

NEET Mock Test 4

Total Time: 3 Hour : 20 Minute

Total Marks: 720

Instructions

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

Navigating & Answering a Question

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

Physics Section A

1. A long solenoid of radius 1 mm has 100 turns per mm. If 1 A current flows in the solenoid, the magnetic field strength at the centre of the solenoid is: (+4, -1)
- a. $6.28 \times 10^{-2} \text{ T}$
 - b. $12.56 \times 10^{-2} \text{ T}$
 - c. $12.26 \times 10^{-4} \text{ T}$
 - d. $6.28 \times 10^{-4} \text{ T}$
-
2. Plane angle and solid angle have: (+4, -1)
- a. Units but no dimensions
 - b. Dimensions but no units
 - c. No units and no dimensions
 - d. Both units and dimensions
-
3. For the given reaction, the particle X is: ${}^6\text{C}_{11} \rightarrow {}^5\text{B}_{11} + \beta^+ + \text{X}$ (+4, -1)
- a. Neutron
 - b. Anti neutrino
 - c. Neutrino
 - d. Proton
-
4. A uniform rod of length l and mass m is free to rotate in a vertical plane about A. The rod initially in horizontal position is released. The initial angular acceleration of the rod is: (Moment of inertia of rod about A is $\left(\frac{ml^2}{3}\right)$) (+4, -1)

- a. $\frac{3g}{2l}$
- b. $\frac{2l}{3g}$
- c. $\frac{3g}{2l^2}$
- d. $mg(\frac{l}{2})$

5. Two bodies of masses m and $4m$ are moving with equal kinetic energies. The ratio of their linear momenta is (+4, -1)

- a. 1 : 2
- b. 1 : 4
- c. 4 : 1
- d. 1 : 1

6. When a wire of uniform cross-section a , length l and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be (+4, -1)

- a. $R/4$
- b. $4R$
- c. $R/8$
- d. $R/2$

7. The radius of a planet is twice the radius of earth. Both have almost equal average mass-densities. v_P and v_E are escape velocities of the planet and the earth, respectively, then (+4, -1)

- a. $v_p = 1.5 v_E$
- b. $v_p = 2 v_E$

c. $v_E = 3 v_p$

d. $V_E = 1.5 V_p$

8. A closed organ pipe (closed at one end) is excited to support the third overtone. It is found that air in the pipe has (+4, -1)

- a. three nodes and three antinodes
- b. three nodes and four antinodes
- c. four nodes and three antinodes
- d. four nodes and four antinodes

9. A body of mass 3 kg hits a wall at an angle of 60° and returns at the same angle. The impact time was 0.2 sec . The force exerted on the wall (+4, -1)

- a. $150\sqrt{3}N$
- b. $50\sqrt{3}N$
- c. $100 N$
- d. $75\sqrt{3}N$

10. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass when the mass m is slightly pulled down and released, it oscillates with a time period of 3 s . When the mass m is increased by 1 kg , the time period of oscillations becomes 5 s . The value of m in kg is (+4, -1)

- a. $\frac{3}{4}$
- b. $\frac{4}{3}$
- c. $\frac{16}{9}$
- d. $\frac{9}{16}$

11. A dipole of dipole moment $\vec{p}$ is placed in uniform electric field $\vec{E}$ then torque acting on it is given by (+4, -1)

a. $\vec{\tau} = \vec{p} \cdot \vec{E}$

b. $\vec{\tau} = \vec{p} \times \vec{E}$

c. $\vec{\tau} = \vec{p} + \vec{E}$

d. $\vec{\tau} = \vec{p} - \vec{E}$

12. A mass m supported by a massless string wound around a uniform hollow cylinder of mass m and radius R . If the string does not slip on the cylinder, with what acceleration will the mass fall on release? (+4, -1)

a. $2g/3$

b. $g/2$

c. $5g/6$

d. g

13. A metallic rod of mass per unit length 0.5 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 30° with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep it stationary is (+4, -1)

a. 11.32 A

b. 7.14 A

c. 14.76 A

d. 5.98 A

14. A particle moves along a straight line such that its displacement at any time t is given by $s = (t^3 - 6t^2 + 3t + 4)$ metres. The velocity when the acceleration is zero is (+4, -1)

- a. 3 m/s
- b. 42 m/s
- c. -9 m/s
- d. -15 m/s

15. A person aiming to reach exactly opposite point on the bank of a stream is swimming with a speed of 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water in the stream, is (+4, -1)

- a. 0.25 m / s
- b. 0.5 m/s
- c. 1.0 m/s
- d. 0.433 m/s

16. Find the value of the angle of emergence from the prism. Refractive index of the glass is $\sqrt{3}$. (+4, -1)

- a. 60°
- b. 30°
- c. 45°
- d. 90°

17. If the energy of a hydrogen atom in n th orbit is E_n , then energy in the n th orbit of a singly ionized helium atom will be (+4, -1)

- a. $4E_n$

b. $E_n/4$

c. $2E_n$

d. $E_n/2$

18. The velocity of electromagnetic wave is parallel to :-

(+4, -1)

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

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

c. $\vec{E}$

d. $\vec{B}$

19. A piece of copper and other of germanium are cooled from the room temperature to 80 K, then

(+4, -1)

a. resistance of each will increase

b. resistance of copper will decrease

c. the resistance of copper will increase while that of germanium will decrease

d. the resistance of copper will decrease while that of germanium will increase

20. An electron of mass m and charge e is accelerated from rest through a potential difference V in vacuum. Its final velocity will be

(+4, -1)

a. $\sqrt{\frac{2eV}{m}}$

b. $\sqrt{\frac{eV}{m}}$

c. $\frac{eV}{2m}$

d. $\frac{eV}{m}$

21. Electromagnets are made of soft iron because soft iron has (+4, -1)
- a. low retentivity and high coercive force
 - b. high retentivity and high coercive force
 - c. low retentivity and low coercive force
 - d. high retentivity and low coercive force
-
22. The peak voltage of the ac source is equal to: (+4, -1)
- a. the value of voltage supplied to the circuit
 - b. the rms value of the ac source
 - c. $\sqrt{2}$ times the rms value of the ac source
 - d. $\frac{1}{\sqrt{2}}$ times the rms value of the ac source
-
23. The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is: (+4, -1)
- a. $36 \times 10^7 \text{ J}$
 - b. $36 \times 10^4 \text{ J}$
 - c. $36 \times 10^5 \text{ J}$
 - d. $1 \times 10^5 \text{ J}$
-
24. The area of rectangular field (in m^2) of length 55.3 m and breadth 25 m after rounding off the value for correct significant digits is: (+4, -1)
- a. 138×101
 - b. 1382
 - c. 1382.5

d. 14×10^2

25. The magnetic energy stored in an inductor of inductance $4\mu\text{H}$ carrying a current of 2 A is: (+4, -1)

a. $4\mu\text{J}$

b. $4\mu\text{J}$

c. 4mJ

d. $8\mu\text{J}$

26. A Carnot engine has an efficiency of 50% when its source is at a temperature 327°C . The temperature of the sink is: (+4, -1)

a. 200°C

b. 27°C

c. 15°C

d. 100°C

27. $X(n, \alpha) {}^7_3\text{Li}$, then X will be (+4, -1)

a. ${}^{10}_5\text{B}$

b. ${}^9_5\text{B}$

c. ${}^{11}_4\text{Be}$

d. ${}^4_2\text{He}$

28. A charge q is located at the centre of a cube. The electric flux through any face is: (+4, -1)

a. $\frac{2\pi q}{6(4\pi\epsilon_0)}$

b. $\frac{4\pi q}{6(4\pi\epsilon_0)}$

c. $\frac{\pi q}{6(4\pi\epsilon_0)}$

d. $\frac{q}{6(4\pi\epsilon_0)}$

29. A force F acting on an object varies with distance x as shown in the figure. (+4, -1)
The force is in N and x in m . The work done by the force in moving the object from $x = 0$ to $x = 6 m$ is

a. 18.0 J

b. 13.5 J

c. 9.0 J

d. 4.5 J

30. Resistance n , each of r ohm, when connected in parallel give an equivalent resistance of R ohm. If these resistances were connected in series, the combination would have a resistance in ohms, equal to (+4, -1)

a. $n^2 R$

b. R/n^2

c. R/n

d. nR

31. A particle of mass m is kept at rest at a height $3R$ from the surface of earth, (+4, -1)
where R is radius of earth and M is mass of earth. The minimum speed with which it should be projected, so that it does not return back, is : (g is acceleration due to gravity on the surface of earth)

a. $\left(\frac{GM}{2R}\right)^{\frac{1}{2}}$

b. $\left(\frac{gR}{4}\right)^{\frac{1}{2}}$

c. $\left(\frac{2g}{R}\right)^{\frac{1}{2}}$

d. $\left(\frac{GM}{R}\right)^{\frac{1}{2}}$

-
32. Two masses as shown in the figure are suspended from a massless pulley. (+4, -1)
The acceleration of the system when masses are left free is

a. $\frac{2g}{3}$

b. $\frac{g}{3}$

c. $\frac{g}{9}$

d. $\frac{g}{7}$

-
33. Displacement between maximum potential energy position and maximum kinetic energy position for a particle executing simple harmonic motion is (+4, -1)

a. $\pm a/2$

b. #NAME?

c. $\pm a$

d. -1

-
34. Two vibrating tuning forks produce waves given $y_1 = 4 \sin 500\pi t$ and $y_2 = 2 \sin 506 \pi t$. Number of beats produced per minute is (+4, -1)

a. 360

b. 180

c. 60

d. 3

35. A milli voltmeter of 25 milli volt range is to be converted into an ammeter of 25 ampere range. The value (in ohm) of necessary shunt will be (+4, -1)
- a. 0.001
 - b. 0.01
 - c. 1
 - d. 0.05



Physics Section B

36. A parallel plate air capacitor has capacity C , distance of separation between plates is d and potential difference V is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is (+4, -1)
- a. $\frac{CV^2}{d}$
 - b. $\frac{C^2V^2}{2d^2}$
 - c. $\frac{C^2V^2}{2d}$
 - d. $\frac{CV^2}{2d}$
-
37. A particle moves in a straight line with a constant acceleration. It changes its velocity from $10ms^{-1}$ to $20ms^{-1}$ while passing through a distance 135 m in t second. The value of t is (+4, -1)
- a. 10
 - b. 1.8
 - c. 12
 - d. 9
-
38. A particle of mass $m = 5$ is moving with a uniform speed $v = 3\sqrt{2}$ in the XOY plane along the line $Y = X + 4$. The magnitude of the angular momentum of the particle about the origin is (+4, -1)
- a. 60 units
 - b. $40\sqrt{2}$ units
 - c. zero
 - d. 7.5 units
-

39. A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-2}) is (Given $g = 9.8 \text{ ms}^{-2}$) (+4, -1)

- a. 3.5
- b. 5.9
- c. 16.3
- d. 110.8

40. Focal length of a convex lens of refractive index 1.5 is 2 cm. Focal length of lens when immersed in a liquid of refractive index of 1.25 will be (+4, -1)

- a. 10 cm
- b. 2.5 cm
- c. 5 cm
- d. 7.5 cm

41. In a Rutherford scattering experiment when a projectile of charge Z_1 and mass M_1 approaches a target nucleus of charge Z_2 and mass M_2 , the distance of closest approach is r_0 . The energy of the projectile is : (+4, -1)

- a. Directly proportional to $z_1 z_2$
- b. Inversely proportional to z_1
- c. Directly proportional to mass M_1
- d. Directly proportional to $M_1 \times M_2$

42. Wavelength of light of frequency 100 Hz (+4, -1)

- a. $4 \times 10^6 m$
- b. $3 \times 10^6 m$
- c. $2 \times 10^6 m$
- d. $5 \times 10^{-5} m$

43. A Zener diode, having breakdown voltage equal to $15 V$, is used in a voltage regulator circuit shown in figure. The current through the diode is (+4, -1)

- a. 5 mA
- b. 10 mA
- c. 15 mA
- d. 20 mA

44. An electron with (rest mass m_0) moves with a speed of $0.8 c$. Its mass when it moves with this speed is (+4, -1)

- a. m_0
- b. $\frac{m_0}{6}$
- c. $\frac{5m_0}{3}$
- d. $\frac{3m_0}{5}$

45. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment $\vec{m}$. Which configuration has highest net magnetic dipole moment? (+4, -1)

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

d. -4

46. A series LCR circuit with inductance 10 H, capacitance 10 μF , resistance 50 Ω is connected to an ac source of voltage, $V = 200 \sin(100 t)$ volt. If the resonant frequency of the LCR circuit is ν_0 and the frequency of the ac source is ν , then: (+4, -1)

a. $\nu_0 = \nu = 50 \text{ Hz}$

b. $\nu_0 = \nu = \frac{50}{\pi} \text{ Hz}$

c. $\nu_0 = \frac{50}{\pi} \text{ Hz}, \nu = 50 \text{ Hz}$

d. $\nu_0 = 100 \text{ Hz}, \nu_0 = \frac{100}{\pi} \text{ Hz}$

47. A metal wire has mass $(0.4 \pm 0.002) \text{ g}$, radius $(0.3 \pm 0.001) \text{ mm}$ and length $(5 \pm 0.02) \text{ cm}$. The maximum possible percentage error in the measurement of density will nearly be: (+4, -1)

a. 1.4%

b. 1.2%

c. 1.3%

d. 1.6%

48. The net magnetic flux through any closed surface is: (+4, -1)

a. Negative

b. Zero

c. Positive

d. Infinity

49. A cup of coffee cools from 90°C to 80°C in t minutes, when the room temperature is 20°C . The time taken by a similar cup of coffee to cool from 80°C to 60°C at a room temperature same at 20°C is (+4, -1)

a. $\frac{5}{13}t$

b. $\frac{13}{10}t$

c. $\frac{13}{5}t$

d. $\frac{10}{13}t$

50. If a ^a_bX species emits firstly a positron, then two α and two β and at last one α is also after initially it finally converts into stable ^c_dY species so correct relation will be (+4, -1)

a. $c = b - 12, d = a - 5$

b. $a = c - 8, d = b - 1$

c. $a = c - 6, d = b - 0$

d. $a = c - 4, a = b - 2$

Chemistry Section A

51. Oxygen will directly react with each of the following elements except? (+4, -1)

- a. P
- b. Cl
- c. Na
- d. S

52. Enzymes are made up of :- (+4, -1)

- a. edible proteins
- b. proteins with specific structure
- c. nitrogen containing carbohydrates
- d. carbohydrates

53. $CuSO_4$ when reacts with KCN forms CuCN which is insoluble in water. It is soluble in excess of KCN due to the formation of the complex :- (+4, -1)

- a. $K_2[Cu(CN)_4]$
- b. $K_3[Cu(CN)_4]$
- c. $Cu(CN)_2$
- d. $Cu[KCu(CN)_4]$

54. Root mean square velocity of a gas molecule is proportional to (+4, -1)

- a. $m^{1/2}$
- b. m^0
- c. $m^{-1/2}$

d. m

55. At 80°C , distilled water has concentration equal to 1×10^{-6} mole/litre. The value of K_w at this temperature will be (+4, -1)

- a. 1×10^{-6}
- b. 1×10^{-12}
- c. 1×10^{-9}
- d. 1×10^{-15}

56. Boron has two stable isotopes, ^{10}B (19%) and ^{11}B (81%). Calculate average atomic weight of boron in the periodic table. (+4, -1)

- a. 10.8
- b. 10.2
- c. 11.2
- d. 10

57. Equivalent conductance of NaCl , HCl and $\text{C}_2\text{H}_5\text{COONa}$ at infinite dilution are 126.45, 426.16 and $91\Omega^{-1}\text{cm}^2$, respectively. The equivalent conductance of $\text{C}_2\text{H}_5\text{COOH}$ is (+4, -1)

- a. $201.28\Omega^{-1}\text{cm}^2$
- b. $390.71\Omega^{-1}\text{cm}^2$
- c. $698.28\Omega^{-1}\text{cm}^2$
- d. $540.48\Omega^{-1}\text{cm}^2$

58. For a reaction, activation energy $E_a = 0$ and the rate constant at 200K is $1.6 \times 10^6\text{s}^{-1}$. The rate constant at 400K will be- [Given that gas constant] $R = 8.314\text{ J}$ (+4, -1)

$K^{-1} \text{ mol}^{-1}$

a. $3.2 \times 10^4 \text{ s}^{-1}$

b. $1.6 \times 10^6 \text{ s}^{-1}$

c. $1.6 \times 10^3 \text{ s}^{-1}$

d. $3.2 \times 10^6 \text{ s}^{-1}$

59. For determination of molar mass of colloids, polymers and protein which colligative property is used (+4, -1)

a. diffusion pressure

b. atmospheric pressure

c. osmotic pressure

d. turgor pressure

60. From the following bond energies : $H - H$ bond energy : $431.37 \text{ kJ mol}^{-1}$ $C = C$ bond energy : $606.10 \text{ kJ mol}^{-1}$ $C - C$ bond energy : $336.49 \text{ kJ mol}^{-1}$ $C - H$ bond energy : $410.50 \text{ kJ mol}^{-1}$ Enthalpy for the reaction, will be (+4, -1)

a. $553.0 \text{ kJ mol}^{-1}$

b. $1523.6 \text{ kJ mol}^{-1}$

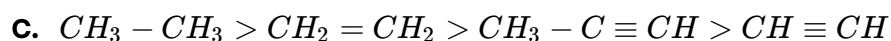
c. $-243.6 \text{ kJ mol}^{-1}$

d. $-120.0 \text{ kJ mol}^{-1}$

61. Which one is the correct order of acidity ? (+4, -1)

a. $CH \equiv CH > CH_3 - C \equiv CH > CH_2 = CH_2 > CH_3 - CH_3$

b. $CH \equiv CH > CH_2 = CH_2 > CH_3 - C \equiv CH > CH_3 - CH_3$



62. Which of the following is not chiral:-

(+4, -1)

- a. 2-Butanol
- b. 2, 3-Dibromopentane
- c. 3-bromopentane
- d. 2-hydroxypropanoic acid

63. An organic compound X (molecular formula $C_6H_7O_2N$) has six carbon atoms in a ring system, two double bonds and a nitro group as substituent, X is

(+4, -1)

- a. homocyclic but not aromatic
- b. aromatic but not homocyclic
- c. homocyclic and aromatic
- d. heterocyclic and aromatic

64. Because of lanthanoid contraction, which of the following pairs of elements have nearly same atomic radii? (Numbers in the parenthesis are atomic numbers)

(+4, -1)

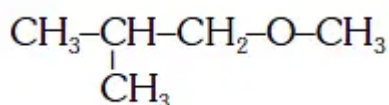
- a. Zr(40) and Hf (72)
- b. Zr (40) and Ta (73)
- c. Ti (22) and Zr (40)
- d. Zr (40) and Nb (41)

65. Consider the following reaction $\rightarrow [H_2][Pd - BaSO_4]'A'$ The product 'A' is -

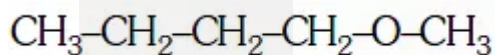
(+4, -1)

- a. C_6H_5OH
- b. $C_6H_5COCH_3$
- c. C_6H_5Cl
- d. C_6H_5CHO

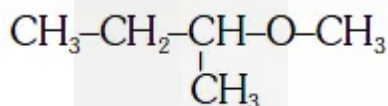
66. Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI ? (+4, -1)



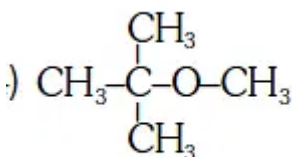
a.



b.



c.



d. _____

67. Iron exhibits *bcc* structure at room temperature. Above 900°C , it transforms to *fcc* structure. The ratio of density of iron at room temperature to that at 900°C (assuming molar mass and atomic radii of iron remains constant with temperature) is (+4, -1)

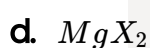
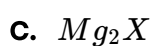
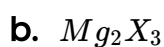
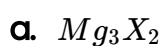
- a. $\frac{1}{2}$

b. $\frac{\sqrt{3}}{\sqrt{2}}$

c. $\frac{3\sqrt{3}}{4\sqrt{2}}$

d. $\frac{4\sqrt{3}}{3\sqrt{2}}$

68. Magnesium reacts with an element (X) to form an ionic compound. If the ground state electronic configuration of (X) is $1s^2 2s^2 2p^3$, the simplest formula for this compound is (+4, -1)

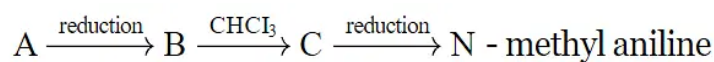


69. Which of the following oxides is most acidic in nature ? (+4, -1)



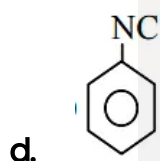
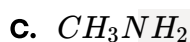
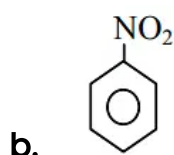
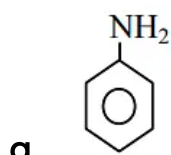
70. Which of the following shows maximum number of oxidation states (+4, -1)



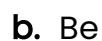


71. Then A is:

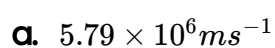
(+4, -1)



72. Which one is not paramagnetic among the following? [at. no. of $\text{Be} = 4, \text{Ne} = 10, \text{As} = 33, \text{Cl} = 17$] (+4, -1)



73. Given, the mass of electron is $9.11 \times 10^{-31} \text{ kg}$, Planck's constant is $6.626 \times 10^{-34} \text{ Js}$, the uncertainty involved in the measurement of velocity within a distance of $0.1 \text{ \AA}$ is (+4, -1)

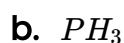


b. $5.79 \times 10^7 ms^{-1}$

c. $5.79 \times 10^8 ms^{-1}$

d. $5.79 \times 10^5 ms^{-1}$

74. Which one has the lowest boiling point? (+4, -1)



75. In the silver plating of copper, $K[Ag(CN)_2]$ is used instead of $AgNO_3$. The reason is :- (+4, -1)

a. a thin layer of Ag is formed on Cu

b. more voltage is required

c. Ag^+ ions are completely removed from solution

d. less availability of Ag^+ ions, as Cu cannot displace Ag from $[Ag(CN)_2]^-$ ion

76. Which one of the following is an amine hormone? (+4, -1)

a. Thyroxin

b. Oxypurin

c. Insulin

d. progesterone

77. An ideal gas cannot be liquefied because (+4, -1)

- a. its critical temperature is always above 0°C
- b. its molecules are relatively smaller in size
- c. it solidifies before becoming a liquid
- d. forces operating between its molecules are negligible

78. At 100°C the K_w of water is 55 *times* its value at 25°C . What will be the pH of neutral solution ? ($\log 55 = 1.74$) (+4, -1)

- a. 7
- b. 7.87
- c. 5.13
- d. 6.13

79. Following limiting molar conductivities are given as $\lambda_m^{\circ}(\text{H}_2\text{SO}_4) = x \text{ S cm}^2 \text{ mol}^{-1}$ (+4, -1)
 $\lambda_m^{\circ}(\text{K}_2\text{SO}_4) = y \text{ S cm}^2 \text{ mol}^{-1}$ $\lambda_m^{\circ}(\text{CH}_3\text{COOK}) = z \text{ S cm}^2 \text{ mol}^{-1}$ λ_m° (in $\text{S cm}^2 \text{ mol}^{-1}$) for CH_3COOH will be-

- a. $x - y + 2z$
- b. $x + y - z$
- c. $x - y + z$
- d. $\frac{(x-y)}{2} + z$

80. For the chemical reaction $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$ the correct option is : (+4, -1)

- a. $-\frac{d[\text{N}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt}$
- b. $3 \frac{d[\text{H}_2]}{dt} = 2 \frac{d[\text{NH}_3]}{dt}$
- c. $-\frac{1}{3} \frac{d[\text{H}_2]}{dt} = 2 \frac{d[\text{NH}_3]}{dt}$

d. $-\frac{d[N_2]}{dt} = 2\frac{d[NH_3]}{dt}$

81. From the colligative properties of solution, which one is the best method for the determination of molecular weight of proteins and polymers? (+4, -1)

- a. Osmotic pressure
- b. Lowering in vapour pressure
- c. Lowering in freezing point
- d. Elevation in boiling point

82. Haemoglobin contains 0.33% of iron by weight. The molecular weight of haemoglobin is approximately 67200 g. The number of iron atoms (at. weight of Fe is 56) present in one molecule of haemoglobin are (+4, -1)

- a. 1
- b. 6
- c. 4
- d. 2

83. Heat of combustion ΔH° for $C(s)$, $H_2(g)$ and $CH_4(g)$ are -94, -68 and -213 Kcal/mol then ΔH° for $C(s) + 2H_2(g) \rightarrow CH_4(g)$ is:- (+4, -1)

- a. - 17 Kcal
- b. - 111 Kcal
- c. - 170 Kcal
- d. - 85 Kcal

84. Which of the following organic compounds has same hybridisation as its combustion (CO_2) product? (+4, -1)

- a. Ethane
- b. Ethyne
- c. Ethene
- d. Ethanol

85. Which of the following is least reactive in a nucleophilic substitution reaction? (+4, -1)

- a. $(CH_3)_3C - Cl$
- b. $CH_2 = CHCl$
- c. CH_3CH_2Cl
- d. $CH_2 = CHCH_2Cl$

Chemistry Section B

86. An sp^3 hybrid orbital contains (+4, -1)

- a. $\frac{1}{4}$ - s-character
- b. $\frac{1}{2}$ - s-character
- c. $\frac{1}{3}$ - s-character
- d. $\frac{2}{3}$ - s-character

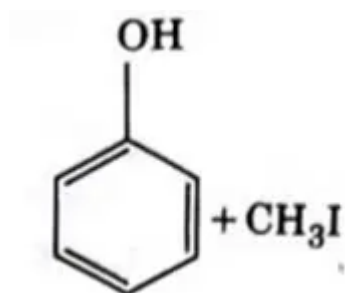
87. Bell-metal is an alloy of (+4, -1)

- a. Cu + Pb
- b. Cu + Sn
- c. Cu + Zn
- d. Cu + Ni

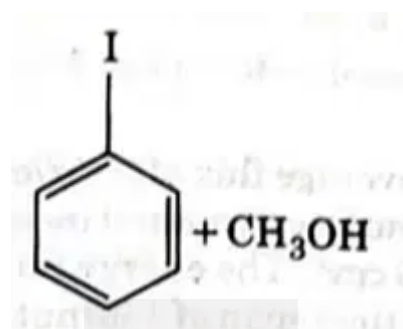
88. Consider the reaction: $RCHO + NH_2NH_2 \rightarrow RCH=N-NH_2$ What sort of reaction is it ? (+4, -1)

- a. Free radical addition - elimination reaction
- b. Electrophilic substitution-elimination reaction
- c. Nucleophilic addition - elimination reaction
- d. Electrophilic addition - elimination reaction

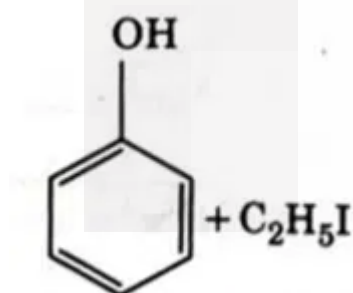
89. Anisole on cleavage with HI gives : (+4, -1)



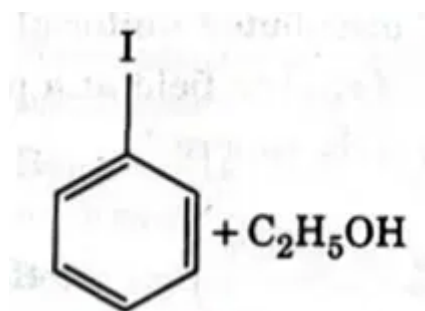
a.



b.



c.



d.

90. Lithium has a *bcc* structure. Its density is 530 kg m^{-3} and its atomic mass is 6.94 g mol^{-1} . Calculate the edge length of a unit cell of Lithium metal. ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$)

(+4, -1)

- a. 352 pm
- b. 527 pm
- c. 264 pm
- d. 154 pm

91. Which of the following is an amphoteric hydroxide ? (+4, -1)

- a. $Mg(OH)_2$
- b. $Be(OH)_2$
- c. $Sr(OH)_2$
- d. $Ca(OH)_2$

92. The spectrum of helium is expected to be similar to that of (+4, -1)

- a. H
- b. Na
- c. Li^+
- d. He^+

93. Which of the following element exhibit maximum oxidation state: (+4, -1)

- a. Cr
 - b. Mn
 - c. Fe
 - d. V
-

94. The number of antibonding electron pairs in O_2^{2-} molecular ion on the basis of molecular orbital theory is (at. no. of O is 18) (+4, -1)

- a. 5
- b. 2
- c. 4
- d. 6

95. If ionisation potential for hydrogen atom is 13.6 eV, then ionisation potential for He^+ will be (+4, -1)

- a. 54.4 eV
- b. 6.8 eV
- c. 13.6 eV
- d. 24.5 eV

96. When orthophosphoric acid is heated to $600^\circ C$, the product formed is (+4, -1)

- a. PH_3
- b. P_2O_5
- c. H_3PO_3
- d. HPO_3

97. In which of the following coordination entities the magnitude of Δ_0 (CFSE in octahedral field) will be maximum? (At. no. of Co = 27) (+4, -1)

- a. $[Co(H_2O)_6]^{3+}$
- b. $[Co(NH_3)_6]^{3+}$

- c. $[Co(CN)_6]^{3-}$
- d. $[Co(C_2O_4)_3]^{3-}$

98. Chargaff's rule states that in an organism (+4, -1)

- a. amount of adenine (A) is equal to that of cytosine (C) and the amount of thymine (T) is equal to that of guanine (G)
- b. amounts of all bases are equal
- c. amount of adenine (A) is equal to that of thymine (T) and the amount of guanine (G) is equal to that of cytosine (C)
- d. amount of adenine (A) is equal to that of guanine (G) and the amount of thymine (T) is equal to that of cytosine (C)

99. At 25°C and 730 mm pressure, 380 mL of dry oxygen was collected. If the temperature is constant, what volume will the oxygen occupy at 760 mm pressure? (+4, -1)

- a. 365 mL
- b. 449 mL
- c. 569 mL
- d. 621 mL

100. 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. $1.0 \times 10^{-7} \text{ mol L}^{-1}$



Zoology Section A

101. What would happen if in a gene encoding a polypeptide of 50 amino acids, 25th codon (UAU) is mutated to UAA: (+4, -1)
- a. A polypeptide of 24 amino acids will be formed
 - b. Two polypeptides of 24 and 25 amino acids will be formed
 - c. A polypeptide of 49 amino acids will be formed
 - d. A polypeptide of 25 amino acids will be formed
-
102. Which one of the following is oviparous? (+4, -1)
- a. Platypus
 - b. Flying fox (Bat)
 - c. Elephant
 - d. Whale
-
103. 'Continuity of germplasm' theory was given by (+4, -1)
- a. De Vries
 - b. Weismann
 - c. Darwin
 - d. Lamarck.
-
104. Extrusion of second polar body from egg nucleus occurs: (+4, -1)
- a. before entry of sperm into ovum
 - b. simultaneously with first cleavage
 - c. after entry of sperm but before fertilization

d. after fertilization

105. Faster distribution of some injectible material/medicine and with no risk of any kind can be achieved by injecting it into the : (+4, -1)

- a. Arteries
- b. Veins
- c. Muscles
- d. Lymph vessels

106. Fertility of soil is measured by its ability to (+4, -1)

- a. retain nutrients
- b. hold organic materials
- c. hold water
- d. support life

107. Five kingdom system of classification suggested by R.H. Whittaker is not based on (+4, -1)

- a. presence or absence of a well defined nucleus
- b. mode of reproduction
- c. mode of nutrition
- d. complexity of body organisation.

108. Impulse of heart beat originates from :- (+4, -1)

- a. S.A. Node
- b. A.V. Node

- c. Vagus Nerve
- d. Cardiac Nerve.

109. In man the zymogen or chief cells are mainly found in (+4, -1)

- a. cardiac part of stomach
- b. pyloric part of stomach
- c. duodenum
- d. fundic part of stomach.

110. The citric acid is produced by (+4, -1)

- a. Candida utilis
- b. Azotobacter suboxydans
- c. Aspergillus niger
- d. Streptococcus lactis.

111. Given below are two statements: one is labelled as Assertion A and other is labelled as Reason R. (+4, -1)

Assertion A: Amniocentesis for sex determination is one of the strategies of Reproductive and Child Health Care Programme.

Reason R: Ban on amniocentesis checks increasing menace of female foeticide.

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

- a. Both A and R are true and R is NOT the correct 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.

112. A plant of F_1 generation with genotype "AABbCC". On selfing of this plant what is the phenotypic ratio in F_2 -generation : - (+4, -1)

- a. 3:1
- b. 1:1
- c. 9:3:3:1
- d. 27:9:9:9:3:3:3:1

113. In meiosis crossing over is initiated at : (+4, -1)

- a. Leptotene
- b. Zygotene
- c. Diplotene
- d. Pachetene

114. Which of the following components is a part of the pectoral girdle? (+4, -1)

- a. sternum
- b. acetabulum
- c. glenoid cavity
- d. ilium.

115. Which part of the brain is responsible for thermoregulation ? (+4, -1)

- a. Corpus callosum
- b. Medulla oblongata

- c. Cerebrum
- d. Hypothalamus

116. Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other ? (+4, -1)

- a. Insulin - Glucagon
- b. Aldosterone - Atrial Natriuretic Factor
- c. Relaxin- Inhibin
- d. Parathormone - Calcitonin

117. During translation initiation in prokaryotes, a GTP molecule is needed in (+4, -1)

- a. Formation of formyl-met-tRNA
- b. Binding of 30S subunit of ribosome with mRNA
- c. Association of 30 S-mRNA with formyl-met-tRNA
- d. Association of 50 S subunit of ribosome with initiation complex

118. Cell wall shows (+4, -1)

- a. complete permeability
- b. semipermeability
- c. differential permeability
- d. impermeability

119. In male cockroaches, sperms are stored in which part of the reproductive system ? (+4, -1)

- a. Seminal vesicles

- b. Mushroom glands
- c. Tester
- d. Vas deferens

120. Which of the following is true for Golden rice ? (+4, -1)

- a. It is drought tolerant, developed using Agrobacterium vector.
- b. It has yellow grains, because of a gene introduced from a primitive variety of rice.
- c. It is Vitamin A enriched, with a gene from daffodil.
- d. It is pest resistant, with a gene from Bacillus thuringiensis.

121. Restriction endonucleases (+4, -1)

- a. are present in mammalian cells for degradation of DNA when the cell dies
- b. are used in genetic engineering for ligating two DNA molecules
- c. are used for in vitro DNA synthesis
- d. are synthesized by bacteria as part of their defense mechanism.

122. Which of the following is not the function of the conducting part of the respiratory system? (+4, -1)

- a. It clears inhaled air from foreign particles
 - b. Inhaled air is humidified
 - c. Temperature of inhaled air is brought to body temperature
 - d. Provides surface for diffusion of O₂ and CO₂
-

123. Conversion of ammonia to urea is done by _ _ _ _ Cycle: **(+4, -1)**

- a. Ornithine cycle
- b. Arginine cycle
- c. Fumaric cycle
- d. Citrulline cycle

124. The catalytic efficiency of two different enzymes can be compared by the: **(+4, -1)**

- a. the K_m value
- b. the pH optimum value
- c. formation of the product
- d. molecular size of the enzyme

125. Which antibiotic inhibits interaction between t-RNA and m-RNA during bacterial protein synthesis ? **(+4, -1)**

- a. Erythromycin
- b. Neomycin
- c. Streptomycin
- d. Tetracycline

126. Which one of the following statements about certain given animals is correct? **(+4, -1)**

- a. Roundworms are pseudocoelomates
- b. Molluscs are acoelomates
- c. Annelids are pseudocoelomates

d. Flatworms are coelomates

127. Convergent evolution is illustrated by

(+4, -1)

- a. Rat and dog
- b. Bacterium and protozoan
- c. Starfish and cuttle fish
- d. Dogfish and whale

128. Eye lens is formed from

(+4, -1)

- a. ectoderm
- b. mesoderm
- c. endoderm
- d. ectoderm and mesoderm.

129. For retting of jute the fermenting microbe used is

(+4, -1)

- a. methanophilic bacteria
- b. butyric acid bacteria
- c. *Helicobacter pylori*
- d. *Streptococcus lactin*.

130. Gause's principle of competitive exclusion states that -

(+4, -1)

- a. Competition for the same resources excludes species having different food preferences
- b. No two species can occupy the same niche indefinitely for the same limiting resources

- c. Larger organisms exclude smaller ones through competition
- d. More abundant species will exclude the less abundant species through competition

131. Grafted kidney may be rejected in a patient due to (+4, -1)

- a. passive immune response
- b. innate immune response
- c. humoral immune response
- d. cell-mediated immune response.

132. In humans blood passes from post caval to the diastolic right atrium of heart due to (+4, -1)

- a. Stimulation of the sino-auricular node
- b. Pressure difference between the post caval and atrium
- c. Pushing open of the venous valves
- d. Suction pull

133. In the stomach, gastric acid is secreted by the : (+4, -1)

- a. Parietal cells
- b. Peptic cells
- c. Acidic cells
- d. Gastrin secreting cells

134. When domestic sewage mixes with river water (+4, -1)

- a. Small animals like rats will die after drinking river water

- b. The increased microbial activity releases micronutrients such as iron
- c. The increased microbial activity uses up dissolved oxygen
- d. The river water is still suitable for drinking as impurities are only about 0.1%

135. Match List - I with List - II.

(+4, -1)

List-I		List-II	
(a)	Vaults	(i)	Entry of sperm through Cervix is blocked
(b)	IUDs	(ii)	Removal of Vas deferens
(c)	Vasectomy	(iii)	Phagocytosis of sperms within the Uterus
(d)	Tubectomy	(iv)	Removal of fallopian tube

Choose the correct answer from the options given below.

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

Zoology Section B

136. Inheritance of skin colour in human is an example of (+4, -1)

- a. Codominance
- b. Point mutation
- c. Chromosomal aberration
- d. Polygenic inheritance

137. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage (G_0). This process occurs at the end of : (+4, -1)

- a. M phase
- b. G_1 phase
- c. S phase
- d. G_2 phase

138. Which one of the following is the correct description of a certain part of a normal human skeleton? (+4, -1)

- a. parietal bone and the temporal bone of the skull are joined fibrous joint
- b. first vertebra is axis which articulates with the occipital condyles
- c. the 9th and 10th pairs of ribs are called the floating ribs
- d. glenoid cavity is a depression to which the thigh bone articulates

139. Which of the following is regarded as a unit of nervous tissue? (+4, -1)

- a. neurons
- b. myelin sheath

- c. axons
- d. dendrites.

140. Which of the following is an amino acid derived hormone ? (+4, -1)

- a. Estriol
- b. Epinephrine
- c. Estradiol
- d. Ecdysone

141. Cellular organelles with membranes are (+4, -1)

- a. endoplasmic reticulum, ribosomes and nuclei
- b. lysosomes, Golgi apparatus and mitochondria
- c. nuclei, ribosomes and mitochondria
- d. chromosomes, ribosomes and endoplasmic reticulum.

142. Degeneration of a genetic code is attributed to the (+4, -1)

- a. First member of a codon
- b. Second member of codon
- c. Entire codon
- d. Third member of a codon

143. Which of the following features is used to identify a male cockroach from a female cockroach ? (+4, -1)

- a. Presence of anal cerci

- b. Presence of a boat shaped sternum on the 9th abdominal segment
- c. Forewings with darker tegmina
- d. Presence of caudal style

144. Which one of the following statements is not true regarding gel electrophoresis technique? (+4, -1)

- a. The process of extraction of separated DNA strands from gel is called elution
- b. The separated DNA fragments are stained by using ethidium bromide
- c. The presence of chromogenic substrate gives blue coloured DNA bands on the gel
- d. Bright orange coloured bands of DNA can be observed in the gel when exposed to UV light

145. Under normal physical conditions in human beings every 100 ml oxygenated blood can deliver _ _ _ ml of O₂ to the tissues. (+4, -1)

- a. 2 ml
- b. 5 ml
- c. 4 ml
- d. 10 ml

146. Maximum number of bases in plasmids discovered so far (+4, -1)

- a. 50 kilo base
- b. 500 kilo base
- c. 5000 kilo base

d. 5 kilo base

147. Which pair is correct:

(+4, -1)

- a. Sweat - temperature regulation
- b. Saliva - sense of food taste
- c. Sebum - sexual attraction
- d. Humerus - Hind leg

148. Which of the following statements regarding enzyme inhibition is correct

(+4, -1)

- a. Non-competitive inhibition of an enzyme can be overcome by adding large amount of substrate
- b. Competitive inhibition is seen when a substrate competes with an enzyme for binding to an inhibitor protein
- c. Competitive inhibition is seen when the substrate and the inhibitor compete
- d. Non-competitive inhibitors often bind to the enzyme irreversibly

149. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence, called as

(+4, -1)

- a. Polymorphic DNA
- b. Satellite DNA
- c. Repetitive DNA
- d. Single nucleotides

150. Which of the following organisms possesses characteristics of a plant and an animal?

(+4, -1)

- a. Englena
- b. Paramecium
- c. bacteria
- d. Mycoplasma.



Botany Section A

151. Transmission tissue is characteristic feature of (+4, -1)

- a. dry stigma
- b. wet stigma
- c. hollow style
- d. solid style.

152. Parthenocarpic tomato fruits can be produced by: (+4, -1)

- a. removing androecium of flowers before pollen grains are released
- b. treating the plants with low concentrations of gibberellic acid and auxins
- c. raising the plants from vernalized seeds
- d. treating the plants with phenylmercuric acetate

153. Life cycle of Ectocarpus and Fucus respectively are: (+4, -1)

- a. Diplontic, Haplodiplontic
- b. Haplodiplontic, Diplontic
- c. Haplodiplontic, Haplontic
- d. Haplontic, Diplontic

154. Which one of the following statements is correct? (+4, -1)

- a. The seed in grasses is not endospermic.
- b. Mango is a parthenocarpic fruit.
- c. A proteinaceous aleurone layer is present in maize grain.

d. A sterile pistil is called a staminode.

155. Identify the incorrect statement related to Pollination: (+4, -1)

- a. Pollination by water is quite rare in flowering plants
- b. Pollination by wind is more common amongst abiotic pollination
- c. Flowers produce foul odours to attract flies and beetles to get pollinated
- d. Moths and butterflies are the most dominant pollinating agents among insects

156. System of classification used by Linnaeus was (+4, -1)

- a. natural system
- b. artificial system
- c. phylogenetic system
- d. asexual system

157. Whorled, simple leaves with reticulate venation are present in (+4, -1)

- a. Calotropis
- b. neem
- c. China rose
- d. Alstonia

158. Given below are two statements: (+4, -1)

Statement I: Cleistogamous flowers are invariably autogamous

Statement II: Cleistogamy is disadvantageous as there is no chance for cross pollination

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

- a. Both Statement I and Statement II are correct
- b. Both Statement I and Statement II are incorrect
- c. Statement I is correct but Statement II is incorrect
- d. Statement I is incorrect but Statement II is correct

159. Which one of the following pairs is wrongly matched ? (+4, -1)

- a. Ginkgo ↔ Archegonia
- b. Salvinia ↔ Prothallus
- c. Viroids ↔ RNA
- d. Mustard ↔ Synergids

160. Which one of the following is monoecious? (+4, -1)

- a. Marchantia
- b. Cycas
- c. Pinus
- d. Papaya

161. Which one of the following plants does not show plasticity? (+4, -1)

- a. Cotton
- b. Coriander
- c. Buttercup
- d. Maize

162. Zygotic meiosis is characteristic of ; (+4, -1)

- a. Fucus
- b. Funaria
- c. Chlamydomonas
- d. Marchantia

163. Which of the following represents the edible part of the fruit of Litchi ? (+4, -1)

- a. Mesocarp
- b. Endocarp
- c. Pericarp
- d. Juicy aril

164. What is the function of tassels in the corn cob? (+4, -1)

- a. To trap pollen grains
- b. To disperse pollen grains
- c. To protect seeds
- d. To attract insects

165. Which one of the following statements is wrong? (+4, -1)

- a. Chlorella and Spirulina are used as space food.
- b. Mannitol is stored food in Rhodophyceae.
- c. Algin and carrageenan are products of algae.
- d. Agar-agar is obtained from Gelidium and Gracilaria.

166. Which of the following is not a stem modification?

(+4, -1)

- a. Thorns of citrus
- b. Tendrils of cucumber
- c. Flattened structures of Opuntia
- d. Pitcher of Nepenthes

167. The term used for transfer of pollen grains from anthers of one plant to stigma of a different plant which, during pollination, brings genetically different types of pollen grains to stigma, is

(+4, -1)

- a. Cleistogamy
- b. Xenogamy
- c. Geitonogamy
- d. Chasmogamy

168. Which one of the following statements is wrong ?

(+4, -1)

- a. Algae increase the level of dissolved oxygen in the immediate environment
- b. Algin is obtained from red algae, and carrageenan from brown algae
- c. Agar-agar is obtained from Gelidium and Gracilaria
- d. Laminaria and Sargassum are used as food

169. Which of the following is a 'true fruit'?

(+4, -1)

- a. banana
- b. fig

- c. apple
- d. pear.

170. In grasses what happens in micro spore mother cell for the formation of mature pollen grains (+4, -1)

- a. One meiotic and two mitotic divisions
- b. One meiotic & one mitotic divisions
- c. One meiotic division
- d. One mitotic division

171. Which one of the following shows isogamy with non-flagellated gametes? (+4, -1)

- a. Sargassum
- b. Ectocarpus
- c. Ulothrix
- d. Spirogyra

172. Following table summarises the comparisons between phyllododes and cladodes (cladophylls). Pick up the wrong differences and select the correct option, (+4, -1)

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

173. What is the direction of micropyle in anatropous ovule (+4, -1)

- a. Upward
- b. Downward
- c. Right
- d. Left

174. Which one of the following is wrong about Chara? (+4, -1)

- a. Upper oogonium and lower round antheridium
- b. Globule and nucule present on the same plant
- c. Upper antheridium and lower oogonium
- d. Globule is male reproductive structure

175. Micropyle of seed is involved in the passage of (+4, -1)

- a. male gamete
- b. pollen tube
- c. water
- d. gases.

176. Endosperm is formed during the double fertilization by: (+4, -1)

- a. Two polar nuclei & one male gamete
- b. One polar nuclei & one male gamete
- c. Ovum and male gamete
- d. Two polar nuclei & two male gametes

177. Which one of the following is a vascular cryptogam? (+4, -1)

- a. Cedrus
- b. Equisetum
- c. Ginkgo
- d. Marchantia

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

- a. Liliaceae
- b. Asteraceae
- c. Brassicaceae
- d. Solanaceae

179. Which one of the following represents an ovule, where the embryo sac becomes horseshoe shaped and the funiculus and micropyle are close to each other? (+4, -1)

- a. Circinotropous
- b. Anatropous
- c. Amphitropous
- d. Atropous

180. Which one of the following is a living fossil? (+4, -1)

- a. Cycas
- b. Moss
- c. Saccharomyces

d. Spirogyra.

181. Perigynous flowers are found in (+4, -1)

a. china rose

b. rose

c. guava

d. cucumber.

182. In which one pair both the plants can be vegetatively propagated by leaf pieces ? (+4, -1)

a. Bryophyllum and Kalanchoe

b. Chrysanthemum and Agave

c. Agave and Kalanchoe

d. Asparagus and Bryophyllum

183. Which one of the following has haplontic life cycle? (+4, -1)

a. Polytrichum

b. Ustilago

c. wheat

d. Funaria

184. Pineapple (ananas) fruit develops from- (+4, -1)

a. a unilocular polycarpellary flower

b. a Multipistillate syncarpous flower

- c. a cluster of compactly borne flowers on a common axis
- d. a Multilocular monocarpellary flower

185. Through which cell of the embryo sac, does the pollen tube enter the embryo sac ?

(+4, -1)

- a. Egg cell
- b. Central cell
- c. Persistent synergid
- d. Degenerated synergid



Botany Section B

186. Which one is wrongly matched ? (+4, -1)

- a. Unicellular organism - Chlorella
- b. Uniflagellate gametes - Polysiphonia
- c. Gemma cups - Marchantia
- d. Biflagellate zoospores - Brown algae

187. Roots play insignificant role in absorption of water in (+4, -1)

- a. pea
- b. wheat
- c. sunflower
- d. Pistia.

188. Anthesis is a phenomenon which refers to (+4, -1)

- a. formation of pollen
- b. Development of anther
- c. Opening of flower bud
- d. Reception of pollen by stigma

189. Which of the following pairs is of unicellular algae ? (+4, -1)

- a. Laminaria and Sargassum
- b. Gelidium and Gracilaria
- c. Anabaena and Volvox

d. Chlorella and Spirulina

190. The correct floral formula of chilli is :

(+4, -1)

a. $\oplus \overline{\sigma} K_5 C_5 A_{(5)} \underline{G}_2$,

b. $\oplus \overline{\sigma} K_{(5)} C_5 A_5 \underline{G}_{(2)}$

c. $\oplus \overline{\sigma} K_{(5)} \overline{C}_{(5)} A_5 \underline{G}_{(2)}$

d. $\oplus \overline{\sigma} K_5 C_{(5)} A_{(5)} \underline{G}_2$

191. In which of the following fruits is the edible part the aril?

(+4, -1)

- a. Custard apple
- b. Pomegranate
- c. Orange
- d. Litchi

192. Which of the following is responsible for peat formation?

(+4, -1)

- a. Marchantia
- b. Riccia
- c. Funaria

d. Sphagnum

193. The correct floral formula of soyabean is

(+4, -1)

a. $\% \begin{array}{c} \nearrow \\ \text{♂} \end{array} K_5 C_{1+(2)+2} A_{(9)+1} \underline{G}_1$

b. $\% \begin{array}{c} \nearrow \\ \text{♀} \end{array} K_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$

c. $\% \begin{array}{c} \nearrow \\ \text{♀} \end{array} K_{(5)} C_{1+2+(2)} A_{1+(9)} \underline{G}_1$

d. $\% \begin{array}{c} \nearrow \\ \text{♀} \end{array} K_{(5)} C_{1+(2)+2} A_{(9)+1} \bar{G}_1$

194. What would be the number of chromosomes in the cells of the aleurone layer in a plant species with 8 chromosomes in its synergids?

(+4, -1)

a. 16

b. 24

c. 32

d. 8

195. In pteridophytes, main plant body is a , which is into true roots, stem and leaves. Fill the blanks in above statement and select the correct option.

(+4, -1)

a. a

b. b

c. c

d. d

196. Which one of the following plants shows vexillary aestivation and diadelphous stamens? (+4, -1)

a. *Colchicum autumnale*

b. *Pisum sativum*

c. *Allium cepa*

d. *Solanum nigrum*

197. Pineapple (ananas) fruit develops from: (+4, -1)

a. a unilocular polycarpellary flower

b. a multi pistillate syncarpous flower

c. a cluster of compactly borne flowers on a common axis

d. a multilocular monocarpellary flower

198. Male and female gametophytes are independent and free-living in (+4, -1)

a. *Castor*

b. *Pinus*

c. *Sphagnum*

d. *Mustard*

199. The flowers are Zygomorphic in: (+4, -1)

- a. Mustard
- b. Gulmohar
- c. Cassia
- d. Datura
- e. Chilli

Choose the correct answer from the options given below:

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

200. Metagenesis refers to

(+4, -1)

- a. occurrence of a drastic change in form during post-embryonic development
- b. presence of a segmented body and partheno- genetic mode of reproduction
- c. presence of different morphic forms
- d. alternation of generation between asexual and sexual phases of an organism.

Answers

1. Answer: b

Explanation:

The correct answer is (b): $12.56 \times 10^{-2} \text{ T}$

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.

2. Answer: a

Explanation:

The correct answer is (a).

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 –

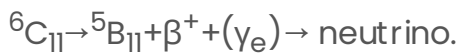
The units of all other physical quantities which are derived from the fundamental units are called the derived units.

3. Answer: c

Explanation:

Correct option is C)

In (β^+) decay, a proton decays into a neutrino. For the given reaction, the particle X is a neutrino.



4. Answer: a

Explanation:

The formula for the torque on A (τ) = $mg(\frac{l}{2})$

We are aware of that. $\tau = (\frac{ml^2}{2}) \times \alpha = \frac{(mgl)}{2}$

$$\alpha = \frac{3g}{2l}$$

The appropriate answer is (A): $\frac{3g}{2l}$

Concepts:

1. Electric charges and field:

What is Electric Charge

It is the property of subatomic particles that experiences a force when put in an electric and **magnetic field**.

What is Electric Field

It is a property associated with each point in space when **charge** is present in any form. The magnitude and direction of the **electric field** are expressed by E , called electric field strength or electric field intensity.

Electric charges are of two types: Positive and Negative. It is commonly carried by charge carriers protons and **electrons**.

Properties of Electric Charge

Various properties of charge include the following :-

- Additivity of Electric Charge
- **Conservation of Electric Charge**
- Quantization of Electric Charge

Types of electric charge

Two kinds of electric charges are there :-

Negative Charge - When an object has a negative charge it means that it has more electrons than protons.

Positive Charge - When an object has a positive charge it means that it has more protons than electrons.

When there is an identical number of positive and negative charges, the negative and positive charges would cancel out each other and the object would become neutral.

5. Answer: a

Explanation:

Mass of first body = m ;

Mass of second body = $4m$ and $KE_1 = KE_2$.

Linear momentum of a body

$$p = \sqrt{2mE} \sqrt{m}.$$

$$\text{Therefore } \frac{p_1}{p_2} = \sqrt{\frac{m_1}{m_2}} = \sqrt{\frac{m}{4m}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$$

or $p_1 : p_2 = 1 : 2$.

6. Answer: a

Explanation:

Both are in parallel.

$$\frac{1}{R'} = \frac{2}{R} + \frac{2}{R} = \frac{4}{R} \Rightarrow R' = \frac{R}{4}.$$

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](#).

7. Answer: b

Explanation:

Here, $R_P = 2R_E$, $\rho_E = \rho_P$

Escape velocity of the earth,

$$V_E = \sqrt{\frac{2GM_E}{R_E}} = \sqrt{\frac{2G}{R_E} \left(\frac{4}{3}\pi R_E^3 \rho_E \right)} = R_E \sqrt{\frac{8}{3}\pi G \rho_E} \dots (i)$$

Escape velocity of the planet

$$V_P = \sqrt{\frac{2GM_P}{R_P}} = \sqrt{\frac{2G}{R_P} \left(\frac{4}{3}\pi R_P^3 \rho_P \right)} = R_P \sqrt{\frac{8}{3}\pi G \rho_P} \dots (ii)$$

Divide (i) by (ii), we get

$$\frac{V_E}{V_P} = \frac{R_E}{R_P} \sqrt{\frac{\rho_E}{\rho_P}}$$

$$\frac{V_E}{V_P} = \frac{R_E}{2R_E} \sqrt{\frac{\rho_E}{\rho_E}} = \frac{1}{2}$$

or $V_P = 2V_E$

Concepts:

1. Gravitation:

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

Newton's Law of Gravitation

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

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

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

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

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

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

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

8. Answer: d

Explanation:

Third overtone has a frequency $4n$, 4^{th} harmonic = three full loops + one half loop, which would make four nodes and four antinodes.

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: a

Explanation:

Given,

Normal initial velocity, $v_i = -10 \sin 60^\circ$

Normal final velocity, $v_f = 10 \sin 60^\circ$

Change in momentum, $\Delta P = m(v_f - v_i) = 3[10 \sin 60^\circ - (-10 \sin 60^\circ)] =$

\$\$

51.96 Ns ⁻¹

\$\$

Force, $F = \frac{\Delta P}{\Delta t} = \frac{51.96}{0.2} = 150\sqrt{3}N$

Hence, force is $150\sqrt{3}N$

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.

10. Answer: d

Explanation:

$$\begin{aligned}3 &= 2\pi\sqrt{\frac{m}{k}} \\5 &= 2\pi\sqrt{\frac{m+1}{k}} \\ \frac{3}{5} &= \sqrt{\frac{m}{m+1}} \\ \frac{9}{25} &= \frac{m}{m+1} \\ 9m + 9 &= 25m \\ 16m &= 9 \\ m &= \frac{9}{16}\end{aligned}$$

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.

11. Answer: b

Explanation:

When an electric dipole is placed in a uniform electrical field $\vec{E}$, the torque on the dipole is given by $\vec{\tau} = \vec{p} \times \vec{E}$

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.

12. Answer: b

Explanation:

For the mass m , $mg - T = ma$

As we know, $a = R\alpha$

So, $mg - T = mR\alpha$ (i)

Torque about centre of pulley

$TxR = mR^2\alpha$ (ii)

From Eqs. (i) and (ii), we get, $a = g/2$

Hence, the acceleration with the mass of a body fall is $g/2$.

13. Answer: a

Explanation:

For equilibrium,

$$mg \sin 30^\circ = I/B \cos 30^\circ$$

$$I = \frac{mg}{B} \tan 30^\circ$$

$$= \frac{0.5 \times 9.8}{0.25 \times \sqrt{3}}$$

$$= 11.32 \text{ A}$$

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.

14. Answer: c

Explanation:

Displacement (s) $t^3 - 6t^2 + 3t + 4$ metres.

velocity (v) $= \frac{ds}{dt} = 3t^2 - 12t + 3$

acceleration (a) $= \frac{dv}{dt} = 6t - 12$

When $a = 0$, we get $t = 2$ seconds.

Therefore velocity when the acceleration is zero

$(v) = 3 \times (2)^2 - (12 \times 2) + 3 = -9 \text{ m/s}.$

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.

15. Answer: a

Explanation:

The component of velocity of man in opposite direction of the flow is $0.5 \times$

$$\cos(180^\circ - 120^\circ) = 0.25m/s$$

so the velocity of flow(stream) will also be $0.25m/s$ so that the person can oppose the stream and in result he will not be drifted by the stream and will reach directly opposite side.

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

16. Answer: a

Explanation:

$$\begin{aligned} \frac{\sin e}{\sin 30^\circ} &= \sqrt{3} \\ \Rightarrow \sin e &= \frac{\sqrt{3}}{2} \\ \Rightarrow e &= 60^\circ \end{aligned}$$

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](#)

17. Answer: a

Explanation:

The energy of the electron in the n^{th} orbit is

$$E = E \propto Z^2 \frac{1}{n^2}$$

Given, $Z_H = 1, Z_{He} = 2$

$$\therefore \frac{E_H}{E_{He}} = \frac{Z_H^2}{Z_{He}^2} = \frac{1}{4}$$

$$\Rightarrow E_{He} = 4E_H$$

Given, $E_H = E_n$

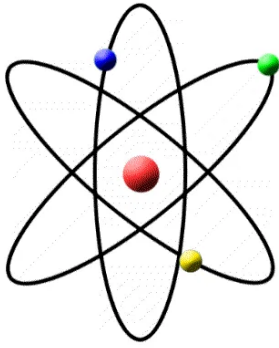
$$\therefore E_{He} = 4E_n$$

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 a 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.

18. Answer: b**Explanation:**

For electromagnetic wave

$$\vec{v}_{\text{wave}} = \vec{E} \times \vec{B}$$

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.

19. Answer: d

Explanation:

Copper is a conductor so its resistance decreases on decreasing temperature as thermal agitation decreases whereas germanium is semiconductor which on decreasing temperature resistance increases.

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.
-

20. Answer: a

Explanation:

The kinetic energy of an electron

$$\frac{1}{2} \times mv^2 = eV$$

or final velocity of electron (v) = $\sqrt{\frac{2eV}{m}}$.

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.

21. Answer: c

Explanation:

Magnetic retentivity determines the magnetism left in the material after the magnetizing field has been switched off. Electromagnets are operated in conditions requiring fast reversal of polarity, so high retentivity is undesirable.

Susceptibility determines to what extent the material responds to the applied field. This means it determines the extent to which the material will be magnetized when a field of given strength is applied. Therefore, electromagnets must be made of materials having high susceptibility and low retentivity. Soft iron is such a material.

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.
-

22. Answer: c

Explanation:

The correct answer is (c). $\sqrt{2}$ times the rms value of the ac source

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.

23. Answer: a

Explanation:

The correct answer is (a). $36 \times 10^7 \text{ J}$

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.

24. Answer: d

Explanation:

The correct answer is (d).

$55.3 \times 25 = \text{-----}$

3 SF 2 SF 2 SF

Option (4) 2 SF

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.

25. Answer: d

Explanation:

The correct option is (D): $8\mu\text{J}$

$$\text{Energy} = \frac{1}{2} Li^2$$

$$= \frac{1}{2} \times 4 \times 10^{-6} \times 2^2$$

$$= 8 \times 10^{-6} \text{ J}$$

$$\text{Energy} = 8\mu\text{J}$$

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.
-

26. Answer: b

Explanation:

The correct option is (B): 27°C

The efficiency of Carnot engine,

$$\% \eta = \left(1 - \frac{T_{\text{sink}}}{T_{\text{source}}} \right) \times 100$$

$$T_{\text{source}} = 327^\circ \text{C} = 600 \text{K}$$

$$50 = \left(1 - \frac{T_{\text{sink}}}{600} \right) \times 100$$

$$\frac{1}{2} = 1 - \frac{T_{\text{sink}}}{600}$$

$$T_{\text{sink}} = 300 \text{K}$$

So the temperature of the sink is = 327 - 300 = 27°C

27. Answer: a

Explanation:

The correct option is (A): 10^5B . Applying conservation of mass n and charge no.
 $A + 1 = 4 + 7$ $Z + 0 = 2 + 3$ $\Rightarrow A = 10$ And $Z = 5$ so, element = 10^5B .

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

28. Answer: b

Explanation:

Total flux passing through the close cube $\phi = \frac{q}{\epsilon_0}$

All six surfaces exhibit symmetry with respect to the charge, resulting in an equal contribution to the flux. Consequently, the flux through any single face is:

$$\phi = \frac{\phi}{6} = \frac{q}{6\epsilon_0}$$

$$\phi_{face} = \frac{q}{6\epsilon_0} = \frac{4\pi q}{6(4\pi\epsilon_0)}$$

So, the correct option is (B): $\frac{4\pi q}{6(4\pi\epsilon_0)}$

Concepts:

1. Gauss Law:

Gauss law states that the total amount of [electric flux](#) passing through any closed surface is directly proportional to the enclosed [electric charge](#).

Gauss Law:

According to the Gauss law, the total flux linked with a closed surface is $1/\epsilon_0$ times the charge enclosed by the closed surface.

$$\oint \vec{E} \cdot d\vec{s} = \frac{1}{\epsilon_0} q$$

For example, a point charge q is placed inside a cube of edge 'a'. Now as per Gauss law, the flux through each face of the cube is $q/6\epsilon_0$.

Gauss Law Formula:

As per the Gauss theorem, the total charge enclosed in a closed surface is proportional to the total flux enclosed by the surface. Therefore, if ϕ is total flux and ϵ_0 is electric constant, the total [electric charge](#) Q enclosed by the surface is;

$$Q = \phi \epsilon_0$$

The Gauss law formula is expressed by;

$$\phi = Q/\epsilon_0$$

Where,

Q = total charge within the given surface,

ϵ_0 = the electric constant.

29. Answer: b

Explanation:

Work done by force = Area under force displacement graph.

$$= 3 \times 3 + \frac{1}{2} \times 3 \times 3 = 9 + 4.5 = 13.5 J$$

30. Answer: a

Explanation:

According to question $R = \frac{r}{n}$

$$\Rightarrow r = nR$$

$$R_{\text{series}} = nr = n^2 R$$

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](#).

31. Answer: a

Explanation:

The minimum speed with which the particle should be projected from the surface of the earth so that it does not return back is known as escape speed and it is given by

$$V_e = \sqrt{\frac{2GM}{(R+h)}}$$

Here, $h = 3R$

$$\begin{aligned} \therefore v_e &= \sqrt{\frac{2GM}{(R+3R)}} = \sqrt{\frac{2GM}{4R}} = \sqrt{\frac{GM}{2R}} \\ &= \sqrt{\frac{gR}{2}} \left(\because g = \frac{GM}{R^2} \right) \end{aligned}$$

Concepts:

1. Gravitation:

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

Newton's Law of Gravitation

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

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

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

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

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

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

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

32. Answer: b

Explanation:

The force equations are

$$T - 5g = 5a,$$

$$10g - T = 10a$$

$$\text{Adding, } 10g - 5g = 15a$$

$$\text{or, } a = \frac{5g}{15} = \frac{g}{3}.$$

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.

33. Answer: c

Explanation:

For a simple harmonic motion between A and B, with O as the mean position, maximum kinetic energy of the particle executing SHM will be at O and maximum

potential energy will be at A and B.

∴ Displacement between maximum potential energy and maximum kinetic energy is $\pm a$

Concepts:

1. Oscillations:

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

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

Read More: [Simple Harmonic Motion](#)

Oscillation- Examples

The tides in the sea and the movement of a simple pendulum of the clock are some of the most common examples of oscillations. Some of 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.

34. Answer: b

Explanation:

$$y_1 = 4 \sin 500\pi t \text{ and } y_2 = 2 \sin 506\pi t.$$

$$\omega_1 = 500\pi, \omega_1 = 2\pi\nu, \nu_1 = 250, \nu_2 = 253$$

$$\text{Number of beats per minute} = 3 \times 60 = 180.$$

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

35. Answer: a**Explanation:**

If the resistance of the meter is G then the full scale deflection current

$$i_g = \frac{25mV}{G} \text{ ampere}$$

The Value of shunt required for converting it into ammeter of range 25 ampere is

$$S = \frac{i_g G}{i - i_g}$$

$$\text{So } \approx \frac{25mV}{25} = 0.001 \Omega$$

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.

36. Answer: d**Explanation:**

Force of attraction between the plates of the parallel plate air capacitor is

$$F = \frac{Q^2}{2\epsilon_0 A}$$

where Q is the charge on the capacitor, ϵ_0 is the permittivity of free space and A is the area of each plate.

But $Q = CV$ and

$$C = \frac{\epsilon_0 A}{d} \text{ or } \epsilon_0 A = Cd$$

$$\therefore F = \frac{C^2 V^2}{2Cd} = \frac{CV^2}{2d}$$

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.

37. Answer: d

Explanation:

Let u and v be the first and final velocities of particle and a and s be the constant acceleration and distance covered by it. From third equation of motion

$$v^2 = u^2 + 2as$$

$$\Rightarrow (20)^2 = (10)^2 + 2a \times 135$$

$$\text{or } a = \frac{300}{2 \times 135} = \frac{10}{9} \text{ ms}^{-2}$$

Now using first equation of motion,

$$v = u + at$$

$$\text{or } t = \frac{v-u}{a} = \frac{20-10}{(10/9)} = \frac{10 \times 9}{10} = 9s$$

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.

38. Answer: a

Explanation:

$$\vec{L} = \vec{r} \times \vec{p}$$

Y + X + 4 line has been shown in the figure.

Y=4, So OP=4,

The slope of the line can be obtained by comparing with the equation of line

$$y = mx + c$$

$$m = \tan \theta = 1 \Rightarrow \theta = 45^\circ$$

$$\angle OQP = \angle OPQ = 45^\circ$$

If we draw a line perpendicular to this line.

Length of the perpendicular = OR

$$\Rightarrow OR = OP \sin 45^\circ$$

$$= 4 \frac{1}{\sqrt{2}} = \frac{4}{\sqrt{2}} = 2\sqrt{2}$$

Angular momentum of particle going along this line

$$= r \times mv = 2\sqrt{2} \times 5 \times 3\sqrt{2} = 60 \text{ units}$$

39. Answer: a

Explanation:

The equation of trajectory is

$$y = x \tan \theta - \frac{gx^2}{2u^2 \cos^2 \theta}$$

where θ is the angle of projection and u is the velocity with which projectile is projected.

For equal trajectories and for same angles of projection,

$$\frac{g}{u^2} = \text{constant.}$$

$$\text{As per, question, } \frac{9.8}{5^2} = \frac{g'}{3^2}$$

where g' is acceleration due to gravity on the planet.

$$g' = \frac{9.8 \times 9}{25} = 3.5 \text{ ms}^{-2}$$

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

40. Answer: c

Explanation:

$$\frac{f_a}{f_e} = \frac{\left(\frac{\mu_g}{\mu_l} - 1\right)}{(\mu_g - 1)} = \frac{\left(\frac{1.5}{1.25} - 1\right)}{1.5 - 1} = \frac{\frac{1}{5}}{\frac{1}{2}} = \frac{2}{5}$$

$$f_e = \frac{5}{2} f_a = \frac{5}{2} \times 2 = 5 \text{ cm}$$

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](#)

41. Answer: a

Explanation:

Energy of the projectile is the potential energy at closest approach, $= \frac{1}{4\pi\epsilon_0} \frac{Z_1 Z_2}{r_0}$
Therefore energy $\propto Z_1 Z_2$.

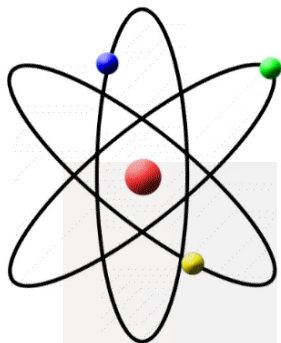
Concepts:

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.

42. Answer: b

Explanation:

$$\lambda = \frac{3 \times 10^8}{100 \text{ Hz}} = 3 \times 10^6 \text{ m}$$

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.

43. Answer: a

Explanation:

$$I_1 = \frac{15}{1 \text{ k}\Omega} = 15 \text{ mA}$$

$$I = \frac{20 - 15}{250} = 20 \text{ mA}$$

$$I_2 = I - I_1 = 20 \text{ mA} - 15 \text{ mA} = 5 \text{ mA}$$

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.

44. Answer: c

Explanation:

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{m_0}{\frac{c^2 - (0.8c)^2}{c^2}} = \frac{5m_0}{3}$$

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](#).

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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.

45. Answer: c

Explanation:

The direction of magnetic dipole moment is from south to north pole of the magnet. In configuration (1),

In configuration (2),

In configuration (3),

In configuration (4),

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.

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Read More: [Magnetism and Matter](#)

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- 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.
-

46. Answer: b

Explanation:

The correct answer is (B): $v_0 = v = \frac{50}{\pi}$ Hz

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.

47. Answer: d

Explanation:

We know that,

$$\rho = \frac{M}{V}$$

$$\rho = \frac{M}{\pi r^2 l}$$

$$\frac{\Delta \rho}{\rho} = \frac{\Delta M}{M} + \frac{2\Delta r}{r} + \frac{\Delta l}{l}$$

$$\frac{\Delta \rho}{\rho} \% = \left[\frac{0.002}{0.4} + \frac{2(0.001)}{0.3} + \frac{0.02}{5} \right] \times 100$$

$$\frac{\Delta \rho}{\rho} \% = \frac{1}{2} \% + \frac{2}{3} \% + \frac{2}{5} \%$$

$$\frac{\Delta \rho}{\rho} \% = 1.6\%$$

So, the correct option is (D): 1.60%

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.

48. Answer: b

Explanation:

The correct option is (B): Zero

Magnetic field exist in closed loops.

$$\oint \vec{B} \cdot d\vec{A} = 0$$

(Gauss law for magnetism)

49. Answer: c

Explanation:

The correct answer is option (C): $\frac{13}{5}t$

Concepts:

1. Newton's Law of Cooling:

Newton's law of cooling states that the rate of heat loss from a body is directly proportional to the difference in temperature between the body and its surroundings.

Derivation of Newton's Law of Cooling

Let a body of mass m , with specific heat capacity s , is at temperature T_2 and T_1 is the temperature of the surroundings.

If the temperature falls by a small amount dT_2 in time dt , then the amount of heat lost is,

$$dQ = ms dT_2$$

The rate of loss of heat is given by,

$$dQ/dt = ms (dT_2/dt) \quad \dots\dots(2)$$

Compare the equations (1) and (2) as,

$$-ms (dT_2/dt) = k (T_2 - T_1)$$

Rearrange the above equation as:

$$dT_2/(T_2 - T_1) = - (k / ms) dt$$

$$dT_2 / (T_2 - T_1) = - K dt$$

where $K = k/ms$

Integrating the above expression as,

$$\log_e (T_2 - T_1) = - K t + c$$

or

$$T_2 = T_1 + C' e^{-Kt}$$

where $C' = ec$

50. Answer: a

Explanation:

The correct option is (A): $c = b - 12$, $d = a - 5$. Initially, the species a^b emits a positron, which reduces the atomic number (a) by 1. Then, it emits two alpha particles (2α), reducing the atomic number (a) by 8. It also emits two beta particles (2β), reducing the atomic number (a) by 2. Finally, it emits one more alpha particle (1α), reducing the atomic number (a) by 4. So, the overall change in atomic number (a) is $-1 - 8 - 2 - 4 = -15$, which is equivalent to $d = a - 5$. Since the species ends up as a stable c^d , the final atomic number (c) must be 12 less than the initial atomic number (b), which is represented by $c = b - 12$.

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](#)

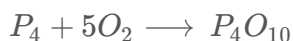
Following are the terms related to nucleus:

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

51. Answer: b

Explanation:

Out of P, Na, S and Cl, chlorine does not react directly but Na, P and S react with oxygen directly.



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

52. Answer: b

Explanation:

Enzymes are made up of protein with specific structure and acts as a catalyst for biochemical reactions.

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.

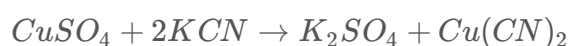
1. **Carbohydrates** are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
2. **Proteins** are another class of indispensable biomolecules, which make up around 50 per cent of the cellular dry weight. Proteins are polymers of amino acids arranged in 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.

53. Answer: b

Explanation:

$CuSO_4$ reacts with KCN to give a white precipitate of cuprous cyanide and cyanogen gas.

The cuprous cyanide dissolves in excess of KCN forming $K_3[Cu(CN)_4]$



\$\hspace{57mm}\$ Unstable \$\hspace{57mm}\$



\$\hspace{30mm}\$ Insoluble \$\hspace{30mm}\$, \$\hspace{30mm}\$, cyanogen \$\hspace{30mm}\$



\$\hspace{45mm}\$ Soluble \$

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.

54. Answer: c

Explanation:

Root mean square speed is given by the expression

$$U_{rms} = \sqrt{\frac{3RT}{M}} \quad [\text{because } M = mN]$$

$$U_{rms} \sqrt{\frac{1}{m}} \Rightarrow U_{rms} \propto (m)^{-1/2}$$

Concepts:

1. States of Matter:

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

There are three States of Matter:

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

Solid State:

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

Liquid State:

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

Gaseous State:

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

55. Answer: b

Explanation:

The correct option is(A): 1×10^{-12} .

$$[H_3O^+] = 1 \times 10^{-6} \text{ mol L}^{-1}$$

$$\text{or } [H^+] = 1 \times 10^{-6} \text{ mol L}^{-1}$$

As for distilled water $[H^+] = [OH^-]$

$$[H^+] = [OH^-] = 1 \times 10^{-6} \text{ mol L}^{-1}$$

$$\begin{aligned} K_w &= [H^+][OH^-] \\ &= 10^{-12} \text{ mol}^2 \text{ L}^{-2}. \end{aligned}$$

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](#)

56. Answer: a

Explanation:

Average of atomic weight

$$\begin{aligned} & \% \text{ of } B \times \text{atomic mass of } ^{10}\text{B} + \% \text{ of } ^{11}\text{B} \\ & \$ = \frac{\{ \times \text{atomic mass of } ^{11}\text{B} \} \{ \% \text{ of } ^{10}\text{B} + \% \text{ of } ^{11}\text{B} \}}{19 \times 10 + 81 \times 11} \\ & \frac{190 \times 891}{100} = 10.81 \end{aligned}$$

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.

57. Answer: b

Explanation:

By Kohlrausch's law

$\lambda_{\infty} \text{ for NaCl} = \lambda_{\infty} \{Na^+\} + \lambda_{\infty} \{Cl^-\}$ (i)

$\lambda_{\infty} \text{ for HCl} = \lambda_{\infty} \{H^+\} + \lambda_{\infty} \{Cl^-\}$ (ii)

$\lambda_{\infty} \text{ for } C_2H_5COONa = \lambda_{Na^+} + \lambda_{C_2H_5COO^-}$... (iii)

So, $\lambda_{\infty} \text{ for } C_2H_5COOH$

On adding Eqs. (ii) and (iii) and then subtracting

E (i)

$= \lambda_{\infty} \text{ of } C_2H_5COONa + \lambda_{\infty} \text{ of HCl}$

$-\lambda_{\infty} \text{ for NaCl}$

$= (91 + 426.16 - 126.45) \Omega^{-1} \text{ cm}^2$

$= 390.71 \Omega^{-1} \text{ cm}^2$

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.

58. Answer: b

Explanation:

$$\log \left(\frac{K_2}{K_1} \right) = \frac{E}{2.303R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$E_a = 0$$

$$\log \left(\frac{K_2}{K_1} \right) = 0$$

$$\frac{K_2}{K_1} = 10^0 = 1$$

$$\Rightarrow K_2 = K_1$$

$$K_2 = 1.6 \times 10^6 s^{-1} \text{ at } 400K$$

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.

59. Answer: c

Explanation:

Osmotic pressure is used to calculate the molar mass of such substances

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.

60. Answer: d

Explanation:

ΔH = dissociation energy of reactant – Bond dissociation of energy of product.

$$\begin{aligned}\Delta H &= (606.10 + 4 \times 410.5 + 431.37) - (6 \times 410.50 + 336.49) \\ &= -120.0 \text{ kJ/mol}\end{aligned}$$

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.

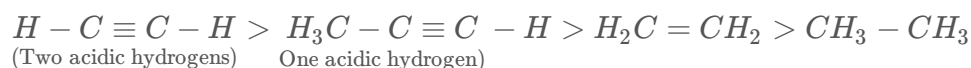
Third Law of Thermodynamics

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.

61. Answer: a

Explanation:

Correct order is



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.

62. Answer: c

Explanation:

Hence, 3-bromopentane is not a chiral molecule due to absence of chiral C-atom.

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.

63. Answer: a

Explanation:

For a compound to be aromatic, it must have $(4n + 2)\pi$ electrons.

Here two double bonds are present, 4π electrons are present in the compound.

Therefore, it is anti-aromatic.

Homocyclic compounds are ring structures that consist only of carbon atoms within the ring. A nitro group is attached to the ring system as a substituent, so, $C_6H_7NO_2$ is homocyclic but not aromatic.

64. Answer: a

Explanation:

Due to lanthanide contraction $4d$ and $5d$ series of elements have almost same atomic radii.

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](#)

65. Answer: d

Explanation:

In Rosenmund reaction, acid chloride reacts with H_2 in the presence of $Pd/BaSO_4$ to yield aldehyde.

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.

66. Answer: d

Explanation:

C-O bond cleavage of ether depends on mechanism involved in reaction which can be SN^1 or SN^2 . If any one group can form stable carbocation like tertiary butyl group then reaction follow's SN^1 mechanism

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](#)

67. Answer: c

Explanation:

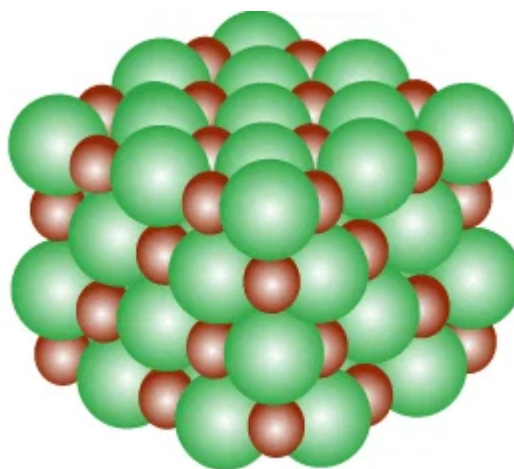
$$\text{For } BCC \text{ lattice : } Z = 2, a = \frac{4r}{\sqrt{3}} \quad \text{For } FCC \text{ lattice : } Z = 4, a = 2\sqrt{2}r \therefore \frac{d_{25^\circ C}}{d_{900^\circ C}} = \frac{\left(\frac{ZM}{N_A a^3}\right)_{BCC}}{\left(\frac{ZM}{N_A a^3}\right)_{FCC}} =$$

$$\frac{2}{4} \left(\frac{2\sqrt{2}r}{\frac{4r}{\sqrt{3}}}\right)^3 = \left(\frac{3\sqrt{3}}{4\sqrt{2}}\right)$$

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.

68. Answer: a

Explanation:

Element (X) electronic configuration $1s^2 2s^2 2p^3$ So, valency of X will be 3 . Valency of Mg is 2 . Formula of compound formed by Mg and X will be Mg_3X_2

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.

69. Answer: d

Explanation:

– $> [BeO < MgO < CaO < BaO]$ [Basic character increases.] So, the most acidic should be BeO . In fact, BeO is amphoteric oxide while other given oxides are basic.

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.

70. Answer: c

Explanation:

The correct option is (C) : Mn

Each of the elements in groups IIIB to VIIB can show the Maximum oxidation equal to its group number. Mn shows a Maximum number of oxidation states on the basis of the following electronic configuration. $25_Mn = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^2 (+7)$

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.

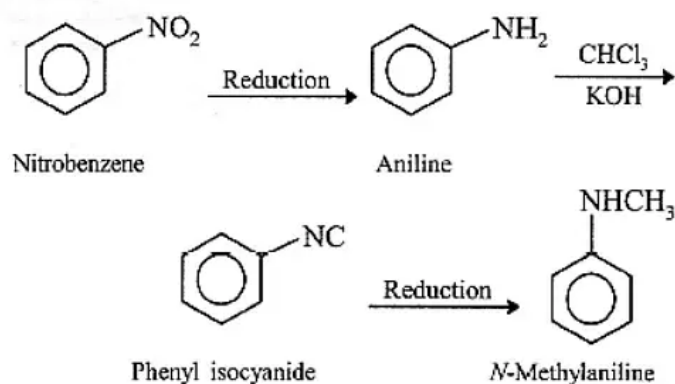
Oxidation number or oxidation state of an atom or ion in a molecule/ion is assigned by:

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.

71. Answer: b

Explanation:

'C' must be an isocyanide, which is derived from a primary amine through the Carbylamine reaction ($CHCl_3 + KOH$). Additionally, the primary amine must be produced through the reduction of a nitro hydrocarbon. Therefore, 'A' is nitrobenzene.



So, the correct option is (B).

Concepts:

1. Amines:

[Amine](#) is a type of compound which is derived from ammonia (NH_3). According to Organic chemistry, they are basically classified as the functional groups of the organic nitrogen compounds that contain nitrogen atoms with a lone pair.

Amine – Types

Primary Amines:

It is formed when one hydrogen atom in ammonia is substituted by an alkyl or aromatic group. Amino acids and methyl amine are the best examples that why aromatic amines include aniline.

Secondary Amines:

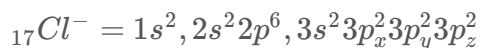
Amines that have two organic substitutes either alkyl or aryl ones or both and are bound to the nitrogen together with one hydrogen are termed as secondary amines. For Example, Dimethylamine.

Tertiary Amines:

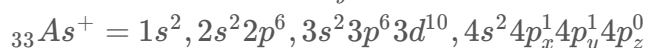
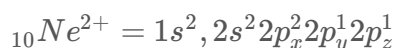
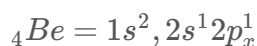
Tertiary Amines are the amines where the nitrogen consists of three organic substitutes. For example, Trimethylamine and EDTA.

72. Answer: a**Explanation:**

Paramagnetic character is based upon presence of unpaired electron



In Cl^- no unpaired electron, so diamagnetic.



While all others have unpaired electron, so paramagnetic in nature.

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

73. Answer: a

Explanation:

By Heisenberg's uncertainty principle

$$15mm\Delta x \times \Delta p \geq \frac{h}{4\pi}$$

$$\text{or } 10mm\Delta x \times (mv_x) \geq \frac{h}{4\pi}$$

$$15mm\Delta x \times \Delta v_x \geq \frac{h}{4\pi m}$$

Δp = uncertainty in momentum

Δx = uncertainty in position

Δv = uncertainty in velocity

m = mass of particle

Given that,

$$\Delta x = 0.1\text{\AA} = 0.1 \times 10^{-10}m$$

$$m = 9.11 \times 10^{-31}kg$$

$$h = \text{Planck's constant} = 6.626 \times 10^{-34}$$

$$n = 3.14$$

Thus,

$$\Delta v \times 0.1 \times 10^{-10} = \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 9.11 \times 10^{-31}}$$

$$\Delta v = \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 9.11 \times 10^{-31} \times 0.1 \times 10^{-10}} ms^{-1}$$

$$= 5.785 \times 10^6 ms^{-1} = 5.79 \times 10^6 ms^{-1}$$

Concepts:

1. Structure of Atom:

Atomic Structure:

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

Dalton's Atomic Theory

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

The following are the postulates of his theory:

- Every matter is made up of atoms.
- Atoms are indivisible.
- Specific elements have only one type of atoms in them.
- Each atom has its own constant mass that varies from element to element.
- [Atoms](#) undergo rearrangement during a chemical reaction.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

Cons of Dalton's Atomic Theory

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

Subatomic Particles

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

Atomic Structure of Isotopes

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

74. Answer: b

Explanation:

In the hydrides of group number five, the boiling points changes as

$$238.5\text{ K} > 185.5\text{ K} > 254.6\text{ K} > 254.6\text{ K} > 290\text{ K}$$

$$\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$$

∴ Generally mass increases then boiling point increases.

The higher boiling point of NH_3 is due to excessive hydrogen bonding, so PH_3 have lowest boiling point among hydrides of group number 15, i.e. nitrogen family.

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
-

75. Answer: d

Explanation:

In the silver plating of copper, $K[Ag(CN)_2]$ is used instead of $AgNO_3$. The reason is less availability of Ag^+ ions, as Cu cannot displace Ag from $[Ag(CN)_2]^-$ ion.

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.

76. Answer: a

Explanation:

Thyroxine is an amine hormone which is secreted by thyroid gland.

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.

77. Answer: d

Explanation:

Gases can be liquefied by lowering the temperature and increasing the pressure. An ideal gas has no intermolecular force of attraction, so it cannot be liquefied by applying high pressure and decreasing temperature.

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.

78. Answer: d

Explanation:

Answer (d) 6.13

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](#)

79. Answer: d

Explanation:



According to Kohlrausch's law-

$$\lambda_{\text{CH}_3\text{COOH}}^\circ = \lambda_{\text{CH}_3\text{COO}^-}^\circ + \lambda_{\text{H}^+}^\circ$$

$$e(1) = eq.(4) + eq.(2) - eq.(3)$$

$$\therefore \lambda_{\text{CH}_3\text{COOH}}^\circ = z + \frac{X}{2} - \frac{Y}{2}$$

$$\lambda_{\text{CH}_3\text{COOH}}^\circ = \frac{(X-Y)}{2} + z(S \times \text{cm}^2 \text{mol}^{-1})$$

Concepts:

1. Electrochemical Cells:

An [electrochemical cell](#) is a device that is used to create electrical energy through the chemical reactions which are involved in it. The electrical energy supplied to

electrochemical cells is used to smooth the chemical reactions. In the electrochemical cell, the involved devices have the ability to convert the chemical energy to electrical energy or vice-versa.

Classification of Electrochemical Cell:

Cathode

- Denoted by a positive sign since electrons are consumed here
- A reduction reaction occurs in the cathode of an electrochemical cell
- Electrons move into the cathode

Anode

- Denoted by a negative sign since electrons are liberated here
- An oxidation reaction occurs here
- Electrons move out of the anode

Types of Electrochemical Cells:

Galvanic cells (also known as Voltaic cells)

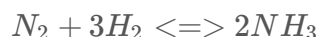
- Chemical energy is transformed into electrical energy.
- The redox reactions are spontaneous in nature.
- The anode is negatively charged and the cathode is positively charged.
- The electrons originate from the species that undergo oxidation.

Electrolytic cells

- Electrical energy is transformed into chemical energy.
- The redox reactions are non-spontaneous.
- These cells are positively charged anode and negatively charged cathode.
- Electrons originate from an external source.

80. Answer: a

Explanation:



Rate of reaction is given as

$$-\frac{d[N_2]}{dt} = -\frac{1}{3} \frac{d[H_2]}{dt} = +\frac{1}{2} \frac{d[NH_3]}{dt}$$

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.
-

81. Answer: a

Explanation:

Osmotic pressure is the best method for the determination of molar mass of proteins and polymers. Because a small amount of solute will produce a much larger change in this quantity than in the boiling point, freezing point, or vapor pressure. even a 10⁻⁶ molar solution would have a measurable osmotic pressure. Molecular weight determinations are very frequently made on proteins or other high molecular weight polymers. These substances, owing to their large molecular size, tend to be only sparingly soluble in most solvents, so measurement of osmotic pressure is often the only practical way of determining their molecular weights.

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.

82. Answer: c

Explanation:

$\therefore$ 0.33% of iron by weight means 100 g of haemoglobin has 0.33 g of iron
 100 g of haemoglobin contains iron = 0.33 g
 $\therefore$ 67200g of haemoglobin contains iron
 $= \frac{0.33 \times 67200}{100} \text{ g} = 221.76 \text{ g of Fe}$
 Number of Fe-atoms $\frac{221.76}{56}$
 $= 3.96 \approx 4$

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:

- Solids** – have definite volume and definite shape
- Liquids – have definite volume but not definite shape.
- Gases – have neither definite volume nor definite shape.

(B) Chemical Classification:

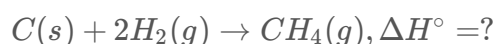
Based upon the composition, matter can be divided into two main types:

- 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
- 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.

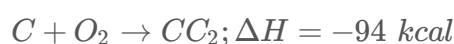
83. Answer: a

Explanation:

For reaction ,



$$\Delta H^\circ = -[(H^\circ \text{ of combustion of } C + 2 \times \Delta H^\circ \text{ of combustion of } H_2)]$$



$$= -[(-213) - (-94 + 2 \times -68)] \text{ Kcal/mol}$$

$$= -[-213 + 230] = -17 \text{ kcal/mol}$$

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.

84. Answer: b

Explanation:

Hybridisation of carbon = $sp^{3-\text{number of } \pi\text{-bonds}}$

In CO_2 , $\begin{matrix} O= & C= & O \\ 1\pi & 1\pi & \end{matrix}$ hybridisation of carbon

$\$ \hspace{50mm} = sp^{3-2} = sp$

In ethyne or acetylene, C_2H_2 , $(H - C \equiv C - H)$

hybridisation of carbon = $sp^{3-2} = sp$

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.

85. Answer: b

Explanation:

Chlorine of vinyl chloride ($CH_2 = CHCl$) is non-reactive (less reactive) towards nucleophile (in nucleophilic substitution reaction) because it shows the following resonating structure due to $+M$ effect of $-Cl$ atom.

In structure II, Cl -atom have positive charge and partial double bond character with C of vinyl group, so it is more tightly attracted towards the nucleus and it does not get replaced by nucleophile in S_N reaction.

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.

86. Answer: a

Explanation:

In sp^3 hybrid orbital one part, out of four orbital is s-orbital, so it have 25% or $\frac{1}{4}$ s-character.

87. Answer: b**Explanation:**

Bell-metal is an alloy of **copper and tin**. $Cu = 80\%$ and $Sn = 20\%$.

Bell metal is a hard **alloy** used for the casting of high-quality bells and related instruments, such as cymbals. It is a form of bronze and the metal used is a high-tin alloy of **copper and tin** with approximately a 4:1 ratio of copper to tin (78% copper, 22% tin).

Therefore, the correct answer is **option B**.

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](#)

88. Answer: c**Explanation:**

Nucleophilic addition – elimination reaction.

Concepts:

1. Aldehydes, Ketones, and Carboxylic Acids:

Aldehydes, Ketones, and Carboxylic Acids are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

Aldehydes:

Aldehydes are organic compounds that have the functional group -CHO .

Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

Ketones:

Ketones are organic compounds that have the functional group C=O and the structure R-(C=O)-R' .

Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

Carboxylic Acid:

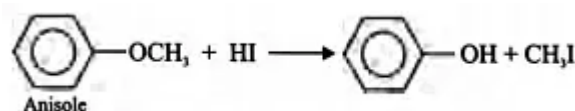
Carboxylic acids are organic compounds that contain a $(\text{C=O})\text{OH}$ group attached to an R group (where R refers to the remaining part of the molecule).

Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

89. Answer: a

Explanation:



Reaction is S_N2 reaction in which I^- attacks at alkyl group with lesser steric hindrance and weak $C - O$ bond

Concepts:

1. Alcohols, Phenols, and Ethers:

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

Phenol is formed when the $-\text{OH}$ group replaces the hydrogen atom in benzene. It is an organic compound in which a hydroxyl group directly attaches to an aromatic hydrocarbon.

Ether is formed when oxygen atom bonds to two alkyl or aryl groups. It is an organic compound that has an oxygen atom that is connected to two aryl and alkyl groups.

Read More: [Alcohol, Phenol, and Ethers](#)

90. Answer: a

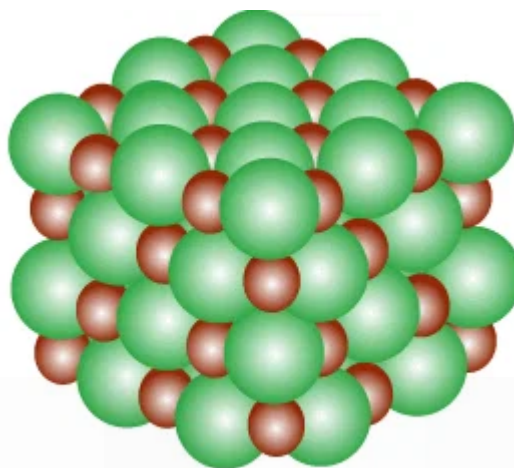
Explanation:

$$\text{For BCC } d = \frac{Z \times M}{N_A \times a^3} \quad 530 = \frac{2 \times 694 \times 10^{-3}}{6.02 \times 10^{23} \times a^3} \quad a^3 = \frac{2 \times 694}{530 \times 6.02 \times 10^{28}} \quad a^3 = 0.435 \times 10^{-28} \text{ m} = 43.5 \times 10^{-30} \text{ m} \\ = 43500000 \text{ pm} \therefore a = 352 \text{ pm}$$

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.

91. Answer: b

Explanation:

$\text{Be}(\text{OH})_2$ amphoteric in nature, since it can react both with acid and base



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 $1s^1 2s^1$.
- 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.

92. Answer: c

Explanation:

The spectrum of an atom depends on the number of electrons present in it. Here, helium has two electrons, so the spectrum of Li^+ ($Z = 3$) is similar to that of helium

because both He and Li^+ have two electrons.

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.

93. Answer: b

Explanation:

Among the mentioned elements, manganese (Mn) exhibits the maximum oxidation state. Manganese can have an oxidation state of +7 in compounds like potassium permanganate ($KMnO_4$), where it has lost all its valence electrons.

So, the correct option is (B): Mn

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:

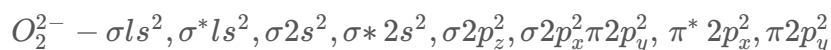
In this, the more reactive metal will displace the less reactive one in a chemical reaction. The reactivity of an element is represented in a series called the reactivity series (arranged in decreasing order of reactivity) which makes it easier to determine the chemical reaction and its products.

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.

94. Answer: c**Explanation:**

The electronic configuration of O_2^{2-} ion is



Hence, number of antibonding electron pairs in O_2^{2-} molecular ion are four.

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

95. Answer: a**Explanation:**

The correct option is (A): 54.4 eV.

For hydrogen atom $Z = 1$

$$\therefore \text{Ionisation energy, } E_H = \frac{2\pi^2 me^4}{n^2 h^2} \quad \dots (i)$$

For He^+ ion, ($He^+ = 1s^1$)

so, ($He^+ = H$) ionisation energy

$$E_{He^+} = \frac{2\pi^2 me^4 Z^2}{n^2 h^2} \quad \dots (ii)$$

Eq (i)/Eq (ii), we get

$$\begin{aligned} E_{He^+} &= E_H \times Z^2 \\ &= 13.6 \times 4 = 54.4 \text{ eV} \end{aligned}$$

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

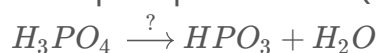
Atomic Structure of Isotopes

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.

96. Answer: d

Explanation:

When orthophosphoric acid (H_3PO_4) is heated and dehydration takes place. It forms metaphosphoric acid (HPO_3).



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

97. Answer: c

Explanation:

As in all the given complex the central metal atom is same and contains same number of d electrons, thus *CFSE* is decided by ligands. In case of strong field ligand, *CFSE* is maximum. CN^- is a strong field ligand, Hence, in $[Co(CN)_6]^{3-}$ *CFSE* is maximum. The magnitude of Δ_{oct} will be maximum in $[Co(CN)_6]^{3-}$.

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.

98. Answer: c

Explanation:

Chargaff's rule states that amount of adenine (A) is equal to that of the amount of thymine (T) and the amount of guanine (G) is equal to that of the amount of cytosine (C)

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.

99. Answer: a

Explanation:

As the temperature is constant, Boyle- law is applicable.

$$p_1 V_1 = p_2 V_2$$

$$V_1 = 380mL, p_1 = 730mm, V_2 = ?,$$

$$p_2 = 760mm$$

$$730 \times 380 = 760 \times V_2$$

$$V_2 = \frac{730 \times 380}{760} = 365mL$$

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.

100. Answer: d

Explanation:

Base, BOH is dissociated as follows



So, the dissociation constant of BOH base

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

At equilibrium $[\text{B}^+] = [\text{OH}^-]$

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

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

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

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

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

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

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.

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



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

Check Out: [Equilibrium Important Questions](#)

101. Answer: a

Explanation:

If the 25th codon (UAU) in a gene encoding a polypeptide of 50 amino acids is mutated to UAA, the likely outcome is that a polypeptide of 24 amino acids will be formed. The reason for this is that UAA is a stop codon, and when it is encountered during translation, it signals the termination of protein synthesis. Therefore, translation would terminate immediately upon encountering the UAA codon at position 25, resulting in a polypeptide that is 24 amino acids long.

So, the correct option is (A): A polypeptide of 24 amino acids will be formed.

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](#)

102. Answer: a

Explanation:

Platypus, bat, elephant and whale, all belong to Class Mammalia of sub-phylum Vertebrata. Out of the four, only platypus is oviparous (egg laying), rest are viviparous (give birth to young ones).

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](#)

103. Answer: b

Explanation:

Weismann

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.

104. Answer: c

Explanation:

Extrusion of second polar body from egg nucleus occurs after entry of sperm but before fertilization.

The entry of sperm into the ovum induces completion of the meiotic division of the secondary oocyte.

Entry of sperm causes breakdown of metaphase promoting factor (MPF) and turns on anaphase promoting complex (APC).

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.

105. Answer: b

Explanation:

Intravenous injection is given for rapid distribution of drugs/substance. Intramuscular injection is given for producing local effect.

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](#)

106. Answer: d

Explanation:

Soil fertility is the characteristic of soil that supports abundant plant life. In particular the term is used to describe agricultural and garden soil.

107. Answer: a

Explanation:

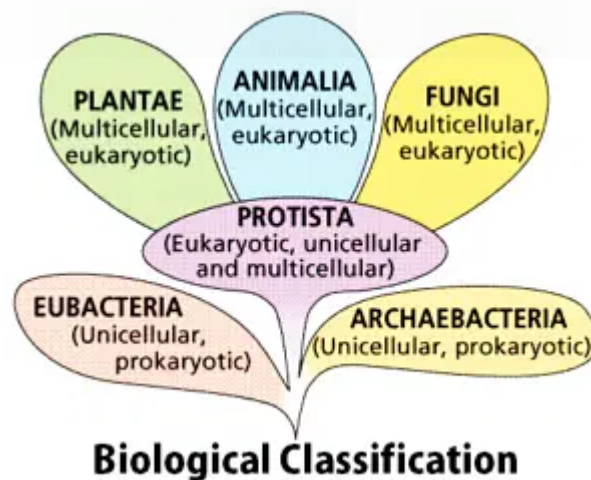
R. H. Whittaker's five-kingdom classification is mainly based on Cell structure, Thallus organization, Mode of Nutrition, Mode of reproduction and Phylogenetic relationship.

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](#)



108. Answer: a

Explanation:

SA node is a specialised bundle of neurons located in the upper part of the right atrium of the heart. SA node is the natural cardiac pacemaker from which the heart beat originates. If this system is damaged, it may send non-coordinated impulses to the heart chambers resulting in symptoms like irregular heart rate, tiredness, dizziness and loss of consciousness. As the pacemaker cells create these rhythmical impulse therefore an artificial pacemaker is implanted at the site of SA node to mimic the actions of the node and conducting system and helps to regulate heart beat.

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
-

109. Answer: d

Explanation:

Zymogen or chief cells are present in the fundic part of stomach. Chief cells are usually basal in location and secrete gastric digestive enzymes as proenzymes or zymogens; pepsinogen and prorennin.

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.

110. Answer: c**Explanation:**

Citric acid is produced by aerobic fermentation of sucrose in beet molasses by *Aspergillus niger*. The fermentation process is completed in about 5-14 days at 27 – 33°C. Citric acid is made available in the market in the form of anhydrous crystalline chemical as powder. Citric acid is used in food industry (e.g. fruit drinks, confectionery, jams, jellies, preserved fruits), pharmacy (e.g. blood transfusion), cosmetics (e.g. astringent lotions, shampoos and hair setting fluids), and industries (e.g. electroplating leather tanning).

Concepts:**1. Microbes in Human Welfare:**

There are several valuable [microorganisms that are beneficial to humans](#) in various manners such as:

In Household Products

1. Fermentation of milk to produce yogurt.
2. Milk curdling to produce curd, cheese, and paneer.

In Industrial Products

1. Production of beverages such as wine, beer, whiskey, brandy, or rum.
2. Production of antibiotics such as Penicillin and other chemical substances to kill or retard the expansion of disease-causing microbes.

Fermented Beverages

1. A fermentor is used to produce microbes on a large scale for industrial purposes.
2. The brewer's yeast (*Saccharomyces cerevisiae*) is used to make ethanol. At this time, the yeast ferments malted cereals and fruit juices.

Antibiotics

1. The term antibiotic means “against life”. These materials can kill or destroy the growth of other microbes.

111. Answer: c

Explanation:

Amniocentesis examines cases of female foeticide and is not used to determine sex.

Therefore, The correct option is (C): A is false but R is true.

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](#)

112. Answer: a

Explanation:

Selfing is the process of fertilization with polar or male gametes of the same individual. AABbCC will produce two type of gametes ABC and AbC. Thus in F₁ generation three genotypes will be obtained. These are AABBCC, AABbCC and

AAbbCC in the ratio of 1 : 2 : 1. Phenotypically AABBCC and AABbCC are same. So the phenotypic ratio in F₂ generation will be 3 : 1.

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.

113. **Answer: d**

Explanation:

The Pachytene stage is characterized by the formation of the synaptonemal complex. This allows the exchange of genetic material between two homologous **chromosomes** by crossing over process. Initiation of crossing over occurs in the pachytene stage of prophase I of **meiosis**.

In meiosis crossing over is initiated at the pachytene stage.

- During Leptotene, chromosomes become gradually visible under a **microscope**. The chromosome compaction continues through this stage.
- During Zygotene, chromosomes start pairing together, known as synapsis.
- **During Pachytene, bivalent chromosomes clearly appear. During this stage, the crossing over is initiated.**
- During the Diplotene stage, the dissolution of synaptonemal takes place.

Therefore, the correct answer is Option A – Pachytene

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

114. Answer: c

Explanation:

The pectoral girdle lies on the posterolateral aspect of the upper region of the thorax. It consists of 2 bones : scapula and clavicle. The scapula, also called shoulder blade, is a large, flat, triangular bone placed at the back of the shoulder. It has at its lateral angle a shallow concavity, the glenoid cavity, for the articulation of the head of the humerus. Acetabulum and ilium are parts of pelvic girdle. Sternum is a long, narrow, flat vertical bone in the middle of the front wall of the chest.

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](#)

115. Answer: d

Explanation:

The correct answer is D:Hypothalamus
Hypothalamus in the thermoregulatory centre of our brain. It is responsible for maintaining constant body temperature.

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.

116. Answer: c

Explanation:

In this match the column which pairing of hormones are not antagonistic (having opposite effects) to each other is Relaxin-Inhibin

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

117. **Answer: c**

Explanation:

Answer (c) Association of 30 S-mRNA with formyl-met-tRNA

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](#)

118. Answer: a

Explanation:

A cell wall is a tough and flexible layer surrounding the [cell membrane](#) in plants, [algae](#), and most prokaryotes. **The cell wall shows complete permeability as it helps to transport substances in and out of the cell.**

- The cell wall mainly provides mechanical support.
- The transportation of molecules through cell walls is governed by the pH.

So, the correct answer is A) 'Complete permeability'.

Concepts:

1. Cell: The Unit of Life:

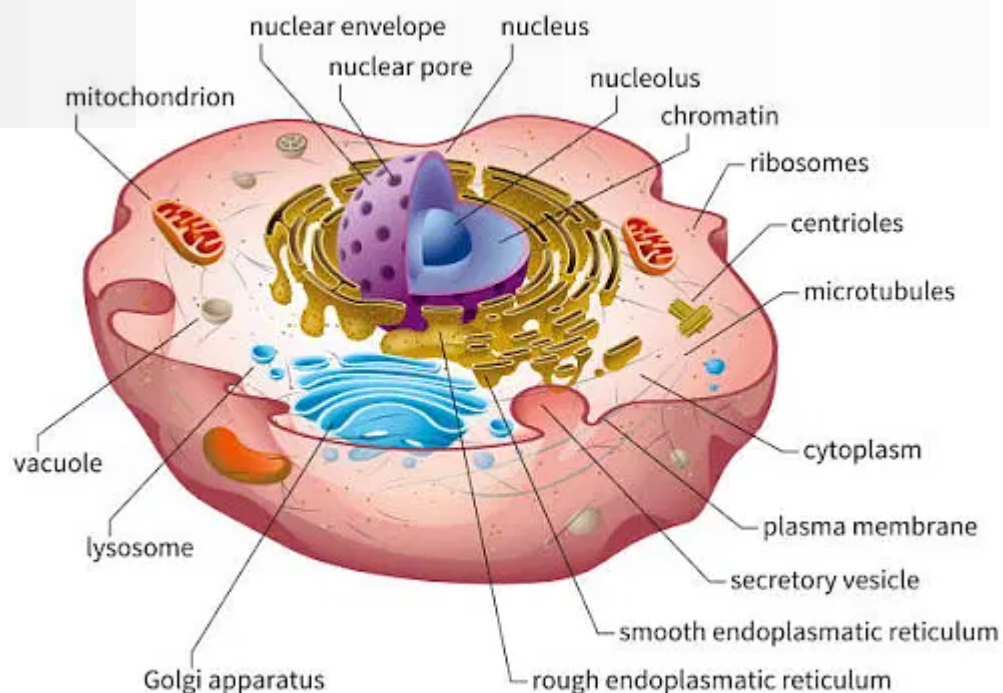
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus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

In male cockroach sperms are stored in seminal vesicle after their release from testis.

120. Answer: c**Explanation:**

Golden rice is vitamin A enriched rice, with a gene from daffodil and is rich in carotene.

Concepts:**1. Applications of Biotechnology:**

Biotechnology is the technology that utilizes biological systems, living organisms, or parts of this to develop or create different products.

For example, brewing and baking bread fall within the concept of biotechnology (use of yeast (= living organism) to produce the desired product).

Agriculture

Alternative to conventional farming: A possible solution is the use of genetically modified crops which is an alternative path to conventional farming.

Medicine

In the area of healthcare, recombinant DNA technological processes have made an immense impact which enables the mass production of safe and more effective therapeutic drugs.

Gene Therapy

A collection of methods that allows the correction of a gene defect that has been diagnosed in a child/embryo is called Gene Therapy.

CRISPR technology

For editing genomes, CRISPR is a simple yet powerful tool which allows researchers to easily alter DNA sequences and modify gene function.

121. Answer: d

Explanation:

Restriction endonucleases are enzymes that digest double stranded DNA following recognition of specific nucleotide sequences. This is achieved by cleaving the two phosphodiester bonds, one within each strand of the DNA duplex. They are found in bacteria and their function in bacteria is to cut up any invading virus as a part of its defense mechanism, thus restricting the multiplication of viruses in the bacterial cell. Different species of bacteria produce different restriction endonucleases.

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.

122. Answer: d

Explanation:

The part starting with the external nostrils up to the terminal bronchioles constitute the conducting part whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system. The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature. Exchange part is the site of actual diffusion of O₂ and CO₂ between blood and atmospheric air.

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](#)

123. Answer: a

Explanation:

The conversion of ammonia to urea is a vital process in the removal of toxic ammonia from the body. This conversion is done by the urea cycle, also known as the ornithine cycle. In this cycle, ammonia is first converted to carbamoyl phosphate, then to citrulline, and eventually to urea. The urea is then excreted by the kidneys. This process takes place primarily in the liver and helps maintain the body's nitrogen balance.

So, the correct option is (A): Ornithine cycle

Concepts:

1. Excretory products and their elimination:

The physiological process of the elimination of metabolic waste from the body is called [excretion](#). The excretory products comprise amino acids, carbon dioxide, urea, uric acid, water, and ammonia. Some of the Molluscs and Echinoderms excrete waste products from the body in the form of amino acids. Ammonia is the foremost excretory product in animals, it is derived from the proteins exists in the food we eat.

Excretory Products in Different Organisms:

Organisms	Excretory Products	Excretory Organs
Paramecium,	Ammonia	Contractile vacuole
Amoeba	Ammonia	Contractile vacuole
Hydra	Ammonia	General body surface
Ascaris	Ammonia	Renette cells
Periplaneta	Uric acid	Malpighian tubule
Palaemon	Uric acid	Antennary gland
Pheretima	Ammonia	Nephridial system
Spider	Uric acid	Coxal glands, Malpighian tubule
Taenia	Ammonia	Protonephridia
Leucon	Ammonia	General body surface

Read More: [Excretion in Human Beings](#)

124. Answer: a

Explanation:

The K_m value, also known as the Michaelis-Menten constant, is a measure of the substrate concentration at which an enzyme reaches half of its maximum catalytic activity. Lower K_m values indicate higher affinity of the enzyme for the substrate and, often, greater catalytic efficiency. Therefore, comparing the K_m values of two enzymes can provide insights into their relative catalytic efficiencies.

So, the correct option is (A): the K_m value

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.

125. Answer: d

Explanation:

Tetracycline disrupts the binding of tRNA molecules carrying amino acids to the mRNA-ribosome complex, thereby preventing the incorporation of amino acids into the developing polypeptide chain. Streptomycin, on the other hand, disrupts the initial stages of protein synthesis by altering the conformation of the 30S subunit

within the 70S prokaryotic ribosome. Erythromycin, meanwhile, interacts with the 50S subunit of the 70S prokaryotic ribosome.

so, the correct option is (D): Tetracycline

Concepts:

1. Antibiotics:

[Antibiotics](#) are a class of drugs used to treat bacterial infections. They work by targeting and killing or inhibiting the growth of bacteria, thus helping the body's immune system to fight off the infection.

[Antibiotics can be classified](#) based on their mechanism of action. Some antibiotics, such as penicillin and cephalosporins, interfere with bacterial cell wall synthesis, leading to cell death. Others, such as tetracyclines and macrolides, inhibit bacterial protein synthesis, preventing the bacteria from growing and multiplying. Some antibiotics, such as sulfonamides and trimethoprim, target bacterial metabolism, interfering with the production of essential nutrients and leading to bacterial death.

Antibiotics are commonly prescribed by doctors to treat bacterial infections such as strep throat, pneumonia, and urinary tract infections. However, antibiotics are not effective against viral infections such as the common cold or flu, and their overuse can lead to the development of antibiotic-resistant bacteria. Therefore, antibiotics should only be prescribed when necessary and used according to the prescribed dose and duration.

The discovery of antibiotics has been one of the most significant medical advancements of the 20th century, and antibiotics continue to play a vital role in modern medicine. However, the overuse and misuse of antibiotics have led to the development of antibiotic-resistant bacteria, which pose a significant threat to public health. Therefore, it is important to use antibiotics judiciously to preserve their effectiveness for future generations.

126. Answer: a

Explanation:

A body cavity can mean any internal space, or a series of spaces present inside body, whereas coelom or true body cavity generally refers to a large fluid-filled space (cavity) lying between the outer body wall and the inner digestive tube. In acoelomates, no body cavity or coelom is present. Embryonic mesoderm remains as a solid layer, space between endoderm (gut wall) and ectoderm (body wall) is filled with mesenchyme and muscle fibres. In pseudocoelomates, body space is a pseudocoelom or false coelom. In coelomates or eucoelomates, body space is a true coelom, enclosed by mesoderm on both sides. Aschelminthes are pseudocoelomates. Molluscs and insects are coelomates while flatworms are acoelomates.

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](#)

127. Answer: d

Explanation:

Convergent evolution is the formation of similar traits by unrelated groups of organisms. Dogfish and whale are the interesting examples of convergent evolution in animals as both of them have more or less similar body organization.

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.

128. Answer: a

Explanation:

Ectoderm, mesoderm and endoderm are the three germ layers that give rise to the specific tissues, organs and organ-systems. Ectoderm gives rise to conjunctiva, cornea, lens of eye, muscles of iris, vitreous humour, retina, lacrimal gland along with other parts of the body.

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.

129. Answer: b

Explanation:

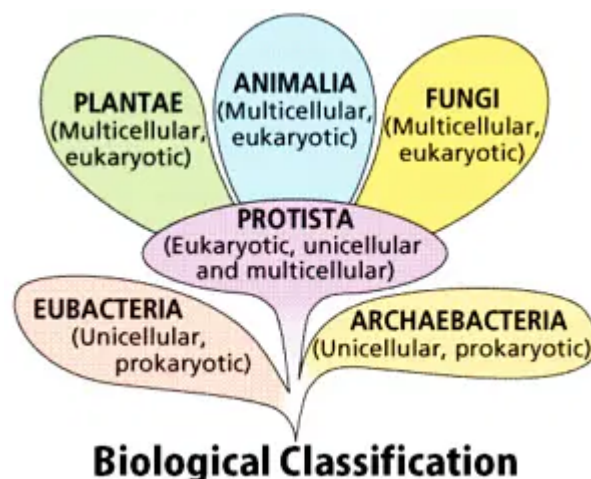
Retting is the process of separating fibres that are held together in close association using a variety of bacteria. Fibers of jute are held together in close association and they are separated by the action of butyric acid bacteria e.g. *Clostridium butyricum*. These plants are immersed in water so that they absorb water and swell. Due to the activity of bacteria, the pectic substances of middle lamella are hydrolysed and the fibers are separated. These separated fibers are used in making of ropes and sacks.

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](#)



Explanation:

Gause's competitive exclusion principle states that no two species can occupy the same niche indefinitely in a habitat.

131. Answer: d

Explanation:

Cell-mediated immune response (CMIS) consists of T-lymphocytes. It reacts against transplants. Transplantation may result in the rejection of the transplanted organs. The immune system recognises the protein in the transplanted tissue or organ as foreign and initiates cellular immunity against it.

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](#)

132. Answer: b

Explanation:

Blood passes from the superior and inferior vena cava into the right atrium. During the start of diastole, the pressure drops in the right atrium, thereby forcing the blood from vena cava to enter the right atrium. During diastole as the atrium relaxes and enlarges in size, the pressure falls.

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
-

133. Answer: a

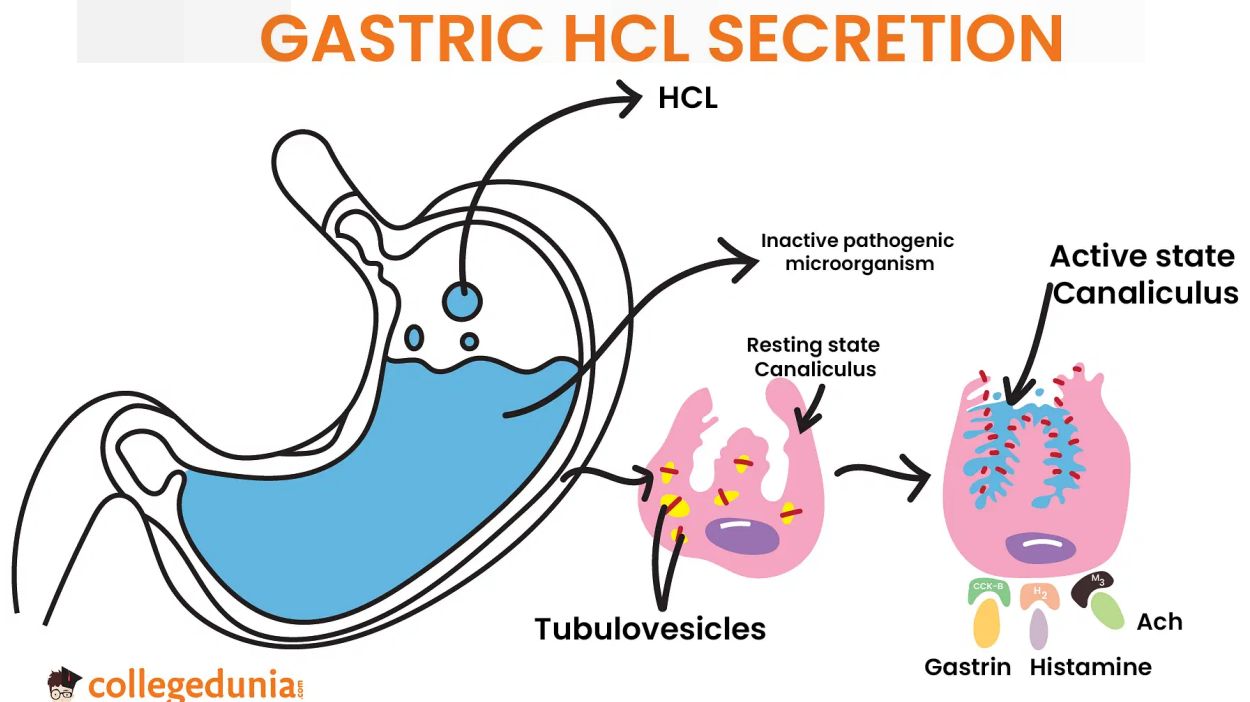
Explanation:

The stomach's production of hydrochloric acid is controlled by parietal cells. The pH of the stomach is brought down to 1.5 to 2.5 by gastric acid.

In the presence of an acidic pH, this secretion is critical for the function of stomach enzymes.

Additionally, it is crucial for eliminating any pathogens that may be present in the food.

In the stomach mucosa, there are many tiny tubular glands. The epithelium of the gastric glands contains parietal cells, which are more prevalent on the side walls of the glands. They are also known as oxyntic cells because eosin causes them to stain so dramatically. They release hydrochloric acid and castle intrinsic factors, both of which are necessary for vitamin B12 absorption. In the stomach, HCl maintains a highly acidic pH of 1.5 to 2.5. This eliminates germs as well as any other potentially hazardous organisms that could be present in food.



Parietal or oxyntic cells release intrinsic factors and HCl, which causes the stomach's pH to be very acidic. Pepsinogen, which is secreted by parietal glands and changed

into pepsin by hydrochloric acid, is also produced. Protein is digested as a result of pepsin. Protein digestion will be directly impacted if parietal cells stop functioning.

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.

134. Answer: c

Explanation:

When sewage mixes with water body, micro-organisms present in it biodegrade organic matter of sewage using oxygen. This results into a sharp decline in dissolved oxygen which may cause mortality of aquatic creatures. Gradually, however, dissolved oxygen increases in concentration with the completion of biodegradation of sewage matter.

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.

135. Answer: c

Explanation:

The correct answer is option (C): (i) (iii) (ii) (iv)

Concepts:

1. Population Explosion:

It refers to the rapid increase in the population of an area among human beings. Furthermore, it is a situation where the economy is not capable of coping with the increasing demand of its population. Population explosion refers to the number of people that live in an area. It is a major issue for developing countries. Also, the government is not taking proper measures to control this problem

Causes of Population Explosion:

The cause of the population explosion includes many factors and reasons. These includes:

1. Increase in the birth rate
 2. A decrease in infant mortality rate
 3. The life expectancy growth
 4. High level of illiteracy
-

136. Answer: d

Explanation:

Polygenic (or Quantitative) inheritance is that type of inheritance in which the complete expression of a trait is controlled by two or more genes in which a dominant allele of each gene contributes only a unit fraction of the trait and total phenotypic expression is the sum total of a additive or cumulative effect of all the dominant alleles of genes/polygenes. Human skin colour is an example of such polygenic inheritance which is controlled by three pairs of polygenes A, B and C. Negro/black colour is due to presence of all the six dominant contributing alleles AABBCc. Very light colour or white colour is due to presence of all six recessive noncontributing alleles aabbcc.

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.

137. Answer: b

Explanation:

G_1 phase

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

138. Answer: a

Explanation:

The bones of skulls are joined by white fibrous tissue which sustain no movement between the skull bones. This kind of joint is classified as fibrous or immovable joints. Thus, parietal and temporal bone of the skull are joined by fibrous joints. First cervical vertebra, atlas, joins the second cervical vertebra axis to form a joint (pivot joint) which allows movement in one plane. The atlas supports the head and allows movement of head over neck. The last two pairs of ribs are called floating ribs because their anterior ends are not attached to either the sternum or the cartilage of anterior rib. Glenoid cavity is a depression to which humerus articulates.

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](#)

139. Answer: a

Explanation:

Neurons or nerve cells are the structural and functional unit of nervous system. These have a special structure but vary greatly in size and shape. Each neuron has a cell body which encloses cytoplasm and has a nucleus. A number of processes arise from the cell body. There is usually a single axon and a variable number of dendrites. The medullated nerve fibres is composed of a shining, white, fatty substance called myelin.

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: b

Explanation:

Epinephrine is derived from tyrosine amino acid by the removal of carboxyl group. It is a catecholamine.

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 (duodenum), 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: b

Explanation:

Endoplasmic reticulum, nuclei, lysosomes, Golgi apparatus and mitochondria are membrane bound cell organelles whereas ribosomes are naked ribonucleoprotein protoplasmic particles. Chromosomes are the hereditary particles present in the nucleus.

Concepts:

1. Cell: The Unit of Life:

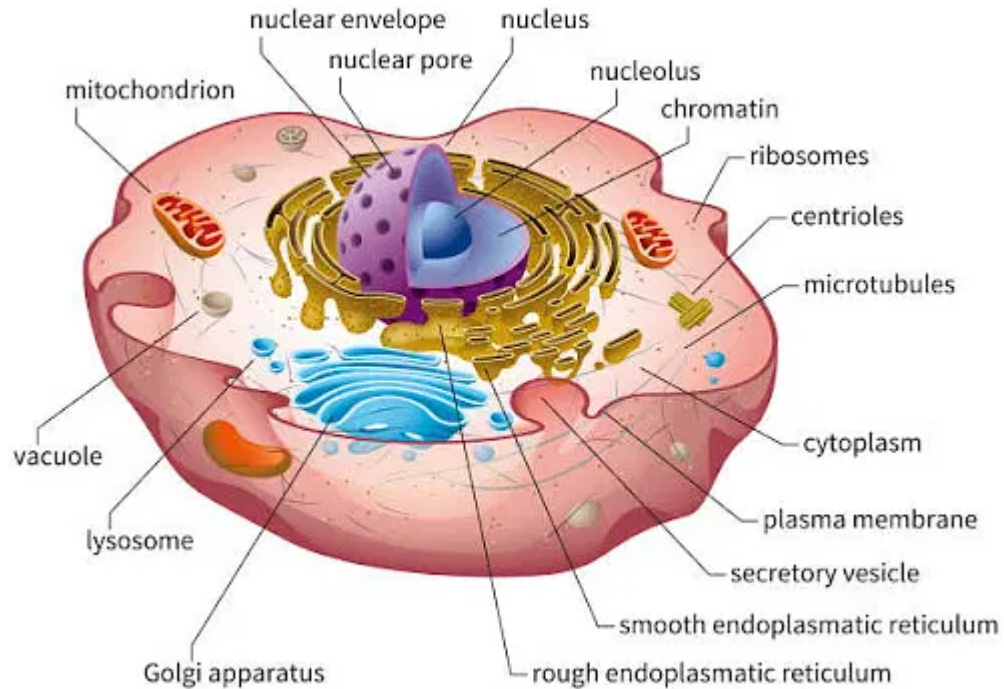
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus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



142. Answer: d

Explanation:

In a triplet for a particular amino acid more than one word (synonyms) can be used. This phenomenon is described by saying that the code is degenerate. A degenerate code would be one where there is one to one relation between aminoacids and the codons that 44 codons out of 64 will be useless or nonsense codons. A code is degenerate because of the third base of the codon. It has been shown that the same /RNA can recognize more than one codons differing only at the third position. For example GCU, GCC and GCA all code for alanine amino acids.

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](#)

143. Answer: d

Explanation:

Males bear a pair of short, thread like anal styles which are absent in females. Anal/caudal styles arise from 9th abdominal segment in male cockroach.

144. Answer: c

Explanation:

Gel electrophoresis does not employ chromogenic substrates; instead, the DNA is made visible by intercalating it with EtBr, which can be viewed under UV light. Without UV illumination, DNA bands are not discernible in the gel.

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.

145. Answer: b

Explanation:

The correct answer is (b).

Every 100 ml of oxygenated blood can deliver around 5 ml of O_2 to the tissues under normal physiological conditions.

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](#)

146. Answer: b

Explanation:

Plasmids can vary in size, but the maximum number of bases in plasmids discovered so far can exceed 500 kilobases (kb) and can even reach into the megabase (Mb) range for some exceptionally large plasmids. However, it's important to note that plasmids can be smaller or larger depending on the specific plasmid and its role in carrying genetic information in various organisms. So, the closest option is (B): 500 kilobases (kb)

Concepts:

1. Acids and Bases:

Acid is any hydrogen-containing substance that is capable of donating a proton (hydrogen ion) to another substance. Base is an ion or molecule capable of accepting a hydrogen ion from acid.

Physical Properties of Acids and Bases

Physical Properties	ACIDS	BASES
Taste	Sour	Bitter
Colour on Litmus paper	Turns blue litmus red	Turns red litmus blue
Ions produced on dissociation	H ⁺	OH ⁻
pH	<7 (less than 7)	>7 (more than 7)
Strong acids	HCl, HNO ₃ , H ₂ SO ₄	NaOH, KOH
Weak Acids	CH ₃ COOH, H ₃ PO ₄ , H ₂ CO ₃	NH ₄ OH

Chemical Properties of Acids and Bases



Type of Reaction	Acid	Bases
Reaction with Metals	Acid + Metal $\rightarrow$ Salt + Hydrogen gas (H_2) E.g., $Zn(s) + \text{dil. } H_2SO_4 \rightarrow ZnSO_4 \text{ (Zinc Sulphate)} + H_2$	Base + Metal $\rightarrow$ Salt + Hydrogen gas (H_2) E.g., $2NaOH + Zn \rightarrow Na_2ZnO_2 \text{ (Sodium zincate)} + H_2$
Reaction with hydrogen carbonates (bicarbonate) and carbonates	Metal carbonate/Metal hydrogen carbonate + Acid $\rightarrow$ Salt + Carbon dioxide + Water E.g., $HCl + NaOH \rightarrow NaCl + H_2O$ 2. $Na_2CO_3 + 2 HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$ 3. $Na_2CO_3 + 2H_2SO_4(aq) \rightarrow 2Na_2SO_4(aq) + H_2O(l) + CO_2(g)$ 4. $NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$	Base + Carbonate/bicarbonate $\rightarrow$ No reaction
Neutralisation Reaction	Base + Acid $\rightarrow$ Salt + Water E.g., $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$	Base + Acid $\rightarrow$ Salt + Water E.g., $CaO + HCl(l) \rightarrow CaCl_2(aq) + H_2O(l)$
Reaction with Oxides	Metal oxide + Acid $\rightarrow$ Salt + Water	Non-Metallic oxide + Base $\rightarrow$ Salt + Water

	E.g, $\text{CaO} + \text{HCl (l)} \rightarrow \text{CaCl}_2 \text{ (aq)} + \text{H}_2\text{O (l)}$	E.g, $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
Dissolution in Water	Acid gives H^+ ions in water. E.g, $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$ $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$	Base gives OH^- ions in water.

Read more on [Acids, Bases and Salts](#)

147. Answer: a

Explanation:

Sweat is produced by sweat glands as a response to increased body temperature, and its evaporation from the skin helps cool the body, regulating temperature.

So, the correct option is (A): Sweat – temperature regulation

Concepts:

1. Excretory products and their elimination:

The physiological process of the elimination of metabolic waste from the body is called [excretion](#). The excretory products comprise amino acids, carbon dioxide, urea, uric acid, water, and ammonia. Some of the Molluscs and Echinoderms excrete waste products from the body in the form of amino acids. Ammonia is the foremost excretory product in animals, it is derived from the proteins exists in the food we eat.

Excretory Products in Different Organisms:

Organisms	Excretory Products	Excretory Organs
Paramecium,	Ammonia	Contractile vacuole
Amoeba	Ammonia	Contractile vacuole
Hydra	Ammonia	General body surface
Ascaris	Ammonia	Renette cells
Periplaneta	Uric acid	Malpighian tubule
Palaemon	Uric acid	Antennary gland
Pheretima	Ammonia	Nephridial system
Spider	Uric acid	Coxal glands, Malpighian tubule
Taenia	Ammonia	Protonephridia
Leucon	Ammonia	General body surface

Read More: [Excretion in Human Beings](#)

148. Answer: c

Explanation:

The correct statement regarding enzyme inhibition is Competitive inhibition is seen when the substrate and the inhibitor compete.

Explanation:

- (A) This statement is not correct. Non-competitive inhibition cannot be overcome by adding more substrate because the inhibitor binds to a different site on the enzyme, not the active site where the substrate binds.
- (B) This statement is not entirely accurate. In competitive inhibition, the inhibitor molecule competes with the substrate for binding to the active site of the enzyme, not to an "inhibitor protein."
- (D) This statement is also not correct. Non-competitive inhibitors bind to the enzyme reversibly, meaning they can eventually dissociate from the enzyme, although they don't compete with the substrate for the active site.

So, the correct statement is (C): Competitive inhibition is seen when the substrate and the inhibitor compete.

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.

149. Answer: c

Explanation:

In DNA fingerprinting, specific regions of repetitive DNA sequences, known as minisatellites or microsatellites, are used to identify differences in DNA sequences. These regions are indeed referred to as repetitive DNA.

So, the correct option is (C): Repetitive DNA

Concepts:

1. DNA Fingerprinting:

[DNA fingerprinting](#), also called DNA typing, DNA profiling, genetic fingerprinting, genotyping, or identity testing, in genetics, method of isolating and identifying variable elements within the base-pair sequence of DNA.

The procedure of DNA Fingerprinting:

The procedure for creating a DNA fingerprint consists of first obtaining a sample of cells, such as skin, hair, or blood cells, which contain DNA. The DNA is extracted from the cells and purified. In Jeffreys's original approach, which was based on restriction fragment length polymorphism (RFLP) technology, the DNA was then cut at specific points along the strand with proteins known as restriction enzymes. The enzymes

produced fragments of varying lengths that were sorted by placing them on a gel and then subjecting the gel to an electric current (electrophoresis): the shorter the fragment, the more quickly it moved toward the positive pole (anode). The sorted double-stranded DNA fragments were then subjected to a blotting technique in which they were split into single strands and transferred to a nylon sheet. The fragments underwent autoradiography in which they were exposed to DNA probes—pieces of synthetic DNA that were made radioactive and that bound to the minisatellites. A piece of X-ray film was then exposed to the fragments, and a dark mark was produced at any point where a radioactive probe had become attached. The resultant pattern of marks could then be analyzed.

150. Answer: a

Explanation:

Euglena possesses the characteristics of both plant and animal. It has chlorophyll, thus it is autotrophic like plants. In contrast to this, it has flagellated locomotion like animals.

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](#)

151. Answer: d

Explanation:

Style is traversed by the pollen tube to reach the ovule. It is of two types – hollow and solid. In hollow styles, the stylar canal is lined by glandular cells, which are usually multinucleate and polyploid whereas solid style has a core of transmitting tissue, composed of thin walled cells, through which, the pollen tube moves.

Concepts:

1. Sexual Reproduction in Flowering Plants:

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

An individual flower comprises the following parts –

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen

- Pistil
- Receptacle

152. Answer: b

Explanation:

Parthenocarpic fruits are those that develop without fertilization, and hormonal treatments like gibberellic acid and auxins can induce this phenomenon in plants like tomatoes. These treatments stimulate fruit development without the need for pollination and fertilization.

So, the correct option is (B): treating the plants with low concentrations of gibberellic acid and auxins

Concepts:

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An individual flower comprises the following parts -

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

153. Answer: b

Explanation:

Ectocarpus has haplodiplontic life cycle and Fucus has diplontic life cycle.

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](#)

Explanation:

Grass seeds are endospermic. Mango is a seeded fruit. A sterile pistil is called pistillode and a sterile stamen is called staminode. Maize grains consist of fruit wall, seed coat, endosperm and embryo. The endosperm occupies most of the grains interior and consists of two parts, homy aleurone layer and mainly storage layers. The aleurone layer lies immediately below the grain covering and is 1-3 cell thick. Aleurone cells are thick walled with cytoplasm filled with aleurone grains which produce enzymes during seed germination to mobilise stored nutrients.

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.

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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.

155. Answer: d

Explanation:

Among the animals, insects particularly bees are the dominant pollinating agents. Pollination carried out through water is called hydrophily.

Pollination by water is quite rare in flowering plants (only 2%).

Pollination by wind is more common amongst abiotic pollination. Wind pollination requires the light and non-sticky pollen grains so that they can be transported in wind currents.

Some plants whose flowers are pollinated by flies and beetles smell this way (foul odour), mainly to attract flies and beetles, which normally lay their eggs in faeces and rotting materials.

Concepts:

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An individual flower comprises the following parts –

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

156. Answer: b

Explanation:

Linnaeus put forward an 'Artificial system' of plant classification which was based on sexual characters like cryptogamia, monoecia, monandria, diandria, polyandria etc. It is commonly also called as sexual system of plant classification.

Concepts:

1. Plant Kingdom:

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Read More: [Classification of Plants](#)

157. Answer: d

Explanation:

In Alstonia, five or more leaves arise from each node, so it shows whorled phyllotaxy. The leaves are leathery, sessile, simple which are elliptical or ovate or wedge shaped at the base. It is used in traditional medicines.

Concepts:

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158. Answer: a

Explanation:

Cleistogamous flowers are the ones that do not open and show self-pollination. Hence, there is no cross pollination occurring at all in these plants, there is little to no variation, which is disadvantageous for the plants.

Concepts:

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An individual flower comprises the following parts -

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

159. Answer: b

Explanation:

Genera like Selaginella and Salvinia which produce two kinds of spores, macro (large) and micro (small) spores, are known as heterosporous pteridophytes. The megaspores and microspores germinate and give rise to female and male

gametophytes, respectively. The female gametophytes in these plants are retained on the parent sporophytes for variable periods. The development of the zygotes into young embryos takes place within the female gametophytes. This event is a precursor to the seed habit considered an important step in evolution.

Concepts:

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Read More: [Classification of Plants](#)

Explanation:

Monoecious plants have separate male and female flowers on the same plant. Pinus have both the male and female cones or strobili on the same tree.

Concepts:

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161. Answer: d

Explanation:

Plasticity is the ability of the plant to adjust to a particular environment by altering the rate of growth, development, and metabolism. For example, heterophylly in cotton, coriander, larkspur and buttercup. Maize does not show plasticity.

Concepts:

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An individual flower comprises the following parts –

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

162. Answer: c

Explanation:

Chlamydomonas has haplontic life cycle hence showing zygotic meiosis or initial meiosis.

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Read More: [Classification of Plants](#)

163. Answer: d

Explanation:

In litchi, aril forms the edible part in fruit. It is a collar like out growth from the base of the ovule forming a kind of third integument. Aril is also found in Asphodelus, Trianthema and Ulmus. Litchi is a nut. In litchi, the epicarp and mesocarp (layers of pericarp) together become leathery and the endocarp is membranous.

Concepts:

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164. **Answer: b**

Explanation:

- Tassels are the male reproductive structures located at the top of plants.

- The function of tassels is to produce male gamete pollens, which carry male gametes inside them.
- When the pollens mature, they are released from the tassels
- These pollens are carried by wind to the silks of corn.
- Each silk is attached to the female reproductive structure.
- Pollen grains land on silk and reach the inner part, where ovules are present.
- Pollens fertilize the ovules and produce kernels on corn cobs.
- Generally, in corn plants, the male and female reproductive parts are present on the same plant; hence, they are called “monoecious plants.”.

So, the correct option is (B): To disperse pollen grains.

Concepts:

1. Flower:

A [flower](#) is a modified shoot. A flower bud is formed when shoot apical meristem in angiospermous plants gets transformed into floral meristem and leaves transform into floral appendages.

In angiosperms, flowers are the reproductive units and they are meant for [sexual reproduction](#). A typical flower possesses four types of floral organs or whorls — sepals (calyx), petals (corolla), stamens (androecium), and carpels (gynoecium). These whorls are arranged on the swollen end of the stalk or pedicel, called the thalamus or receptacle.

Importance of Flowers:

Flowers are the place where pollination takes place. Due to the vibrant color and fragrance of flowers, insects get attracted to them that helps in the process of pollination that in turn leads to seed production. These seeds turn into fruits and are also a very important part of plant survival as they create new plants.

Read More: [Flower Structure](#)

165. Answer: b

Explanation:

Laminarin and mannitol are food reserves of brown algae or Phaeophyceae.
Rhodophycean algae store food in the form of floridean starch.

Concepts:

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Read More: [Classification of Plants](#)

166. Answer: d

Explanation:

Pitcher of *Nepenthes* or pitcher plant is modification of leaf not stem

Concepts:

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167. Answer: b

Explanation:

The correct answer is option (B) : Xenogamy

Concepts:

1. Fertilisation:

Fertilization happens when a sperm fuses with the female act during sexual intercourse and further forms an egg that gets implanted in the uterus of the female. The sperm goes through the fallopian tube and penetrates the zona pellucida layer of the ovum (female egg) and then fuses with it which forms a zygote (fertilized egg). Thousand of sperms are generated in a male body to compensate for the ones unfit and non-motile ones. Once the zygote is created or formed, it gets implanted in the uterus and further growth starts taking place when cells start dividing and forming tissues, and tissues further form organs which result in the formation of an organ system, eventually or in time turning into an organism.

168. Answer: b

Explanation:

Algin is obtained from brown algae and carrageenan from red algae

Concepts:

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Read More: [Classification of Plants](#)

169. Answer: a

Explanation:

A fruit is a ripened ovary. On the basis of the formation of fruits, they are classified into two types – true fruits and false fruits. True fruits are developed from the ovary only. Banana is a fleshy fruit – berry. It develops from multicarpellary syncarpous superior or inferior ovary. The pericarp of berries is differentiated into epicarp, mesocarp and endocarp (like drupes) but the endocarp is not stony as is drupes. Apple and pear are pome. Pome is a false fruit in which the edible part is thalamus where the true fruit remains embedded. Fig is a composite fruit. These fruits are the products of the whole inflorescence together with its component parts.

Concepts:

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170. Answer: a

Explanation:

In grasses, the formation of mature pollen grains from a microspore mother cell involves: (A) One meiotic and two mitotic divisions. During this process, meiosis occurs first to reduce the chromosome number, followed by two mitotic divisions to produce a multicellular structure called a mature pollen grain, which contains two cells – a vegetative cell and a generative cell. This generative cell is essential for fertilization in plants.

Concepts:

1. Fertilisation:

Fertilization happens when a sperm fuses with the female act during sexual intercourse and further forms an egg that gets implanted in the uterus of the female. The sperm goes through the fallopian tube and penetrates the zona pellucida layer of the ovum (female egg) and then fuses with it which forms a zygote (fertilized egg). Thousand of sperms are generated in a male body to compensate for the ones unfit and non-motile ones. Once the zygote is created or formed, it gets implanted in the uterus and further growth starts taking place when cells start dividing and forming tissues, and tissues further form organs which result in the formation of an organ system, eventually or in time turning into an organism.

171. Answer: d

Explanation:

Sexual reproduction in algae takes place through fusion of two gametes. In Spirogyra, the gametes are similar in size (isogamy) and non- flagellated (non-motile).

Concepts:

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Read More: [Classification of Plants](#)

172. Answer: b

Explanation:

Phyllododes have unlimited (or indefinite) growth whereas cladodes have a limited (or definite) growth. Opuntia and Euphorbia royleana are the examples of phyllododes whereas Ruscus aculeatus and Asparagus are the examples of cladodes.

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173. Answer: b

Explanation:

The correct option is (B) : Downward

The body of the ovule is rotated by 180 degrees in an anatropous ovule. The ovule and micropyle's bodies are parallel to the funicle. The micropyle is located at the side of the hilum or in close proximity to it, making it an inverted ovule. At the top, the chalazal end is visible. Two polar nuclei in the core of the ovule fuse, resulting in the formation of a seven-celled stage.

Concepts:

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An individual flower comprises the following parts –

- Pedicle
- Calyx

- Petals
 - Sepals
 - Stamen
 - Pistil
 - Receptacle
-

174. Answer: c

Explanation:

All species of Chara reproduce sexually and show highly advanced oogamy. The sex organs are the most distinctive features of the order Charales and are the most complicated among the thallophytes. Male and female gametangia are called antheridia and oogonia respectively. Male fructification (cluster of antheridia) is called globule and the female is nucule. They are borne at the nodes of short branches, globule towards lower side and nucule (female structure) towards upper side.

Concepts:

1. Plant Kingdom:

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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 **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](#)

175. Answer: c

Explanation:

Micropyle of seed is involved in the passage of water. Micropyle plays an very important role in absorbing water during the time of germination.

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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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.

176. Answer: a

Explanation:

Double fertilization is a characteristic event observed in angiosperms, wherein both the embryo and the endosperm are formed simultaneously. In this process, a male gamete combines with two polar nuclei, giving rise to a triploid nucleus, which subsequently matures to create the endosperm.

So, the correct option is (A): Two polar nuclei & one male gamete

Concepts:

1. Sexual Reproduction in Flowering Plants:

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An individual flower comprises the following parts -

- Pedicle
- Calyx
- Petals
- Sepals

- Stamen
 - Pistil
 - Receptacle
-

177. Answer: b

Explanation:

Pteridophytes are known as vascular cryptogams (Gk kryptos = hidden + gamos = wedded). They reproduce by spores rather than seeds. They are the first vascular land plant. The pteridophyte Equisetum belongs to the class sphenophyta. All vegetative parts of it possess vascular tissues (i.e. hadrome equivalent to xylem & leptome equivalent to phloem) organised in definite groups of steles.

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Read More: [Classification of Plants](#)

178. Answer: d

Explanation:

A pentamerous actinomorphic flower is one where the floral parts are in multiples of five and the flower can be divided into two equal halves in more than one plane. Gynoecium is bicarpellary, syncarpous, forming a superior bilocular ovary. Each locule has many ovule on axile placentation. Members of solanaceae are characterised by the presence of an obliquely placed septum in the ovary and highly swollen placentae. The oblique septum is probably due to shifting in the position of the ovary. Family liliaceae has trimerous actinomorphic flowers with tricarpeal syncarpous superior ovary, family asteraceae has zygomorphic flowers and family brassicaceae has dimerous or tetramerous actinomorphic or zygomorphic flower with bicarpellary syncarpous superior ovary.

Concepts:

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179. Answer: c

Explanation:

The description of an ovule where the embryo sac becomes horseshoe-shaped, and the funiculus and micropyle are close to each other corresponds to Amphitropous.

So, the correct option is (C): Amphitropous

Concepts:

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An individual flower comprises the following parts –

- Pedicle
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 - Petals
 - Sepals
 - Stamen
 - Pistil
 - Receptacle
-

180. Answer: a

Explanation:

Cycas and Ginkgo are often considered as the living fossil because they are lone/one of the few representative of once a large group of plants (which was once a well flourished group) and possess traits of extinct pteridosperms and other gymnosperms.

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Read More: [Classification of Plants](#)

181. Answer: b

Explanation:

If gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level, it is called perigynous. The ovary here is said to be half inferior, e.g., plum, rose, peach.

Concepts:

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182. **Answer: a**

Explanation:

Both Bryophyllum and Kalanchoe are succulent plants that can produce new plants from individual leaves, making them suitable for vegetative propagation through leaf cuttings.

So, the correct option is (A): Bryophyllum and Kalanchoe

Concepts:

1. Reproduction:

The term **reproduction** is a biological process that means to reproduce. It is a process by which an organism reproduces an offspring that is biologically similar or identical to its parents. Reproduction accredits and ensures the continuity of species, generation after generation, and is the main character of life on earth.

Types of Reproduction:

There are two types of reproduction such as:

Asexual Reproduction:

It is the production an offspring by a single parent beyond the formation and fusion of gametes. The young one obtains all its genes from one parent, so are identical.

Sexual Reproduction:

Sexual reproduction is mostly biparental, includes the formation of meiosis gamete usually fertilization also, instigates genetic variation in the offspring, and plays a role in the evolution of species, found in higher plants and animals.

183. Answer: b

Explanation:

Funaria exhibits gametophytic (n) as well as sporophytic ($2n$) generation in its life cycle. The gametophytic generation is represented by a short lived protonema which produces spermatozoids in antheridium of male shoot & egg in archegonium of female shoot. Egg and spermatozoids are fused to form zygote. From zygote diploid sporophyte is produced. The capsule of sporophyte produces haploid spores. Then the haploid gametophyte is produced from the haploid spores. So the zygote is the only diploid stage in the life cycle. So the life cycle represents haplontic life cycle.

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Read More: [Classification of Plants](#)

184. Answer: c

Explanation:

Pineapple is a sorosis type of fruit that develops from spike or spadix inflorescence. Here the flowers frise by their succulent tepals and axis bearing the flowers becomes fleshy or woody, thus forming a compact mass. These are composite or multiple fruits. In pineapple fleshy axis, bracts, fused perianth and pericarp are edible.

Concepts:

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185. Answer: d

Explanation:

The pollen tube gains access to the embryo sac through the micropylar end, and it can directly penetrate either the synergid or the space between the egg cell and synergid. This process typically occurs through the degenerated synergid.

So, the correct option is (D): Degenerated synergid

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An individual flower comprises the following parts –

- Pedicle
 - Calyx
 - Petals
 - Sepals
 - Stamen
 - Pistil
 - Receptacle
-

186. Answer: b

Explanation:

Polysiphonia is a genus of red algae, where asexual spores and gametes are non-motile or non-flagellated.

Other options (1, 3 & 4) are correctly matched

Concepts:

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Read More: [Classification of Plants](#)

187. Answer: d

Explanation:

Pistia (water lettuce) is a floating aquatic plant. In aquatic plants, roots are generally poorly developed and do not take part in absorption of water. ; Water is absorbed by the general body surface in these plants.

Concepts:

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188. Answer: c

Explanation:

Anthesis refers to the phase of flowering when a flower bud blossoms and becomes fully functional. This process involves the elongation of the style, the development and maturity of stamen, and a noticeable change in coloration.

Concepts:

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Read More: [Classification of Plants](#)

189. Answer: d

Explanation:

Chlorella and Spirulina are unicellular green algae, which are commercially very important.

Anabaena is Cyanobacteria, Laminaria, Sargassum, Gelidium, Gracilaria are multicellular algae.

Volvox is unicellular colonial algae.

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Read More: [Classification of Plants](#)

190. Answer: c

Explanation:

Chilli (*Capsicum annum*) belongs to family-Solanaceae. In this family, flower is actinomorphic, complete and bisexual; calyx has five sepals which are gamosepalous showing valvate aestivation; corolla has five petals which are polypetalous showing valvate aestivation; androecium has five free stamens (polyandrous) but epipetalous; gynoecium is bicarpellary, syncarpous, bilocular with superior ovary having axile placentation.

Concepts:

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191. Answer: d

Explanation:

In the litchi fruit, the aril is the fleshy, translucent, and sweet part that surrounds the seed. It is the part of the fruit that is commonly eaten.

So, the correct option is (D): Litchi

Concepts:

1. Sexual Reproduction:

Sexual reproduction takes place in both plants and animals. In sexual reproduction, genetically diverse organisms or sphinx are built this happens when two individuals of unique sex are combined.

The offspring built by sexual reproduction are genetically diverse in nature and can embrace themselves in accordance with the climate and other adaptable conditions many multicellular organisms practice sexual reproduction.

There are four types of sexual reproduction:

- Allogamy
 - Internal fertilization
 - External fertilization
 - Autogamy
-

192. Answer: d

Explanation:

Among the bryophytes Sphagnum accounts by far the most important place economically. It is popularly called bog moss or peat moss. It is perennial and its growth continues year after year. Older portions undergo death but do not decompose due to secretion of acid that accounts for the antibacterial and antifungal actions. The increasing mass of dead remains accumulate year after year and form a compact dark coloured mass rich in carbon which is called peat. Peat is used as fuels. Paraffin, acetic acid, peat tar and ammonia are formed as by-products of peat obtained for industrial uses.

Concepts:

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Read More: [Classification of Plants](#)

193. Answer: b

Explanation:

The plants belonging to the family fabaceae such as soyabean, pea, sem, moong, gram, etc have the floral formula $\% \overline{K}_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$

Concepts:

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194. Answer: b

Explanation:

Synergids are characterized by their haploid nature, with a chromosome number represented as $n = 8$.

Conversely, the aleurone layer exhibits a triploid nature, resulting in the aleurone layer containing ' $3n$ ' chromosomes.

In this case, ' $3n$ ' equals ' 3×8 ,' which means that there are 24 chromosomes present in the aleurone layer.

So, the correct option is (B): 24

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195. Answer: a

Explanation:

Answer (a) a

Concepts:

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Read More: [Classification of Plants](#)

196. Answer: b

Explanation:

Pisum, which is also known as pea, exhibits vexillary aestivation and has stamens that are diadelphous. On the other hand, Colchicum autumnale, Solanum nigrum, and Allium cepa exhibit valvate aestivation.

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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.

197. Answer: c

Explanation:

Pineapple fruit forms from a cluster of closely packed flowers that fuse together as they develop, creating a single fruit structure. This is known as a multiple or aggregate fruit.

So, the correct option is (C): a cluster of compactly borne flowers on a common axis

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: c

Explanation:

Sphagnum is a bryophyte in which dominant phase or plant body is independent and free living gametophyte. The sporophyte is parasitic over gametophyte. In Pinus (a gymnosperm), mustard and castor (angiosperms), the main plant body is sporophytic. Gametophyte is highly reduced and is completely dependent on sporophyte.

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](#)

199. Answer: b

Explanation:

Flowers that can only be divided into two halves from a single plane, meaning they are bilaterally symmetrical, are called zygomorphic flowers. This category includes plants such as pea, Gulmohar, Cassia, and beans.

On the other hand, flowers such as mustard, datura, and chilli are actinomorphic, which means they can be divided into two halves from any plane, or are radially symmetrical.

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.

200. Answer: d

Explanation:

An alternation of generation between asexual and sexual phases of an organism is referred to as metagenesis. E.g. in Obelia (a coelenterate), polyps reproduce asexually and medusae reproduce sexually.

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1. Plant Kingdom:

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