple terms, means "no moving parts." Thus [solid-state](#) electronic devices are the ones inclusive of solid components that don't change their position. Solid is a state of matter where the composed particles are arranged close to each other. The composed particles can be either atoms, molecules, or ions.



Solid state

Types of Solids:

Based on the nature of the order that is present in the arrangement of their constituent particles solids can be divided into two types;

- **Amorphous solids** behave the same as super cool liquids due to the arrangement of constituent particles in short-range order. They are isotropic and have a broad melting point (range is about greater than 5°C).
- **Crystalline solids** have a fixed shape and the constituent particles are arranged in a long-range order.

63. Answer: a

Explanation:

IUPAC name of an element with atomic number 119 is ununennium

Concepts:

1. Classification of Elements & Periodicity in Properties:

Since many elements were being discovered in the 19th century and the study of these elements individually was proving difficult, classification of elements was made necessary.

Classification by Johann Dobereiner – German chemist Johann Dobereiner classified certain elements on the basis of their similar properties in the groups of continuing –

three elements each. These groups were called 'triads'. In every triad, the atomic weight of the middle element was equal to the average of the atomic weights of the first and third elements.

Newlands Law of Octaves – The elements were arranged in increasing order of their atomic weights and found that every 8th element shows similarity with the 1st element.

Mendeleev's Periodic Table – The arrangement of all 63 elements in rows or columns in order of their atomic weight was made by Mendeleev. He left some space for corresponding elements in his periodic table which were not even discovered till then. Although he predicted the properties of those elements through his periodic classification of elements.

Modern Periodic Law – The properties of the elements of the modern periodic law are periodic functions of their atomic numbers.

64. Answer: d

Explanation:

Li $\Rightarrow$ electrochemical cells

Na $\Rightarrow$ coolant in fast breeder reactors

KOH $\Rightarrow$ absorbent for carbon dioxide

Cs $\Rightarrow$ photoelectric cell

Concepts:

1. Group 1 Elements:

Group one of alkali metals is [s-block elements](#) with just one electron in their s-orbital. They are alkali metals. They are named so because of the alkaline nature of the hydroxides and oxides.

Alkali metals are characterized by one s-electron in the valence shell of their atoms.

Alkali metals have a corresponding [Noble gas] ns¹ [electronic configuration](#). They occupy the first column of the periodic table. Alkali elements are:

- Lithium(Li)

- Sodium (Na)
- Potassium (K)
- Rubidium (Ru)
- Cesium (Cs)
- Francium (Fr)

They have occupied successive periods from first to seven. Francium is a radioactive element with very low half-life.

Electronic Configuration:

- Alkali metals have **one electron in their valence shell**.
- The electronic configuration is given by ns^1 . For example, the electronic configuration of lithium is given by $1s^1 2s^1$.
- They tend to lose the outer shell electron to form cations with charge +1 (monovalent ions).

This makes them the **most electropositive elements** and due to the same reason, they are not found in the pure state.

65. Answer: b

Explanation:

Given the oxidation states:

- A has an oxidation state of +2.
- B has an oxidation state of +5.
- C has an oxidation state of -2.

To create a compound with a neutral charge, you must balance the charges. In this case, you need three +2 charges from A to balance the three -2 charges from C and two +5 charges from B. The possible formula of the compound is $A_3(BC_4)_2$

So, the Correct option is (B): $A_3(BC_4)_2$

Concepts:

1. Redox Reactions:

Redox Reaction:

[Redox reactions](#) are chemical reactions where oxidation and reduction take place simultaneously. In this type of reaction, there is a gain of electrons for one chemical species while the other loses electrons or simply involves transfer of electrons. The species that loses electrons is oxidized while the one that gains electrons is reduced.

Types of Redox Reactions:

Redox reactions can be differentiated into [4 categories](#) namely combination reactions, decomposition reactions, displacement reactions, and disproportionation reactions. Each is explained separately below:

Combination Reaction:

In this, the molecules combine to form new compounds. For example, when magnesium reacts to nitrogen.

Decomposition Reaction:

Opposite to the combination reaction, here there is a breakdown of compounds to simpler substances. For example, electrolysis of water.

Displacement Reaction:

In this, the more reactive metal will displace the less reactive one in a chemical reaction. The reactivity of an element is represented in a series called the reactivity series (arranged in decreasing order of reactivity) which makes it easier to determine the chemical reaction and its products.

Disproportionation Reaction:

This is a peculiar type of reaction where an element showing a particular oxidation state will be oxidized and reduced simultaneously. Another thing to note is that these reactions will always have an element that can exhibit three oxidation states.

Explanation:

According to V.S.E.P.R.T lone-lone pair repulsion is maximum because lone pair electron held by nuclei of one atom there for occupy more space.

Repulsion $\Rightarrow$ lone pair-lone pair $>$ lone pair-bond pair $>$ bond pair-bond pair

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: a

Explanation:

White and red phosphorus are the main allotropes of phosphorus. White phosphorus is soluble in carbon disulphide whereas red phosphorus is insoluble in carbon disulphide.

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

68. Answer: a

Explanation:

According to Heisenberg's uncertainty principle

$$\Delta x \cdot \Delta p = \frac{h}{4\pi}$$

Given, $\Delta x = \Delta p$ ($\Delta x =$ uncertainty in position)

$$(\Delta p)^2 = \frac{h^4}{4\pi^2} (\Delta p = m \times \Delta v)$$

$$m^2 \Delta v^2 = \frac{h^4}{4\pi^2} \quad m = \text{mass}$$

$$\Delta v^2 = \frac{h^2}{m^2 4\pi^2}$$

$$\Delta v = \frac{1}{2m} \sqrt{\frac{h}{\pi}}$$

$\Delta v =$ uncertainty in velocity)

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.

69. Answer: b

Explanation:

The formula of sodium nitroprusside is $Na_2[Fe(CN)_5NO]$. Its IUPAC name is sodium pentacyanonitrosyl ferrate (II). The name of sodium cation is written first. the names of ligands are written in alphabetical order. The name of iron metal is written as ferrate. The roman numeral III indicates oxidation state.

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.

70. Answer: a

Explanation:

Glycolysis is the first stage in the oxidation of glucose. It is an anaerobic process and involves the degradation of glucose into two molecules of pyruvate with the generation of two molecules of ATP

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.
-

71. Answer: a

Explanation:

If small amount of an acid or alkali is added to a buffer solution, it converts them into unionised acid or base. Thus, its pH remains unaffected or in other words its acidity/alkalinity remains constant, e.g.



If acid is added, it reacts with A^- to form undissociated H A. Similarly, if base/alkali is added, OH^- combines with HA to give H_2O and A^- and thus, maintains the acidity/alkalinity of buffer solution.

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

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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](#)

72. Answer: c

Explanation:

$$\text{Average velocity} = \sqrt{\frac{8RT}{\pi M}}$$

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.

73. Answer: a

Explanation:

We know that, standard Gibbs energy,

$$\Delta G^0 = -nFE_{cell}^0$$

For the cell reaction,



$$\Delta E_{cell}^0 = +0.46 V$$

$$\Delta G^0 = -nFE_{cell}^0$$

$$n=2$$

$$\Delta G^0 = -2 \times 96500 \times 0.46$$

$$= -88780 J$$

$$= -88.7 kJ \approx -89.0 kJ$$

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.
-

74. Answer: c

Explanation:

$$K = \frac{0.693}{t_{1/2}} = \frac{0.693}{1386} = 0.5 \times 10^{-3} S^{-1}$$

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.

75. Answer: d

Explanation:

Q mass of 1 mol (6.022×10^{23} atoms) of carbon = 12g

If Avogadro Number (NA) is changed

than mass of 1 mol (6.022×10^{20} atom) of carbon.

$$= \frac{12 \times 6.022 \times 10^{20}}{6.022 \times 10^{23}} = 12 \times 10^{-3} g$$

Therefore the mass of 1 mol of carbon is changed

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.

76. Answer: d

Explanation:

As $\Delta H = \Delta E + \Delta n_g RT$

if $n_p < n_r$; $\Delta n_g = n_p - n_r = -ve$.

Hence $\Delta H < \Delta E$.

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.

77. Answer: c

Explanation:

$$X_{H_2O} = 0.02$$
$$\therefore X_{gas} = 0.98$$

$$P_{total} = 1.2 \text{ atm}$$

partial pressure of dry-air = $P_T \times$ mole fraction of dry-air

$$\begin{aligned}\text{Partial pressure of dry-air} &= 1.2 \text{ atm} \times 0.98 \\ &= 1.176 \text{ atm.}\end{aligned}$$

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.

78. Answer: d

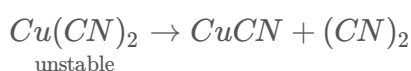
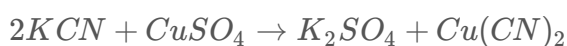
Explanation:

Weaker the acid, strongest is its conjugate base.

Among alkane, alkene and alkyne, alkynes are most acidic and alkanes are least acidic, so the order of base strength is $alkane > alkene > alkyne$ or $CH_3 < CH_2 < CH < C \equiv$

79. Answer: b

Explanation:



i.e. $[Cu(CN)_4]^{3-}$

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](#)

80. Answer: b

Explanation:

Compounds having either $\text{CH}_3\overset{\text{O}}{\parallel}\text{C}-$ group or $\text{CH}_3\text{CHOH}-$ group, give iodoform when warmed with I_2 and NaOH . Thus, $\text{CH}_3\underset{\text{H}}{\text{C}}\text{HOH}$, $\text{CH}_3-\overset{\text{O}}{\parallel}\text{C}-\text{CH}_3$, $\text{CH}_3-\underset{\text{CH}_3}{\text{C}}\text{HOH}$ give iodoform when warmed with I_2 and NaOH . (Remember, NaOI oxidises $\text{CH}_3\text{CH}_2\text{OH}$ to CH_3CHO , thus it gives positive iodoform test.)

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 $-\text{CHO}$.

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 $\text{C}=\text{O}$ and the structure $\text{R}-(\text{C}=\text{O})-\text{R}'$.

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 $(\text{C}=\text{O})\text{OH}$ 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: a

Explanation:

has all sp^2 carbons so it is co-planar molecule.

Concepts:

1. Hydrocarbons:

Hydrocarbons can be described as **organic compounds** that consists only hydrogen and carbon atoms. These compounds are of different types and thereby have distinct natures. Hydrocarbons are colorless gases and are known for discharging faint odours. These have been categorized under four major classes named as alkynes, alkanes, alkenes, and aromatic hydrocarbons.

Types of Hydrocarbons

1. **Saturated hydrocarbons** – Saturated hydrocarbons are those compounds where there is a single bond exists between carbon atoms and are saturated with atoms of hydrogen.
 2. **Unsaturated hydrocarbons** – Hydrocarbons comprises of at least one double or triple bond between carbon atoms are known as unsaturated hydrocarbons.
 3. **Aliphatic hydrocarbons** – The term denotes the hydrocarbons formed as an outcome of the chemical degradation of fats. **Aliphatic hydrocarbons** are basically chemical compounds.
 4. **Aromatic hydrocarbons** – They are distinguished because of the presence of benzene rings in them. They give away distinct types of aroma. These hydrocarbons comprises of only hydrogen and carbon atoms.
-

82. Answer: a**Explanation:**

Both phenyl ring placed in different plane so plane of symmetry absent result in it is optically active

Concepts:**1. Haloalkanes and Haloarenes:**

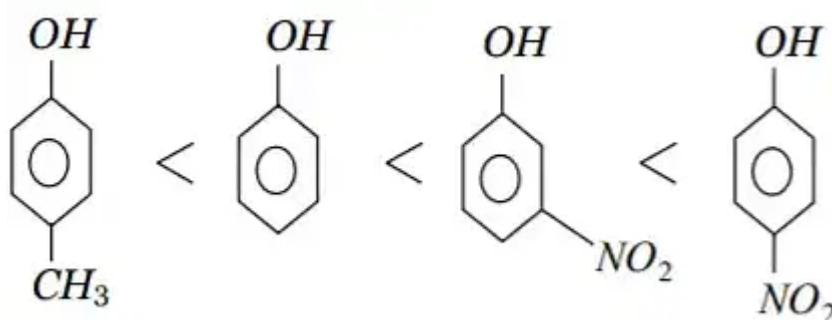
The hydrocarbons such as [Haloalkanes and Haloarenes](#) are the ones, in which one or more [hydrogen](#) atoms are replaced with halogen atoms. The main difference between Haloalkanes and Haloarenes is that Haloalkanes are derived from open chained hydrocarbons, also called alkanes, and Haloarenes are 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 CH_3CH_2Br (Ethyl Bromide) and the example of haloarenes is Chlorobenzene, Bromobenzene.
-

83. Answer: b

Explanation:

- I group increases acidity of the compound whereas + I group reduces acidity. At *m*-position with respect to $-OH$, the nitro group increases the acidity lesser than that of at Ortho and Para-positions.



Concepts:

1. Alcohols, Phenols, and Ethers:

Alcohol is formed when a saturated carbon atom bonds to a hydroxyl ($-OH$) group. It is an organic compound that contains a hydroxyl functional group attached to a carbon atom.

Phenol is formed when the $-OH$ 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](#)

84. Answer: d

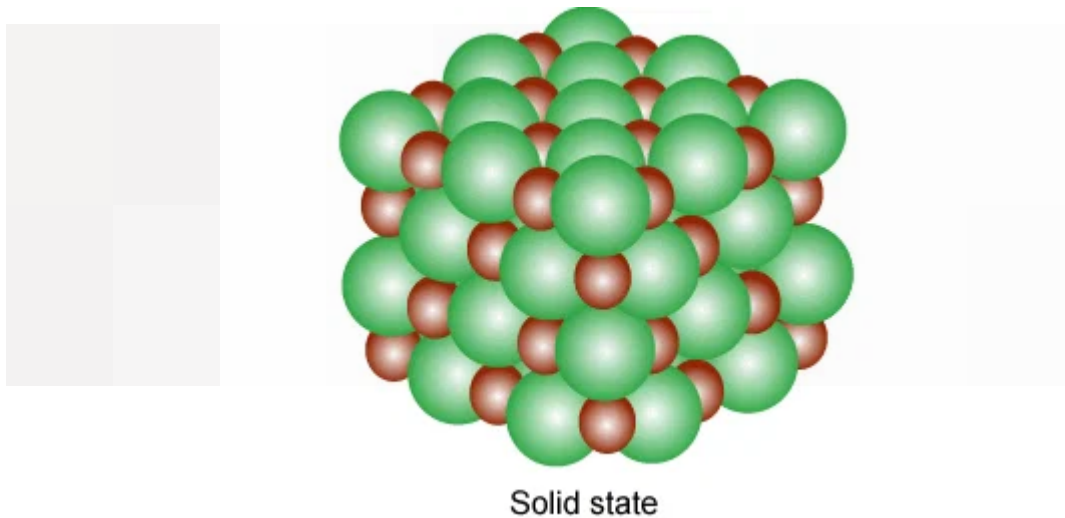
Explanation:

According to Bragg- equation, $n\lambda = 2d \sin \theta$ $n=2$ $\lambda = 1$ deflected
 angle $\theta = 60^\circ$ $d = ?$ Distance between two plane of crystal $2 \times 1 = 2 \times d \times$
 $\sin 60^\circ$ $2 \times 1 = 2 \times d \times \frac{\sqrt{3}}{2}$ $d = \frac{2}{\sqrt{3}} = \frac{2}{1.7} = 1.17 \text{ \AA}$

Concepts:

1. Solid State:

[Solids](#) are substances that are featured by a definite shape, volume, and high density. In the solid-state, the composed particles are arranged in several manners. Solid-state, in simple terms, means "no moving parts." Thus [solid-state](#) electronic devices are the ones inclusive of solid components that don't change their position. Solid is a state of matter where the composed particles are arranged close to each other. The composed particles can be either atoms, molecules, or ions.



Types of Solids:

Based on the nature of the order that is present in the arrangement of their constituent particles solids can be divided into two types;

- **Amorphous solids** behave the same as super cool liquids due to the arrangement of constituent particles in short-range order. They are isotropic and have a broad melting point (range is about greater than 5°C).
- **Crystalline solids** have a fixed shape and the constituent particles are arranged in a long-range order.

85. Answer: c**Explanation:**

The correct answer is option (C) : Strontium chloride

Concepts:**1. Group 1 Elements:**

Group one of alkali metals is [s-block elements](#) with just one electron in their s-orbital. They are alkali metals. They are named so because of the alkaline nature of the hydroxides and oxides.

Alkali metals are characterized by one s-electron in the valence shell of their atoms.

Alkali metals have a corresponding [Noble gas] ns^1 [electronic configuration](#). They occupy the first column of the periodic table. Alkali elements are:

- Lithium (Li)
- Sodium (Na)
- Potassium (K)
- Rubidium (Ru)
- Cesium (Cs)
- Francium (Fr)

They have occupied successive periods from first to seven. Francium is a radioactive element with very low half-life.

Electronic Configuration:

- Alkali metals have **one electron in their valence shell**.
- The electronic configuration is given by ns^1 . For example, the electronic configuration of lithium is given by $1ns^1 2ns^1$.
- They tend to lose the outer shell electron to form cations with charge +1 (monovalent ions).

This makes them the **most electropositive elements** and due to the same reason, they are not found in the pure state.

86. Answer: a

Explanation:

The correct answer is option (A) : Fe^{2+} , Mn^{2+}

Concepts:

1. Electronic Configuration of Atoms:

Electronic configuration, also called electronic structure, the arrangement of electrons in energy levels around an atomic nucleus. According to the older shell atomic model, electrons occupy several levels from the first shell nearest the nucleus, K, through the seventh shell, Q, farthest from the nucleus. Electrons have to be filled in the s, p, d, f in accordance with the following rule. For example, the electron configuration of sodium is $1s^2 2s^2 2p^6 3s^1$.

Writing Electron Configurations:

Maximum number of electrons that can be accommodated in a shell is based on the principal quantum number (n). It is represented by the formula $2n^2$, where 'n' is the shell number.

Shell and 'n' value	Max. Electrons in the Electron Configuration
K shell, n=1	$2 \times 1^2 = 2$
L shell, n=2	$2 \times 2^2 = 8$
M shell, n=3	$2 \times 3^2 = 18$
N shell, n=4	$2 \times 4^2 = 32$

Filling of Atomic Orbitals:

1. Aufbau's principle: The filling of electrons should take place in accordance with the ascending order of energy of orbitals:

- Lower energy orbital should be filled first and higher energy levels.
- The energy of orbital $\propto (n + l)$ value if two orbitals have same $(n + l)$ value, $E \propto n$
- Ascending order of energy $1s, 2s, 2p, 3s, 3p, 4s, 3d, \dots$

2. Pauli's exclusion principle: No two electrons can have all the four **quantum numbers** to be the same or if two electrons have to be placed in an energy state they should be placed with opposite spins.

3. Hund's rule of maximum multiplicity: In the case of filling degenerate (same energy) orbitals, all the degenerate orbitals have to be singly filled first and then only pairing has to happen.

87. Answer: a

Explanation:

For SO_3^{2-} (sulfite ion), The oxidation state of sulfur can be calculated as follows:

Let the oxidation state of sulfur be x . So, you have:

$$x + 3(-2) = -2$$

$$x - 6 = -2$$

$$x = +4$$

For $\text{S}_2\text{O}_4^{2-}$ (dithionite ion), The oxidation state of sulfur can be calculated as follows:

$$x + 4(-2) = -2$$

$$x - 8 = -2$$

$$x = +6$$

For $\text{S}_2\text{O}_6^{2-}$ (tetrathionate ion), The oxidation state of sulfur can be calculated as follows:

$$x + 6(-2) = -2$$

$$x - 12 = -2$$

$$x = +10$$

Now, let's order these oxidation states:

$$+4 (\text{SO}_3^{2-}) < +6 (\text{S}_2\text{O}_4^{2-}) < +10 (\text{S}_2\text{O}_6^{2-})$$

So, the correct option is (A): $\text{S}_2\text{O}_4^{2-} < \text{SO}_3^{2-} < \text{S}_2\text{O}_6^{2-}$

Concepts:

1. Oxidation Number:

Oxidation number, also called **oxidation state**, the total number of **electrons** that an **atom** either gains or loses in order to form a **chemical bond** with another atom.

Oxidation number of an atom is defined as the charge that an atom appears to have on forming ionic bonds with other heteroatoms. An atom having higher electronegativity (even if it forms a **covalent bond**) is given a negative oxidation state.

The definition, assigns oxidation state to an atom on conditions, that the atom –

1. Bonds with heteroatoms.
2. Always form ionic bonding by either gaining or losing electrons, irrespective of the actual nature of bonding.

Oxidation number is a formalized way of keeping track of oxidation state.

Read More: [Oxidation and Reduction](#)

Way To Find Oxidation Number Of An Atom?

Oxidation number or state of an atom/ion is the number of electrons an atom/ion that the molecule has either gained or lost compared to the neutral atom.

Electropositive metal atoms, of group 1, 2 and 3 lose a specific number of electrons and have always constant positive oxidation numbers.

In molecules, more electronegative atom gain electrons from a less electronegative atom and have negative oxidation states. The numerical value of the oxidation state is equal to the number of electrons lost or gained.

Oxidation number or oxidation state of an atom or ion in a molecule/ion is assigned by:

1. Summing up the constant oxidation state of other atoms/molecules/ions that are bonded to it and
 2. Equating, the total oxidation state of a molecule or ion to the total charge of the molecule or ion.
-

88. Answer: b**Explanation:**

Bond energy of F_2 is less than Cl_2 because in F_2 molecule electron-electron repulsion of 2p-orbital of two fluorine atom is maximum in comparison to the repulsion of 3p-orbitals of two chlorine atom. So, less amount of energy is required to break the bond of F_2 in comparison to Cl_2 .

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
-

89. Answer: a**Explanation:**

When two hybridised orbitals of two atoms undergoes linear combination, they form sigma bond

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

90. Answer: d

Explanation:

Phospholipids are esters of glycerol with two carboxylic acid residue and one phosphate group. Hence, phospholipids may be regarded as derivative of glycerol in which two hydroxyl groups are esterified with fatty acid, while third is esterified with phosphoric acid.

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.

91. Answer: a

Explanation:

$$\text{Frequency } (\nu) = \frac{c}{\lambda} = \frac{3 \times 10^8 \text{ m s}^{-1}}{8 \times 10^{15} \text{ s}^{-1}}$$

$$\lambda = 0.375 \times 10^{-7} \text{ m}$$

$$\lambda = 3.75 \times 10^{-1} \text{ nm} \approx 4 \times 10^{-1} \text{ nm}$$

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

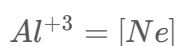
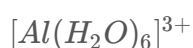
Atomic Structure of Isotopes

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: a

Explanation:

$AlCl_3$ in acidified aqueous solution form a



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:

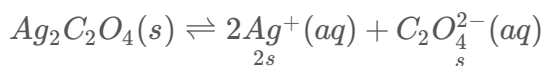
A coordination entity composes of a central metal atom or ion bonded to a fixed number of ions or molecules.

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.

93. Answer: c

Explanation:



$$K_{SP} = [Ag^+]^2 [C_2O_4^{2-}]$$

$$[Ag^+] = 2.2 \times 10^{-4} M$$

$$\therefore [C_2O_4^{2-}] = \frac{2.2 \times 10^{-4}}{2} M = 1.1 \times 10^{-4} M$$

$$\therefore K_{SP} = (2.2 \times 10^{-4})^2 (1.1 \times 10^{-4})$$

$$= 5.324 \times 10^{-12}$$

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](#)

94. Answer: c

Explanation:

If temperature, volume and pressure of fixed amount (say n mole) of a gas vary from T_1, V_1 and p_1 to T_2, V_2 and p_2 respectively. Then, ideal gas equation for two states can be written as

$$p_1 V_1 = nRT_1 \quad \text{or} \quad \frac{p_1 V_1}{T_1} = nR \quad \dots(i)$$

$$p_2 V_2 = nRT_2 \quad \text{or} \quad \frac{p_2 V_2}{T_2} = nR \quad \dots(ii)$$

On combining Eqs. (i) and (ii), we get

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$\text{or} \quad \frac{p_1 V_1}{p_2 V_2} = \frac{T_1}{T_2}$$

So, it called combined gas equation.

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.

95. Answer: a**Explanation:**

Answer (a) By lowering activation energy

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.

96. Answer: a

Explanation:

In closed insulated container a liquid is stirred with a paddle to increase the temperature, therefore it behaves as adiabatic process, so, for it $q = 0$. Hence, from first law of thermodynamics

$$\Delta E = q + W \text{ i f } q = 0$$

$\therefore \Delta E = W$ but not equal to zero.

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.

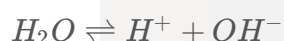
Third Law of Thermodynamics

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.

97. Answer: b

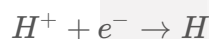
Explanation:

Sodium chloride in water dissociates as



When electric current is passed through this solution using platinum electrodes, Na^+ and H^+ move towards cathode whereas Cl^- and OH^- ions move towards anode.

At cathode



At anode



If mercury is used as cathode, H^+ ions are not discharged at mercury cathode because mercury has a high hydrogen over voltage. Na^+ ions are discharged at cathode in preference of H^+ ions yielding sodium, which dissolves in mercury to form sodium amalgam.

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.

98. Answer: c

Explanation:

The correct answer is– all the oxygen will be consumed

The chemical reactions would be –



Here, 5 mole of Oxygen = 4 mole of Ammonia

So, 1 mole of $O_2 = 4/5 = 0.8$ mole of NH_3

By reversing it one can say, 1 mole of NH_3 requires $5/4 = 1.25$ mole of O_2

So, when a reaction between one mole of ammonia and one mole of oxygen is brought to a successful conclusion, all of the oxygen is then consumed.

The charge of nitrogen in ammonia increases from -3 to +2, and the charge of oxygen falls from 0 to -2, making the equation a form of redox reaction. Any elemental compound or atom has an oxidation state of zero. Redox reactions are those in which oxidation and reduction both take place concurrently. Ammonia is undergoing oxidation in this instance, whereas oxygen is undergoing reduction.

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.

99. Answer: d

Explanation:

Number of moles of $CHCl_3$,

$$\begin{aligned} n_A &= \frac{w}{M} \\ &= \frac{25.5}{119.5} \\ &= 0.213 \end{aligned}$$

Number of moles of CH_2Cl_2 ,

$$n_B = \frac{40}{85} = 0.47$$

Mole fraction of $CHCl_3$

$$\begin{aligned} \chi_A &= \frac{n_A}{n_A + n_B} \\ &= \frac{0.213}{0.683} = 0.31 \end{aligned}$$

Mole fraction of CH_2Cl_2 ,

$$\begin{aligned} \chi_B &= 1 - \chi_A \\ &= 1 - 0.31 = 0.69 \end{aligned}$$

$$\therefore p_{total} = p_A \chi_A + p_B \chi_B$$

$$= 200 \times 0.31 + 41.5 \times 0.69$$

$$= 62 + 28.63$$

$$= 90.63 \text{ mm Hg}$$

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.

100. **Answer: a**

Explanation:

Hyperconjugation is possible if α – hydrogens is present

101. **Answer: c**

Explanation:

The first geological time scale was developed by Giovanni Avduina, Italian scientist in 1760. The history of the earth has been divided into a number of major divisions called eras. The eras are sub-divided into periods. The modern periods are further divided into epochs. There are four eras. The correct sequence is Precambrian Palaeozoic (era of ancient life) ' > Mesozoic (era of medieval life) >> Coenozoic (era of modern life).

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.

102. Answer: a

Explanation:

Sperm and egg can lead to formation of zygote only when both of them are viable.
Life of sperm after insemination – 4 to 5 days
Life of egg after ovulation – 2 days

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.

103. Answer: c

Explanation:

Bacteria has no nuclear membrane hence it is called as nucleoid. The genetic material is referred to as genophore. Genophore is the bacterial chromosome. It

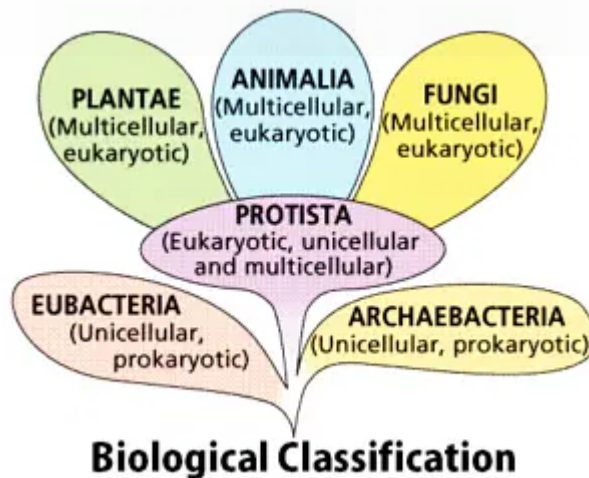
has a double stranded circular supercoiled DNA. DNA has about 10,000 genes in *E.coli*. Double stranded DNA in bacteria is without histones.

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](#)



104. Answer: a

Explanation:

The AIDS retrovirus, called human immunodeficiency virus (HIV), mounts a direct attack on CD4+ cells because it recognizes the CD4+ coreceptors associated with these cells. HIV's attack on CD4+ cells cripples the immune system in at least three ways. First, HIV-infected cells die only after releasing replicated viruses that infect other CD4+T cells, until the entire population of CD4+ T cell is destroyed. Second, HIV causes infected CD4+T cells, to secrete a soluble suppressing factor that blocks other T cells from responding to the HIV antigen. Finally, HIV may block transcription of MHC genes, hindering the recognition and destruction of infected CD+T cells, and thus protecting those cells from any remaining vestiges of the immune system. The combined effect of these responses to HIV infection is to wipe out the human immune defense.

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	Viruses like <i>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](#)

105. Answer: d

Explanation:

Parasitism $\Rightarrow$ Parasite is benefitted (+) but host is harmed (-) so it is a (+, -) type of population interaction.

106. Answer: b

Explanation:

Hepatic vein carries largest amount of urea. Urea is produced in liver. Hepatic vein transports liver?? deoxygenated blood to heart for oxygenation.

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
-

107. Answer: d

Explanation:

Kupffer cells are specialized macrophages that dispose of old blood cells and particulate matter. Kupffer cells, named after Karl Wilhelm von Kupffer (1829–1902), are found in the liver, attached to the walls of the sinusoids.

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.

108. 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 cuddling 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.

109. Answer: c

Explanation:

Morphallaxis is a type of regeneration where existing tissues are reorganized and modified to produce different organ structures. This process involves the remodeling of existing cells and tissues rather than the complete rebuilding of the organ from scratch. So, the correct option is (C): Morphallaxis

Concepts:

1. Menstrual cycle:

Menstrual cycle is the monthly series of changes a woman's body goes through while having a possibility of pregnancy. Each month one egg is released by the and this process is called ovulation. If ovulation takes place and the egg isn't fertilized, the lining of the uterus sheds through the vagina. This is a menstrual period.

Menstrual cycle irregularities can have many different causes, including:

- Pregnancy or breast-feeding.
- Eating disorders, extreme weight loss or excessive exercising.
- Polycystic ovary syndrome (PCOS)
- Premature ovarian failure
- Pelvic inflammatory disease (PID)
- Uterine fibroids

110. Answer: b

Explanation:

The correct answer is B: Controls multiple traits in an individual

It is a gene that can control multiple traits in an individual. A single gene can influence some unrelated traits and characteristics. This is because of the involvement of the biochemical pathways and has the cascade effect on the individual. One of the common examples of pleiotropy is phenylketonuria

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.

111. Answer: b

Explanation:

Gliding joint permits sliding movements of two bones over each other. Hinge joint allows movements in one plane only. Knee joint, elbow joint, ankle joint are of this type. Cartilaginous joint is a slightly movable joint and is found between the centre of vertebrae, at the pubic symphysis and between ribs and sternum. Fibrous joint is an immovable joint which occur between the bones of cranium.

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](#)

112. Answer: a**Explanation:**

The correct sequence of events during mitosis would be as follows

- (i) Condensation of DNA so that chromosomes become visible occurs during early to mid-prophase.
- (ii) Nuclear membrane disassembly begins at late prophase or transition to metaphase.
- (iii) Arrangement of chromosomes at equator occurs during metaphase, called congression.
- (iv) Centromere division or splitting occurs during anaphase forming daughter chromosomes.
- (v) Segregation also occurs during anaphase as daughter chromosomes separate and move to opposite poles.
- (vi) Telophase leads to formation of two daughter nuclei.

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

113. Answer: b

Explanation:

The posterior Pituitary or neurohypophysis is a structure under direct regulation of hypothalamus. The nuclei of hypothalamus accumulate Vasopressin and Oxytocin in this neurohypophysis which serves as release centre of these neurohormones. So, the correct answer is 'Posterior Pituitary lobe'.

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

114. Answer: b

Explanation:

Totipotency is the ability of a living somatic plant cell to develop into a complete plant. It was first demonstrated by Steward et. al (1964) using phloem cells of carrot. This technique is now used for multiplying rare and endangered plants through micro-propagations. This technique is widely used for multiplying plants e.g. – Chrysanthemum, Dioscorea floribunda, Coleus, Crotons, carnation plants etc.

Concepts:

1. Cell: The Unit of Life:

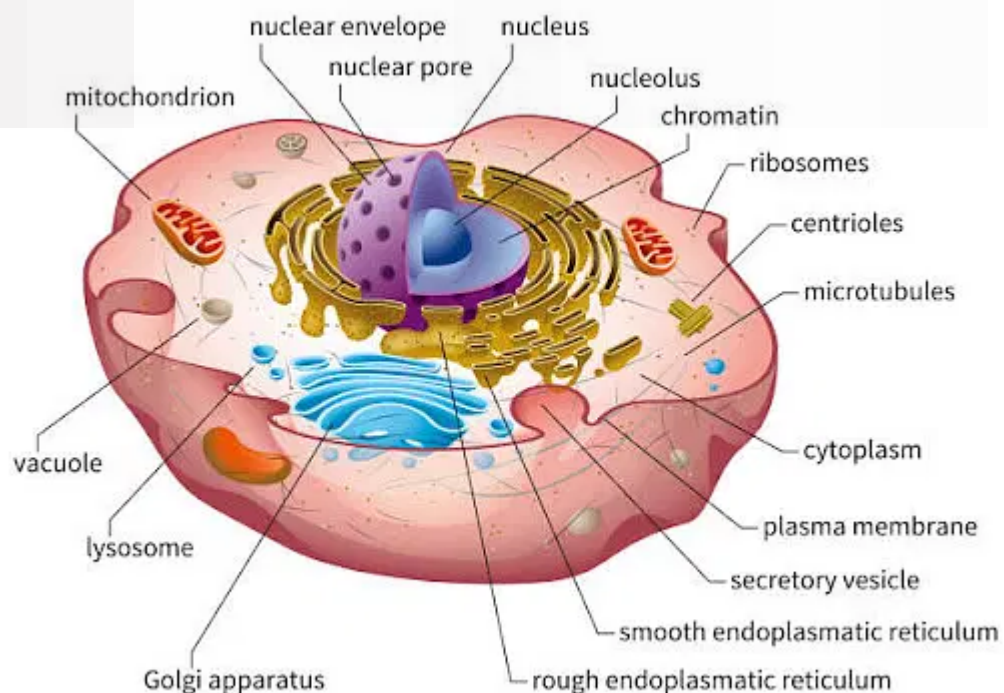
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus 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:

Diploid chromosome number in human is 46. All animals including man have a characteristic number of chromosomes in their body cells called diploid (or $2n$) number. These occur as homologous pairs, one member of each pair has been acquired from the gamete of one of the two parents of the individual whose cells are being examined. It is actually $44 + XX$ or $44 + XY$.

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](#)

116. Answer: d

Explanation:

Answer (d) d

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.

117. Answer: a

Explanation:

The respiratory system is well developed in a cockroach in order to compensate the poorly developed circulatory system. It consists of tracheae, tracheoles and spiracles. The main tracheal trunks open to the exterior on body surface through 10 pairs of segmentally arranged apertures termed spiracles or stigmata. Two pairs of spiracles are thoracic, one between pro and mesothorax and the other between meso and metathorax. Haemocoel contains a network of elastic, closed and

branching air tubes or tracheae. The ultimate finer branches of tracheae are called tracheoles which come in contact with the individual body cells. The elaborate tracheal system carries oxygen directly to all the body cells.

118. Answer: b

Explanation:

The sequence 5' GAATTC 3' ; 3' CTTAAG 5' exhibits palindromic properties, making it easily cleavable by a restriction endonuclease. Conversely, the other sequences are not palindromic. Notably, the sequence 5' GAATTC 3' ; 3' CTTAAG 5' is recognized by the restriction enzyme EcoRI.

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.
-

119. Answer: b

Explanation:

The correct answer is option (B): $pO_2=104$ and $pCO_2=40$

Concepts:

1. Breathing and Exchange of Gases:

A metabolic process, which is carried out by all living organisms including plants, animals, and humans for the production of energy and to stay alive is Respiration. Except for required anaerobes, every other organism from amoeba to humans needs oxygen for survival. And evolution has reported a number of systems that allows the exchange of gases in organisms.

There are two types of respiration such as;

1. **Aerobic respiration** — to produce energy, it occurs in the presence of oxygen
2. **Anaerobic respiration** — to produce energy, occurs in the absence of oxygen

Breathing can be simply derived as the process of inhaling oxygen gas from the atmosphere and exhaling the carbon dioxide gas back into the atmosphere is termed breathing and the process is commonly known as respiration.

Read More: [Breathing and Exchange of Gases](#)

120. Answer: c

Explanation:

Bt strains are well-known for their ability to produce proteins that are toxic to certain insect pests. These Bt proteins have been incorporated into genetically modified (GM) plants to create bio-insecticidal crops, often referred to as Bt crops. These plants produce their own insecticidal proteins, providing built-in protection against specific insect pests, reducing the need for chemical pesticides.

So, the correct option is (C): bio-insecticidal plants

Concepts:

1. Biotechnology:

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Principles of Biotechnology:

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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.

121. Answer: c

Explanation:

Carbohydrates, including cellulose, starch, glycogen, glucose, fructose, and others, constitute the most prevalent biomolecules on Earth. These carbohydrates are generated through photosynthesis, a process that involves the reduction of atmospheric carbon dioxide using light energy. Photosynthesis is primarily carried out by green plants, including aquatic algae, which convert carbon dioxide into carbohydrates. While some bacteria can also perform photosynthesis, their process differs in that they rely on chemical energy instead of light energy and do not

produce oxygen as a byproduct, in contrast to the photosynthesis occurring in green plants.

So, the correct option is (C): Some bacteria, algae and green plant cells

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.

122. Answer: c

Explanation:

RNA polymerase III is responsible for transcribing a variety of small RNA molecules, including transfer RNA (tRNA), 5S ribosomal RNA (5S rRNA), and small nuclear RNAs (snRNA), among others. It is not responsible for transcribing the precursor of mRNA, which is primarily the role of RNA polymerase II.

So, the correct option is (C): Transcribes tRNA, 5s rRNA and snRNA

Concepts:

1. DNA Replication:

The process by which the genome's DNA is copied in cells is called **DNA Replication**. It must first copy (or replicate) its entire genome before cell division so that each resulting daughter cell ends up with its own complete genome.

It is the natural cycle of creating two indistinguishable imitations of DNA from one unique DNA molecule. DNA replication happens to take all things together living creatures going about as the most core part for organic legacy. This is important for cell division during the development and fixation of harmed tissues, while it likewise guarantees that every one of the new cells gets its duplicate of the DNA. The phone has the unmistakable property of division, which makes replication of DNA fundamental.

The parental DNA stays together, and the recently shaped daughter strands are together in conservative replication. The semi-conservative strategy recommends that every one of the two parental DNA strands goes about as a format for new DNA to be integrated; after that each two-fold abandoned DNA incorporates one "old" strand (parental) and one "new" strand.

123. Answer: d

Explanation:

The term metamerism refers to a linear repetition of parts in an animal body. It occurs in three highly organized phyla : Annelida, Arthropoda and Chordata. Each segment is called a metamere, or somite. Segmentation often affects both external and internal structures. Such a condition is called metameric segmentation. In

chordates, the segmentation is apparent only in the embryonic stage. In the adult chordates, segmentation is visible in the internal structures, such as vertebrae, ribs, nerves and blood vessels. Other animals have unsegmented bodies.

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 share 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](#)

124. Answer: c

Explanation:

Darwin's finches show adaptive radiation. This radiation occurred in response to various food resources available. These finches feed on insects, tree buds, seeds, l cactus etc. Carrion are dead bodies and no finches feed on them.

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.

125. Answer: c

Explanation:

Egg (ovum) secretes a chemical named fertilizin (composed of glycoprotein = monosaccharides + amino acids). Sperm has on its surface a protein substance called antifertilizin (composed of acidic amino acids). The fertilizin of an egg interacts with the antifertilizin of a sperm of the same species. This interaction makes the sperms stick to the egg surface. The adhesion of sperm to the egg of the same species through chemical recognition is known as agglutination.

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.

126. **Answer: c**

Explanation:

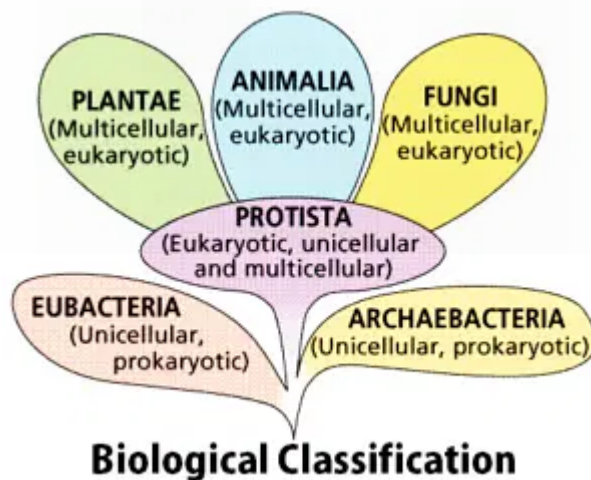
A – Head B – Sheath C – Collar D – Tail fibre

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](#)



127. Answer: d

Explanation:

HIV is a [retrovirus](#), which contains single-stranded RNA, surrounded by a protein coat (core-shell) as genetic material. It causes [AIDS](#). The structure of HIV varies from other retroviruses. It is around 120 nm in diameter (120 billionths of a meter; around 60 times smaller than a red [blood](#) cell) and roughly spherical.

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](#)

128. Answer: b

Explanation:

In a growing population of a country, **pre-reproductive individuals are more than reproductive individuals**.

Whenever the **population** is of a growing or expanding type, the population of pre-reproductive individuals or the younger population is very large. The reproductive population will be moderate whereas the post-reproductive individuals are very few. Thus, the **rate of growth** will depend on the size of the pre-reproductive population.

Also Read: [Human Population](#)

129. Answer: c

Explanation:

Veins carry blood at low pressure as compared to blood carried by arteries. Arteries carry blood from the heart whose function is to pump blood at high pressure so that blood can reach each and every part of the body. Veins carry blood from tissues to the heart, so they carry blood at low pressure. Valves are present in the veins to prevent backflow of blood due to force of gravity.

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
-

130. **Answer: c**

Explanation:

Answer (c) Gastric juice

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.

131. Answer: a**Explanation:**

Methanogens are a type of archaeobacteria that occurs in marshes, swamps and rumen of cattles. They are obligate anaerobes that can catabolize acetate and H_2 to gaseous products and are used in the final stage called methanogenesis of biogas production in gobar gas plant. Nitrifying bacteria oxidise NH_3 , into NO_2 and later to NO_3 . Ammonifying bacteria convert proteins into NH_3 . Denitrifying bacteria reduce NO_3 , into NH_3 .

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.
-

132. Answer: a

Explanation:

Progesterone in oral contraceptive pills primarily works to inhibit ovulation, preventing the release of eggs from the ovaries. It does this by suppressing the release of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) from the pituitary gland, which are essential for the ovulation process. Additionally, progesterone thickens cervical mucus, making it more difficult for sperm to reach and fertilize an egg. It also alters the uterine lining, making it less receptive to implantation, further preventing pregnancy.

So, the correct option is (A): To inhibit ovulation

Concepts:

1. Reproductive Health:

- The biological process by which a new individual or an offspring is produced from a parent or parents that are biologically similar or identical is known as [reproduction](#). It is the elemental trait of all known forms of life. In fact, each and every individual have life because of reproduction.
- The state or position of male and female reproductive systems during their lifetime refers to their reproductive health. The system comprises organs and glands, including the pituitary gland in our brain, which are responsible for the production and release of hormones.
- In other words, reproductive health can be described as a state of physical, mental, and social well-being in all aspects relating to the reproductive system. It includes the liberation and appropriate capacity to reproduce as and when one decides to do so, apart from having a safe and satisfying sex life.

Read More: [Reproductive Health](#)

133. Answer: d

Explanation:

The genotype of trihybrid would be AaBbCc. Eight different types of gametes ABC, ABc, AbC, Abe, aBC, aBe, abC, abc would be formed. The number of zygotes would be $8^2=64$

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.

134. Answer: d

Explanation:

Progressive degeneration of skeletal muscle mostly due to genetic disorder is muscular dystrophy where as tetany is muscular spasm due to low calcium in body fluid. Myasthenia gravis is an auto immune disorder leading to paralysis of skeletal muscles. Botulism is rare and dangerous type of food poisoning caused by bacterium *Clostridium Botulinum*.

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](#)

135. Answer: c

Explanation:

The Ornithine cycle, primarily taking place in the liver, is responsible for eliminating two waste products, namely Ammonia (NH_3) and Carbon dioxide (CO_2), from the bloodstream. Within the liver, specific molecules and enzymes interact with carbon dioxide and ammonia, converting them into urea. This process is commonly referred to as the urea cycle. In each cycle of this process, two ammonia molecules and one carbon dioxide molecule are converted into urea.

So, the correct option is (C): CO_2 and ammonia

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.

136. Answer: a**Explanation:**

A chloroplast is a vesicle bounded by an envelope of two unit membranes and filled with a fluid ; matrix called stroma. The lamellae, after separation from the inner membrane, usually take the form of closed, flattened, ovoid sacs, the thylakoids, which lie closely packed in piles, the grana. The thylakoid membrane contains photosynthetic pigments namely, chlorophyll a, chlorophyll b, carotenoids (carotene, xanthophylls) and plastoquinone. The thylakoid membranes also contain : coupling factors that bring about ATP synthesis.

Concepts:**1. Cell: The Unit of Life:**

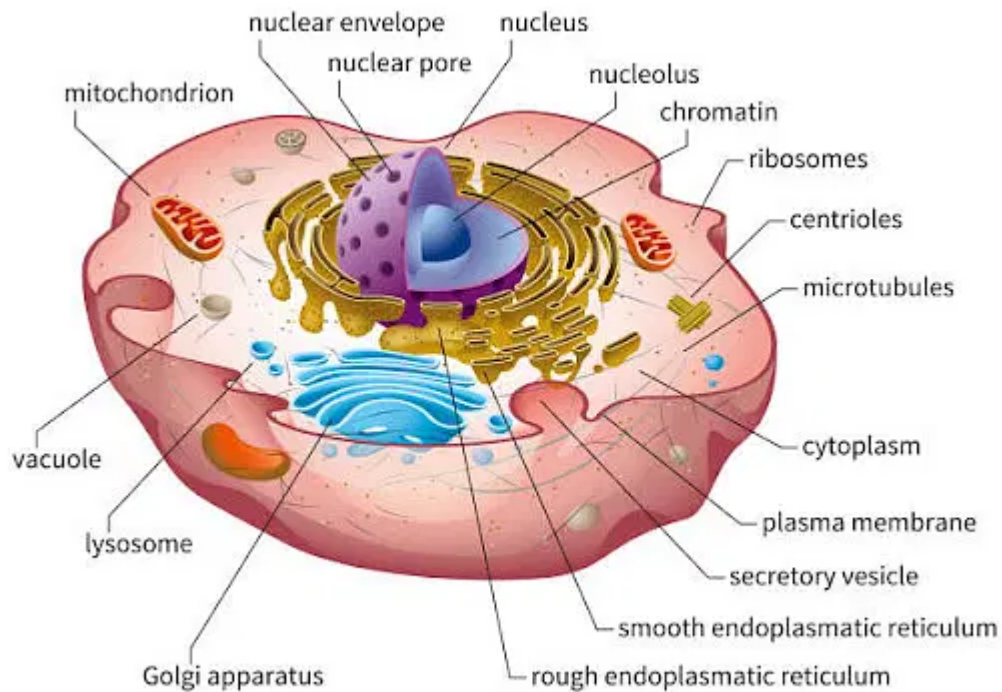
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus 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



137. Answer: a

Explanation:

The DNA-dependent RNA polymerase catalyze the polymerisation in only one direction that is 5' → 3', the strand with polarity 5' → 3' act as template and is called as template strand.

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.

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Genetic Code:

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Read More: [Molecular Basis of Inheritance](#)

138. Answer: b

Explanation:

◆ Zygotene ◆ ynapsis ◆ Pachytene ◆ Crossing over ◆ Diplotene ◆ Chiasmata
◆ Diakinesis ◆ Terminalization

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

139. Answer: d

Explanation:

A small area of the optical part of the retina lying exactly opposite to the centre of the cornea is called the macula lutea, or yellow spot which has a yellow pigment (xanthophyll). The macula lutea has at its middle a shallow depression, the fovea centralis. The fovea has cone cells only, and is the place of most distinct vision. Away from the fovea, the rod and cone cells occur in equal numbers, and at the periphery of the retina, the rods are more numerous than the cones. This is why we see better in dimlight by looking out of the corner of the eye. The point on the retina from where the optic nerve starts is called the blind spot, or optic disc, as it lacks the receptor cells and is insensitive to light.

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.

140. Answer: c

Explanation:

Gastrin hormone is secreted by mucosa of stomach and it stimulates secretion of gastric juice. Enterogastrone is secreted by duodenal epithelium. Enterokinase is an enzyme that converts trypsinogen into trypsin. Renin converts caesin of milk into paracaesin and whey protein.

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

141. Answer: d

Explanation:

Cartilage is a semi-rigid supportive or skeletal connective tissue in which matrix is solid and made of mucoprotein or proteoglycan called chondrin. It is of four types – hyaline, fibrous, calcified and elastic. Yellow elastic fibrocartilage is found in pinna and external auditory canal of the ear, Eustachian tubes, epiglottis and tip of the nose. Its matrix contains numerous yellow fibres which form a network by uniting with one

another. Due to the presence of yellow fibres, the cartilage becomes more flexible. Hence, it provides flexibility to these organs. SImg

142. Answer: d

Explanation:

In some children ADA deficiency can be cured by bone marrow transplantation; in others it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection. But the problem with both of these approaches is that they are not completely curative. As a first step towards gene therapy, lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.

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.

143. Answer: a

Explanation:

The net pressure gradient that causes fluid to filter out of the glomeruli into the capsule in the renal corpuscle (part of the kidney) is typically around 20 mm Hg. This pressure gradient is a result of the difference between the blood pressure in the glomerular capillaries (higher pressure) and the opposing pressures created by the capsular hydrostatic pressure and the colloid osmotic pressure of plasma proteins.

So, the correct answer is (A): 20 mm Hg

Concepts:

1. Excretory System:

Excretory System Organs:

The [human excretory system organs](#) include:

- A pair of kidneys
- A pair of ureters
- A urinary bladder
- A urethra

Read More: [Excretion in Human Beings](#)

Kidneys:

The organ that has an inner concave structure is the kidney. The blood vessels, nerves, and ureters enter the kidneys through the hilum, which is a notch in the inner concave surface of the kidney. The renal pelvis, a large funnel-shaped space, present inside the hilum, has many projections, called calyces.

Ureter:

A pair of thin muscular tubes called the ureter comes out of each kidney outstretched from the renal pelvis. It is the carrier of urine from the kidney to the urinary bladder.

Urinary Bladder:

It is a muscular sac-like structure, where urine is stored. The urinary bladder is being emptied by the process of micturition, which acts as urination.

Urethra:

This tube rises from the urinary bladder and helps to throw urine out of the body. In males, it works as the common route for sperms and urine. Sphincter muscles guard the opening of the urethra.

Read More: [Excretion](#)

144. Answer: d

Explanation:

Enzymes facilitate chemical reactions in metabolism, vitamins are essential coenzymes and cofactors that assist enzymes, and hormones are chemical messengers that regulate various metabolic processes in the body.

So, the correct option is (D): help in regulating metabolism

Concepts:

1. Enzymes - Biology:

Enzymes are proteins that help accelerate metabolism or the chemical reactions in our bodies. They build some substances and decompose others. All living creatures have enzymes.

Our bodies naturally build enzymes. But enzymes are also in mass produce products and food.

One of the most important roles of enzymes is to succor digestion. The process of turning the food that we eat into energy is called digestion. For instance, there are

enzymes in our saliva, pancreas, stomach, and intestines. They decompose fats, proteins, and carbohydrates. Enzymes make use of these nutrients for growth and cell repair.

145. Answer: b

Explanation:

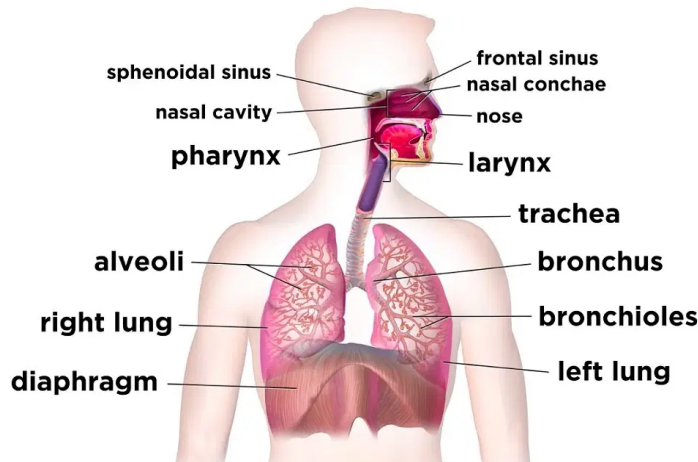
In the resting state of neurons, if ion diffusion is permitted owing to a concentration gradient, it would result in the movement of sodium ions (Na^+) into the cell. This occurs because, during the resting state, the concentration of sodium ions inside the nerve cell is lower compared to the external environment. Conversely, the concentration of potassium ions (K^+) is higher inside the cell than outside. Since diffusion involves ions moving from regions of higher concentration to lower concentration, sodium ions will move into the cell, while potassium ions will move out of the cell.

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 vessels](#). 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.

146. Answer: d

Explanation:

In order to obtain virus-free plants through tissue culture, the best method is meristem culture. Meristem tissue is the region of the plant where cell division occurs, and it is less likely to harbor viruses compared to other plant tissues.

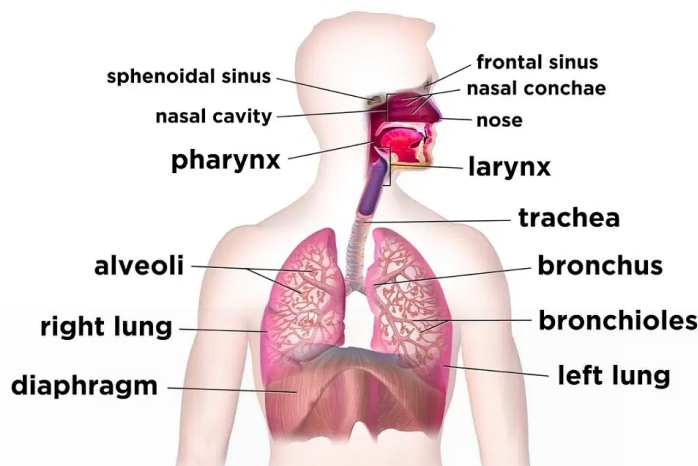
Therefore, the correct option is (D): meristem culture

Concepts:

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The Respiratory System



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- There is an arrangement of muscles such as the diaphragm and intercostal muscles that aid in the process of human respiration.

147. Answer: d

Explanation:

Beadle and Tatum conducted seminal experiments using *Neurospora crassa* to demonstrate that in a multi-step biochemical pathway, distinct enzymes control

each step, and each of these enzymes is determined by a specific gene. This concept is referred to as the "one gene, one enzyme hypothesis".

So, the correct option is (D): Beadle and Tatum

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.

148. Answer: a

Explanation:

The function of contractile vacuole is osmoregulatory. Water in freshwater protozoa enters the organism by endosmosis and during feeding. If the organism does not possess a mechanism to get rid of this excess water, it will swell to the point of rupture and dissolution. The mechanism which is assumed to effect water regulation

is the contractile vacuole. The vacuole periodically increases in volume (diastole) to get filled with water and contracts (systole) to discharge its water content to the surrounding environment.

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](#)

149. Answer: d

Explanation:

According to theory of pangenesis Darwin thought that every somatic cell of the body produces a tiny particle called gemmule or pangene which contains both the parental and acquired characters. All gemmules or pangenes of the body cells collect in the gametes and are passed on to the zygote where they guide the growth of different parts of the embryo.

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.

150. Answer: b

Explanation:

The egg released is haploid (has only one X-chromosome and 22 autosomes) as it is formed due to meiotic division of diploid primary oocyte having XX chromosome and 44 autosomes.

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.

151. Answer: c

Explanation:

- Thorns, which are woody, straight, and pointed structures, can also develop from axillary buds on stems. Many plants, including Citrus and Bougainvillea, have thorns.
- Stem tendrils, which are slender and spirally coiled, develop from axillary buds and assist plants in climbing. Examples of plants that use stem tendrils include

cucumber, pumpkins, and watermelon.

- In arid regions, some plants modify their stems into flattened structures, such as Opuntia. These structures contain chlorophyll and carry out photosynthesis.
- Rhizophora grows in swampy areas, and many of its roots emerge from the ground and grow vertically upward. These roots, known as pneumatophores, aid in respiration by obtaining oxygen.
- Grass and strawberry underground stems spread to new environments, and new plants are formed through vegetative propagation when older parts die.

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.

152. Answer: c

Explanation:

The partially decomposed Sphagnum mass accumulates to form compressed mass called peat, which after drying is used as coal. So it is also called peat moss.

Sphagnum has the capacity to retain water for long periods and thus it is used to cover plant roots during transportation.

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:

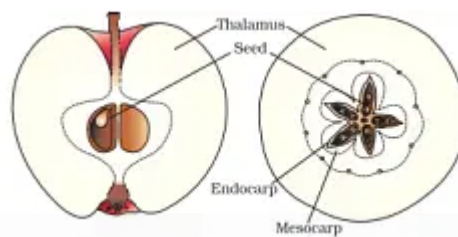
- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon 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 secure 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](#)

153. Answer: c

Explanation:

Fruits are formed from the ovary of a flower after fertilisation. Such fruits are called true fruits. However, in a few species such as apple, strawberry, cashew, etc., some other parts of the flower, such as the thalamus also contribute to fruit formation. Such fruits are called false fruits. The diagram shown here is of an apple. The parts labeled as A is mesocarp, B is endocarp, C is thalamus, and D is seed.



Concepts:

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154. Answer: d

Explanation:

Oomycetes (egg fungus) include water moulds, white rusts and downy mildews. In these, female gamete is smaller and motile, whereas male gamete is larger and non-motile. Isogametes are found in algae like Ultrix, Chlamydomonas, Spirogyra, etc., which are similar in structure, function and behavior. An isogametes are found in Chlamydomonas in which one gamete is larger and non-motile and the other one is motile and smaller. Oogamy is the fusion of non-motile egg with motile sperm. The gametes, differ both morphologically as well as physiologically. It occurs in Chlamydomonas, Fucus Chara, Volvox, etc.

Concepts:

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Several features of Kingdom Plantae are as follows:

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- 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.
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- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

155. Answer: c

Explanation:

Axile placentation refers to the arrangement of the placenta at the central axis of the ovary. This pattern can be observed in plants like China rose, Petunia, Lemon, and tomato.

Therefore, The correct option is (C): China rose, Petunia and Lemon

Concepts:

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156. Answer: c

Explanation:

Hydrocolloids used as thickening and gelling agents can be derived from brown algae and red algae. Carrageenan, a hydrocolloid, is an example of a substance produced by red algae (Rhodophyceae).

Concepts:

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Read More: [Classification of Plants](#)

157. Answer: b

Explanation:

Assertion A is true. Gymnosperms do release their pollen grains from the microsporangia, and these pollen grains are often carried by air currents for pollination.

However, Reason R is incorrect. Air currents do play a role in carrying pollen grains, but the pollen grains are not carried to the mouth of the archegonia. In gymnosperms, the male gametes are indeed discharged from the pollen tube, which grows from the pollen grain towards the archegonia. The pollen tube delivers the male gametes to the vicinity of the ovule, allowing fertilization to occur.

Therefore, The correct option is (B): A is true but R is false

Concepts:

1. Gymnosperms:

Gymnosperms are flowerless plants that produce cones and seeds. It literally means "naked seed". They sit exposed on the surface of leaf-like structures called

bracts. Gymnosperms are vascular plants of the subkingdom *Embryophyta* and include conifers, cycads, ginkgoes, and gnetophytes. They are abundant in temperate forest and boreal forest biomes with species that can tolerate moist or dry conditions.

Characteristics of Gymnosperms

1. They do not produce flowers.
2. Seeds are not formed inside a fruit.
3. They are found in colder regions where snowfall occurs.
4. They form cones with reproductive structures.
5. Xylem does not have vessels and the phloem and it has no companion cells and sieve tubes.

158. Answer: b

Explanation:

Spirogyra: Sporophytic generation is represented only by the one-celled zygote. There are no free-living sporophytes. The dominant, photosynthetic phase in such plants is the free-living gametophyte.

Fern: The diploid sporophyte is represented by a dominant, independent, photosynthetic, vascular plant body. It alternates with multicellular, saprophytic/autotrophic, independent but short-lived haploid gametophyte.

Funaria: Dominant haploid leafy gametophyte alternating with partially dependent multicellular sporophyte.

Cycas: Dominant diploid sporophyte vascular plant, with highly reduced male or female gametophyte. This is found in all gymnosperms (Cycas) and angiosperms.

Concepts:

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Read More: [Classification of Plants](#)

159. Answer: d

Explanation:

In the family Fabaceae, the stamens are typically arranged in two groups (diadelphous) and each stamen has two distinct chambers (ditheous) in the anther. This arrangement is not present in Solanaceae or Liliaceae.

To provide a bit more context:

Polyadelphous and epipetalous stamens: This characteristic refers to stamens that are fused into several groups, and they are attached to the petals. This is not a specific characteristic of Fabaceae and can be found in some other plant families.

Monadelphous and Monotheous anthers: This refers to stamens that are fused into a single group, and each stamen has a single chamber in the anther. This characteristic is not typical of Fabaceae.

Epiphyllous and Ditheous anthers: This refers to anthers that are attached to the

surface of a leaf (epiphyllous) and have two chambers (ditheous). This characteristic is not specific to Fabaceae and is not present in Solanaceae or Liliaceae.

Diadelphous and Ditheous anthers: This is the correct characteristic for Fabaceae. It refers to stamens arranged in two groups and each stamen having two chambers in the anther. This arrangement is not found in Solanaceae or Liliaceae.

So, the correct option is (D): Diadelphous and Ditheous anthers

Concepts:

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Root System

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160. Answer: a

Explanation:

Heterospory involves the creation of spores in two distinct sizes and developmental trajectories: smaller ones known as microspores with a male role, and larger ones referred to as megaspores with a female role. This phenomenon, which is pivotal in the evolution of vascular plants, has ultimately paved the way for the emergence of seeds. Examples of plants showcasing heterospory include Selaginella, Salvinia, Azolla, and others.

Therefore, The correct option is (A): Selaginella and Salvinia

Concepts:

1. Pteridophytes:

[Pteridophytes](#) are the first terrestrial vascular plants. Carolus Linnaeus classified them under the group cryptogamae. Pteridophytes occupy a transitional position between bryophytes and spermatophytes.

For Example, Silver fern, Equisetum, Selaginella

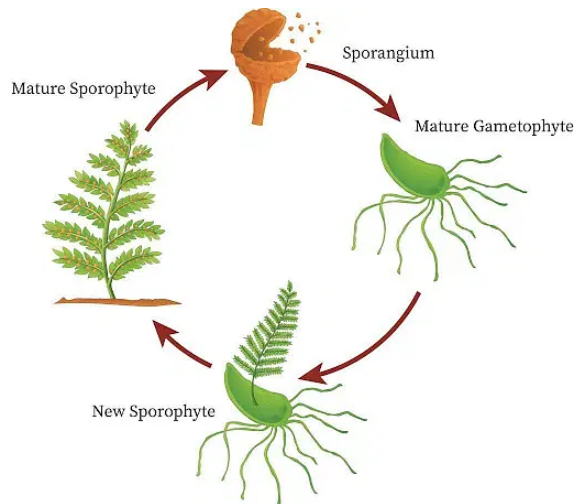
The general characteristics of Pteridophytes are:

1. They are seedless.
2. They are multicellular.
3. They reproduce through spores.
4. They are independent and free-living organisms.
5. They have a well-differentiated plant body into root, stem and leaves.

Classification of Pteridophytes:



Life Cycle of Pteridophyta:



161. Answer: a

Explanation:

The correct answer is option (A) : Leaf

Concepts:

1. Leaf:

A primary function of the [leaf](#) is to provide nourishment for a plant. Leaves get this by extracting water from the earth and carbon dioxide from the air with the help of sunshine.

Parts of a leaf

Following are the parts of a leaf:

- The top part of the leaf is the apex or tip that can be round, pointed, and smooth.
- On most leaves, the lamina, or leaf blade, is the broadest part of the leaf.
- A petiole is a leaf that links to the plant stem.
- Stipules, which are little green addendums near the base of the petiole, can also be seen on leaves.

- Most leaves have a midrib that branches out to initiate vascular [tissue](#) veins on the sides.
 - Margin refers to the leaf's outer border, which varies depending on the plant type.
 - At the bottom of the blade, the base is found; it can be flat, heart-shaped, and round.
-

162. Answer: a

Explanation:

The correct answer is option (A) : Heterosporous

Concepts:

1. Algae:

An Algae is a term mentioning a group of photosynthetic eukaryotic organisms. It has chlorophyll and nucleus but no root, stem, leaves and many features like normal land plants. Algae is both unicellular (e.g. Euglenophyta) and multicellular (e.g. seaweeds). Algae do photosynthesis and help in oxygen production

Algae can live in various habitats like moist rocks, soils, water bodies (both freshwater and marine) and in some animals (e.g. Sloth). Unicellular Algae belong to the Protista Kingdom and Multicellular algae belong to the Plantae Kingdom, but formerly all algae are categorized under kingdom Plantae for their photosynthetic nature.

Also Read: [Difference Between Algae and Fungi](#)



163. Answer: c

Explanation:

The correct option is (C) : Utricularia, Drosera, Dionea

Utricularia is the scientific name for bladderwort. Drosera is the scientific name for sundew. Dionaea is the formal name for the Venus flytrap. They are all classified as carnivorous plants.

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.

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embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

164. Answer: d

Explanation:

The correct answer is option (D) : Pea

Concepts:

1. Morphology of Flowering Plants:

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embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

165. Answer: b

Explanation:

Malvaceae constitutes a botanical family encompassing various flowering plants, with notable representatives such as okra and cotton, among others.

So, the correct option is (B): Malvaceae – Cotton.

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.

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166. Answer: c

Explanation:

The correct answer is option (C) : Chara

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 secure 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](#)

167. Answer: a

Explanation:

Hair found in the inflorescences of Zea mays, commonly known as maize or corn, are a modification of filaments. These hair-like structures, often referred to as silk, emerge from the female flowers' ovules or kernels. They play a crucial role in the pollination process. Each filament is essentially a style that captures and guides pollen to the stigma, allowing fertilization to occur. This adaptation ensures the successful reproduction of the plant.

So, the correct option is (A): Style

Concepts:

1. Morphology of Flowering Plants:

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168. **Answer: d**

Explanation:

The correct answer is option (D) : Red algae

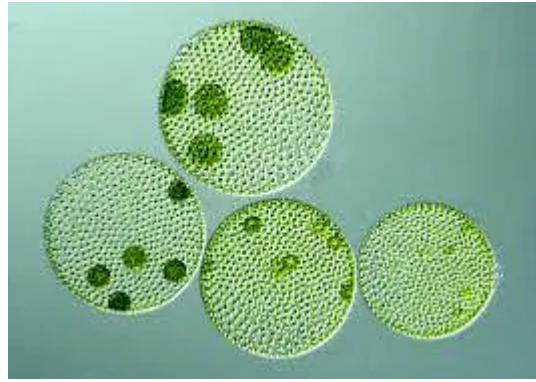
Concepts:

1. Algae:

An Algae is a term mentioning a group of photosynthetic eukaryotic organisms. It has chlorophyll and nucleus but no root, stem, leaves and many features like normal land plants. Algae is both unicellular (e.g. Euglenophyta) and multicellular (e.g. seaweeds). Algae do photosynthesis and help in oxygen production

Algae can live in various habitats like moist rocks, soils, water bodies (both freshwater and marine) and in some animals (e.g. Sloth). Unicellular Algae belong to the Protista Kingdom and Multicellular algae belong to the Plantae Kingdom, but formerly all algae are categorized under kingdom Plantae for their photosynthetic nature.

Also Read: [Difference Between Algae and Fungi](#)



169. Answer: c

Explanation:

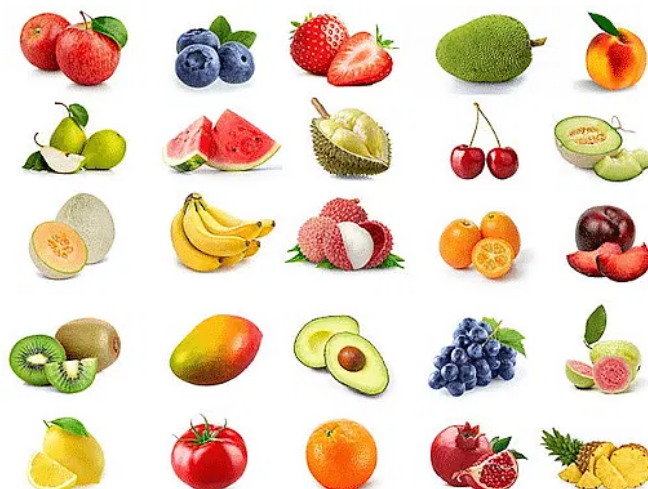
The juicy hair-like structures in citrus fruits like lemon, commonly known as "pulp hairs," develop from the endocarp, which is the innermost layer of the pericarp and surrounds the seeds.

So, the correct option is (C): Endocarp

Concepts:

1. Fruit:

The word '[fruit](#)' entirely refers to a seed-bearing structure that is found in flower-bearing plants. Meaning, that it is created from the ovary present in the seed after flowering in a plant occurs. These plants are commonly called [angiosperms](#), which disperse seeds with the help of fruits. This mechanism of generating fruits helps them to reproduce as they disperse seeds through them.



Types of Fruits:

Based on the number of ovaries and the number of flowers included in the fruit formation, fruits are classified into three major classes namely:

Simple Fruits –

A fruit developed from a single matured ovary in a single flower such as an apple, banana, cherry pear, plum, and tomato is called simple fruit. The simple fruits are further classified into the following categories:

- Drupes
- Berries
- Pomes
- Hesperidium and Pepos

Aggregate Fruits –

A fruit developed from a number of matured ovaries formed in a single flower is called aggregated fruit. Individual ovaries are known as “fruitlets.” Some of the examples are Blackberry, raspberry, and strawberry.

Composite Fruits –

A fruit developed from a complete inflorescence is multiple fruit. These are of two types:

- Sorosis
- Syconus

170. Answer: b

Explanation:

Glycolate is involved in the process of photorespiration, which occurs when there is a low concentration of CO₂ inside the leaf. In such conditions, glycolate accumulates, which can lead to stomatal opening as part of a mechanism to improve CO₂ uptake and minimize the effects of photorespiration. So, the correct option is (B): Low CO₂ conc.

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

171. Answer: a

Explanation:

Pollen grains, the male reproductive cells of plants responsible for fertilization, exhibit varying degrees of viability and longevity. Following their release from the anthers, they undergo dispersal, carried by the wind or other agents to reach the female reproductive structures of flowers. Notably, not all pollen grains share the same persistence. Some have a short lifespan, while others can endure for months, or even years. Among the given family pairs, Rosaceae and Leguminosae stand out for their pollen grains' exceptional durability.

Rosaceae: This family encompasses numerous economically significant plants, including apples, pears, cherries, strawberries, raspberries, and roses. Many Rosaceae species produce pollen grains with a robust exine layer, providing protection against environmental stresses and ensuring prolonged viability. For instance, the pollen grains of apple and pear can remain viable for up to six months.

Leguminosae: This family features many essential food crops like beans, peas, lentils, soybeans, and peanuts. The pollen grains of various Leguminosae species also possess a resilient exine layer, allowing them to maintain viability for extended periods. For example, soybean pollen grains can remain viable for up to ten months.

So, the correct option is (A): Rosaceae ; Leguminosae

Concepts:

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172. Answer: a

Explanation:

Cycas is a gymnosperm and not an angiosperm, primarily due to the presence of naked ovules. Therefore, the correct option is (A): Naked ovules In angiosperms (flowering plants), the ovules are enclosed within an ovary, which is a characteristic feature. Gymnosperms, including Cycas, have ovules that are not enclosed by an ovary, and this is one of the key distinctions between the two groups. The presence of two cotyledons in Cycas is a common feature of many gymnosperms, and it is not a distinguishing factor that separates them from angiosperms.

Concepts:

1. Gymnosperms:

Gymnosperms are flowerless plants that produce cones and seeds. It literally means "naked seed". They sit exposed on the surface of leaf-like structures called bracts. Gymnosperms are vascular plants of the subkingdom *Embryophyta* and include conifers, cycads, ginkgoes, and gnetophytes. They are abundant in temperate forest and boreal forest biomes with species that can tolerate moist or dry conditions.

Characteristics of Gymnosperms

1. They do not produce flowers.

2. Seeds are not formed inside a fruit.
 3. They are found in colder regions where snowfall occurs.
 4. They form cones with reproductive structures.
 5. Xylem does not have vessels and the phloem and it has no companion cells and sieve tubes.
-

173. Answer: d

Explanation:

In sweet pea, the ovules are attached along the margin or edge of the ovary, which is characteristic of marginal placentation.

So, the correct option is (D): Marginal.

Concepts:

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174. Answer: a

Explanation:

Azolla is known for its symbiotic relationship with the nitrogen-fixing cyanobacterium *Anabaena azollae*, which allows it to fix atmospheric nitrogen into ammonia, providing a source of nitrogen for its growth and surrounding aquatic ecosystems. So, the correct option is (A): Azoll

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.

175. Answer: b

Explanation:

In maize, the styles are the long, thread-like structures that extend from the top of each kernel or ovule. They are part of the female reproductive structure and play a role in pollen capture and fertilization.

So, the correct option is (B): styles

Concepts:

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embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

176. Answer: d

Explanation:

Here's the correct matching of items in column-I with those in column-II:

	Column-I		Column-II
A	Peritrichous flagellation	3	Escherichia coli
B	Living fossil	1	Ginkgo
C	Rhizophore	4	Selaginella
D	Smallest flowering plant	5	Wolffia
E	Largest perennial alga	2	Macrocystes

So, the correct answer is (D): A-3, B-1, C-4, D-5, E-2

Concepts:

1. Plant Kingdom:

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- 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 secure their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **c ellulose**.
- 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](#)

177. Answer: c

Explanation:

Pentamerous Flowers: Solanaceae flowers typically have five petals, five sepals, and five stamens. This pentamerous arrangement is a common feature within the Solanaceae family.

Actinomorphic Flowers: Flowers in Solanaceae exhibit radial symmetry, which means you can divide the flower into equal halves in multiple ways, such as a wheel.

Bicarpellary Ovary with Oblique Septa: In the Solanaceae family, the ovary typically has two carpels, and these carpels have oblique septa, which are partitions or divisions within the ovary that are not parallel to its axis.

Fruit as a Capsule or Berry: The fruits produced by members of the Solanaceae family are often in the form of capsules or berries. For example, tomatoes and eggplants are both part of the Solanaceae family and produce berry-type fruits.

The other options:

Asteraceae: This family typically has composite flowers (multiple small flowers in a head), not pentamerous flowers.

Brassicaceae: Brassicaceae family members, such as mustard and cabbage, usually have four-petaled flowers, not pentamerous.

Liliaceae: Liliaceae family members often have trimerous (parts in threes) flowers and various fruit types (e.g., capsules or bulbs), which do not align with the description provided in the question.

Therefore, the combination of pentamerous, actinomorphic flowers, bicarpellary ovary with oblique septa, and fruit in the form of a capsule or berry is a characteristic feature of the Solanaceae family, making option (C) the correct answer.

Concepts:

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Explanation:

Auxospores are formed by several diatoms, and hormocysts are formed by several cyanobacteria.

So, the correct option is (C): several diatoms and a few cyanobacteria

Concepts:**1. Algae:**

An Algae is a term mentioning a group of photosynthetic eukaryotic organisms. It has chlorophyll and nucleus but no root, stem, leaves and many features like normal land plants. Algae is both unicellular (e.g. Euglenophyta) and multicellular (e.g. seaweeds). Algae do photosynthesis and help in oxygen production

Algae can live in various habitats like moist rocks, soils, water bodies (both freshwater and marine) and in some animals (e.g. Sloth). Unicellular Algae belong to the Protista Kingdom and Multicellular algae belong to the Plantae Kingdom, but formerly all algae are categorized under kingdom Plantae for their photosynthetic nature.

Also Read: [Difference Between Algae and Fungi](#)



179. Answer: a

Explanation:

An enzyme that can stimulate the germination of barley seeds is α -amylase, which breaks down starch into simpler sugars to provide energy for germination.

So, the correct option is (A): α -amylase

Concepts:

1. Circulatory Pathways:

Virtually every cell, tissue, organ, and system in the body is impacted by the circulatory system.

1. **Digestive** – Absorbs nutrients and water; delivers nutrients (except most lipids) to liver for processing by hepatic portal vein; provides nutrients essential for hematopoiesis and building hemoglobin.
2. **Endocrine** – Delivers hormones: atrial natriuretic hormone (peptide) secreted by the heart atrial cells to help regulate blood volumes and pressures; epinephrine, ANH, angiotensin II, ADH, and thyroxine to help regulate blood pressure; estrogen to promote vascular health in women and men.
3. **Integumentary** – Carries clotting factors, platelets, and white blood cells for homeostasis, fighting infection, and repairing damage; regulates temperature by controlling blood flow to the surface, where heat can be dissipated; provides some coloration of integument; acts as a blood reservoir.
4. **Muscular** – Provides nutrients and oxygen for contraction; removes lactic acid and distributes heat generated by contraction; muscular pumps aid in venous return; exercise contributes to cardiovascular health and helps to prevent atherosclerosis.

180. Answer: d

Explanation:

Cycads are a group of seed plants known for these characteristics, which distinguish them from other plant groups like angiosperms (both polypetalous and gamopetalous) and conifers.

So, the correct option is (D): cycads

Concepts:

1. Gymnosperms:

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Characteristics of Gymnosperms

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2. Seeds are not formed inside a fruit.
3. They are found in colder regions where snowfall occurs.
4. They form cones with reproductive structures.
5. Xylem does not have vessels and the phloem and it has no companion cells and sieve tubes.

181. Answer: b

Explanation:

Floral formulas serve as symbolic and numeric representations of a flower's various components, conveying essential information about the flower's structural characteristics. This includes details about the types and quantities of floral parts, the symmetry of the flower, the positioning of the ovary relative to other floral whorls, and relationships between different parts of the flower.

The following letters and symbols are commonly employed in floral formulas:

- Br (bracteate)
- K (calyx)
- C (corolla)
- P (perianth)
- A (androecium)

- G (gynoecium)
- G (superior ovary)
- G (inferior ovary)
- ♂ (male)
- ♀ (female)
- ♂ (bisexual plants)
- ⊕ (actinomorphic flower)
- Z (zygomorphic flower)
- Fusion is denoted by enclosing the figure within brackets.
- Adhesion is indicated by a line drawn above the symbols of the floral parts.

Now, let's provide the floral formulas for three distinct plant families:

Fabaceae: The flowers in Fabaceae exhibit zygomorphic symmetry and are bisexual. The calyx is composed of five fused sepals, while the corolla is papilionaceous, consisting of one standard petal, two wing petals, and two fused keel petals. The stamens are diadelphous, and the gynoecium is monocarpellary with a superior ovary.

Solanaceae: Solanaceae flowers are actinomorphic and bisexual. The calyx features five fused sepals, and the corolla consists of five fused petals. There are five epipetalous stamens, and the gynoecium is bicarpellary and apocarpous with a superior ovary.

Liliaceae: Liliaceae flowers are actinomorphic and bisexual. The perianth comprises six fused tepals, arranged in two rows. There are six epipetalous stamens, and the gynoecium is tricarpeal and syncarpous with a superior ovary.

Brassicaceae: Flowers in Brassicaceae exhibit actinomorphic symmetry and are bisexual. The calyx consists of four sepals arranged in two rows (polysepalous), while the corolla comprises four petals (polypetalous). There are six stamens, arranged in two rows (tetradynamous), and the gynoecium is bicarpellary and syncarpous with a superior ovary.

So, the correct option is (B): (a) – (iii), (b) – (iv), (c) – (ii), (d) – (i)

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.

182. Answer: d

Explanation:

Spermatophyta, a category encompassing seed-bearing plants, comprises two major groups gymnosperms and angiosperms. Acacia and sugarcane fall within the category of angiosperms, while Pinus and Cycas are classified as gymnosperms. Notably, Rhizopus belongs to the fungal kingdom, whereas Triticum is categorized as an angiosperm. Ginkgo is a gymnosperm, which differentiates it from Pisum (pea), an angiospermic plant. In summary, Rhizopus is a fungus, Triticum is an angiosperm, and Ginkgo is a gymnospermic plant.

So, the correct option is (D): Ginkgo, Pisum

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](#)

183. Answer: b

Explanation:

Cycas is categorized under "living fossils." Living fossils are species that have remained relatively unchanged in terms of morphology over very long periods of

geological time. Cycas is a genus of ancient seed plants that has a fossil record dating back to the Mesozoic era and has retained many primitive characteristics, making it a living fossil.

So, the correct option is (B): Cycas

Concepts:

1. Gymnosperms – Cycas:

Gymnosperms is one of the classifications of **plants** based on the production of **flowers**. The word **gymnosperm** is derived from a Greek word called 'gymnospermous', which means naked seeds. The gymnosperm plants include ginkgo, pinus, cycas, etc.

Read More: [Economic Importance of Gymnosperm](#)

Seeds and stems of *cycas revoluta* are used to make wine. The gymnosperm plants have a high economic significance for mankind.

Cycas plants belong to the order Cycadales (family Cycadaceae), which consists of 11 genera of tropical and subtropical plants that produce terminal oblong cones containing **orange-yellow** seeds. Within the Cycadales, *C. revoluta* is the most cultivated species.

184. Answer: d

Explanation:

In woody plants, the vascular cambium is responsible for secondary growth, leading to the development of secondary xylem (wood) and secondary phloem. The vascular cambium consists of two components: the fascicular cambium and the interfascicular cambium.

- The fascicular cambium is found within the vascular bundles and is responsible for the production of new xylem and phloem cells within the bundles themselves.
- The interfascicular cambium is located between the vascular bundles and is responsible for the formation of new xylem and phloem cells that connect the individual vascular bundles. These interfascicular cambium cells are often

associated with medullary rays, which are radial files of parenchyma cells that extend from the pith to the bark.

So, option (D) correctly identifies that the cells of medullary rays are part of the interfascicular cambium, which is responsible for connecting the vascular bundles in a plant's stem and allowing for the growth of secondary tissues between the bundles.

Concepts:

1. The Tissue System:

Epidermal Tissue System:

The epidermal tissue system forms the outer-most covering of the whole plant body and comprises epidermal cells, stomata, and the epidermal appendages – the trichomes and hairs. The epidermis is the outermost layer of the primary plant body. It is made up of elongated, compactly arranged cells, which form a continuous layer. The epidermis is usually single-layered.

Ground Tissue System:

All tissues except the epidermis and vascular bundles constitute the ground tissue. It consists of simple tissues such as parenchyma, collenchyma, and sclerenchyma. Parenchymatous cells are usually present in the cortex, pericycle, pith, and medullary rays, in the primary stems and roots. In leaves, the ground tissue consists of thin-walled chloroplast-containing cells and is called mesophyll.

Vascular Tissue System:

The vascular system consists of complex tissues, the phloem, and the xylem. The xylem and phloem together constitute vascular bundles. In dicotyledonous stems, cambium is present between phloem and xylem. Such vascular bundles because of the presence of cambium possess the ability to form secondary xylem and phloem tissues and hence are called open vascular bundles. In the monocotyledons, the vascular bundles have no cambium present in them. Hence, since they do not form secondary tissues they are referred to as closed.

Read More: [Plant Tissue](#)

185. Answer: b

Explanation:

Moss peat has the property of being hygroscopic, which means it can absorb and retain moisture. This helps keep the flowers and plants hydrated during transit, reducing the risk of wilting or drying out.

So, the correct option is (B): it is hygroscopic.

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:

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- 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](#)

186. Answer: b

Explanation:

NAA (Naphthalene Acetic Acid) is a synthetic plant hormone in the [auxin](#) family. It is used as an ingredient in many commercial plants rooting horticultural products.

- NAA and 2,4-D (2,4-dichloro phenoxy acetic acid) are both synthetic auxins.
- IAA and IBA (Indole Butyric Acid) are isolated from [plants](#).
- NAA does not occur naturally and is toxic to plants at high concentrations.

Therefore, B) NAA is the correct answer.

Concepts:

1. Plant Growth Regulators:

What is a plant growth regulator?

[Plant growth regulators \(PGRs\)](#) are chemicals used to modify plant growth such as increasing branching, suppressing shoot growth, increasing return bloom, removing excess fruit, or altering fruit maturity.

Types of Plant Growth:

There are the following types of plant growth.

- **Primary and Secondary Growth:** The growth of a plant is termed primary when the same happens through the mitotic division of the meristematic [cells](#) which are present at the root and the shoot of the plants.

Whereas, the secondary growth in a plant takes place through the division of the secondary meristem, which, in turn increases the diameter of the body of the plants.

- **Primary and Secondary Plant Growth**
- Unlimited Growth
- Limited Growth

- Vegetative Growth
- Reproductive Growth

The five groups of plant growth regulators used in fruit crops include:

1. **Auxins:** [Auxins](#) are one of the most important plant hormones. The chief naturally occurring auxin is indole-3 acetic acid – IAA and other related compounds.
2. **Gibberellins:** [Gibberellins](#) are an extensive chemical family based on the ent-gibberellane structure. The first gibberellin to be discovered was gibberellic acid. Now there are more than 100 types of gibberellins.
3. **Cytokinins:** These are produced in the regions where cell division occurs; mostly in the roots and shoots. They help in the production of new leaves, lateral shoot growth, chloroplasts in leaves etc.
4. **Abscissic Acid:** Abscissic acid controls the dormancy of buds and seeds, inhibits shoot growth and is involved in regulating water loss from plants.
5. **Ethylene:** Ethylene is a simple, gaseous plant growth regulator, synthesised by most of the plant organs includes ripening fruits and ageing tissues.

187. Answer: d

Explanation:

Oxidative phosphorylation leads to synthesis of ATP by the use of energy obtained by oxidation of substrate

Concepts:

1. Aerobic respiration:

It is the release of a relatively large amount of energy in cells by the breakdown of food substances in the presence of oxygen:

Glucose + Oxygen → Carbon Dioxide + Water.

188. Answer: b

Explanation:

Grasses are monocots and monocots usually do not have secondary growth. Palm like monocots have anomalous secondary growth.

Concepts:

1. Secondary Growth:

[Secondary growth](#) is an increase in girth or thickness of the axis due to activity of lateral meristem. The [tissues](#) involved in secondary growth are two lateral meristems are vascular cambium and cork cambium.

Secondary Growth in Stem:

Formation of Cambium Ring-

1. The cambium present between the xylem and phloem in vascular bundles is called Fascicular or Interfascicular cambium.
2. In secondary growth, few medullary ray cells that are located between vascular bundles also become meristematic, and it is known as Interfascicular cambium.

Formation of the secondary tissues-

1. The cambium ring cuts off cells on both sides. It produces secondary phloem outwardly and secondary xylem inwardly.
2. The amount of secondary xylem cut off is more than the secondary phloem.

Secondary Growth in Root:

Vascular Cambium-

1. The cambium is absent initially but develops later at the time of secondary growth.
2. The pericycle cells lying outside the protoxylem and the conjunctive parenchyma cells on the lateral side of the phloem bundle become

meristematic to form many cambial strips.

Cork Cambium-

1. The cork cambium develops because of the tangential division of cells of the pericycle.
2. The activity of cork cambium is like that found in the dicot stem, so it produces cork cells or phellem towards the outside and phelloderm or secondary cortex towards the inside.

Abnormal secondary growth:

1. Due to absence of the cambium in monocots, monocots don't show secondary growth and the vascular system is totally composed of primary tissues.
2. The vascular bundles are irregularly scattered in the ground tissues, such that the cortex and other ground tissues can't be differentiated.
3. Dracaena, Yucca, Agave are examples of monocots that exhibit a peculiar type of secondary growth in thickness.

189. Answer: d

Explanation:

House fly belongs to family Muscidae

Concepts:

1. Nomenclature and Taxonomy:

A branch of science that deals with the nomenclature, identification, and classification of living organisms and extinct organisms is known as taxonomy. We have millions of species on Earth that are commonly known by their local names.

The nomenclature of an organism is only possible when we correctly know all the specifications of the organism that describes them clearly. The described process of an organism is known as identification.

Rules for the Binomial Taxonomy Nomenclature:

1. Irrespective of their origin, these biological names are derived from Latin words and are written in italics.
 2. 'Genus' – is the first word in the biological name whereas the second word represents a specific epithet.
 3. To show the Latin origin both the genus and specific epithet are separately underlined or written in italics.
 4. With capital letters, the genus should start and with a small letter, a specific epithet starts.
 5. The name of the author should be written in the abbreviated form after the specific epithet which denotes the name of the person who described the species such as *Mangifera indica* Linn. In this Linn indicates the Biologist Linnaeus who for the very first time described the species of mango.
-

190. Answer: a

Explanation:

The Convention on Biological Diversity (CBD) was adopted during the United Nations Conference on Environment and Development (UNCED), which took place in Rio de Janeiro, Brazil, from June 3 to June 14, 1992. The summit is commonly known as the Earth Summit and marked a significant milestone in global efforts to address biodiversity conservation and sustainable development.

Therefore, The correct option is (A): 1992

Concepts:

1. Loss of Biodiversity:

The reduction in the number, genetic variability, and the variety of species and the biological community of a place is known as the [Loss of Biodiversity](#). By humans, due to the colonization of the tropical Pacific Island, there has been a deprivation of more than 2000 species. Present data evaluates that around 15,500 species are endangered. Presently the loss of biodiversity is evaluated at – 23% of all mammal species, 12% of all bird species, 32% of all amphibian species, and 31% of gymnosperm species on the planet are facing the threat or warning of extinction.

Loss of Biodiversity: Causes

1. Loss of Habitat and Fragmentation
 2. Over Exploitation of Natural Resources
 3. Alien Species Invasion
 4. Co-Extinction
-

191. Answer: c

Explanation:

The correct option is (c) : Larva of stone fly

Exopterygote stoneflies have large antennae, biting mouthparts, aquatic nymphs, and a shaky flying. Lichens and algae with one cell tend to be the primary sources of food for adults. These are reliable markers of pollution. The larva of stoneflies (Plecoptera order) require clean, well-aerated water. Polluted water lacks it.

Concepts:

1. Transport of Water and Minerals in Plants:

Transportation is the process of [movement of water and minerals](#) to all parts of the plant body. Plants have a specialized system that enables them to distribute water and nutrients throughout their body. They use several processes such as translocation, absorption, storage and utilization of water.

Transportation in Plants:

The water and minerals are [transported in plants](#) by two types of conducting tissues:

- **Xylem:** The xylem distributes water and dissolved minerals upward through the plant, from the roots to the leaves.
- **Phloem:** The phloem carries food downward from the leaves to the roots.

The three modes of transportation:

- **Diffusion:** The molecules in this system travel from a high-concentration region to a low-concentration region. This procedure does not necessitate the use of any energy.

- **Facilitated diffusion:** With the help of a carrier, usually a protein, the mechanism transports molecules from an area of higher concentration to a region of lower concentration. Because this process does not require any energy, it is referred to as a passive process.
 - **Active Transport:** With the help of membrane **proteins**, this mechanism transports molecules from a lower to a higher concentration region. Because it requires ATP to function, this system is referred to as active transport.
-

192. Answer: a

Explanation:

The primary outcomes of the light reactions in photosynthesis are the formation of ATP and NADPH₂. These high-energy molecules are essential for the subsequent dark reactions (Calvin cycle) where sugars are synthesized.

So, the correct option is (A): Formation of ATP and NADPH₂

Concepts:

1. Light-Dependent Reaction:

One of the major surfaces of **Light Reaction** is giving rise to organic energy molecules, such as ATP and NADPH, which are especially necessary for the subsequent occurrence of the dark reaction that works without the presence of sunlight.

1. During the process of light reaction, the elemental step involves **chlorophyll** absorbing the energy released from the sunlight and transforming it into chemical energy in the appearance of electron charge carrier molecules, like ATP and NADPH, with photosynthesis happening or occurring subsequently.
2. This procedure in general takes place in large complexes of protein, called Photosystems, which are further categorized into PSI and PSII.
3. The elevated pigments of chlorophyll then give their electrons up. In order to recompense for the loss of electrons, water is usually cleaved to discharge four H⁺ ions, four electrons, and O₂.
4. The lost electrons of the PSII further enter ETC, concise or abbreviated from Electron Transfer Chain. Upon entering ETC, the electrons unite with NADP⁺,

bringing it down further to NADPH.

5. There is a subsequent movement of electrons that is used for the transportation of hydrogen ions over the thylakoid membrane.
 6. The H^+ ions, subsequent to building up within the lumen, help build a layer of a positive gradient. These H^+ ions, in the presence of ATP synthase, combine with the ADP to further form [ATP](#).
 7. Oxygen, afterward, which holds on to as a waste product gets released into the [atmosphere](#).
-

193. Answer: c

Explanation:

On December 3, 1984, the Bhopal gas tragedy occurred as a consequence of the reaction between methyl isocyanate and water within a cooling tank. This reaction generated heat, leading to a rise in pressure that ultimately caused the rupture of the safety valve, resulting in the release of toxic gas.

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.

194. Answer: c

Explanation:

<div>The pair that is not correctly matched is (C): Anopheles culifaciens – Leishmaniasis

Anopheles mosquitoes are primarily known for transmitting malaria, not leishmaniasis. Leishmaniasis is typically transmitted by sandfly vectors. So, the correct match for Anopheles mosquitoes is malaria transmission, not leishmaniasis.

</div>

Concepts:

1. Soil as Reservoir of Essential Elements:

- Soil is firstly formed due to the slow breakdown and weathering of rocks.
- The clay and the humus part structure colloidal particles in the soil. These colloids hold a lot of charges on their surface and also have a large surface area that assists in the interaction with mineral elements.
- It is also the area of decomposition, a huge number of microbes in the soil decompose the organic remains (leftover) of plant parts or dead animals and release the minerals bound in organic matter.
- Soil can sustain a regular supply of minerals due to the activity of decomposers.
- Nitrogen-fixing bacteria are also found in the soil changing or transforming the atmospheric nitrogen into usable forms to be utilized by the plants.
- Mineral nutrients are withdrawn from the soil at a much faster rate than it gets replenished naturally. Hence, often there is a deficiency of core minerals in the soil.
- The deficiency of crucial minerals affects crop production, which is replenished through artificial fertilisers.
- Macro-nutrients like N, P, K, S, etc. and micro-nutrients like Cu, Zn, Fe, Mn, etc. are ingredients of fertilizers and are used in crop fields based on their requirement.

195. Answer: a

Explanation:

In tetradynamous condition there are six stamens, 4 are long and 2 are short i.e. 4 + 2 arrangement of stamens. It is characteristic feature of cruciferae members. In liliaceae 6 stamens are arranged in whorls of 3 each (3 + 3). In solanaceae there are 5 stamens they are epipetalous and polyandrous. In malvaceae there are numerous stamens that are monadelphous.

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

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1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

Shoot System

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196. Answer: c

Explanation:

Ulothrix is a green filamentous alga, belonging to class chlorophyceae. The plant body is an unbranched filament consisting of numerous cylindrical cells joined end and end. Under favourable conditions, each cell produces zoospores except holdfast. These zoospores are of two types – Macrozoospores and microzoospores. The macrozoospores are larger in size and are quadriflagellate and the microzoospores are smaller zoospores which may be bi flagellate or quadriflagellate. Under unfavourable conditions, nonmotile mitospores called aplanospores are produced. Sexual reproduction in Ulothrix is of isogamous type. The isogametes fuse to form a quadriflagellate zygospore which after meiosis forms 16 aplanospores or zoospores.

Concepts:

1. Plant Kingdom:

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Read Also: [Two Kingdom Classification](#)

Several features of Kingdom Plantae are as follows:

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- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
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- They secure 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](#)

197. Answer: d

Explanation:

Many pollen tubes of same species can also grow into the style.

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
-

198. Answer: b

Explanation:

Fermentation is referred to as the decomposition of organic compounds, anaerobically by enzymes yielding alcohol, organic acids; gases etc.

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-



199. Answer: b

Explanation:

Photosynthesis is actually oxidation reduction process in which water is oxidised and CO₂, is reduced to carbohydrates. The reduction of CO₂ to carbohydrates needs assimilatory powers, i.e., ATP and NADPH₂. The process of photosynthesis involves two steps- (i) Light dependent phase or photochemical reaction. (ii) Light independent these or dark reaction. Light reaction occurs in grana fraction of chloroplast and in this reaction are included those activities, which are dependent on light. Assimilatory powers (ATP and NADPH₂) are mainly produced in this light reaction. The grana of chloroplasts contains many collaborating molecules of pigment. A quantum of light is absorbed by a single antenna chlorophyll, then it migrates from one molecule to the other till it reaches the reaction center. This quantum of light is used for generating ATP and NADPH.

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)

200. Answer: b

Explanation:

Magnesium is an important constituent of chlorophyll, found in all green plants and essential for photosynthesis. The chlorophyll molecule has a tetrapyrrolic or porphyrin head and a phytol tail. Mg atom is present in the centre of porphyrin head. It is like tennis racket.

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