

NEET Mock Test 2

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. With what velocity should a particle be projected so that its height becomes equal to radius of earth? (+4, -1)

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

b. $\left(\frac{8GM}{R}\right)^{1/2}$

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

d. $\left(\frac{4GM}{R}\right)^{1/2}$

-
2. Starting from rest, a body slides down a 45° inclined plane in twice the time it takes to slide down the same distance in the absence of friction. The coefficient of friction between the body and the inclined plane is (+4, -1)

a. 0.8

b. 0.75

c. 0.25

d. 0.33

-
3. A point performs simple harmonic oscillation of period T and the equation of motion is given by $x = a \sin(\omega t + \pi/6)$. After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity? (+4, -1)

a. $T/3$

b. $T/12$

c. $T/8$

d. $T/6$

4. The time period of mass suspended from a spring is T . If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then the new time period will be (+4, -1)

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

5. A parallel-plate capacitor of area A , plate separation d and capacitance C is filled with four dielectric materials having dielectric constants k_1, k_2, k_3 and k_4 as shown in the figure below. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then its dielectric constant k is given by (+4, -1)

- a. $k = k_1 + k_2 + k_3 + 3k_4$
- b. $k = \frac{2}{3}(k_1 + k_2 + k_3) + 2k_4$
- c. $\frac{2}{k} = \frac{3}{k_1 + k_2 + k_3} + \frac{1}{k_4}$
- d. $\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} + \frac{3}{2k_4}$

6. A rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance a from A. The normal reaction on A is (+4, -1)

- a. $\frac{W(d-x)}{x}$
- b. $\frac{W(d-x)}{d}$
- c. $\frac{Wx}{d}$
- d. $\frac{Wd}{x}$

7. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is $\vec{F}$.the net force on the remaining three arms of the loop is (+4, -1)

- a. $3\vec{F}$
- b. $-\vec{F}$
- c. $-3\vec{F}$
- d. $\vec{F}$

8. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is :- (+4, -1)

- a. $h_1 = h_2 = h_3$
- b. $h_1 = 2h_2 = 3h_3$
- c. $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$
- d. $h_2 = 3h_1$ and $h_3 = 3h_2$

9. An object of mass 3 kg is at rest. Now a force of $\vec{F} = 6t^2\hat{i} + 4t\hat{j}$ is applied on the object then velocity of object at $t = 3$ second is :- (+4, -1)

- a. $18\hat{i} + 3\hat{j}$
- b. $18\hat{i} + 6\hat{j}$
- c. $3\hat{i} + 18\hat{j}$
- d. $18\hat{i} + 4\hat{j}$

10. In an astronomical telescope in normal adjustment a straight black line of length L is drawn on inside part of objective lens. The eye-piece forms a real (+4, -1)

image of this line. The length of this image is I . The magnification of the telescope is

- a. $\frac{L+I}{L-I}$
- b. $\frac{L}{I}$
- c. $\frac{L}{I} + I$
- d. $\frac{L}{I} - I$

11. In the nuclear decay given below ${}^A_Z X \rightarrow {}^{A-1}_{Z+1} Y + {}^{A-1}_{Z-1} B + \gamma$, the particles emitted in the sequence are (+4, -1)

- a. γ, β, α
- b. β, γ, α
- c. α, β, γ
- d. β, α, γ

12. Which of the following ray are not electromagnetic waves (+4, -1)

- a. X-rays
- b. γ -rays
- c. β -rays
- d. Heat rays

13. Depletion layer consists of (+4, -1)

- a. mobile ions
- b. protons

- c. electrons
- d. immobile ions

14. Electrons of mass m with de-Broglie wavelength λ fall on the target in an X-ray tube. The cutoff wavelength (λ_0) of the emitted X-ray is (+4, -1)

- a. $\lambda_0 = \frac{2mc\lambda^2}{h}$
- b. $\lambda_0 = \frac{2h}{mc}$
- c. $\lambda_0 = \frac{2m^2c^2\lambda^3}{h^2}$
- d. $\lambda_0 = \lambda$

15. Above Curie temperature : (+4, -1)

- a. a ferromagnetic substance becomes paramagnetic
- b. a paramagnetic substance becomes diamagnetic
- c. a diamagnetic substance becomes paramagnetic
- d. a paramagnetic substance becomes ferromagnetic

16. A 12V, 60W lamp is connected to the secondary of a step down transformer, whose primary is connected to ac mains of 220V. Assuming the transformer to be ideal, what is the current in the primary winding? (+4, -1)

- a. 0.37 A
- b. 0.27 A
- c. 2.7 A
- d. 3.7 A

17. If E and G respectively denote energy and gravitational constant, then $\frac{E}{G}$ has the dimensions (+4, -1)

- a. $[M^2] [L^{-2}] [T^{-1}]$
 - b. $[M^2] [L^{-1}] [T^0]$
 - c. $[M] [L^{-1}] [T^{-1}]$
 - d. $[M] [L^0] [T^0]$
-

18. Consider two rods of the same length and different specific heats (S_1, S_2), conductivities (K_1, K_2), and area of cross-sections (A_1, A_2) and both having temperature T_1 and T_2 at their ends. If the rate of loss of heat due to conduction is equal, then (+4, -1)

- a. $K_1 A_1 = K_2 A_2$
 - b. $\frac{K_1 A_1}{S_1} = \frac{K_2 A_2}{S_2}$
 - c. $K_2 A_1 = K_1 A_2$
 - d. $\frac{K_2 A_1}{S_2} = \frac{K_1 A_2}{S_1}$
-

19. A deuteron is bombarded on ${}^8\text{O}_{16}$ nucleus then the α -particle is emitted then the product nucleus is (+4, -1)

- a. ${}^7\text{N}_{13}$
 - b. ${}^5\text{B}_{10}$
 - c. ${}^4\text{Be}_9$
 - d. ${}^7\text{N}_{14}$
-

20. A coil of 40 henry inductance is connected in series with a resistance of 8 ohms and the combination is joined to the terminals of a 2-volt battery. The time constant of the circuit is (+4, -1)

- a. $\frac{1}{5}$ seconds
- b. 40 seconds
- c. 20 seconds
- d. 5 seconds

21. One mole of an ideal gas at an initial temperature of T K does $6R$ joules of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is $\frac{5}{3}$, the final temperature of gas will be (+4, -1)

- a. $(T - 2.4)$ K
- b. $(T + 4)$ K
- c. $(T - 4)$ K
- d. $(T + 2.4)$ K

22. A position dependent force, $F = (7 - 2x + 3x^2)$ N acts on a small body of mass 2 kg and displaces it from $x = 0$ to $x = 5$ m. The work done in joule is (+4, -1)

- a. 135
- b. 270
- c. 35
- d. 70

23. Copper and silicon is cooled from 300 K to 60 K, the specific resistance (+4, -1)

- a. decrease in copper but increase in silicon
- b. increase in copper but decrease in silicon
- c. increase in both

d. decrease in both.

-
24. The mean radius of earth is R , its angular speed on its own axis is ω and the acceleration due to gravity at earth's surface is g . What will be the radius of the orbit of a geostationary satellite ? (+4, -1)

- a. $(R^2 g / \omega^2)^{1/3}$
- b. $(Rg / \omega^2)^{1/3}$
- c. $(R^2 \omega^2 / g)^{1/3}$
- d. $(R^2 g / \omega)^{1/3}$

-
25. A car is negotiating a curved road of radius R . The road is banked at an angle θ . The coefficient of friction between the types of the car and the road is μ_s . The maximum safe velocity on this road is : (+4, -1)

- a. $\sqrt{gR \frac{\mu_s + \tan \theta}{1 - \mu_s \tan \theta}}$
- b. $\sqrt{\frac{g}{R} \frac{\mu_s + \tan \theta}{1 - \mu_s \tan \theta}}$
- c. $\sqrt{\frac{g}{R^2} \frac{\mu_s + \tan \theta}{1 - \mu_s \tan \theta}}$
- d. $\sqrt{gR^2 \frac{\mu_s + \tan \theta}{1 - \mu_s \tan \theta}}$

-
26. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is (+4, -1)

- a. $(\sqrt{I_1} - \sqrt{I_2})^2$
 - b. $2(I_1 + I_2)$
 - c. $I_1 + I_2$
 - d. $(\sqrt{I_1} + \sqrt{I_2})^2$
-

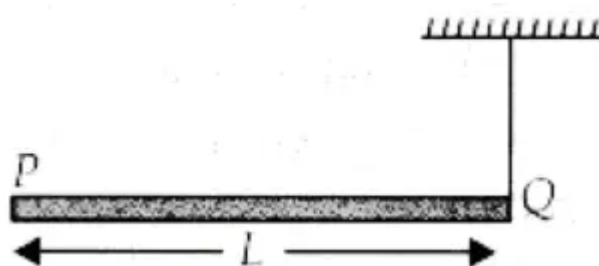
27. A linear harmonic oscillator of force constant $2 \times 10^6 \text{ N/m}$ and amplitude 0.01 m has a total mechanical energy of 160 J . Show that its (a) maximum potential energy is 160 J (b) maximum kinetic energy is 100 J (+4, -1)

- a. P.E. is 160 J
- b. P.E. is zero
- c. P.E. is 100 J
- d. P.E. is 120 J

28. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p . If the distance of Q from the dipole is r (much larger than the size of the dipole), then the electric field at Q is proportional to (+4, -1)

- a. p^2 and r^{-3}
- b. p and r^{-2}
- c. p^{-1} and r^{-2}
- d. p and r^{-3}

29. A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is: (+4, -1)



- a. $\frac{2g}{3L}$
- b. $\frac{3g}{2L}$
- c. $\frac{g}{L}$

d. $\frac{\mu_0 i}{2g} L$

30. A straight conductor carrying current i splits into two parts as shown in the figure. The radius of the circular loop is R . The total magnetic field at the centre P at the loop is : (+4, -1)

a. Zero

b. $3\mu_0 i / 32 R$, outward

c. $3\mu_0 i / 32 R$, inward

d. $\frac{\mu_0 i}{2R}$, inward

31. Identify the vector quantity among the following (+4, -1)

a. distance

b. angular momentum

c. heat

d. energy

32. If a ball is thrown vertically upwards with speed u , the distance covered during the last ' t ' seconds of its ascent is (+4, -1)

a. ut

b. $\frac{1}{2}gt^2$

c. $ut - \frac{1}{2}gt^2$

d. $(u + gt)t$

33. In the nucleus of ${}_{11}\text{Na}^{23}$, the number of protons, neutrons and electrons are (+4, -1)

a. 11,12,0

- b. 23,12,11
- c. 12,11,0
- d. 23,11,12

34. In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be angle of refraction ? **(+4, -1)**

- a. equal to angle of incidence
- b. 90°
- c. 180°
- d. 0°

35. Diamond is very hard because **(+4, -1)**

- a. it is covalent solid
- b. it has large cohesive energy
- c. high melting point
- d. insoluble in all solvents

Physics Section B

36. For photoelectric emission from certain metal the cutoff frequency is ν . If radiation of frequency 2ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass) : (+4, -1)

- a. $2\sqrt{h\nu/m}$
- b. $\sqrt{h\nu/(2m)}$
- c. $\sqrt{h\nu/m}$
- d. $\sqrt{2h\nu/m}$

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

	List - I (Electromagnetic Waves)		List - II (Wavelength)
(a)	AM radio waves	(i)	10^{-10} m
(b)	Microwaves	(ii)	10^2 m
(c)	Infrared Radiations	(iii)	10^{-2} m

Choose the correct answer from the options given below:

- a. (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
 - b. (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)
 - c. (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)
 - d. (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)
38. A big circular coil of 1000 turns and average radius 10 m is rotating about its horizontal diameter at 2 rad s^{-1} . If the vertical component of earth's magnetic field at that place is $2 \times 10^{-5} \text{ T}$ and electrical resistance of the coil is 12.56Ω , then the maximum induced current in the coil will be: (+4, -1)

- a. 0.25 A

b. 1.5 A

c. 1 A

d. 2 A

39. If force $[F]$, acceleration $[A]$ and time $[T]$ are chosen as the fundamental physical quantities. Find the dimensions of energy (+4, -1)

a. $[F] [A^{-1}] [T]$

b. $[F] [A] [T]$

c. $[F] [A] [T^2]$

d. $[F] [A] [T^{-1}]$

40. A step-down transformer connected to an ac mains supply of 220 V is made to operate at 11 V, 44 W lamp. Ignoring power losses in the transformer, what is the current in the primary circuit (+4, -1)

a. 4 A

b. 0.2 A

c. 0.4 A

d. 2 A

41. Which of the following circular rods, (given radius r and length l) each made of the same material and whose ends are maintained at the same temperature will conduct most heat? (+4, -1)

a. $r = 2r_0 ; l = 2l_0$

b. $r = 2r_0 ; l = l_0$

c. $r = r_0; l = l_0$

d. $r = r_0; l = 2l_0$

42. In the reaction ${}^2_1H + {}^3_1H \rightarrow {}^4_2He + {}^1_0n$, if the binding energies of 2_1H , 3_1H and 4_2He are respectively a , b and c (in MeV), then the energy (in MeV) released in this reaction is: (+4, -1)

a. $c + a - b$

b. $c - a - b$

c. $a + b + c$

d. $a + b - c$

43. The ratio (W/Q) for a carnot-engine is $\frac{1}{6}$, Now the temperature of sink is reduced by $62^\circ C$, then this ratio becomes twice, therefore the initial temperature of the sink and source are respectively: (+4, -1)

a. $33^\circ C, 67^\circ C$

b. $37^\circ C, 99^\circ C$

c. $67^\circ C, 33^\circ C$

d. $97K, 37K$

44. When a body moves with a constant speed along a circle (+4, -1)

a. no work is done on it

b. no acceleration is produced in it

c. its velocity remains constant

d. no force acts on it

45. If specific resistance of a potentiometer wire is $10^{-7} \Omega m$ and current flow through it is 0.1 amp., cross-sectional area of wire is $10^{-6} m^2$ then potential gradient will be (+4, -1)
- $10^{-2} \text{ volt}/m$
 - $10^{-4} \text{ volt}/m$
 - $10^{-6} \text{ volt}/m$
 - $10^{-8} \text{ volt}/m$
-
46. The escape velocity of a body on the surface of the earth is $11.2 km/s^{-1}$. If the earth's mass increases to twice its present value and radius of the earth becomes half, the escape velocity becomes (+4, -1)
- $22.4 km/s^{-1}$
 - $44.8 km/s^{-1}$
 - $5.6 km/s^{-1}$
 - $11.2 km/s^{-1}$
-
47. A car of mass $1000 kg$ negotiates a banked curve of radius $90 m$ on a frictionless road. If the banking angle is 45° , the speed of the car is (+4, -1)
- $20 ms^{-1}$
 - $30 ms^{-1}$
 - $5 ms^{-1}$
 - $10 ms^{-1}$
-
48. A particle executes linear simple harmonic motion with an amplitude of $3 cm$. When the particle is at $2 cm$ from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is : (+4, -1)

a. $\frac{\sqrt{5}}{2\pi}$

b. $\frac{4\pi}{\sqrt{5}}$

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

d. $\frac{\sqrt{5}}{\pi}$

49. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distances of 2 m and 3 m respectively from the source. The ratio of the intensities of the waves at P and Q is

(+4, -1)

a. 3 : 2

b. 2 : 3

c. 9 : 4

d. 4 : 9

50. A rope of negligible mass is wound round a hollow cylinder of mass 3 kg and radius 40 cm. If the rope is pulled with a force of 30 N, then the angular acceleration produced in the cylinder is

(+4, -1)

a. 15 rad s^{-2}

b. 20 rad s^{-2}

c. 25 rad s^{-2}

d. 30 rad s^{-2}

Chemistry Section A

51. Cuprous compounds such as $CuCl$, $CuCN$ and $CuSCN$ are the only salts stable in H_2O due to (+4, -1)

- a. high hydration energy of Cu^+ ions
- b. their inherent tendency not to disproportionate
- c. diamagnetic nature
- d. insolubility in water

52. Given are cyclohexanol (I), acetic acid (II), 2, 4, 6-trinitrophenol (III) and phenol (IV). In these, the order of decreasing acidic character will be (+4, -1)

- a. $III > II > IV > I$
- b. $II > III > I > IV$
- c. $II > III > IV > I$
- d. $III > IV > II > I$

53. obtained by chlorination of n-butane, will be (+4, -1)

- a. meso form
- b. racemic mixture
- c. d-form
- d. l-form

54. **Statement I:** The acidic strength of monosubstituted nitrophenol is higher than phenol because of electron withdrawing nitro group. (+4, -1)

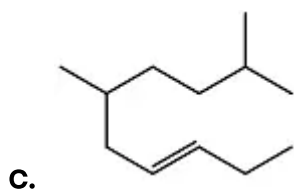
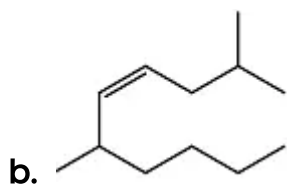
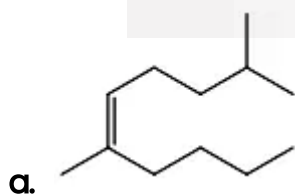
Statement II: o-nitrophenol, m-nitrophenol and p-nitrophenol will have same acidic strength as they have one nitro group attached to the phenolic ring. Choose the most appropriate answer from the options given below:

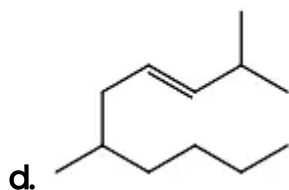
- a. Both Statement I and Statement II are correct.
- b. Both Statement I and Statement II are incorrect.
- c. Statement I is correct but Statement II is incorrect.
- d. Statement I is incorrect but Statement II is correct.

55. Copper crystallises in fcc unit cell with cell edge length of 3.608×10^{-8} cm. (+4, -1)
The density of copper is 8.92 g cm^{-3} . Calculate the atomic mass of copper

- a. 63.1 u
- b. 31.55 u
- c. 60 u
- d. 65 u

56. The correct structure of 2,6-Dimethyl-dec-4-ene is : (+4, -1)





57. The ions O_2^- , F^- , Na^+ , Mg^{2+} and Al^{3+} are isoelectronic. Their ionic radii show: (+4, -1)

- a. A significant increase from O_2^- to Al^{3+}
- b. A significant decrease from O_2^- to Al^{3+}
- c. An increase from O_2^- to F^- and then decrease from Na^+ to Al^{3+}
- d. An decrease from O_2^- to F^- and then increase from Na^+ to Al^{3+}

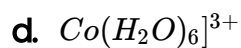
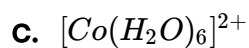
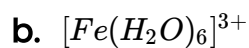
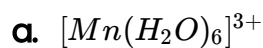
58. Which one shows maximum hydrogen bonding? (+4, -1)

- a. H_2O
- b. H_2Se
- c. H_2S
- d. HF

59. Vitamin B_{12} contains (+4, -1)

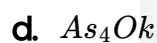
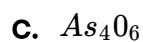
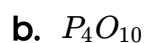
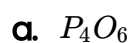
- a. Zn (II)
- b. Ca (II)
- c. Fe (II)
- d. Co (III)

60. Among the following complexes, the one which shows zero crystal field stabilisation energy (CFSE) is (+4, -1)



61. Among the following oxides, the least acidic is

(+4, -1)



62. Consider the following sets of quantum number:

(+4, -1)

	n	ℓ	m	s
(a)	3	0	0	+1/2
(b)	2	2	1	+1/2
(c)	4	3	-2	-1/2
(d)	1	0	-1	-1/2
(e)	3	2	3	+1/2

Which of the following sets of quantum number is not possible:

a. (ii), (iii) and (iv)

b. (i), (ii), (iii) and (iv)

c. (ii), (iv) and (v)

d. (i) and (iii)

63. Cyclopropane and oxygen at partial pressures 170 torr and 570 torr are mixed in a gas cylinder. What is the ratio of the number of moles of cyclopropane to the number of moles of oxygen? (+4, -1)

a. $\frac{170 \times 42}{570 \times 32} = 0.39$

b. $\frac{170}{42} \div \left(\frac{170}{42} + \frac{570}{32} \right) \approx 0.19$

c. $\frac{170}{740} = 0.23$

d. $\frac{170}{570} = 0.30$

64. Equal volumes of three acid solutions of pH 3, 4 and 5 are mixed in a vessel. What will be the H^+ ion concentration in the mixture? (+4, -1)

a. $1.11 \times 10^{-4} M$

b. $3.7 \times 10^{-4} M$

c. $3.7 \times 10^{-3} M$

d. $1.11 \times 10^{-3} M$

65. If the rate constant for a first order reaction is k, the time(t) required for the completion of 99% of the reaction is given by : (+4, -1)

a. $t = 4.606/k$

b. $t = 2.303/k$

c. $t = 0.693/k$

d. $t = 6.909/k$

66. The e.m.f. of a Daniell cell at 298 K is E_1 . $Zn/SO_4(0.01M)||CuSO_4(1.0M)/Cu$ (+4, -1)
When the concentration of $ZnSO_4$ is 1.0 M and that of $CuSO_4$ is 0.01 M, the e.m.f. is changed to E_2 . What is the relationship between E_1 and E_2 :

- a. $E_1 < E_2$
- b. $E_1 > E_2$
- c. $E_2 = 0 \neq E_1$
- d. $E_1 = E_2$

67. In which case change in entropy is negative ? (+4, -1)

- a. Sublimation of solid to gas
- b. $2H(g) \rightarrow H_2(g)$
- c. Evaporation of water
- d. Expansion of a gas at constant temperature

68. In which case is the number of molecules of water maximum ? (+4, -1)

- a. 10^{-3} mol of water
- b. 18 mL of water
- c. 0.00224 L of water vapours at 1 atm and 273 K
- d. 0.18 g of water

69. What is the molarity of H_2SO_4 solution that has a density of 1.84 g/cc at 35°C (+4, -1)
and contains 98% by weight ?

- a. 4.18 M
- b. 8.14 M

c. 18.4 M

d. 18 M

70. Correct the increasing order of acidity is as (+4, -1)

a. H_2O, C_2H_2, H_2CO_3 , phenol

b. C_2H_2, H_2O, H_2CO_3 , phenol

c. Phenol, C_2H_2, H_2CO_3, H_2O

d. C_2H_2, H_2O , phenol and H_2CO_3

71. For the four successive transition elements (Cr, Mn, Fe and Co), the stability of +2 oxidation state will be there in which of the following order? (At. no. $Cr = 24, Mn = 25, Fe = 26, Co = 27$) (+4, -1)

a. $Fe > Mn > Co > Cr$

b. $Co > Mn > Fe > Cr$

c. $Cr > Mn > Co > Fe$

d. $Mn > Fe > Cr > Co$

72. Ketones $[RCOR]$ where $R = R_1 =$ alkyl group, can be obtained in one step by (+4, -1)

a. hydrolysis of esters

b. oxidation of primary alcohols

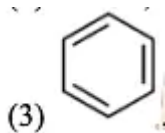
c. oxidation of tertiary alcohols

d. reaction of acid halide with alcohols

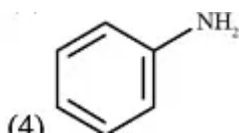
73. Which of the following sequence of reactions is suitable to synthesize chlorobenzene? (+4, -1)

a. Benzene, Cl_2 , anhydrous FeCl_3

b. Phenol, NaNO_2 , HCl , CuCl



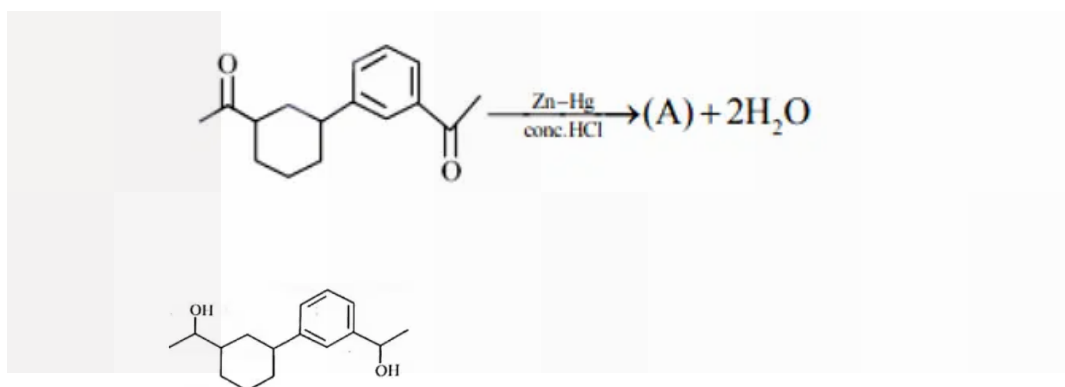
c. HCl



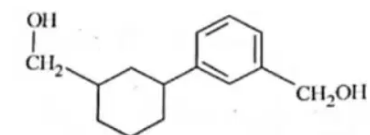
d. HCl , Heating

74. Identify product (A) in the following reaction:

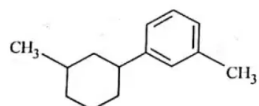
(+4, -1)



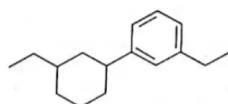
a.



b.



c.



d.

75. What fraction of one edge centred octahedral void lies in one unit cell of fcc? (+4, -1)

- a. $\frac{1}{3}$
- b. $\frac{1}{4}$
- c. $\frac{1}{12}$
- d. $\frac{1}{2}$

76. The major product formed in the dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This product formation is based on (+4, -1)

- a. Huckel's Rule
- b. Saytzeff's Rule
- c. Hund's Rule
- d. Hofmann Rule

77. A nuclide of an alkaline earth metal undergoes radioactive decay by emission of three α particles in succession. The group of the periodic table to which the resulting daughter element would belong is: (+4, -1)

- a. Group 14
- b. Group 16
- c. Group 4
- d. Group 6

78. Which statement is not correct? (+4, -1)

- a. A sigma bond is weaker than a π -bond
- b. A sigma bond is stronger than a π -bond

- c. A double bond is stronger than a single bond
- d. A double bond is shorter than a single bond

79. α -D-glucose and β -D-glucose are (+4, -1)

- a. anomers
- b. epimers
- c. enantiomers
- d. geometrical isomers

80. Among the following the correct order of acidity is : (+4, -1)

- a. $HClO < HClO_2 < HClO_3 < HClO_4$
- b. $HClO_4 < HClO < HClO_3 < HClO_4$
- c. $HClO_4 < HClO_2 < HClO < HClO_3$
- d. $HClO_3 < HClO_4 < HClO_2 < HClO$

81. Among the following which is not the π -bonded organometallic compound (+4, -1)

- a. $K [PtCl_3 (\eta^2 - C_2H_4)]$
- b. $Fe(\eta^5 - C_5H_5)_2$
- c. $Cr(\eta^6 - C_6H_6)_2$
- d. $(CH_3)_4Sn$

82. An ion has 18 electrons in the outermost shell, it is (+4, -1)

- a. Cu^+
- b. Th^{4+}

c. Cs^+

d. K^+

83. Dipole induced dipole interactions are present in which of the following pairs (+4, -1)
:-

a. SiF_4 and He atoms

b. H_2O and alcohol

c. Cl_2 and CCl_4

d. HCl and He atoms

84. Equilibrium constant K_p for following reaction : $MgCO_3 \rightleftharpoons MgO(S) + CO_2(g)$ (+4, -1)

a. $K_p = P_{CO_2}$

b. $K_p = P_{CO_2} \times \frac{P_{CO_2} \times P_{MgO}}{P_{MgCO_3}}$

c. $K_p = \frac{P_{CO_2} + P_{MgO}}{P_{MgCO_3}}$

d. $K_p = \frac{P_{MgCO_3}}{P_{CO_2} \times P_{MgO}}$

85. If the rate of a reaction is equal to the rate constant, the order of the reaction is (+4, -1)

a. 2

b. 3

c. 0

d. 1

Chemistry Section B

86. Limiting molar conductivity of NH_4OH [i.e. $\Lambda_m^\circ(NH_4OH)$] is equal to (+4, -1)

- a. $\Lambda_m^\circ(NH_4OH) + \Lambda_m^\circ(NaCl) - \Lambda_m^\circ(NaOH)$
- b. $\Lambda_m^\circ(NH_4Cl) + \Lambda_m^\circ(NHOH) + \Lambda_m^\circ(NaCl)$
- c. $\Lambda_m^\circ(NH_4Cl) + \Lambda_m^\circ(NaCl) - \Lambda_m^\circ(NaOH)$
- d. $\Lambda_m^\circ(NH_4Cl) + \Lambda_m^\circ(NaOH) - \Lambda_m^\circ(NaCl)$

87. Under isothermal condition, a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is: [Given that 1 L bar = 100 J] (+4, -1)

- a. 25 J
- b. 30 J
- c. - 30 J
- d. 5 kJ

88. What is the mass of the precipitate formed when 50 mL of 16.9% solution of $AgNO_3$ is mixed with 50 mL of 5.8% $NaCl$ solution? (Ag = 107.8, N = 14, O = 16, Na = 23, Cl = 35.5) (+4, -1)

- a. 7 g
- b. 14 g
- c. 28 g
- d. 3.5 g

89. What is the mole fraction of the solute in a 1.00 *m* aqueous solution? (+4, -1)

- a. 0.0354

b. 0.0177

c. 0.177

d. 1.77

90. For the following: (a) I^- (b) Cl^- (c) Br^- The increasing order of nucleophilicity would be: (+4, -1)

a. $Br^- < Cl^- < I^-$

b. $I^- < Br^- < Cl^-$

c. $Cl^- < Br^- < I^-$

d. $I^- < Cl^- < Br^-$

91. Identify the correct order of solubility in aqueous medium : (+4, -1)

a. $Na_2S > ZnS > CuS$

b. $CuS > ZnS > Na_2S$

c. $ZnS > Na_2S > CuS$

d. $Na_2S < CuS > ZnS$

92. Which of the following is incorrect : - (+4, -1)

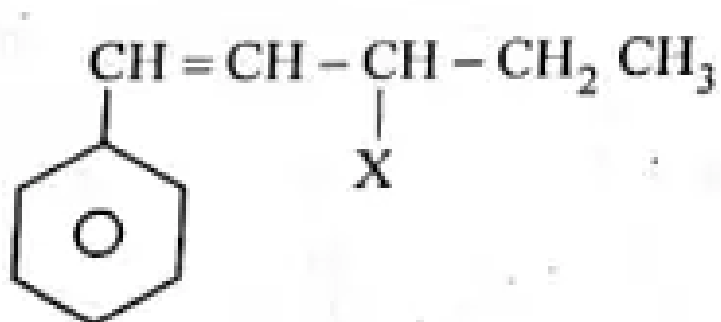
a. $FeCl_3$ is used in detection of phenol

b. Fehling solution is used in detection of glucose

c. Tollen reagent is used in detection of unsaturation

d. $NaHSO_3$ is used in detection of carbonyl compound

93. The given compound (+4, -1)

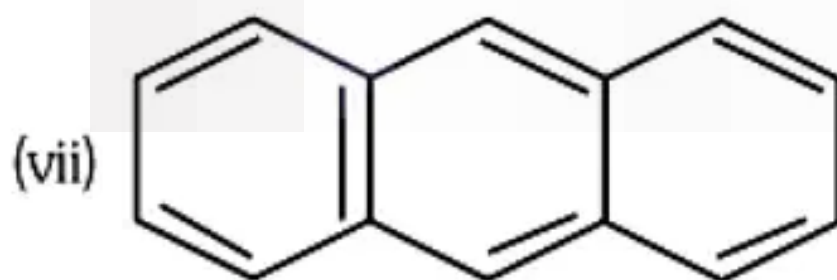
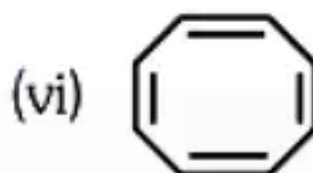
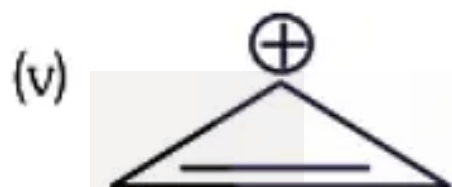
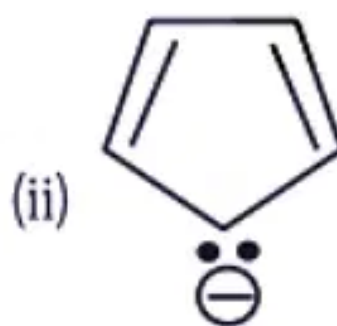
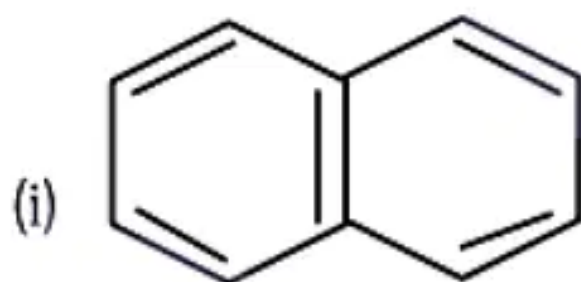


is an example of _____.

- a. Aryl halide
- b. Allylic halide
- c. Vinylic halide
- d. Benzylic halide

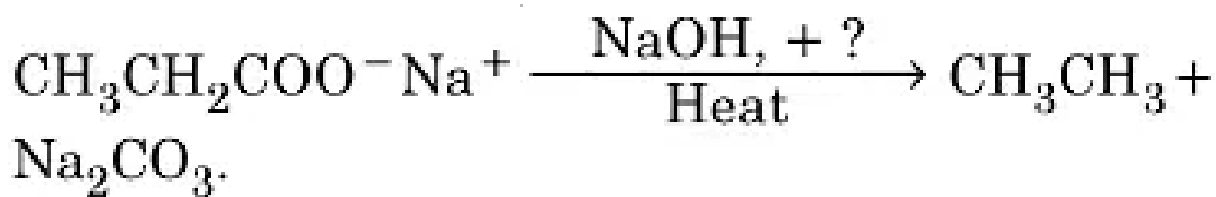
94. Consider the following compounds/species:

(+4, -1)



The number of compounds/species which obey Huckel's rule is _ _ _ _ _.

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



95. Consider the above reaction and identify the missing reagent/chemical. (+4, -1)

- a. DIBAL-H
 - b. B_2H_6
 - c. Red Phosphorus
 - d. CaO
-

96. Number of atom per unit cell in B.C.C. (+4, -1)

- a. 9
 - b. 4
 - c. 2
 - d. 1
-

97. Among LiCl , BeCl_2 , BCl_3 and CCl_4 , the covalent bond character follows the order (+4, -1)

- a. $\text{LiCl} < \text{BeCl}_2 > \text{BCl}_3 > \text{CCl}_4$
 - b. $\text{LiCl} < \text{BeCl}_2 < \text{BCl}_3 > \text{CCl}_4$
 - c. $\text{LiCl} < \text{BeCl}_2 < \text{BCl}_3 < \text{CCl}_4$
 - d. $\text{LiCl} > \text{BeCl}_2 > \text{BCl}_3 > \text{CCl}_4$
-

98. Among the following which is the strongest oxidising agent?

(+4, -1)

- a. F_2
- b. Br_2
- c. I_2
- d. Cl_2

99. RNA and DNA are chiral molecules, their chirality is due to

(+4, -1)

- a. L-sugar component
- b. chiral bases
- c. chiral phosphate ester units
- d. D-sugar component

100. Which of the following will give a pair of enantiomers? (en = $NH_2CH_2CH_2NH_2$)

(+4, -1)

- a. $[Cr(NH_3)_6][Co(CN)_6]$
- b. $[Co(en)_2Cl_2]Cl$
- c. $[Pt(NH_3)_4][PtCl_6]$
- d. $[Co(NH_3)_4Cl_2]NO_2$

Zoology Section A

101. In Amoeba and Paramecium osmoregulation occurs through (+4, -1)
- a. pseudopodia
 - b. nucleus
 - c. contractile vacuole
 - d. general surface.
-
102. In which point, pulmonary artery is different from pulmonary vein? (+4, -1)
- a. its lumen is broad
 - b. its wall is thick
 - c. it has valves
 - d. it does not possess endothelium.
-
103. Increased asthmatics attacks in certain seasons are related to (+4, -1)
- a. eating fruits preserved in tin containers
 - b. inhalation of seasonal pollen
 - c. low temperature
 - d. hot and humid environment.
-
104. Large woody vines are more commonly found in (+4, -1)
- a. Tropical rainforests
 - b. Alpine forests
 - c. Temperate forests

d. Mangroves

105. The vitamin C or ascorbic acid prevents (+4, -1)

- a. scurvy
- b. antibody synthesis
- c. rickets
- d. pellagra.

106. Which of the following fern is an excellent biofertilizer? (+4, -1)

- a. Marsilia
- b. Pteridium
- c. Azolla
- d. Salvinia.

107. Ovulation in the human female normally takes place during the menstrual cycle (+4, -1)

- a. Just before the end of the secretory cycle
- b. At the beginning of the proliferative phase
- c. At the end of the proliferative phase
- d. At the mid secretory phase

108. Haemophilia is more commonly seen in human males than in human females because (+4, -1)

- a. A greater proportion of girls die in infancy
- b. This disease is due to an Y-linked recessive mutation

- c. This disease is due to an X-linked recessive mutation
- d. This disease is due to an X-linked dominant mutation

109. Which of the following joints would allow no movements? (+4, -1)

- a. Synovial joint
- b. Ball and Socket joint
- c. Fibrous joint
- d. Cartilaginous joint

110. Cytoskeleton is made up of (+4, -1)

- a. callose deposits
- b. cellulosic microfibrils
- c. proteinaceous filaments
- d. calcium carbonate granules

111. DNA fingerprinting refer to (+4, -1)

- a. Molecular analysis of profiles of DNA samples
- b. Analysis of DNA samples using imprinting devices
- c. Techniques used for molecular analysis of different specimens of DNA
- d. Techniques used for identification of fingerprints of individuals.

112. Meiosis I is reductional division. Meiosis II is equational division due to (+4, -1)

- a. pairing of homologous chromosomes
- b. crossing over

- c. separation of chromatids
- d. disjunction of homologous chromosomes.

113. The sympathetic nerves, in mammals, arise from (+4, -1)

- a. sacral nerves
- b. 3rd, 7th, 9th and 10th cranial nerves
- c. thoraco-lumbar nerves
- d. cervical nerves.

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

Statement I: Restriction endonucleases recognise specific sequences to cut DNA known as palindromic nucleotide sequences.

Statement II: Restriction endonucleases cut the DNA strand a little away from the centre of the palindromic site.

In the light of the above statements, choose the most appropriate 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

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

	List I		List II
A	Taenia	I	Nephridia
B	Paramoecium	II	Contractile vacuole
C	Periplaneta	III	Flame cells
D	Pheretima	IV	Urecose gland

Choose the correct answer from the options given below:

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

116. Erythropoietin hormone which stimulates R.B.C. formation is produced by (+4, -1)

- a. Juxtaglomerular cells of the kidney
- b. Alpha cells of pancreas
- c. The cells of rostral adenohypophysis
- d. The cells of bone marrow

117. A person is undergoing prolonged fasting. His urine will be found to contain abnormal quantities of: (+4, -1)

- a. fats
- b. ketones
- c. amino acids
- d. glucose

118. In which one of the following enzymes, is copper necessarily associated as an activator (+4, -1)

- a. Tryptophanase
- b. Lactic dehydrogenase
- c. Tyrosinase
- d. Carbonic anhydrase

119. Mast cells of connective tissue contain (+4, -1)

- a. Heparin and histamine
- b. Heparin and calcitonin
- c. Serotonin and melanin
- d. Vasopressin and relaxin

120. Triticale, the first man-made cereal crop, has been obtained by crossing wheat with : (+4, -1)

- a. rye
- b. pearl millet
- c. sugarcane
- d. barley

121. The organisms attached to the substratum, generally, possess (+4, -1)

- a. one single opening of the digestive canal
- b. cilia on the surface to create water current
- c. radial symmetry

d. asymmetrical body.

122. De Vries gave his mutation theory on organic evolution while working on (+4, -1)

- a. *Pisum sativum*
- b. *Drosophila melanogaster*
- c. *Oenothera lamarckiana*
- d. *Althaea rosea*

123. How many sperms are formed from a secondary spermatocyte? (+4, -1)

- a. 4
- b. 8
- c. 2
- d. 1



124. In bacteria, plasmid is :- (+4, -1)

- a. extra chromosomal material
- b. main DNA
- c. non functional DNA
- d. repetitive gene.

125. Infection of *Ascaris* usually occurs by (+4, -1)

- a. Mosquito bite
- b. Drinking water containing eggs of *Ascaris*
- c. Eating imperfectly cooked pork

d. Tsetse fly

126. Lymph differs from blood in possessing (+4, -1)

- a. only WBC
- b. more RBC and WBC
- c. more RBC and few WBC
- d. more WBC and few RBC.

127. Plants such as Prosopis, Acacia and Capparis represent examples of tropical (+4, -1)

- a. deciduous forests
- b. evergreen forests
- c. grass lands
- d. thorn forests.

128. Vitamin K is required for (+4, -1)

- a. change of prothrombin into thrombin
- b. synthesis of prothrombin
- c. change of fibrinogen to fibrin
- d. formation of thromboplastin.

129. Which one of the following is not used in organic farming ? (+4, -1)

- a. Earthworm
- b. Oscillatoria
- c. Snail

d. Glomus

130. In oogamy fertilization involves (+4, -1)

- a. A large non-motile female gamete and a small motile male gamete
- b. A large non-motile female gamete and a small non-motile male gamete
- c. A large motile female gamete and a small non-motile male gamete
- d. A small non-motile female gamete and a large motile male gamete

131. A tall true breeding garden pea plant is crossed with a dwarf true breeding garden pea plant. When the F₁ plants were selfed the resulting genotypes were in the ratio of - (+4, -1)

- a. 1 : 2 : 1 :: Tall heterozygous : Tall homozygous : Dwarf
- b. 3 : 1 :: Tall : Dwarf
- c. 3 : 1 :: Dwarf : Tall
- d. 1 : 2 : 1 :: Tall homozygous : Tall heterozygous : Dwarf

132. Which of the following is the contractile protein of a muscle? (+4, -1)

- a. tropomyosin
- b. tubulin
- c. myosin
- d. all of these.

133. DNA is mainly found in (+4, -1)

- a. nucleolus

- b. nucleus only
- c. cytoplasm only
- d. none of these.

134. DNA is not present in

(+4, -1)

- a. nucleus
- b. mitochondria
- c. chloroplast
- d. ribosomes

135. Microtubule is involved in the

(+4, -1)

- a. muscle contraction
- b. membrane architecture
- c. cell division
- d. DNA recognition.

Zoology Section B

136. The transparent lens in the human eye is held in its place by (+4, -1)

- a. smooth muscles attached to the ciliary body
- b. ligaments attached to the ciliary body
- c. smooth muscles attached to the iris
- d. ligaments attached to the iris

137. Statements related to human insulin are given below: Which statement(s) (+4, -1)
is/are correct about genetically engineered Insulin?

- a. Pro-hormone insulin contain extra stretch of C-peptide
- b. A peptide and B-peptide chains of insulin were produced separately in E. coli, extracted and combined by creating a disulphide bond between them.
- c. Insulin used for treating Diabetes was extracted from Cattles and Pigs.
- d. Pro-hormone insulin needs to be processed for converting into a mature and functional hormone.
- e. Some patients develop allergic reactions to the foreign insulin.

Choose the most appropriate answer from the options given below:

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

138. Identify the types of cell junctions that help to stop the leakage of the (+4, -1)
substances across a tissue and facilitation of communication with
neighboring cells via rapid transfer of ions and molecules

- a. Adhering junctions and Gap junctions, respectively

- b. Gap junctions and Adhering junctions, respectively
- c. Tight junctions and Gap junctions, respectively
- d. Adhering junctions and Tight junctions, respectively

139. Melatonin is secreted by:

(+4, -1)

- a. Pineal body
- b. Skin
- c. Pituitary Gland
- d. Thyroid

140. If Henle's loop were absent from mammalian nephron, which of the following is to be expected:

(+4, -1)

- a. There will be no urine formation
- b. There will be hardly any change in the quality and quantity of urine formed
- c. The urine will be more concentrated
- d. The urine will be more dilute

141. Which of the following statements is not true for retroviruses

(+4, -1)

- a. Retroviruses carry gene for RNA-dependent DNA polymerase
 - b. The genetic material in mature retroviruses is RNA
 - c. Retroviruses are causative agents for certain kinds of cancer in man
 - d. DNA is not present at any stage in the life cycle of retroviruses.
-

142. When CO₂ concentration in blood increases, breathing becomes **(+4, -1)**

- a. There is no effect on breathing
- b. Slow and deep
- c. Faster and deeper
- d. Shallower and slow

143. One of the special characters of coelenterata only is the occurrence of **(+4, -1)**

- a. polymorphism
- b. flame cells
- c. hermaphroditism
- d. nematocysts.

144. Diversification in plant life appeared **(+4, -1)**

- a. due to long periods of evolutionary changes
- b. due to abrupt mutations
- c. suddenly on earth
- d. by seed dispersal.

145. Identify the correct statement on 'inhibin' - **(+4, -1)**

- a. Is produced by granulose cells in ovary and inhibits the secretion of FSH
- b. Is produced by granulose cells in ovary and inhibits the secretion of LH
- c. Is produced by nurse cells in testes and inhibits the secretion of LH
- d. Inhibits the secretion of LH, FSH and Prolactin

146. In eubacteria, a cellular component that resembles eukaryotic cell is (+4, -1)

- a. Plasma membrane
- b. Nucleus
- c. Ribosomes
- d. Cell wall

147. Interferons are synthesized in response to (+4, -1)

- a. mycoplasma
- b. bacteria
- c. viruses
- d. fungi.

148. Plants which produce characteristic pneumatophores and show vivipary belong to : (+4, -1)

- a. Halophytes
- b. Psammophytes
- c. Hydrophytes
- d. Mesophytes

149. Wharton's duct is associated with (+4, -1)

- a. sublingual salivary gland
- b. parotid salivary gland ,
- c. submaxillary salivary gland

d. Brunner's glands.

150. What would be the heart rate of a person if the cardiac output is 5 L, blood volume in the ventricles at the end of diastole is 100 mL and at the end of ventricular systole is 50 mL ? **(+4, -1)**

- a. 100 beats per minute
- b. 125 beats per minute
- c. 50 beats per minute
- d. 75 beats per minute



Botany Section A

151. Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature ? (+4, -1)

- a. The first word in a biological name represents the genus name, and the second is a specific epithet
- b. The names are written in Latin and are italicised
- c. When written by hand, the names are to be underlined
- d. Biological names can be written in any language

152. Organisms called methanogens are most abundant in a (+4, -1)

- a. Sulphur rock
- b. Cattle yard
- c. Polluted stream
- d. Hot spring

153. Which is correct pair for edible part? (+4, -1)

- a. tomato-thalamus
- b. maize-cotyledons
- c. guava-mesocarp
- d. date palm-mesocarp.

154. Which one of the following is not common between Funaria and Selaginella (+4, -1)

- a. archegonium
- b. embryo

- c. flagellate sperms
- d. roots.

155. Pollen tablets are available in the market for (+4, -1)

- a. in vitro fertilization
- b. breeding programmes
- c. supplementing food
- d. ex situ conservation.

156. All enzymes of *TCA* cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is (+4, -1)

- a. Malate dehydrogenase
- b. Isocitrate dehydrogenase
- c. Succinate dehydrogenase
- d. Lactate dehydrogenase

157. Which element is located at the centre of the porphyrin ring in chlorophyll ? (+4, -1)

- a. Calcium
- b. Magnesium
- c. Potassium
- d. Manganese

158. Biodiversity Act of India was passed by the Parliament in the year (+4, -1)

- a. 1992

- b. 1996
- c. 2000
- d. 2002

159. Boron in green plants assists in (+4, -1)

- a. Activation of enzymes
- b. Acting as enzyme co-factor
- c. Photosynthesis
- d. Sugar transport

160. Coiling of garden pea tendrils around any support is an example of (+4, -1)

- a. thigmotaxis
- b. thigmonasty
- c. thigmotropism
- d. thermotaxis.

161. Compared to a bull a bullock is docile because of (+4, -1)

- a. higher levels of cortisone
- b. lower levels of blood testosterone
- c. lower levels of adrenaline/noradrenaline in its blood
- d. higher levels of thyroxine.

162. During ecological succession (+4, -1)

- a. the numbers and types of animals remain constant

- b. the changes lead to a community that is in near equilibrium with the environment and is called pioneer community
- c. the gradual and predictable change in species composition occurs in a given area
- d. the establishment of a new biotic community is very fast in its primary phase.

163. Guard cells help in

(+4, -1)

- a. transpiration
- b. guttation
- c. fighting against infection
- d. protection against grazing.

164. The cork cambium, cork and secondary cortex are collectively called :

(+4, -1)

- a. Phelloderm
- b. periderm
- c. Phellogen
- d. Phellem

165. Which one of the following statement is not valid for aerosols ?

(+4, -1)

- a. They alter rainfall and monsoon patterns
 - b. They cause increased agricultural productivity
 - c. They have negative impact on agricultural land
 - d. They are harmful to human health
-

166. Megaspores are produced from the megaspore mother cells after (+4, -1)

- a. mitotic division
- b. formation of thick wall
- c. differentiation
- d. meiotic division.

167. Male gametes are flagellated in (+4, -1)

- a. Ectocarpus
- b. Spirogyra
- c. Polysiphonia
- d. Anabaena.

168. 'Origin of Species' was written by (+4, -1)

- a. Oparin
- b. Weismann
- c. Lamarck
- d. Darwin.

169. Oxygenic photosynthesis occurs in (+4, -1)

- a. Oscillatoria
- b. Rhodospirillum
- c. Chlorobium
- d. Chromatium

170. Coconut fruit is a : (+4, -1)

- a. Berry
- b. Nut
- c. Capsule
- d. Drupe

171. The plant group that produces spores and embryo but lacks vascular tissues and seeds is (+4, -1)

- a. pteridophyta
- b. rhodophyta
- c. bryophyta
- d. phaeophyta

172. The role of double fertilization in angiosperms is to produce (+4, -1)

- a. cotyledons
- b. endocarp
- c. endosperm
- d. integuments.

173. As per chemiosmotic coupling hypothesis, in mitochondria, protons accumulate in the (+4, -1)

- a. outer membrane
- b. inner membrane
- c. intermembrane space

d. matrix

174. Biodiversity of geographical region represents (+4, -1)

- a. Endangered species found in the region
- b. The diversity in the organisms living in the region
- c. Genetic diversity in the dominant species of the region
- d. Species endemic to the region

175. Bundle sheath cells (+4, -1)

- a. are rich in PEP carboxylase
- b. lack RuBisCO
- c. lack both RuBisCO and PEP carboxylase
- d. are rich in RuBisCO.

176. Crop plants grown in monoculture are - (+4, -1)

- a. Highly prone to pests
- b. Low in yield
- c. Free from intraspecific competition
- d. Characterised by poor root system

177. Cytokinins are known to : (+4, -1)

- a. promote abscission
- b. influence water movement
- c. help retain chlorophyll

d. inhibit protoplasmic streaming.

178. Deficiency symptoms of nitrogen and potassium are visible first in (+4, -1)

- a. senescent leaves
- b. young leaves
- c. roots
- d. buds.

179. Guttation is mainly due to (+4, -1)

- a. root pressure
- b. osmosis
- c. transpiration
- d. imbibition.

180. In a biotic community, the primary consumers are (+4, -1)

- a. detritivores
- b. herbivores
- c. carnivores
- d. omnivores.

181. Tracheids differ from other tracheary elements in (+4, -1)

- a. having casparian strips
- b. being imperforate
- c. lacking nucleus

d. being lignified.

182. Which one of the following is not correct as regards the harmful effects of particulate matter of the size 2.5 micro meters or less ? **(+4, -1)**

- a. It can cause respiratory problems
- b. It can directly enter into our circulatory system
- c. It can cause inflammation and damage to the lungs
- d. It can be inhaled into the lungs

183. The stage during which separation of the paired homologous chromosomes begins is **(+4, -1)**

- a. Zygotene
- b. Pachytene
- c. Diakinesis
- d. Diplotene

184. Male gametes in angiosperms are formed by the division of **(+4, -1)**

- a. generative cell
- b. vegetative cell
- c. microspore mother cell
- d. microspore.

185. Pigment containing membranous extensions in some cyanobacteria are **(+4, -1)**

- a. Chromatophores
- b. Heterocysts

- c. Basal bodies
- d. Pneumatophores



Botany Section B

186. The main difference between active and passive transport across cell membrane is : (+4, -1)
- a. Passive transport is non-selective whereas active transport is selective
 - b. Passive transport requires a concentration gradient across a biological membrane whereas active transport requires energy to move solutes
 - c. Passive transport is confined to anionic carrier proteins whereas active transport is confined to cationic channel proteins
 - d. Active transport occurs more rapidly than passive transport
-
187. The number of substrate level phosphorylations in one turn of citric acid cycle is : (+4, -1)
- a. Zero
 - b. One
 - c. Two
 - d. Three
-
188. The ovary is half inferior in: (+4, -1)
- a. Brinjal
 - b. Mustard
 - c. Sunflower
 - d. Plum
-
189. The primary acceptor, during CO₂ fixation in C₃ plants, is (+4, -1)
- a. phosphoenolpyruvate (PEP)

- b. ribulose 1, 5-diphosphate (RuDP)
- c. phosphoglyceric acid (PGA)
- d. ribulose monophosphate (RMP).

190. The wavelength of light absorbed by *Pr* form of phytochrome is (+4, -1)

- a. 680 nm
- b. 720 nm
- c. 620 nm
- d. 640 nm.

191. What is the best pH of the soil for cultivation of plants : - (+4, -1)

- a. 3.4 - 5.4
- b. 6.5 - 7.5
- c. 4.5 - 8.5
- d. 5.5 - 6.5

192. Which of the following statements is incorrect? (+4, -1)

- a. During aerobic respiration, role of oxygen is limited to the terminal stage.
- b. In ETC (Electron Transport Chain), one molecule of $NADH + H^+$ gives rise to 2 ATP molecules, and one $FADH_2$ gives rise to 3 ATP molecules.
- c. ATP is synthesized through complex V.
- d. Oxidation-reduction reactions produce proton gradient in respiration.

193. A bicollateral vascular bundle is characterised by (+4, -1)

- a. phloem being sandwiched between xylem
- b. transverse splitting of vascular bundle
- c. longitudinal splitting of vascular bundle
- d. xylem being sandwiched between phloem.

194. ICBN stands for

(+4, -1)

- a. International Code of Biological Naming
- b. International Code for Botanical Nomenclature
- c. International Class of Biological Nomenclature
- d. International Classification of Biological Nomenclature

195. Which of the following are most suitable indicators of SO₂ pollution in the environment?

(+4, -1)

- a. Algae
- b. Fungi
- c. Lichens
- d. Conifers

196. Phosphoenol pyruvate (PEP) is the primary CO₂ acceptor in:

(+4, -1)

- a. C₄ plants
 - b. C₂ plants
 - c. C₃ and C₄ plants
 - d. C₃ plants
-

197. Red List contains data or information on (+4, -1)

- a. all economically important plants
- b. plants whose products are in international trade
- c. threatened species
- d. marine vertebrates only

198. The water potential of pure water is : (+4, -1)

- a. Less than zero
- b. More than zero but less than one
- c. More than one
- d. Zero

199. The first movements of the fetus and appearance of hair on its head are usually observed during which month of pregnancy? (+4, -1)

- a. Fourth month
- b. Fifth month
- c. Sixth month
- d. Third month

200. The process of translation of mRNA to proteins begins as soon as: (+4, -1)

- a. The small subunit of ribosome encounters mRNA
- b. The larger subunit of ribosome encounters mRNA
- c. Both the subunits join together to bind with mRNA

- d. The tRNA is activated and the larger subunit of ribosome encounters mRNA



Answers

1. Answer: a

Explanation:

Use $v^2 = \frac{2gh}{1 + \frac{h}{R}}$ given $h = R$.

$$\therefore v = \sqrt{gR} = \sqrt{\frac{GM}{R}}.$$

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 $[M^{-1}L^3T^{-2}]$.

2. Answer: b

Explanation:

The various forces acting on the body have been shown in the figure. The force on the body down the inclined plane in presence of friction μ is

$$F = mg \sin \theta - f = mg \sin \theta - \mu N = ma$$

$$\text{or } a = g \sin \theta - \mu g \cos \theta.$$

Since block is at rest thus initial velocity $u = 0$

$\therefore$ Time taken to slide down the plane

$$t_1 = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2s}{g \sin \theta - \mu g \cos \theta}}$$

$$\text{In absence of friction time taken will be } t_2 = \sqrt{\frac{2s}{g \sin \theta}}$$

$$\text{Given : } t_1 = 2t_2.$$

$$\therefore t_1^2 = 4t_2^2 \text{ or } \frac{2s}{g(\sin \theta - \mu \cos \theta)} = \frac{2s \times 4}{g(\sin \theta)}$$

$$\text{or } \sin \theta = 4 \sin \theta - 4\mu \cos \theta \text{ or } \mu = \frac{3}{4} \tan \theta = 0.75$$

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.

3. Answer: b

Explanation:

$$x = a \sin(\omega t + \pi/6)$$

$$\frac{dx}{dt} = a\omega \cos(\omega t + \pi/6)$$

$$\text{Max. velocity} = a\omega$$

$$\therefore \frac{a\omega}{2} = a\omega \cos(\omega t + \pi/6);$$

$$\therefore \cos(\omega t + \pi/6) = \frac{1}{2}$$

$$60^\circ \text{ or } \frac{2\pi}{6} \text{ radian} = \frac{2\pi}{T} \cdot t + \pi/6$$

$$\frac{2\pi}{T} \cdot t = \frac{2\pi}{6} - \frac{2\pi}{6} = +\frac{2\pi}{6}$$

$$\therefore t = +\frac{\pi}{6} \times \frac{T}{2\pi} = \left| +\frac{T}{12} \right|$$

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

4. Answer: c

Explanation:

$$K\ell = \text{constant} \Rightarrow K' = 4K$$

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

$$\Rightarrow T' = \frac{T}{2}$$

Concepts:

1. Oscillations:

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

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

Read More: [Simple Harmonic Motion](#)

Oscillation– Examples

The tides in the sea and the movement of a simple pendulum of the clock are some of the most common examples of oscillations. Some of examples of oscillations are vibrations caused by the guitar strings or the other instruments having strings are also

and etc. The movements caused by oscillations are known as oscillating movements. For example, oscillating movements in a sine wave or a spring when it moves up and down.

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

5. Answer: c

Explanation:

$$\begin{aligned}\frac{1}{C} &= \frac{1}{C_1} + \frac{1}{C_2} \\ \frac{d}{kA\infty} &= \frac{3d}{2(k_1+k_2+k_3)A\infty} + \frac{d}{2k_4A\infty} \\ \frac{d}{kA\infty} &= \frac{d}{A\infty} \left[\frac{3}{2(k_1+k_2+k_3)} + \frac{1}{2k_4} \right] \\ \frac{2}{k} &= \frac{3}{k_1+k_2+k_3} = \frac{1}{k_4}\end{aligned}$$

Concepts:

1. Electrostatic Potential and Capacitance:

Electrostatic Potential

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

Some major things that we should know about electric potential:

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

Capacitance

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

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

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

In Series

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

In Parallel

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

6. Answer: b

Explanation:

Given situation is shown in figure.

N_1 = Normal reaction on A

N_2 = Normal reaction on B

W = Weight of the rod

In vertical equilibrium,

$$N_1 + N_2 = W \quad \dots\dots(i)$$

Torque balance about centre of mass of the rod,

$$N_1 x = N_2 (d - x)$$

Putting value of N_2 from equation (i)

$$N_1 x = (W - N_1)(d - x)$$

$$\Rightarrow N_1 x = Wd - Wx - N_1 d + N_1 x$$

$$\Rightarrow N_1 d = W(d - x)$$

$$\therefore N_1 = \frac{W(d-x)}{d}$$

7. Answer: b

Explanation:

When a current carrying loop is placed in a magnetic field, the coil experiences a torque given by $\tau = NBiA \sin \theta$. Torque is maximum when $\theta = 90^\circ$, i.e., the plane of the coil is parallel to the field $\tau_{\max} = NBiA$. Forces $\vec{F}_1$ and $\vec{F}_2$ acting on the coil are equal in magnitude and opposite in direction. As the forces $\vec{F}_1$ and $\vec{F}_2$ have the same line of action their resultant effect on the coil is zero. The two forces $\vec{F}_3$ and $\vec{F}_4$ are equal in magnitude and opposite in direction. As the two forces have different lines of action, they constitute a torque. Thus, if the force on one arc of the loop is $\vec{F}$, the net force on the remaining three arms of the loop is $-\vec{F}$.

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.

8. Answer: c

Explanation:

$$h_1 = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times 5^2 = 125$$

$$h_2 = \frac{1}{2} \times 10 \times 10^2 - \frac{1}{2} \times 10 \times 5^2 = 375$$

$$h_3 = \frac{1}{2} \times 10 \times 15^2 - \frac{1}{2} \times 10 \times 10^2 = 625$$

$$\text{Hence } h_1 = \frac{h_2}{3} = \frac{h_3}{5}$$

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.

9. Answer: b

Explanation:

The correct answer is B: $18\hat{i} + 6\hat{j}$

$$\vec{a} = \frac{\vec{F}}{m} = 2t^2\hat{i} + \frac{4}{3}t\hat{j}$$

$$d\vec{v} = \left(2t^2\hat{i} + \frac{4}{3}t\hat{j} \right) dt$$

Integrate on both sides

$$\vec{v} = 2 \left[\frac{t^3}{3} \right] \hat{i} + \frac{4}{3} \left[\frac{t^2}{2} \right] \hat{j}$$

at $t = 3 \text{ sec}$

$$\begin{aligned} \vec{v} &= \frac{2}{3}(3)^3 \hat{i} + \frac{4}{3}(3)^2 \hat{j} \\ &= 18 \hat{i} + 6 \hat{j} \end{aligned}$$

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

10. Answer: b

Explanation:

(b): The situation is shown in the figure.

Objective

Let f_o and f_e be the focal lengths of the objective

and eyepiece respectively.

For normal adjustment distance of the objective

from the eyepiece (tube length) = $f_o + f_e$

Treating the line on the objective as the object

and eyepiece as the lens.

$\therefore u = -(f_o + f_e)$ and $f = f_e$

As $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\therefore \frac{1}{v} - \frac{1}{(f_o + f_e)} = \frac{1}{f_e}$

$\frac{1}{v} = \frac{1}{f_e} + \frac{1}{f_o + f_e} = \frac{f_o + f_e + f_e}{f_e(f_o + f_e)} = \frac{f_o}{f_e(f_o + f_e)}$

or $v = \frac{f_e(f_o + f_e)}{f_o}$

Thus $\frac{I}{O} = \frac{v}{u} = \frac{f_o}{f_o + f_e} = \frac{f_e}{f_o}$

or $\frac{f_o}{f_e} = \frac{L}{f}$ (i)

$\therefore$ The magnification of the telescope in normal

adjustment is

$m = \frac{f_o}{f_e} = \frac{L}{f}$ (using (i))

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](#).

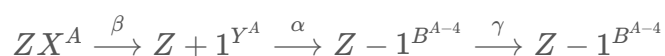
Total Internal Reflection is the reflection of light when the light ray enters into a rarer medium from a denser medium and the angle of incidence is higher than the critical angle of incidence then that light ray will be reflected back to the denser medium.

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

11. Answer: d

Explanation:

The correct option is (D): β, α, γ



First X decays by β emission emitting $\bar{\nu}$, antineutrino simultaneously. Y emits α resulting in the excited level of B which in turn emits a γ ray.

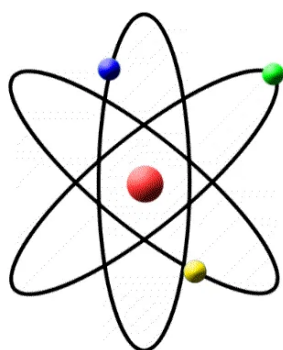
$\therefore \beta, \alpha, \gamma$ is the answer.

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.

12. Answer: c

Explanation:

Cosmic rays, γ -rays, and X -rays are part of electromagnetic spectrum, while β -rays are emitted by radioactive elements. Hence β -rays is not electromagnetic waves.

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.

13. Answer: d

Explanation:

Answer (d) immobile ions

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.
-

14. Answer: a

Explanation:

$$\begin{matrix} \lambda_0 = \frac{hc}{KE_e} \\ \lambda_0 = \frac{hc}{h^2/2m\lambda^2} \\ \lambda = \frac{h}{\sqrt{2mKE_e}} \\ KE_e = \frac{h^2}{2m\lambda^2} \\ \lambda_0 = \frac{2mc}{h} \lambda^2 \end{matrix}$$

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.

15. Answer: a

Explanation:

Ferromagnetism decreases with rise in temperature. If we heat a ferromagnetic substance, then at a definite temperature the ferromagnetic property of the substance suddenly disappears and the substance becomes paramagnetic. The temperature above which a ferromagnetic substance becomes paramagnetic is called the Curie temperature of the substance. Note: The Curie temperature of iron is 770°C and that of nickel in 358°C .

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.

16. Answer: b**Explanation:**

$$V_s I_s = V_p I_p \text{ (ideal transformer)}$$

$$\Rightarrow P_{out} = P_{in}$$

$$60 = 220 \times I_p$$

$$I_p = \frac{60}{220} = 0.27 A$$

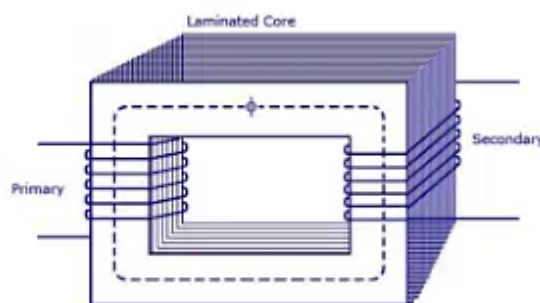
So, the correct answer is option (B): 0.27A

Concepts:

1. Transformers:

Transformer is a device used in power transmission to change the AC voltage without changing the frequency between the circuits. Electrical **transformer** consists of two coils named as the primary coil and secondary coil which is wound on a soft iron core. The soft iron core is laminated to minimize eddy currents. Both the coil in the transformer has high mutual inductance. Transformers work on the principle of Faraday's law of electromagnetic induction and mutual inductions.

A mutual electro-motive force is induced in the transformer from the alternating flux that is set up in the laminated core, due to the coil that is connected to a source of alternating voltage.



Other types of transformers:

- **Autotransformers:** This kind of transformers contain only one coil wound over a laminated core. In Autotransformers, primary and secondary windings share the same coil.

- **Power transformers:** They are majorly used in power generation stations as they are suitable for major higher voltages.
-

17. Answer: b

Explanation:

The correct answer is option (B) : $[M^2] [L^{-1}] [T^0]$

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.

18. Answer: a

Explanation:

The correct option is (A) : $K_1 A_1 = K_2 A_2$

$$\text{Use } \frac{dQ}{dt} = \frac{KA}{L}(T_1 - T_2)$$

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.

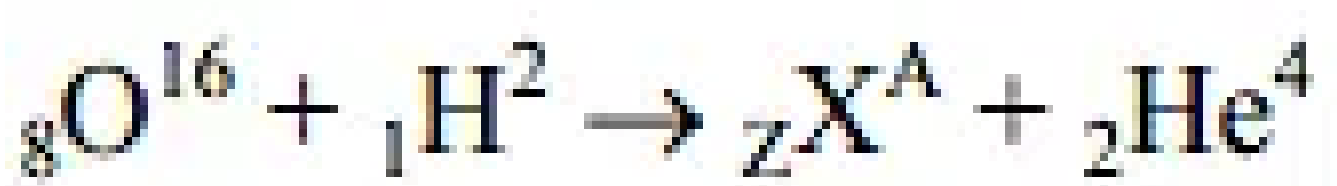
Thermal Stress:

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.

19. Answer: d

Explanation:

The correct option is (D): ${}^7\text{N}_{14}$



use the conservation of charge and mass.

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

20. Answer: d

Explanation:

$$\tau = LR = \frac{40}{8} = 5 \text{ sec}$$

Concepts:

1. Electromagnetic Induction:

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

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

Formula:

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

$$e = N \times \frac{d\phi}{dt}$$

Where

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

Applications of Electromagnetic Induction

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

21. Answer: c

Explanation:

The final temperature of the gas will be the same as the initial temperature, which is T Kelvin.

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.

22. Answer: a

Explanation:

Force (F) = $7 - 2x + 3x^2$; Mass (m) = 2 kg and displacement (d) = 5 m.

Therefore work done

$$(W) = \int F dx = \int_0^5 (7 - 2x + 3x^2) dx = (7x - x^2 + x^3)_0^5 \\ = (7 \times 5) - (5)^2 + (5)^3 = 35 - 25 + 125 = 135 \text{ J.}$$

23. Answer: a

Explanation:

The specific resistance or resistivity, $\rho = \rho_0(1 + \alpha T)$

where α = temperature coefficient of resistivity is positive for metals (copper) and is negative for semiconductor (silicon). Thus, when cooling, resistivity decreases in copper and increases in silicon.

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](#).

24. Answer: a

Explanation:

$$\frac{GMm}{r^2} = m\omega^2 r \Rightarrow r^3 = \frac{GM}{\omega^2} = \frac{gR^2}{\omega^2}$$

$$\therefore r = (gR^2/\omega^2)^{1/3}$$

Concepts:

1. Gravitation:

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

Newton's Law of Gravitation

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

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

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

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

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

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

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

25. Answer: a

Explanation:

$$\frac{v^2}{Rg} = \left(\frac{\mu_s + \tan \theta}{1 - \mu_s \tan \theta} \right)$$

$$\Rightarrow v = \sqrt{Rg \left[\frac{\mu_s + \tan \theta}{1 - \mu_s \tan \theta} \right]}$$

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.

26. Answer: b

Explanation:

Other factors such as ω and v remaining the same, $I = A^2 \times \text{constant } K$, or A

On superposition

$$A_{max} = A_1 + A_2 \text{ and } A_{min} = A_1 - A_2$$

$$\therefore A_{max}^2 = A_1^2 + A_2^2 + 2A_1A_2$$

$$\Rightarrow \frac{I_{max}}{K} = \frac{I_1}{K} + \frac{I_2}{K} + \frac{2\sqrt{I_1I_2}}{K}$$

$$A_{min}^2 = A_1^2 + A_2^2 - 2A_1A_2$$

$$\Rightarrow \frac{I_{min}}{K} = \frac{I_1}{K} + \frac{I_2}{K} - \frac{2\sqrt{I_1I_2}}{K}$$

$$\therefore I_{max} + I_{min} = 2I_1 + 2I_2 = 2(I_1 + I_2)$$

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
-

27. Answer: c

Explanation:

Force constant (k) = 2×10^6 N/m ; amplitude

(x) = 0.01 m and total mechanical energy = 160 J.

Potential energy = $\frac{1}{2} k x^2 = \frac{1}{2} \times (2 \times 10^6) \times (0.01)^2 = 100$ J.

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.

28. Answer: d

Explanation:

The electric field at a point on equatorial line (perpendicular bisector) of dipole at a

distance r is given by, $E = \frac{P}{4\pi\epsilon_0} \cdot \frac{1}{(r^2 + a^2)^{3/2}}$

where $2a = \text{length of dipole}$ ($\because r \gg a$)

$\therefore E = \frac{P}{4\pi\epsilon_0} \cdot \frac{1}{r^3} \cdot i$, i.e., $E \propto p$ and $E \propto r^{-3}$.

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.

29. Answer: b

Explanation:

$$\begin{aligned}\tau &= I\alpha \\ \Rightarrow mg \left(\frac{L}{2} \right) &= \left(\frac{ml^2}{3} \right) \alpha \\ \Rightarrow \alpha &= \frac{3g}{2L}\end{aligned}$$

So, the correct option is (B): $\frac{3g}{2L}$

Concepts:

1. System of Particles and Rotational Motion:

1. The system of particles refers to the extended body which is considered a **rigid body** most of the time for simple or easy understanding. A rigid body is a body with a perfectly definite and unchangeable shape.
2. The distance between the pair of particles in such a body does not replace or alter. Rotational motion can be described as the motion of a rigid body originates in such a manner that all of its particles move in a circle about an axis with a common angular velocity.
3. The few common examples of rotational motion are the motion of the blade of a windmill and periodic motion.

30. Answer: a

Explanation:

The correct answer is A:Zero

Magnetic field due to $i_1 = \frac{\mu_0 i_1}{2R} \frac{\theta_1}{2\pi}$
(Into the plane)

Magnetic field due to $i_2 = \frac{\mu_0 i_2}{2R} \frac{\theta_2}{2\pi}$
(out of the plane)

For parallel combination $\frac{i_1}{i_2} = \frac{\rho l_2}{A} \times \frac{A}{\rho l_1} = \frac{l_1}{l_2}$

$$\Rightarrow \frac{i_1}{i_2} = \frac{\frac{1}{4}(2\pi R)}{\frac{3}{4}(2\pi R)}$$

$$= \frac{1}{3}$$

$$\Rightarrow i_1 = \frac{i_2}{3}$$

$$\Rightarrow i_2 = 3i_1$$

∴ Net magnetic field

$$= \frac{\mu_0 i_1}{2R} \left(\frac{\theta_1}{2\pi} \right) - \frac{\mu_0 i_2}{2R} \left(\frac{\theta_2}{2\pi} \right)$$

$$= \frac{\mu_0}{2R} \left(\frac{3\pi}{2 \times 2\pi} \right) - \frac{\mu_0 i_2}{2R} \left(\frac{\pi}{2 \times 2\pi} \right)$$

$$= \frac{\mu_0}{2R} \left[\frac{3i_1}{4} - \frac{i_2}{4} \right]$$

$$= \frac{\mu_0}{2R} \left[\frac{3i_1}{4} - \frac{3i_1}{4} \right] = 0$$

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.

31. Answer: b

Explanation:

Since the angular momentum has both magnitude and direction, it is a vector quantity.

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
-

32. Answer: b

Explanation:

Let time of flight be T then $T = \frac{u}{g}$

Let h be the distance covered during last 't' second of its ascent

Velocity at point $B = v_B = u - g(T - t)$

$$= u - g\left(\frac{u}{g} - t\right) = gt$$

$$\Rightarrow h = v_B t - \frac{1}{2}gt^2$$

$$\Rightarrow h = gt^2 - \frac{1}{2}gt^2 = \frac{1}{2}gt^2$$

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.
-

33. Answer: a**Explanation:**

$Z = 11$ i.e., number of protons = 11, $A = 23$

$\therefore$ Number of neutrons = $A - Z = 12$

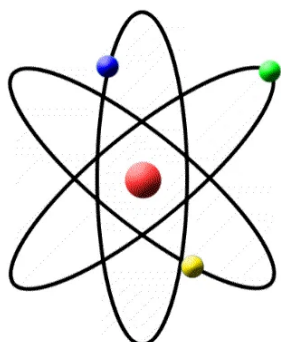
Number of electron = 0 (No electron in nucleus)

Therefore 11, 12, 0.

Concepts:**1. Atoms:**

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

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



Atom

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

34. Answer: b

Explanation:

At $i = i_c$, refracted ray grazes with the surface.
So angle of refraction is 90°

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](#)

35. Answer: b

Explanation:

Diamond is very hard due to large cohesive energy.

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.
-

36. Answer: d

Explanation:

$$h(2v) = hv + \frac{1}{2}mv_{max}^2 \Rightarrow v_{max} = \sqrt{\frac{2hv}{m}}$$

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.

37. Answer: d

Explanation:

The correct answer is (d). (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)

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.

38. Answer: c

Explanation:

$$E_{\max} = NWAB$$

$$E_{\max} = 1000 \times 2 \times \pi \times (10)^2 \times 2 \times (10)^{-5}$$

$$E_{\max} = 12.56 \text{ V}$$

$$I_{\max} = \frac{E_{\max}}{R}$$

$$I_{\max} = \frac{12.56}{12.56}$$

$$I_{\max} = 1 \text{ A}$$

So, the correct option is (C): 1 A

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.

39. Answer: c

Explanation:

The correct answer is option (C): $[F] [A] [T^2]$

Concepts:

1. Dimensional Analysis:

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

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

Using Dimensional Analysis to check the correctness of the equation

Let us understand this with an example:

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

We don't know whether

- (i) Speed = Distance/Time is correct or
- (ii) Speed =Time/Distance.

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

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

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

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

40. Answer: b

Explanation:

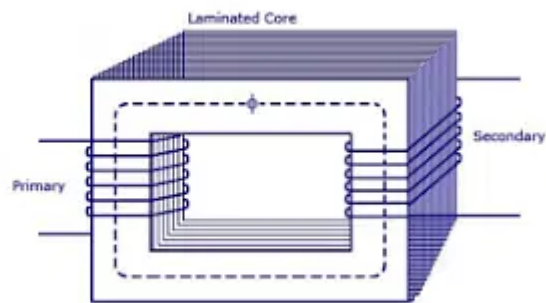
The correct answer is option (B): 0.2 A

Concepts:

1. Transformers:

Transformer is a device used in power transmission to change the AC voltage without changing the frequency between the circuits. Electrical **transformer** consists of two coils named as the primary coil and secondary coil which is wound on a soft iron core. The soft iron core is laminated to minimize eddy currents. Both the coil in the transformer has high mutual inductance. Transformers work on the principle of Faraday's law of electromagnetic induction and mutual inductions.

A mutual electro-motive force is induced in the transformer from the alternating flux that is set up in the laminated core, due to the coil that is connected to a source of alternating voltage.



Other types of transformers:

- **Autotransformers:** This kind of transformers contain only one coil wound over a laminated core. In Autotransformers, primary and secondary windings share the same coil.
- **Power transformers:** They are majorly used in power generation stations as they are suitable for major higher voltages.

41. Answer: b

Explanation:

$$\text{Heat} = KA \Delta \theta_x$$

$$= K \pi r^2 \frac{\Delta \theta}{l}$$

For option B the value of H will be more.

Therefore, the correct option is (B): $r = 2r_0$; $l = l_0$

Concepts:

1. Conductance:

What is conductance?

Conductance is an expression of the ease with which **electric current** flows through materials like metals and nonmetals. In equations, an uppercase letter G symbolizes

conductance. The standard unit of conductance is siemens ($\underline{S}$), formerly known as *mho*.

What is conductance in electricity?

Conductance in electricity is considered the opposite of resistance ($\underline{R}$). Resistance is essentially the amount of friction a component presents to the flow of current.

The conductivity of electrolytic solutions is governed by the following factors:

- Interionic attraction
- Solvation of ions
- The viscosity of the solvent
- Temperature

42. Answer: b

Explanation:

we have ${}^2_1H + {}^3_1H \rightarrow {}^4_2He + {}^1_0n$,

Energy released, $E = (\Delta m) \times 931 \text{ MeV}$

atomic mass unit = 931 MeV

$\Delta m = \text{mass of product} - \text{mass of reactant}$

$\Delta m = c - a - b$

$E = (\Delta m) \times 931$

i.e., $E = (c - a - b)$

The binding energies of 2_1H , 3_1H and 4_2He are respectively a, b and c

Therefore, the correct answer is (B): $c - a - b$

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

43. Answer: b

Explanation:

$$\frac{W}{Q} = \frac{1}{6}$$

$$1 - \frac{T_L}{T_H} = \frac{1}{6}$$

$$\frac{T_L}{T_H} = \frac{5}{6}$$

If sink temp. decrease by $62^\circ C$ then

$$1 - \frac{T_L - 62}{T_H} = \frac{2}{6}$$

$$\Rightarrow \frac{T_L - 62}{T_H} = \frac{2}{3}$$

$$2T_H = 3T_L - 186$$

$$\Rightarrow 2T_H = 3 \times \frac{5}{6}T_H - 186$$

$$2T_H - \frac{5}{2}T_H = -186$$

$$\Rightarrow \frac{5-4}{2}T_H = 186$$

$$T_H = 186 \times 2 = 372K = 99^\circ C$$

$$T_L = \frac{5}{6} \times 372 = 310K = 37^\circ C$$

So, the correct option is (B) : $37^\circ C$, $99^\circ C$

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.

44. Answer: a

Explanation:

If the speed is constant then no force is acting in tangential direction. Only force acting is perpendicular to direction of velocity. Hence, work done will be zero.

45. Answer: a

Explanation:

Resistance of the potentiometer wire $R = \rho \frac{l}{A}$

Potential difference across the wire $V = Il$

So, potential gradient $\frac{V}{l} = \frac{IR}{l} = \frac{I\rho l}{Al}$

Or $\frac{V}{l} = \frac{I\rho}{A} = \frac{0.1 \times 10^{-7}}{10^{-6}} = 0.01 = 10^{-2} \text{ V/m}.$

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.

46. Answer: a

Explanation:

Escape velocity of a body $(v_e) = 11.2 \text{ km/s}$;

New mass of the earth $M'_e = 2M_e$ and new radius of the earth $R'_e = 0.5R_e$.

Escape velocity $(v_e) = \sqrt{\frac{2GM_e}{R_e}} \propto \sqrt{\frac{M_e}{R_e}}$.

Therefore $\frac{v_e}{v'_e} = \sqrt{\frac{M_e}{R_e} \times \frac{0.5R_e}{2M_e}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

or, $v'_e = 2v_e = 22.4 \text{ km/sec}$.

Concepts:

1. Gravitation:

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

Newton's Law of Gravitation

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

- $F \propto (M_1M_2) \dots (1)$
- $(F \propto 1/r^2) \dots (2)$

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

$$F \propto M_1M_2/r^2$$

$$F = G \times [M_1M_2]/r^2 \dots (7)$$

$$\text{Or, } f(r) = GM_1M_2/r^2$$

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

47. Answer: b

Explanation:

Here, $m = 1000 \text{ kg}$, $R = 90 \text{ m}$, $\theta = 45^\circ$

For banking, $\tan \theta = \frac{v^2}{Rg}$

$$\begin{aligned}\text{or } v &= \sqrt{Rg \tan \theta} \\ &= \sqrt{90 \times 10 \times \tan 45^\circ} \\ &= 30, \text{ ms}^{-1}\end{aligned}$$

Concepts:

1. Laws of Motion:

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

Newton's First Law of Motion

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

Newton's Second Law of Motion

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

Newton's Third Law of Motion

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

48. Answer: b

Explanation:

$$\begin{aligned}v &= \omega \sqrt{A^2 - x^2} \\ a &= x\omega^2 \\ v &= a \\ \omega \sqrt{A^2 - x^2} &= x\omega^2\end{aligned}$$

$$\sqrt{(3)^2 - (2)^2} = 2 \left(\frac{2\pi}{T} \right)$$

$$\sqrt{5} = \frac{4\pi}{T}$$

$$T = \frac{4\pi}{\sqrt{5}}$$

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.

49. Answer: c

Explanation:

$$d_1 = 2\text{ m}, d_2 = 3\text{ m}$$

$$\text{Intensity ?} = \frac{1}{(\text{distance})^2}$$

$$I_1 ? \frac{1}{2^2} \text{ and } I_2 ? \frac{1}{3^2}$$

$$\therefore \frac{I_1}{I_2} = \frac{9}{4}$$

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

50. Answer: c

Explanation:

Here, $M = 3 \text{ kg}$

$R = 40 \text{ cm} = 40 \times 10^{-2} \text{ m}$

Force applied, $F = 30 \text{ N}$

Torque, $\tau = FR = (30 \text{ N})(40 \times 10^{-2} \text{ m}) = 12 \text{ N m}$

Moment of inertia of hollow cylinder about its axis is

$I = MR^2 = (3 \text{ kg})(40 \times 10^{-2} \text{ m})^2 = 0.48 \text{ kg m}^2$

Let α is the angular acceleration produced.

As $\tau = I\alpha$

$$\begin{aligned} \therefore \alpha &= \frac{\tau}{I} \\ &= \frac{12 \text{ N m}}{0.48 \text{ kg m}^2} \\ &= 25 \text{ rad s}^{-2} \end{aligned}$$

51. Answer: a

Explanation:

Cuprous compound contains Cu^+ ion which has small size, so the hydration is maximum and hence, the system has lower energy.

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](#)

52. Answer: a

Explanation:

Higher the tendency to give a proton, higher is the acidic character and tendency to lose a proton depends upon the stability of intermediate,

1. e. carbanion formed. 2, 4, 6-trinitrophenol after the loss of a proton gives 2,4,6-trinitrophenoxide ion which is stabilised by resonance, -I-effect and -M-effect, thus is most acidic among the given compounds. Phenol after losing a proton forms phenoxide ion which is also stabilised by resonance, -M and -I effects but is less stabilised as compared to 2, 4, 6-trinitrophenoxide ions. Thus, it is less acidic as compared to 2, 4, 6-trinitrophenol. (CH_3COOH) after losing a proton gives acetate ion which is stabilised by only resonance. However, it is more resonance stabilised as compared to a phenoxide ion, thus more acidic as compared to phenol. 2, 4, 6-trinitrophenol, however, is more acidic than acetic acid due to the presence of three electron withdrawing $-\text{NO}_2$ groups. Cyclohexanol gives an anion that is least stable among the given, thus, it is least acidic.

Hence, the correct order of acidic strength is

2, 4, 6-trinitrophenol > acetic acid > phenol > cyclohexanol

$III > II > IV > I$

Concepts:

1. Aldehydes, Ketones, and Carboxylic Acids:

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

Aldehydes:

Aldehydes are organic compounds that have the functional group $-\text{CHO}$.

Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with [hydrogen](#) in the presence of palladium catalyst spread on barium sulfate.

Ketones:

Ketones are organic compounds that have the functional group $C=O$ 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.

53. Answer: b

Explanation:

Chlorination of n-butane takes place by free radical mechanism are as follows: Step I



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.

54. Answer: c

Explanation:

S-I is correct but S-II is incorrect as o-, m- and p-nitrophenol are more acidic than phenol.

o-,p- and m-nitrophenol have different acidic strength.

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](#)

55. Answer: a

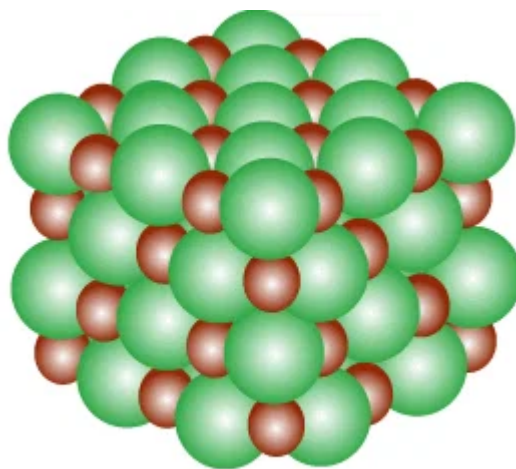
Explanation:

The correct option is (A): 63.1 u

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:

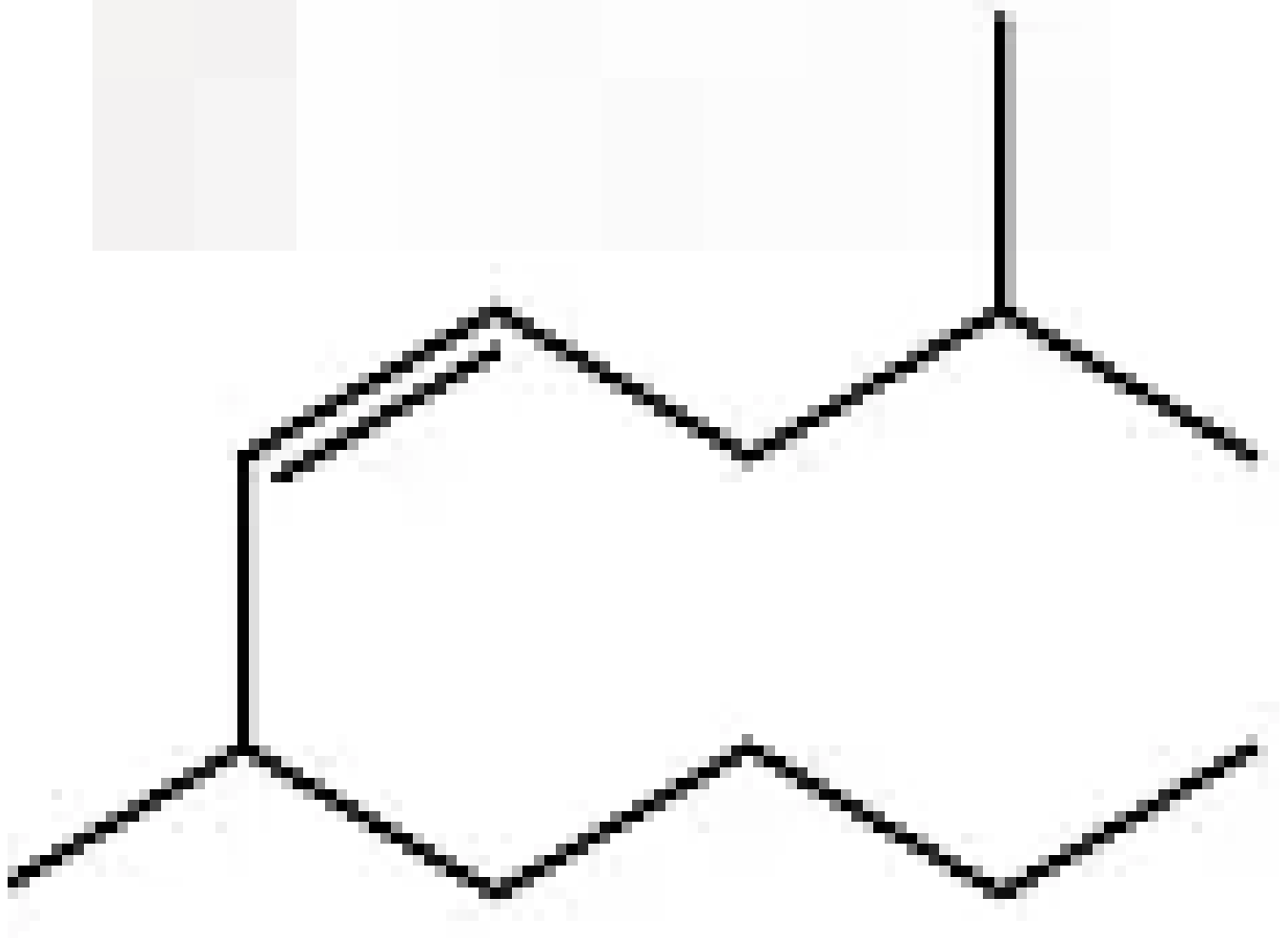
Based on the nature of the order that is present in the arrangement of their constituent particles solids can be divided into two types;

- **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.
-

56. Answer: b

Explanation:

The correct answer is option (B) :



Concepts:

1. Alkenes:

Alkenes

In organic chemistry, an **alkene** is a **hydrocarbon** containing a **carbon-carbon double bond**.^[1]

Alkene is often used as synonym of **olefin**, that is, any hydrocarbon containing one or more double bonds.

Read More: [Ozonolysis](#)

IUPAC Nomenclature of Alkenes

1. An alkene or cycloalkene is indicated by the suffix (ending) ene.
2. For the root name, the longest chain must include both carbon atoms of the double bond.
3. The root chain must be numbered beginning at the end closest to a double bond carbon atom. If the double bond is in the chain's centre, the nearest substituent rule is used to determine where the numbering begins.
4. If the compound contains more than one double bond, it is named with a diene, triene, or equivalent prefix indicating the number of double bonds, and each double bond is assigned a locator number.

Read More: [Unsaturated Hydrocarbon](#)

57. Answer: b

Explanation:

To determine the trend in ionic radii, let's analyze the situation:

Oxygen ion (O_2^-) has 10 electrons, fluorine ion (F^-) has 10 electrons, sodium ion (Na^+) has 10 electrons, magnesium ion (Mg^{2+}) has 10 electrons, and aluminum ion (Al^{3+}) has 10 electrons.

All these ions have the same number of electrons, so the main factor affecting their ionic radii will be the effective nuclear charge. The effective nuclear charge increases as you move across a period (from left to right) in the periodic table. As you move from O_2^- to Al^{3+} , you are going across the periodic table from left to

right. This means that the effective nuclear charge is increasing, which generally leads to a decrease in ionic radii.

So, the correct option is (B): A significant decrease from O_2^- to Al^{3+}

Concepts:

1. Trends in Periodic Table:

The following trend in [periodic properties of elements](#) is observed:

Atomic size Trends:

The distance between the centre of the nucleus and the outermost shell of an atom is known as the atomic radius. In a group the atomic size increases due to the addition of shells as we move from one period to another. Across a period the atomic size decreases as the number of shells remain the same while the nuclear charge increases.

Metallic character Trends:

The elements which lose electrons to form cations are known as metals. Metallic character increases as we move down the group because the atomic size increases which lead to easy loss of electrons. On the other hand, it decreases across a period as we move from left to right.

Non-metallic character Trends:

The elements which have a tendency to gain electrons are known as non-metals. The tendency to gain electrons increases on moving across a period due to an increase in the nuclear charge and decrease in the atomic size. Hence, non-metallic character increases across a period.

Ionization potential Trends:

Ionization potential is defined as the amount of energy required to remove an electron from the outermost shell of a gaseous atom and convert it into a positively charged gaseous ion. The periodic properties in terms of ionization potential increase because the atomic size decreases across a period due to increase in the nuclear charge.

Melting Point Trends:

The melting point of an element is basically the energy required to change the state of an element from its solid state to its liquid state. Which essentially implies breaking a few bonds. Thus, higher the stronger the bond between the atoms, higher will be the melting point.

58. Answer: d

Explanation:

Hydrogen bonding $\propto$ electronegativity $\propto \frac{1}{\text{Size of atom to which H is covalently bonded}}$

Since, F is most electronegative and has smaller size, HF shows maximum strength of hydrogen bond.

Concepts:

1. Chemical Bonding and Molecular Structure:

Such a group of atoms is called a **molecule**. Obviously, there must be some force that holds these constituent atoms together in the molecules. The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a **chemical bond**.

Types of Chemical Bonds:

There are 4 types of chemical bonds which are formed by atoms or molecules to yield compounds.

- **Ionic Bonds** – Ionic bonding is a type of chemical bonding which involves a transfer of electrons from one atom or molecule to another.
- **Covalent Bonds** – Compounds that contain carbon commonly exhibit this type of chemical bonding.
- **Hydrogen Bonds** – It is a type of polar covalent bonding between oxygen and hydrogen wherein the hydrogen develops a partial positive charge
- **Polar Bonds** – In Polar Covalent chemical bonding, electrons are shared unequally since the more electronegative atom pulls the electron pair closer to itself and away from the less electronegative atom.

Factors Affecting Bond Enthalpy in Chemical Bonding:

- Size of the Atom
- Multiplicity of Bonds
- Number of Lone Pair of Electrons Present
- Bond Angle

59. Answer: d

Explanation:

The molecular formula of vitamin $-B_{12}$ is $N_{14}O_{14}PCo$ and the chemical name is cyanocobalamine. So, cobalt is present in vitamin- B_{12}

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.

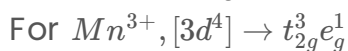
There are four major classes of Biomolecules – Carbohydrates, Proteins, Nucleic acids and Lipids.

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.

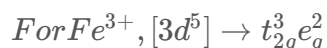
60. Answer: b**Explanation:**

The CFSE for octahedral complex is given by

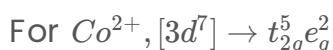
$$CFSE = [-0.4t_{2g}e^- + 0.6e_g e^-]$$



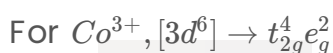
$$\therefore CFSE = [(-0.4 \times 3) + (0.6 \times 1)] = -0.6$$



$$CFSE = [-(0.4 \times 3) + (0.6 \times 2)] = 0$$



$$CFSE = [(-0.4 \times 5) + (2 \times 0.6)] = 0 \\ = -0.8$$



$$CFSE = [(-0.4 \times 4) + (2 \times 0.6)] \\ = -0.4$$

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.

61. Answer: c

Explanation:

Acidic character of oxides decreases down the group. Thus, oxides of As are less acidic than those of P. Acidic character increases with increase in oxidation state. Thus As_4O_{10} (O.S. = 5) is more acidic than As_4O_6 (O.S. = 3). Thus As_4O_6 is least acidic

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

62. Answer: c

Explanation:

The value of l varies from 0 to $(n - 1)$ and the value of m varies from -1 to $+1$ through zero. The value of ' s ' $\pm \frac{1}{2}$ which signifies the spin of electron. The correct sets

of quantum number are following
$$\begin{array}{l} \text{(i)} \quad n, l, m, s \\ \text{(ii)} \quad 2l+1 \\ \text{(iii)} \quad \frac{n^2}{2} \\ \text{(iv)} \quad \frac{n^2}{2} \\ \text{(v)} \quad 3n^2 + \frac{n^2}{2} \end{array}$$

Concepts:

1. Structure of Atom:

Atomic Structure:

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

Dalton's Atomic Theory

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

The following are the postulates of his theory:

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

Cons of Dalton's Atomic Theory

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

Subatomic Particles

1. Protons - are positively charged subatomic particles.
2. Electron - are negatively charged subatomic particles.

3. Neutrons – are electrically neutral particles and carry no charge

Atomic Structure of Isotopes

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

63. Answer: d

Explanation:

According to ideal gas equation,

$$p_1 V = n_1 RT \quad \dots(i)$$

$$p_2 V = n_2 RT \quad \dots(ii)$$

From Eqs. (i) and (ii)

$$\frac{p_1 V}{p_2 V} = \frac{n_1 RT}{n_2 RT} \Rightarrow \frac{p_1}{p_2} = \frac{n_1}{n_2}$$

$$\frac{n_1}{n_2} = \frac{p_1}{p_2} = \frac{170}{570} = 0.30$$

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.

64. Answer: b

Explanation:

Let the volume of each acid = V

pH of first, second and third acids = 3, 4 and 5 respectively

$[H^+]$ of first acid (M_1) = 1×10^{-3} [$\therefore H^+ = 1 \times 10^{-pH}$]

$[H^+]$ of second acid (M_2) = 1×10^{-4}

$[H^+]$ of third acid (M_3) = 1×10^{-5}

Total $[H^+]$ concentrated of mixture

$$\begin{aligned}
 (M) &= \frac{M_1 V_1 + M_2 V_2 + M_3 V_3}{V_1 + V_2 + V_3} \\
 &= \frac{1 \times 10^{-3} \times V + 1 \times 10^{-4} \times V + 1 \times 10^{-5} \times V}{V + V + V} \\
 &= \frac{1 \times 10^{-3} \times V(1 + 0.1 + 0.01)}{3V} \\
 &= \frac{1.11 \times 10^{-3}}{3} = 3.7 \times 10^{-4} M
 \end{aligned}$$

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](#)

65. Answer: a

Explanation:

First order rate constant is given as,

$$k = \frac{2.303}{t} \log \frac{[A_0]}{[A]_t}$$

99% completed reaction,

$$k = \frac{2.303}{t} \log \frac{100}{1}$$

$$= \frac{2.303}{t} \log 10^2$$

$$k = \frac{2.303}{t} \times 2 \log 10$$

$$t = \frac{2.303}{k} \times 2 = \frac{4.606}{k}$$

$$t = \frac{4.606}{k}$$

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. $R \rightarrow P$

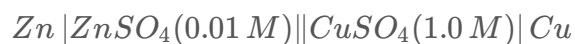
Read More: [Chemical Kinetics MCQ](#)

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.

66. Answer: b

Explanation:



$$\therefore E_1 = E_{cell}^{\circ} - \frac{2.303 RT}{2 \times F} \times \log \frac{(0.01)}{1}$$

When concentrations are changed

$$\therefore E_2 = E_{cell}^{\circ} - \frac{2.303 RT}{2 \times F} \times \log \frac{1}{0.01}$$

$$\text{i.e., } E_1 > E_2$$



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.

67. Answer: b

Explanation:

- $H_2P(\ell) \rightleftharpoons H_2O(v), \Delta S > 0$
- Expansion of gas at constant temperature, $\Delta S > 0$
- Sublimation of solid to gas, $\Delta S > 0$
- $2H(g) \rightarrow H_2(g), \Delta S < 0 (\because \Delta n_g < 0)$

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.

68. Answer: b

Explanation:

$$(1) \text{ Molecules of water} = \text{mole} \times N_A = 10^{-3} N_A$$

$$(2) \text{ Mass of water} = 18 \times 1 = 18 \text{ g}$$

$$\begin{aligned} \text{Molecules of water} &= \text{mole} \times N_A = \frac{18}{18} N_A \\ &= N_A \end{aligned}$$

$$(3) \text{ Moles of water} = \frac{0.00224}{22.4} = 10^{-4}$$

$$\text{Molecules of water} = \text{mole} \times N_A = 10^{-4} N_A$$

$$(4) \text{ Molecules of water} = \text{mole} \times N_A = \frac{0.18}{18} N_A \\ = 10^{-2} N_A$$

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.

69. Answer: c

Explanation:

$$\text{Molarity} = \frac{(\%w/w) \times \text{density} \times 10}{\text{Molar mass of solute}}$$

$$= \frac{9.8 \times 1.84 \times 10}{98} = 18.4 \text{ M}$$

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.

70. Answer: d

Explanation:

C_2H_2 have acidic nature but it is less acidic than water but phenol is more acidic than water due to resonance stabilisation of phenoxide ion. H_2CO_3 is most acidic due to resonating stabilisation of carbonate ion (CO_3^{2-}).

Thus, the correct order is



71. Answer: d

Explanation:

On the basis electrode potential, the correct order is



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](#)

72. Answer: c

Explanation:

By oxidation of tertiary alcohol with stronger oxidising agents, ketones may be formed along with carboxylic acid.

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).

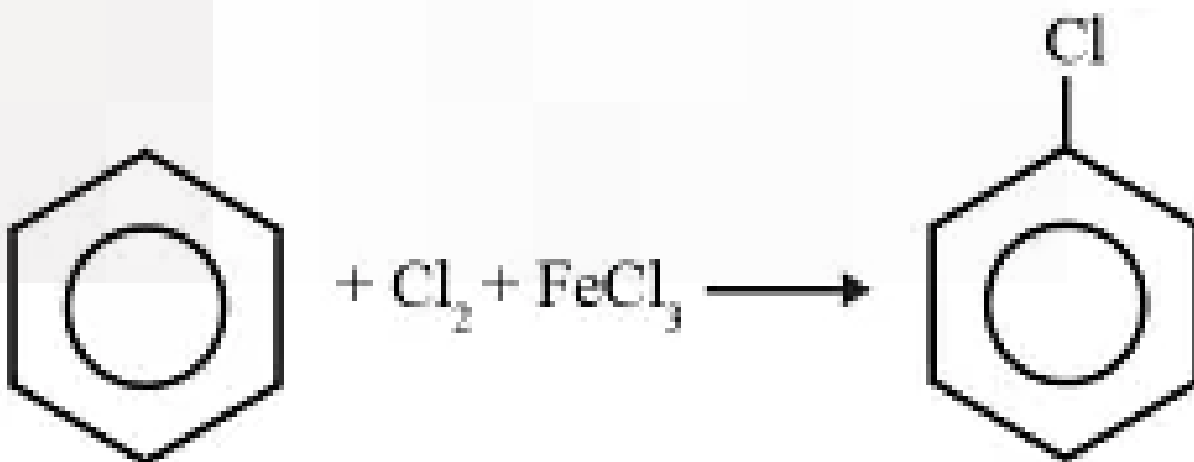
Preparation of Carboxylic Acids

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.

73. Answer: a

Explanation:

The correct option is (A): Benzene, Cl_2 , anhydrous $FeCl_3$



Concepts:

1. Haloalkanes and Haloarenes:

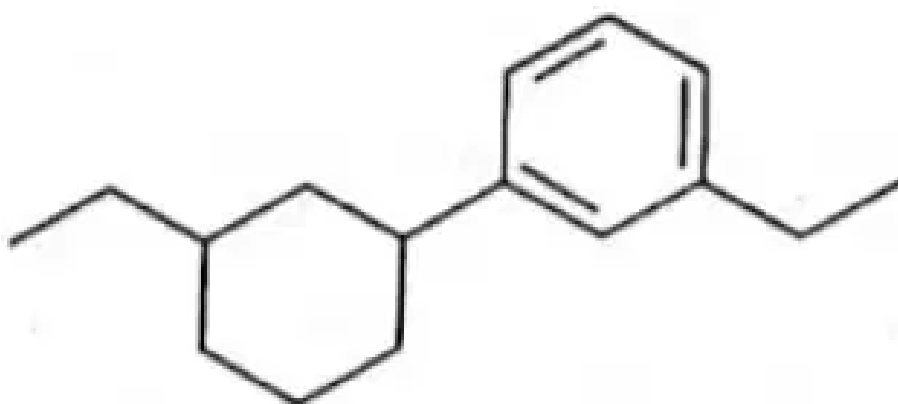
The hydrocarbons such as **Haloalkanes and Haloarenes** are the ones, in which one or more **hydrogen** atoms are replaced with halogen atoms. The main difference between Haloalkanes and Haloarenes is that Haloalkanes are derived from open chained hydrocarbons, also called alkanes, and Haloarenes are 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.

74. Answer: d

Explanation:

The correct option is (D):



Concepts:

1. Alcohols, Phenols, and Ethers – Chemical Reactions:

The reaction of alcohols:

1. Reaction with Metal
2. Reaction with Halides
3. Reaction with HNO_3
4. Reaction with Carboxylic Acid (Esterification)
5. Dehydration of Alcohol
6. Haloform Reaction

The reaction of phenols:

1. Formation of Ester
2. Hydrogenation
3. Oxidation of Quinones
4. Electrophilic Substitution
5. Halogenation

The reaction of ethers:

1. Contact with Air
2. Halogenation of Ether
3. Electrophilic Substitution Reaction

Read More: [Alcohols, Phenols, and Ethers](#)

75. Answer: b

Explanation:

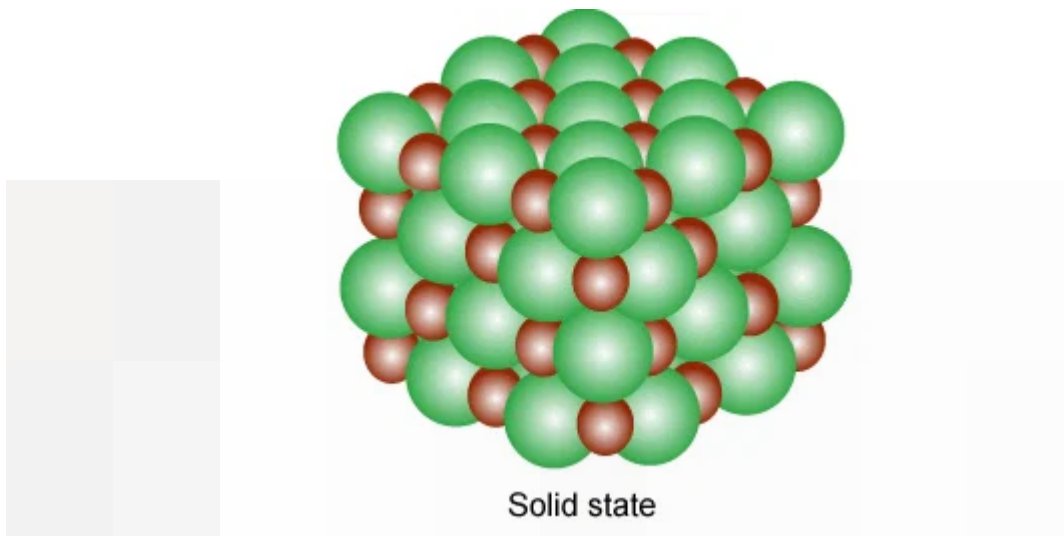
In a face-centered cubic unit cell, each edge is shared by 4 adjacent unit cells. Therefore, if you consider the edge-centered octahedral void, only $\frac{1}{4}^{th}$ of the void is contained within one unit cell. This is because each unit cell contributes $\frac{1}{4}^{th}$ of the void, and when you sum up the contributions from all adjacent cells, you get the complete void.

So, the correct option is (B): $\frac{1}{4}$

Concepts:

1. Solid State:

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



Types of Solids:

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

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

76. Answer: b

Explanation:

The correct answer is option (B): Saytzeff's Rule

Concepts:

1. Alkenes:

Alkenes

In organic chemistry, an **alkene** is a **hydrocarbon** containing a **carbon-carbon double bond**.^[1]

Alkene is often used as synonym of **olefin**, that is, any hydrocarbon containing one or more double bonds.

Read More: [Ozonolysis](#)

IUPAC Nomenclature of Alkenes

1. An alkene or cycloalkene is indicated by the suffix (ending) ene.
2. For the root name, the longest chain must include both carbon atoms of the double bond.
3. The root chain must be numbered beginning at the end closest to a double bond carbon atom. If the double bond is in the chain's centre, the nearest substituent rule is used to determine where the numbering begins.
4. If the compound contains more than one double bond, it is named with a diene, triene, or equivalent prefix indicating the number of double bonds, and each double bond is assigned a locator number.

Read More: [Unsaturated Hydrocarbon](#)

77. Answer: a

Explanation:

Atomic number drops by 6 after 3 alpha decays. and the daughter's atomic number drops by 6, and the parent atom is in the second group, she will be a member of the 14th group.

Concepts:

1. Modern Periodic Table:

Modern Periodic Table is the tabular arrangement of the elements in increasing order of their atomic numbers. It is commonly referred to as the Long Form of the Periodic Table and is based on the modern periodic law and is the tabular arrangement of elements in increasing order of their atomic numbers (Z).

Periodic table of the elements

		Alkali metals		Halogens																																
		Alkaline-earth metals		Noble gases																																
		Transition metals		Rare-earth elements (21, 39, 57–71) and lanthanoid elements (57–71 only)																																
		Other metals		Actinoid elements																																
		Other nonmetals																																		
period	group 1*											13	14	15	16	17	18																			
1	1	H	2											5	6	7	8	9	10																	
2	3	Li	4	Be											B	C	N	O	F	Ne																
3	11	Na	12	Mg	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																
4	19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr
5	37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe
6	55	Cs	56	Ba	57	La	72	Hf	73	Ta	74	W	75	Re	76	Os	77	Ir	78	Pt	79	Au	80	Hg	81	Tl	82	Pb	83	Bi	84	Po	85	At	86	Rn
7	87	Fr	88	Ra	89	Ac	104	Rf	105	Db	106	Sg	107	Bh	108	Hs	109	Mt	110	Ds	111	Rg	112	Cn	113	Nh	114	Fl	115	Mc	116	Lv	117	Ts	118	Og
lanthanoid series 6		58	59	60	61	62	63	64	65	66	67	68	69	70	71																					
		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu																					
actinoid series 7		90	91	92	93	94	95	96	97	98	99	100	101	102	103																					
		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr																					

**Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC).*

- The elements in the same group of the Modern Periodic Table have the same valence **electron configuration** and thus have similar chemical properties.
- The elements in the same period of the Modern Periodic Table will have an increasing order of **valence electrons**. Hence, the number of energy sub-levels per energy level increases as the energy level of the **atom** increases.

The periodic table of elements is as follows:

Atomic number (Z)	Symbol	Name
1	H	Hydrogen
2	He	Helium
3	Li	Lithium
4	Be	Beryllium
5	B	Boron
6	C	Carbon
7	N	Nitrogen
8	O	Oxygen
9	F	Fluorine
10	Ne	Neon
11	Na	Sodium
12	Mg	Magnesium
13	Al	Aluminium
14	Si	Silicon
15	P	Phosphorus
16	S	Sulfur
17	Cl	Chlorine
18	Ar	Argon
19	K	Potassium
20	Ca	Calcium
21	Sc	Scandium
22	Ti	Titanium
23	V	Vanadium

24	Cr	Chromium
25	Mn	Manganese
26	Fe	Iron
27	Co	Cobalt
28	Ni	Nickel
29	Cu	Copper
30	Zn	Zinc
31	Ga	Gallium
32	Ge	Germanium
33	As	Arsenic
34	Se	Selenium
35	Br	Bromine
36	Kr	Krypton
37	Rb	Rubidium
38	Sr	Strontium
39	Y	Yttrium
40	Zr	Zirconium
41	Nb	Niobium
42	Mo	Molybdenum
43	Tc	Technetium
44	Ru	Ruthenium
45	Rh	Rhodium
46	Pd	Palladium
47	Ag	Silver

48	Cd	Cadmium
49	In	Indium
50	Sn	Tin
51	Sb	Antimony
52	Te	Tellurium
53	I	Iodine
54	Xe	Xenon
55	Cs	Caesium
56	Ba	Barium
57	La	Lanthanum
58	Ce	Cerium
59	Pr	Praseodymium
60	Nd	Neodymium
61	Pm	Promethium
62	Sm	Samarium
63	Eu	Europium
64	Gd	Gadolinium
65	Tb	Terbium
66	Dy	Dysprosium
67	Ho	Holmium
68	Er	Erbium
69	Tm	Thulium
70	Yb	Ytterbium
71	Lu	Lutetium

72	Hf	Hafnium
73	Ta	Tantalum
74	W	Tungsten
75	Re	Rhenium
76	Os	Osmium
77	Ir	Iridium
78	Pt	Platinum
79	Au	Gold
80	Hg	Mercury
81	Tl	Thallium
82	Pb	Lead
83	Bi	Bismuth
84	Po	Polonium
85	At	Astatine
86	Rn	Radon
87	Fr	Francium
88	Ra	Radium
89	Ac	Actinium
90	Th	Thorium
91	Pa	Protactinium
92	U	Uranium
93	Np	Neptunium
94	Pu	Plutonium
95	Am	Americium

96	Cm	Curium
97	Bk	Berkelium
98	Cf	Californium
99	Es	Einsteinium
100	Fm	Fermium
101	Md	Mendelevium
102	No	Nobelium
103	Lr	Lawrencium
104	Rf	Rutherfordium
105	Db	Dubnium
106	Sg	Seaborgium
107	Bh	Bohrium
108	Hs	Hassium
109	Mt	Meitnerium
110	Ds	Darmstadtium
111	Rg	Roentgenium
112	Cn	Copernicium
113	Nh	Nihonium
114	Fl	Flerovium
115	Mc	Moscovium
116	Lv	Livermorium
117	Ts	Tennessine
118	Og	Oganesson

Read More: [Periodic Classification of Elements](#)

78. Answer: a

Explanation:

A sigma bond is formed by the end to end overlapping, so the extent of overlapping is more in case of sigma bond and hence sigma bond is stronger than pi-bond

Concepts:

1. Chemical Bonding and Molecular Structure:

Such a group of atoms is called a **molecule**. Obviously, there must be some force that holds these constituent atoms together in the molecules. The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a **chemical bond**.

Types of Chemical Bonds:

There are 4 types of chemical bonds which are formed by atoms or molecules to yield compounds.

- **Ionic Bonds** – Ionic bonding is a type of chemical bonding which involves a transfer of electrons from one atom or molecule to another.
- **Covalent Bonds** – Compounds that contain carbon commonly exhibit this type of chemical bonding.
- **Hydrogen Bonds** – It is a type of polar covalent bonding between oxygen and hydrogen wherein the hydrogen develops a partial positive charge
- **Polar Bonds** – In Polar Covalent chemical bonding, electrons are shared unequally since the more electronegative atom pulls the electron pair closer to itself and away from the less electronegative atom.

Factors Affecting Bond Enthalpy in Chemical Bonding:

- Size of the Atom
- Multiplicity of Bonds
- Number of Lone Pair of Electrons Present
- Bond Angle

79. Answer: a

Explanation:

Those diastereomers which differ only in configuration at C-I are known as anomers

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.

80. Answer: a

Explanation:

Acidic strength $\propto EN \propto +ve O.S.$

$\$ \underset{+1}{\mathop{\{HCl\}}}, O$

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

81. Answer: d

Explanation:

In $(CH_3)_4 Sn$ (organometallic compounds of tin) single bonds are present in form of sigma bond, pi-bonded organometallic compound includes organometallic compounds of alkenes, alkynes and some other carbon containing compounds having pi-electrons in their molecular orbitals.

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.

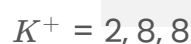
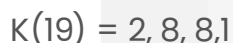
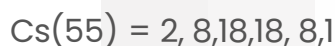
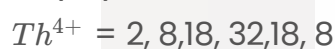
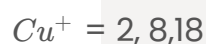
Ligands:

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.

82. Answer: a

Explanation:

The electronic configuration of Cu, Th, Cs and K are



Thus, Cu^+ has 18 electrons in the outermost shell.

An ion with 18 **electrons** in the outermost shell can be one of several possibilities, depending on whether the ion has gained or lost electrons.

If the **ion** has gained electrons, it would have more than 18 electrons in the outermost shell, and would therefore have a negative charge. The most likely ion with 18 electrons in the outermost shell and a negative charge would be the chloride ion (Cl^-), which has a total of 18 electrons in its outermost shell.

If the ion has lost electrons, it would have fewer than 18 electrons in the outermost shell, and would therefore have a positive charge. The most likely ion with 18 electrons in the outermost shell and a positive charge would be the argon ion (Ar^+), which has 17 electrons in its outermost shell. If the argon atom were to lose one electron, it would have 18 electrons in the outermost shell and a net positive charge of +1.

However, it's important to note that the specific ion with 18 electrons in the outermost shell depends on the context of the problem and the specific elements involved.

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.

83. Answer: d

Explanation:

Dipole – induced dipole occurs between polar & Non-polar molecule

HCl	He
-----	----

Polar	Non polar
-------	-----------

$\mu \neq 0$	$\mu = 0$
--------------	-----------

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.

84. Answer: a

Explanation:

In heterogeneous system K_c, K_p is not based upon concentration or pressure of solid substance. Hence, at equilibrium their concentration or pressure are assumed as one .



$$K_p = P_{CO_2}$$

Concepts:

1. Equilibrium:

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

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

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

Equilibrium in Chemical changes

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

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

Read More: [Calculating Equilibrium Concentration](#)

Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

Homogenous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are all in the same phase. [Homogenous equilibrium](#) can be further divided into two types:

Reactions in which the number of molecules of the products is equal to the number of molecules of the reactants. For example,

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

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

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

Heterogeneous Chemical Equilibrium

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

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

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

Check Out: [Equilibrium Important Questions](#)

85. Answer: c

Explanation:

Rate of reaction is equal to the rate constant for zero order reaction. Let us consider the following hypothetical change. $A \rightarrow B + C$

Suppose this reaction is zero order, then

$$\text{rate} \propto [A]^0$$

$$\therefore \text{rate} = k [A]^0 = k$$

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.

86. Answer: d

Explanation:

The limiting molar conductivity that is denoted by Λ° . It is the measure of the conductivity of the solution that contains one mole of an electrolyte that is dissolved in the solution.

For the question, the limiting molar conductivity of NH_4OH is given by:

$$\Lambda^\circ(\text{NH}_4\text{Cl}) + \Lambda^\circ(\text{NaOH}) - \Lambda^\circ(\text{NaCl})$$

According to Kohlrausch law of independent migration of ions:

$$\begin{aligned}\Lambda_m(\text{NH}_4\text{OH}) &= \Lambda_m(\text{NH}_4^+) + \Lambda_m^*(\text{OH}^-) \\ &= \Lambda_m(\text{NH}_4^+) + \Lambda_m(\text{Cl}^-) + \Lambda_m^\circ(\text{OH}^-) \\ &= \Lambda_m^*(\text{NH}_4^+) - \Lambda_m^-(\text{Cl}^-) - \Lambda_m^n(\text{Na}^+) \\ &= \Lambda_m^*(\text{NH}_4\text{Cl}) + \Lambda_m^-(\text{NaOH}) - \Lambda_m^\circ(\text{NaCl})\end{aligned}$$

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.
-

87. Answer: c**Explanation:**

$$\begin{aligned}\therefore W_{irr} &= -P_{ext}\Delta V \\ &= -2 \text{ bar} \times (0.25 - 0.1) \text{ L} \\ &= -2 \times 0.15 \text{ L-bar} \\ &= -0.30 \text{ L-bar} \\ &= -0.30 \times 100 \text{ J} \\ &= -30 \text{ J}\end{aligned}$$

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.

88. Answer: a

Explanation:

16.9 g $AgNO_3$ is present in 100 mL solution.

$\therefore$ 8.45 g $AgNO_3$ is present in 50 mL solution

5.8 g NaCl is present in 100 mL solution

$\therefore$ 2.9 g NaCl is present in 50 mL solution

$$\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$$

$$\frac{8.45}{170} \text{ mol} \quad \frac{2.9}{58.5}$$

$$= 0.049 \text{ mol} = 0.049 \text{ mol}$$

$$\text{After reaction} \quad 0 \quad 0 \quad \rightarrow 0.049 \text{ mol} \quad ; \quad ; \quad ;$$

mass of AgCl precipitated

$= 0.049 \times 143.5 \text{ g}$

$= 7 \text{ g AgCl}$

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.

89. Answer: b

Explanation:

1.00 m solution means 1 mole solute is present in 1000 g water.

$$n_{H_2} = \frac{1000}{18} = 55.5 \text{ mol } H_2O$$

$$X_{\text{solute}} = \frac{n_{\text{solute}}}{n_{\text{solute}} + n_{H_2O}} = \frac{1}{1 + 55.5} = 0.0177$$

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.

90. Answer: c

Explanation:

As we come down the group atomic size increases, thus bond length decreases, bond strength increases and acidic strength increases and basic strength increases and nucleophiles having different donor atoms in the same group then nucleophilicity is anti-parallel to basic strength.

Hence order is $Cl^- < Br^- < I^-$

91. Answer: a

Explanation:

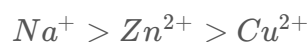
Ionic compounds are more soluble in water or in aqueous medium.

According to Fajans' rule,

Size of the cation increases the ionic character also increases.

Ionic character oc size of cation (if anion is same)

The order of size of cation is



∴ The order of ionic character and hence, of solubility in water is as



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](#)

92. Answer: c

Explanation:

Tollen's reagent is ammoniacal silver nitrate solution and it is used for detection of aldehyde group not for unsaturation. Aldehydes reduces Tollen's reagent to give adds and silver powder is obtained which forms silver coloured mirror in the test tube.



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).

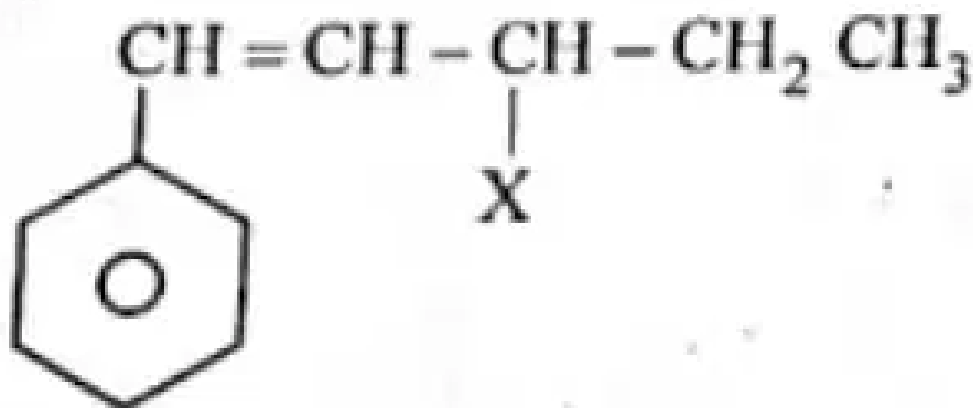
Preparation of Carboxylic Acids

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.

93. Answer: b

Explanation:

The correct option is (B): Allylic halide



Concepts:

1. Haloalkanes and Haloarenes:

The hydrocarbons such as [Haloalkanes and Haloarenes](#) are the ones, in which one or more [hydrogen](#) atoms are replaced with halogen atoms. The main difference between Haloalkanes and Haloarenes is that Haloalkanes are derived from open chained hydrocarbons, also called alkanes, and Haloarenes are derived from aromatic hydrocarbons.

- Haloalkanes have hydrocarbons made up of aliphatic alkanes and one or more hydrogen atoms replaced by [halogens](#) (elements such as Chlorine, Bromine, Fluorine, Iodine, etc.) whereas, haloarenes consist of aromatic ring or rings and one or more hydrogen atoms replaced by halogens.
- In haloalkanes, the halogen atom is attached to the sp^3 hybridized carbon atom of the alkyl group whereas, in haloarenes, the halogen atom is attached to the sp^2 hybridized carbon atom of the alkyl group.
- Haloalkanes are saturated organic compounds where all the chemical bonds are attached to the carbon atom with single bonds and a single carbon atom is attached to the Halogen atom, whereas, the haloarenes differ from Haloalkanes by their method of preparation and properties.
- Haloalkanes are made by aliphatic alkanes by the process of free radical halogenation, whereas, haloarenes are made by direct halogenation of aromatic rings.
- Haloalkanes are odorless compounds, whereas, haloarenes have a sweet odor.

- Haloalkanes precipitate in SN^2 substitution reactions, whereas, haloarenes do not precipitate in SN^2 substitution reactions.
 - Example of haloalkanes is CH_3Cl (Methyl Chloride) and $\text{CH}_3\text{CH}_2\text{Br}$ (Ethyl Bromide) and the example of haloarenes is Chlorobenzene, Bromobenzene.
-

94. Answer: d**Explanation:**

Based on Huckel's rule, a compound or species obeys the rule if it has a π electron count of $4n+2$, where 'n' is a non-negative integer.

Compound/species (i), (ii), (v), (vii) obey Huckel's rule.

Therefore, The correct option is (D): 4

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](#)

95. Answer: d**Explanation:**

The correct answer is option (D) : CaO

Concepts:

1. Alkanes:

In **organic chemistry**, an **alkane** or **paraffin** (a historical trivial name that also has other meanings), is an acyclic saturated hydrocarbon. In other words, an alkane consists of hydrogen and carbon atoms arranged in a tree structure in which all the carbon-carbon bonds are single. **Alkanes** have the general chemical formula C_nH_{2n+2} . The alkanes range in complexity from the simplest case of methane (CH_4), where $n = 1$ (sometimes called the parent molecule), to arbitrarily large and complex molecules, like pentacontane ($C_{50}H_{102}$) or 6-ethyl-2-methyl-5-(1-methylethyl) octane, an isomer of tetradecane ($C_{14}H_{30}$).

Alkane as saturated hydrocarbons:

- Alkanes are a series of compounds that contain carbon and hydrogen atoms with single covalent bonds. These are known as saturated hydrocarbons. This group of compounds consists of carbon and hydrogen atoms with single covalent bonds. Also comprises a homologous series having a *molecular formula of C_nH_{2n+2}* .
- Alkanes are the simplest family of hydrocarbons. They contain only carbon and hydrogen. Each carbon atom forms four bonds and each hydrogen atom forms one bond. Chemists use line-angle formulas because they are easier and faster to draw than condensed structural formulas. Structural formulas for alkanes can be written in yet another condensed form.

Properties of Alkanes:

1. The Solubility of Alkanes

Due to very little difference of electronegativity between carbon and hydrogen and covalent nature of C-C bond or C-H bond, alkanes are generally non-polar molecules. As we generally observe, polar molecules are soluble in polar solvents whereas non-polar molecules are soluble in non-polar solvents. Hence, alkanes are hydrophobic in nature that is, alkanes are insoluble in water.

2. The Boiling Point of Alkanes

As the intermolecular Van Der Waals forces increase with the increase of the molecular size or the surface area of the molecule we observe: The straight-chain alkanes are observed to have a higher boiling point in comparison to their structural isomers.

3. The Melting Point of Alkanes

The melting point of alkanes follow the same trend as their boiling point that is, it increases with increase in molecular weight.

96. Answer: c

Explanation:

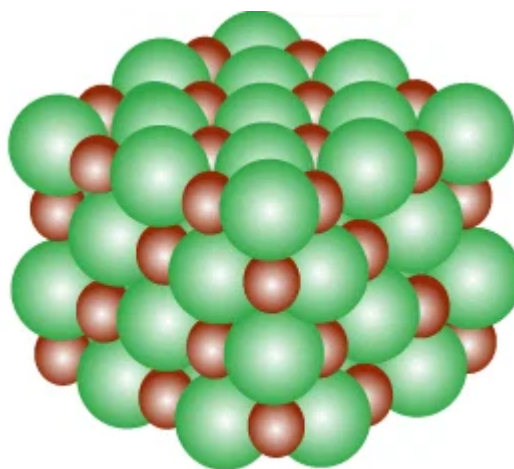
The correct option is (C) : 2

In BCC, the cube's body centre and corners are occupied by lattice atoms. A cube contains 8 corners, each of which contributes $\frac{1}{8}$ of the total. The effective number of atoms per cube = $\frac{1}{8} \times 8 = 1$. Additionally, each cube will contain one body centre, and a body centre will have a contribution of 1. Therefore, the actual number of atoms in a cube is 2. So, the BCC has a total of $1+1=2$ atoms.

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.

97. Answer: c

Explanation:

The electronegativity increases from left to right in any period, so the electronegativity follows the order

$\text{Li} < \text{Be} < \text{B} < \text{C}$ and hence, the covalent character of chlorides of these elements increase from Li to C because size of cation left to right decreases and according to Fajans' rule covalent character increases.

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

98. **Answer: a**

Explanation:

$F_2 \rightarrow$ reduction potential very high so strongest oxidizing agent.

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

99. Answer: d

Explanation:

RNA and DNA molecules have ribose and deoxyribose sugar respectively. Both are chiral, their chirality is due to D-ribose or deoxyribose sugar components.

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.

100. Answer: b

Explanation:

Enantiomorphs or Enantiomers A pair of molecules related to each other as an object and its mirror images are known as enantiomorphs or enantiomers. These are not superimposable on its mirror image. The example is $[Co(en)_2Cl_2]^+$ Dichlorobis (ethylene diamine) cobalt (III)

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.

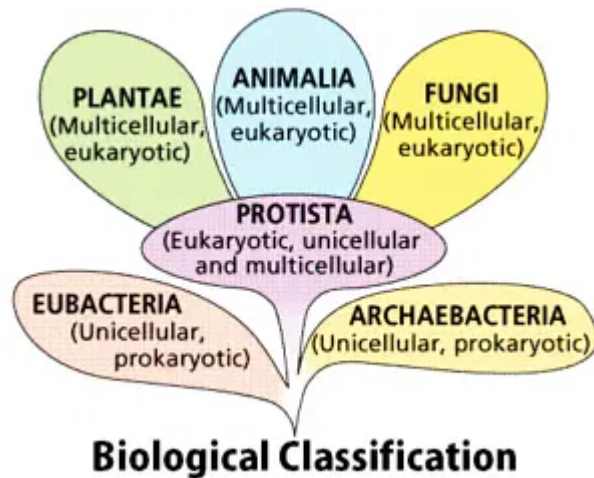
101. Answer: c**Explanation:**

In Amoeba and Paramoecium, osmoregulation occurs through contractile vacuule. Osmoregulation is a phenomenon in which contractile vacuule plays an important role in maintaining the water balance of the cell. Paramoecium contains two contractile vacuules which have fixed position. One contractile vacuule is present near the anterior end while another is present towards posterior end of the body. Each contractile vacuule is surrounded by 5-12 radial canals. Excess of water is transferred from the cytoplasm to the radial canals. The latter pour water into the contractile vacuule. The contractile vacuule expels water outside the body. Thus the contractile vacuules and radial canals are for osmoregulation. In Amoeba the endoplasm, at its posterior end, contains a single, clear rounded and pulsating contractile vacuule, filled with a watery fluid and enclosed by a unit membrane. Surrounding this membrane is a region containing many tiny feeder vacuoles and mitochondria. It helps in the osmoregulatory and excretory activities of the animal.

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](#)



102. Answer: b

Explanation:

its wall is thick

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

103. Answer: b

Explanation:

Increased asthmatic attacks in certain seasons, are related to inhalation of seasonal pollen. Pollens are microscopic grains produced by plants in order to reproduce. Pollen allergy is a hypersensitive reaction to pollen. Pollen induced reactions include extrinsic asthma, rhinitis and bronchitis. Asthma can be defined clinically as a condition of intermittent, reversible airway constriction, due to a hyper- reactivity to certain substances producing inflammation. ; In an asthma attack the smooth muscles of the lungs go into spasm with the surrounding tissue inflamed and secreting mucus into the airways. Thus, the diameter of the airways is reduced causing the characteristic wheezing as the person affected breathes harder to get air into the lungs. Attacks can vary in intensity and frequency. An asthmatic attack may be triggered by environmental allergens, such as pollen, animal dander, mold spores, house dust, feather pillows, some foods, or any other sensitive substance. Asthmatic attacks may also result from infections, emotional

stress, fatigue, endocrine changes and temperature and humidity changes.
Cigarette : smoking is a major factor in asthma.

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](#)

104. Answer: a

Explanation:

Lianas are large climbing woody vines that drape tropical rainforest trees. They have adapted to life in rainforest by having their roots in the ground and climbing high onto the tree canopy to reach available sunlight. Many lianas start life in the rainforest canopy and send roots down to the ground.

105. Answer: a

Explanation:

Scurvy is characterized by bleeding gums and swollen joints as well as decreased resistance to common cold. This occurs due to the deficiency of vitamin C. Vitamin C is a water soluble vitamin with antioxidant properties that is essential in maintaining healthy connective tissues and the integrity of cell walls. It is essential for the synthesis of collagen. Rickets and pellagra are caused due to deficiency of vitamin D and vitamin B3 respectively in the body

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.

106. Answer: c

Explanation:

Azolla is a fern in the leaf cavities of which the blue green algae Anabaena is found. This Azolla-Anabaena symbiotic system is the main biofertilizer which increases yield upto 50%. Anabaena fixes nitrogen which is excreted in the leaf cavities and is made available to the fern. When the fern plants die and decay they release nitrogen for utilization of the rice plants.

Concepts:

1. Microbes in Human Welfare:

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

In Household Products

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

In Industrial Products

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

Fermented Beverages

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

Antibiotics

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

107. Answer: c

Explanation:

Ovulation takes place towards the conclusion of the proliferative phase, which spans from the 7th day to the 14th day of the menstrual cycle. During this phase, follicles develop, and at its end, the egg is released with a peak in luteinizing hormone (LH) surge. If the egg remains unfertilized, the corpus luteum, which forms after ovulation, degenerates and transforms into the corpus albicans. This marks the

onset of the secretory phase. After the passage of 14 days post-ovulation, menstruation occurs, and the menstrual cycle begins anew.

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.
-

108. Answer: c

Explanation:

The correct answer is C: This disease is due to an X-linked recessive mutation. Haemophilia is a sex-linked disease in which the patient continues to bleed even from a minor cut since he or she does not possess the natural phenomenon of blood clotting. Haemophilia (= hemophilia) is genetically due to the presence of a recessive gene h , carried by the Y-chromosome. A female becomes haemophilic only when both its X-chromosomes carry the gene (X^hX^h). However, such females generally die before birth because the combination of these two recessive alleles is lethal. A female having only one allele for haemophilia (XX^h) appears normal because the allele for normal blood clotting present on the other X-chromosome is dominant. Such females are known as carriers. In case of males, a single gene for the defect is able to express itself as the Y-chromosome is devoid of any corresponding allele (X^hY) in which an organism has three times ($3n$) the haploid number (n) of chromosomes.

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.

109. **Answer: c**

Explanation:

Fibrous or immovable joints are the joints in which no movement occurs between the bones concerned. White fibrous tissue is present between the ends of the bones. Fibrous joint occurs between the bones of the skull called sutures and the joints between the teeth and the maxilla, and the teeth and the mandible.

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](#)

110. Answer: c

Explanation:

The cytoskeleton is a system that consists of filaments or fibres with an interlinking network of **protein** filaments. These are present in the **cytoplasm** of eukaryotic cells. Cytoskeleton supports and maintains the shape of cells and helps in their division too. The **cytoskeleton** consists of three types of filaments i.e., **actin filaments**, **microtubules**, and **intermediate filaments**.

1. **Actin filaments:** These are the smallest filaments and are made up of actin protein. These filaments help determine the shape of the **cell** and also help in

movement of the cell.

2. **Microtubules:** These filaments are the largest and are made up of tubulin proteins. Microtubules play an important role in movement of daughter **chromosomes** to form new daughter cells in mitosis.
3. **Intermediate filaments:** These filaments are mid-sized and made from several subunit proteins. These filaments are very stable structures and their function is to place the nucleus within the cell and provide cell with elastic properties.

It can be thus concluded that cytoskeleton are made up of filaments that are **proteinaceous**. Therefore, **Option C** is the correct answer.

Concepts:

1. Cell: The Unit of Life:

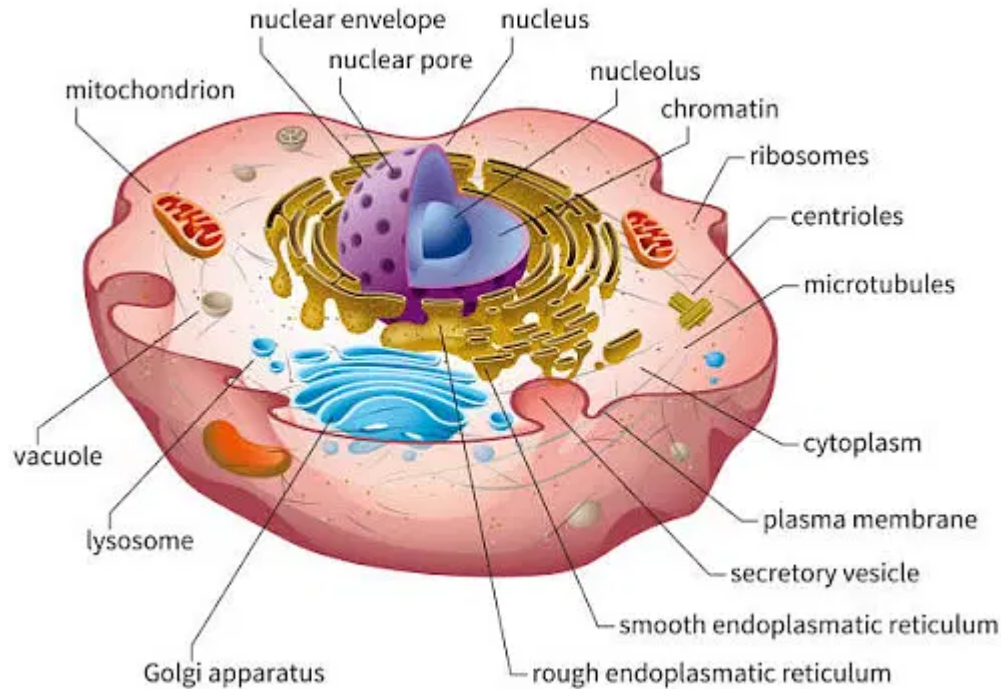
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus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



111. Answer: a

Explanation:

DNA fingerprinting technique in which the banding pattern of DNA fragments is compared and can be used in many species, including the human, to indicate relatedness. DNA is digested with restriction enzymes, run on an electrophoretic gel, and blots made from the gel. Such blots are then hybridized with radiolabelled probe DNA consisting of cloned sequences of the short interspersed repeat sequences which are common in vertebrate genomes. Autoradiography provides a distinct banding pattern of DNA fragments containing such DNA sequences.

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](#)

112. Answer: c

Explanation:

August Weismann in 1887 predicted that the number of chromosomes must be reduced by one half during gamete formation. The two divisions of meiosis are called the first and the second meiotic divisions. In meiosis I, the number of chromosomes are reduced from diploid to haploid condition, whereas in meiosis II, the two chromatids of each chromosomes separate from each other and go to separate daughter cells, as a result the number of chromosomes remains the same as produced by meiosis -1.

Concepts:

1. Cell Cycle and Cell Division:

Cell Cycle:

The sequence of events by which a cell copies itself synthesizes other constituents of the cell and eventually splits into two daughter cells is termed the cell cycle. The cell synthesizes all its constituents in a sequential pattern to make sure the proper division and distribution of components that occurs between the two daughter cells. Therefore, we can say that the cell cycle is the period of time between the development of new daughter cells and their further division.

Stages of Cell Cycle:

The cell cycle can be sub-divided into an additional category of Interphase. Meanwhile, the Interphase can be branched into 3 further stages, such as:

1. G1 Phase - "Gap 1 Phase"
2. S Phase - "Synthesis Phase"
3. G2 Phase - "Gap 2 Phase"

Read More: [Cell Cycle and Cell Division](#)

Cell Division:

The division of the parent cells into two or more cells is called daughter cell, [cell division](#) takes place. In general, it occurs as a part of a larger cell cycle. All the cell reproduces by dividing into two, wherein each parental cell produces two daughter cells.

Stages of Cell Division:

Cell division can be widely divided into several sub-segments that result from Mitosis and Meiosis.

1. Mitosis or (M Phase)
2. Meiosis

113. Answer: c

Explanation:

Sympathetic nervous system forms a part of autonomic nervous system that consists of nerves which connect the visceral receptors and effectors with the

central nervous system through the crania and spinal nerves. Sympathetic nerves arise from thoracolumbar nerves.

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.

114. Answer: a

Explanation:

Restriction endonucleases recognise specific sequences to cut DNA known as palindromic nucleotide sequences. However, the restriction enzymes cut the strand of DNA a little away from the centre of the palindrome site, but between the same two bases on the opposite strands.

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.

115. Answer: b

Explanation:

The correct match between List I and List II is:

- A. Taenia – III. Flame cells
- B. Paramoecium – II. Contractile vacuole
- C. Periplaneta – IV. Urecose gland
- D. Pheretima – I. Nephridia

So, the correct option is (B): A-III, B-II, C-IV, D-I

116. Answer: a

Explanation:

The correct answer is option (A): Juxtaglomerular cells of the kidney

Concepts:

1. Chemical Coordination and Integration – Hormones:

Hormones are chemical messengers that are released directly into the bloodstream, where they are carried to organs and tissues throughout the body to perform their tasks. Hormones are released by the body's endocrine glands.

Functions of Hormones

Following are some important functions of hormones:

- Food metabolism.
- Growth and development.
- Controlling thirst and hunger.
- Maintaining body temperature.
- Regulating mood and cognitive functions.
- Initiating and maintaining sexual development and reproduction.

Types of Hormones

To regulate various functions, different types of hormones are produced in the body. They are classified as follows:

- **Peptide Hormones:** Peptide hormones are composed of amino acids and are soluble in water.
- **Steroid Hormones:** Unlike peptide hormones, steroid hormones are fat-soluble and are able to pass through a cell membrane.

List of Important Hormones

1. Cortisol
2. Estrogen
3. Melatonin
4. Progesterone

5. Testosterone

117. Answer: b**Explanation:**

During prolonged fasting, when the body's glycogen stores are depleted, it starts breaking down fat for energy. The breakdown of fats produces ketone bodies, such as acetoacetate and beta-hydroxybutyrate, which can be detected in the urine. This condition is known as ketonuria and is a common physiological response to fasting or low-carbohydrate diets. The presence of ketones in urine is an indication that the body is using fat as an energy source.

So, the correct option is (B): ketones

Concepts:**1. Excretory System:****Excretory System Organs:**

The [human excretory system organs](#) include:

- A pair of kidneys
- A pair of ureters
- A urinary bladder
- A urethra

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

Kidneys:

The organ that has an inner concave structure is the kidney. The blood vessels, nerves, and ureters enter the kidneys through the hilum, which is a notch in the inner concave surface of the kidney. The renal pelvis, a large funnel-shaped space, present inside the hilum, has many projections, called calyces.

Ureter:

A pair of thin muscular tubes called the ureter comes out of each kidney outstretched from the renal pelvis. It is the carrier of urine from the kidney to the urinary bladder.

Urinary Bladder:

It is a muscular sac-like structure, where urine is stored. The urinary bladder is being emptied by the process of micturition, which acts as urination.

Urethra:

This tube rises from the urinary bladder and helps to throw urine out of the body. In males, it works as the common route for sperms and urine. Sphincter muscles guard the opening of the urethra.

Read More: [Excretion](#)

118. Answer: c

Explanation:

In tyrosinase, copper is associated as an activator. Tyrosinase is an oxidase that is the rate-limiting enzyme for controlling the production of melanin. Tyrosinase is a copper-containing enzyme present in plant and animal tissues that catalyzes the production of melanin and other pigments from tyrosine by oxidation. So, the correct answer is 'Tyrosinase'.

Concepts:

1. Human Endocrine System:

The [human endocrine system](#) is a messenger system that balances or controls distant target organs through feedback loops of hormones released by the internal glands of an organism right into the circulatory system. The hypothalamus is the neural control node for all endocrine systems, in invertebrates.

Functions of the Human Endocrine System are:

The endocrine system controls a variety of body functions through hormone release. Hormones are built by the endocrine system's glands and pass throughout the bloodstream to various organs and tissues in the body. Hormones then command these organs and tissues about how to act.

The Endocrine System is in charge of the following bodily functions:

1. Metabolic rate
2. Development and growth of a human being
3. Reproduction and sexual function
4. Heart Rate
5. Blood pressure
6. The appetite is the need to eat
7. Controls cycles of sleep and wakefulness
8. Controls the temperature of the body

119. Answer: a

Explanation:

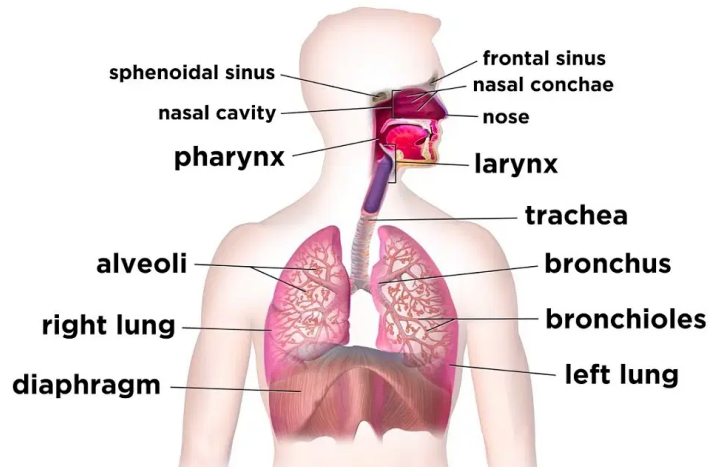
Mast cells are present in various connective tissues, including the lungs, skin, stomach and intestinal linings, and other locations. These cells contain numerous granules that are abundant in histamine and heparin.

Concepts:

1. The Respiratory System:

[Human Respiratory System](#) is a compound biological system of organs and tissues that helps in gaseous exchange. The system includes airways, lungs, and [blood vessels](#). Its core function is to introduce oxygen and expel carbon dioxide from the body. The atmospheric air is continuously pumped in and out through a system of pipes which are called the conducting airways. There are a great number of muscles and blood vessels involved in the whole process of respiration.

The Respiratory System



Features of Human Respiratory System:

- The respiratory system is essential for inhalation of oxygen and transportation of the same to the different parts of the body where it is used for cellular respiration.
- The design of the lungs is created in a manner that helps in gaseous exchange in an efficient manner. The other parts of the respiratory system such as the nose, pharynx, larynx, trachea, and bronchi help in the process of bringing in oxygen to the lungs and taking carbon dioxide out of it.
- There is an arrangement of muscles such as the diaphragm and intercostal muscles that aid in the process of human respiration.

120. Answer: a

Explanation:

Triticale, the first man-made cereal crop, has been obtained by crossing wheat with rye.

Therefore, the correct option is (A): rye

Concepts:

1. Strategies For Enhancement in Food Production:

Animal Husbandry

The raising and breeding of livestock are known as animal husbandry. Dairy farm management and fisheries are also included under animal husbandry and responsible for the selection of good breeds for better yield, maintaining a well-ventilated house and proper cleanliness and hygiene, and regulating proper [disposal of waste](#).

Read More: [Strategies for Enhancement in Food Production](#)

Animal Breeding

The practice of raising a group of animals belonging to a common species. Inbreeding and outbreeding are the two types of animal breeding.

1. Animals of superior male and female breed are made to mate for 4 to 6 generations. According to Mendel's experiment, true-breeding species or pure lines are created by [Inbreeding](#) which results in homozygosity.
2. The breeding involving animals that are not related is known as outbreeding.
3. Bee-keeping: The rearing of bees for the production of honey and beeswax is known as apiculture. One of the most common species of the honey bee is *Apis indica*. Beeswax is used to prepare polish, cosmetics, etc.
4. Fisheries: Cultivation or breeding of aquatic flora and fauna for a commercial purpose is known as aquaculture. Fish and fish products for consumption are known as pisciculture.

Plant Breeding

In order to get rid of [nutrient deficiency diseases](#), crops need to have a specific nutrient value besides disease resistance, pest resistance, and high yield capacity. There are many strategies for enhancing food production through plant breeding.

1. Somatic Hybrids
2. Totipotency
3. Biofortification

Plant Breeding for Disease Resistance

Plant Breeding for Pest Resistance

Plant Breeding for Improved Food Quality

Single-Cell Protein

One of the ways to meet the growing demand of nutrients in plants and animals is a single-cell protein which is biomass that is rich in protein. microbes are produced on an industrial scale to get single-cell protein.

121. **Answer: c**

Explanation:

The organisms attached to the substratum possess radial symmetry in all vertical planes. All the animals belonging to cnidaria (e.g. jellyfish) and echinodermata (e.g. starfish) are radially symmetrical and typically sessile in their adult form. In radial symmetry the parts in an organ or organism when cut through the centre in any direction produces two halves that are mirror images of each other.

Concepts:

1. Animal Kingdom:

Animals are eukaryotic, multicellular species that belong to the [Kingdom Animalia](#). Every animal has a distinct characteristic. They get energy either by feeding on plants or on other animals. There are millions of species that have been recognized, few shares similar characteristics while others vary drastically.

Kingdom Animalia comprises all animals. In the midst of the five kingdoms, the largest kingdom is the animal kingdom. Animals are multicellular eukaryotes. Though, like plants, they do not possess chlorophyll or a cell wall. Therefore, members of the animal kingdom indicate a heterotrophic mode of nutrition. Kingdom Animalia is further classified into ten different subphyla based on their body designs or differentiations.

The different phyla of the Kingdom Animalia are as follows:

1. Porifera
2. Coelenterata (Cnidaria)
3. Platyhelminthes
4. Nematoda
5. Annelida

- 6. Arthropoda
- 7. Mollusca
- 8. Echinodermata
- 9. Hemichordata
- 10. Chordata

Read More: [Classification of Animal Kingdom](#)

122. Answer: c

Explanation:

Hugo de Vries, a Dutch botanist, one of the independent rediscoverers of Mendelism, put forward his views regarding the formation of new species in 1901. According to him, new species are not formed by continuous variations but by sudden appearance of variations, which he named as mutations. Hugo de Vries stated that mutations are heritable and persist in successive generations. He conducted his experiments on *Oenothera lamarckiana* (evening primrose). Mendel worked on *Pisum sativum* and gave principal of inheritance. T.H. Morgan worked on *Drosophila* and gave linkage theory.

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.

123. Answer: c

Explanation:

At sexual maturity, the undifferentiated primordial germ cells divide several times by mitosis to produce a large number of spermatogonia. Each spermatogonium actively grows to a larger primary spermatocyte. Each primary spermatocyte undergoes two successive divisions, called maturation divisions. The first maturation division is reductional or meiotic. Hence, the primary spermatocyte divides into two haploid daughter cells called secondary spermatocytes. Both secondary spermatocytes now undergo second maturation division which is an ordinary mitotic division to form four haploid spermatids. Thus each secondary spermatocyte gives rise to four spermatids that undergo transformation to form four sperms. Overall, both secondary spermatocytes give rise to four sperms.

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.

124. Answer: a

Explanation:

In addition to the nucleoid, bacterial cytoplasm normally contains many small, separate pieces of DNA, called plasmids. These circular DNA units are 1/100 the size of the main nuclear DNA (nucleoid) and are also not enclosed in a membrane structure. When found in cytoplasm, entirely independent of the bacterial chromosome, they replicate autonomously. Sometimes it becomes integrated into the main DNA and replicates with it. During conjugation, the plasmids, sometimes called episomes, help in the transfer of the genetic material between different bacteria. It may carry some genes of resistance to a variety of antibiotics.

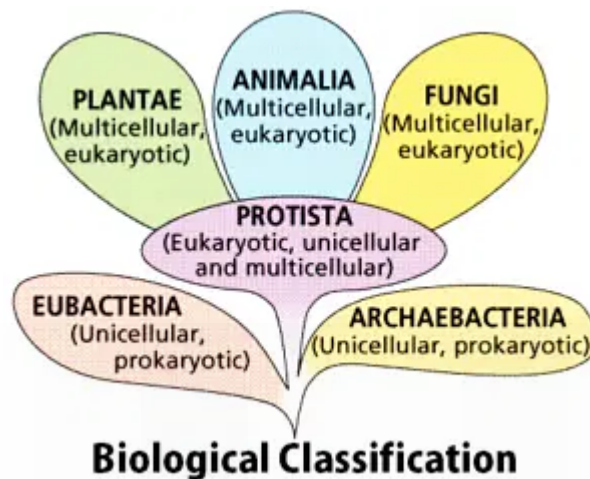
Concepts:

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](#)



125. Answer: b

Explanation:

Infection of *Ascaris* occurs in a healthy person due to contaminated water, vegetables, fruits, etc. Mosquito bite causes malaria due to the entry of *Plasmodium* parasite into the blood. Eating imperfectly cooked pork causes trichinosis disease (parasitic disease). Tse-tse fly causes trypanosomiasis, an infection of the central nervous system.

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](#)

126. Answer: a

Explanation:

Lymph (called tissue fluid in the intercellular spaces) is a vascular tissue consisting of two parts—a clear, colourless fluid matrix, the plasma and floating amoeboid cells, the white blood cells, mostly lymphocytes. It differs from the blood in lacking red blood cells and some blood proteins. The lymph eventually enters the bloods near the heart.

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

127. Answer: d

Explanation:

Tropical shrubs or thorn forests are found in places where moisture conditions are intermediate between desert and savanna on one hand and seasonal or rain forests on the other hand. Acacia and Prosopis are non-succulent perennial plants and Capparis is a xerophytic shrub.

128. Answer: b

Explanation:

Thromboplastin, a lipoprotein, helps in clot formation. Thromboplastin helps in the formation of an enzyme prothrombinase. This enzyme inactivates heparin and it also converts the inactive plasma protein prothrombin into its active form, thrombin. Both the changes require calcium ions. Thrombin converts fibrinogen molecule to insoluble fibrin. The fibrin monomers polymerize to form long, sticky fibres. The fibrin threads form a fine network over the wound and trap blood corpuscles (RBCs, WBCs, platelets) to form a crust, the clot.

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.

129. **Answer: c**

Explanation:

Organic farming is a method of farming system which primarily aimed to keep the soil alive and in good health by use of organic wastes and other biological material alongwith beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an ecofriendly, pollution free environment. Basic components of organic farming are green manures, farm yard manure, vermicompost, crop rotation, biopesticides and biofertilizers. Glomus being a mycorrhizal component, earthworm being a vermicompost and Oscillatoria being a nitrogen fixing blue green algae can be used in organic farming. Snail cannot be a component of organic farming.

Concepts:

1. Microbes in Human Welfare:

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

In Household Products

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

In Industrial Products

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

Fermented Beverages

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

Antibiotics

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

130. Answer: a

Explanation:

Large non-motile female gamete and a small motile male gamete: This option is correct because in oogamous reproduction, fusion occurs between these types of gametes. Large non-motile female gamete and a small non-motile male gamete: This option is not correct because the male gamete should be motile. A large motile female gamete and a small non-motile male gamete: This option is incorrect because the female gamete should be non-motile. A small non-motile female gamete and a large motile male gamete: This option is also incorrect because it doesn't follow the typical pattern of oogamous reproduction.

Concepts:

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 - **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.
-

131. Answer: d

Explanation:

The correct option is (D) 1 : 2 : 1 :: Tall homozygous : Tall heterozygous : Dwarf.

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.

132. **Answer: c**

Explanation:

Myosin is a contractile protein of muscle. Primary myofilaments are made up of this protein. Each myosin filament is a polymerised protein made of many monomeric protein called meromyosins. Secondary myofilaments are composed of a protein actin, having with it two regulatory proteins : tropomyosin and troponin. Myosin interacts with actin to bring about contraction of muscle or cell movement. Tubulin is a protein of which the microtubules of cells are formed.

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](#)

133. Answer: b

Explanation:

DNA is mainly found in nucleus. It is associated with RNA and proteins to form compact chromosomes. But some amount of DNA is also found in chloroplasts and mitochondria. This DNA is called extra-chromosomal DNA.

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](#)

134. Answer: d

Explanation:

A ribosome is a small spherical body within a living cell that is the site of **protein** synthesis. It does not have **DNA**.

- A. DNA is mainly present in the nucleus, however, extranuclear DNA is also found in certain organelles.
- B. Mitochondrial DNA is significant in maternal inheritance.
- C. **Chloroplast** DNA contains genes that are important for **photosynthesis**.
- D. DNA is not present in ribosomes.

Ribosomes consist of two subunits, one large and one small, each of which comprises some RNA (called ribosomal RNA) and protein. They are found in both **eukaryotic and prokaryotic cells**. They do not have any DNA. Therefore, option D is the correct answer.

Concepts:

1. Cell: The Unit of Life:

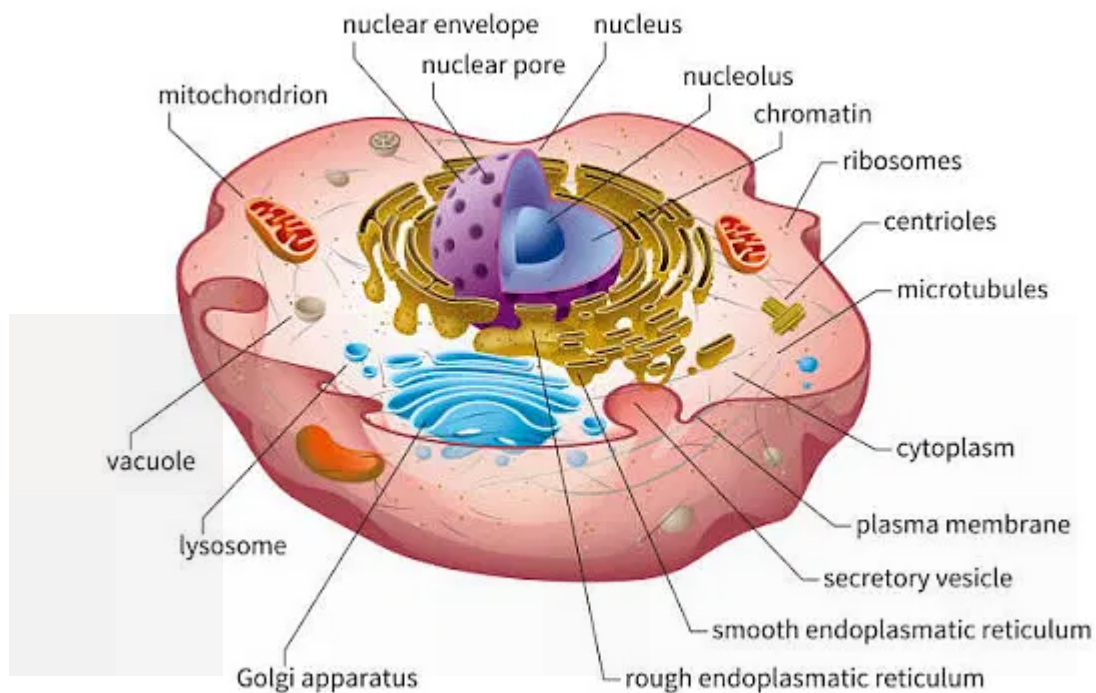
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus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



135. Answer: c

Explanation:

Microtubules are unbranched hollow submicroscopic tubules of protein tubulin which develop on specific nucleating regions and can undergo quick growth or dissolution at their ends by assembly or disassembly of monomers. Microtubules form spindle during cell division. Centrioles help in cell division by forming spindle poles or microtubules. In animal cells, microfilament collect in the middle region of the cell below the cell membrane. They induce the cell membrane to invaginate. In plant cells, cell plate is formed to separate the two daughter cells. Some of the spindle fibres called interzonal microtubules are deposited around phragmoplast. Vesicles from Golgi apparatus are deposited and coalesce on the phragmoplast to form a cell plate.

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

136. Answer: b

Explanation:

Lens in the human eye is held in its place by suspensory ligaments attached to the ciliary body.

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.

137. Answer: b

Explanation:

In mammals, including humans, insulin is synthesised as a pro-hormone which contains an extra stretch called the C peptide. The pro-hormone needs to be processed before it becomes fully mature and functional. However, in case of genetically engineered insulin, there is no C-peptide, hence no proinsulin is formed.

Genetically engineered insulin that is used for diabetes is produced using yeast and bacteria, unlike natural insulin which was earlier extracted from pancreas of slaughtered cattle and pigs.

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.

138. Answer: c

Explanation:

The correct Answer is Option (C): Tight junctions and Gap junctions, respectively

Concepts:

1. Animal Tissues:

Human bodies, like most animal bodies, are made up of four different types of tissue:

Epithelial Tissue:

This tissue forms the outer layer of the body and also lines many of the body's cavities where it has a protective function.

General functions of epithelial tissue:-

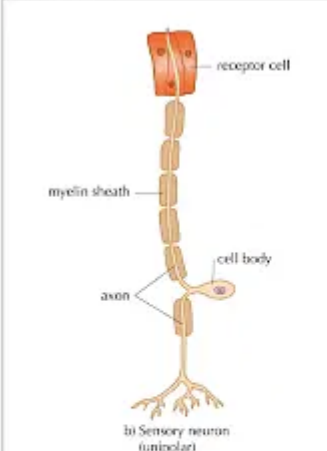
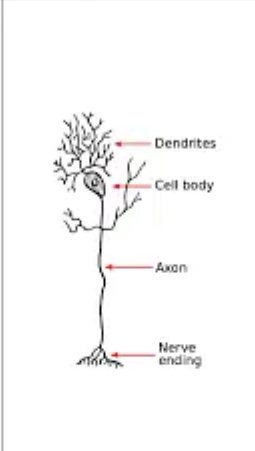
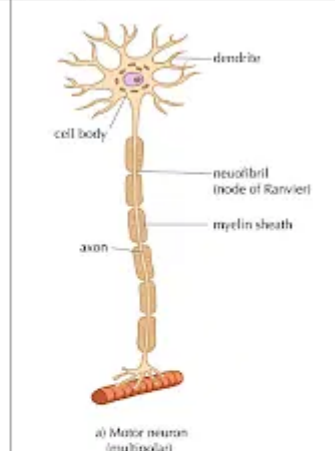
1. Provides a barrier between the external environment and the organ that it is covering.
2. Specialized to function in secretion and absorption.
3. Protects organisms from microorganisms, injury, and fluid loss.

Connective Tissue:

This tissue assists in the support and protection of organs and limbs and depending on the location in the body it may join or separate organs or parts of the body.

Muscle Tissue:

This tissue enables various forms of movement, both voluntary and involuntary.

Sensory neuron	Motor neuron	Interneuron
 b) Sensory neuron (unipolar)		 a) Motor neuron (multipolar)
Sensory neurons are responsible for sending information about the environment (called stimuli) to the central nervous system. They are activated by touch, light, temperature, pressure, hearing etc. Sensory nerve cells (or sensory neurons) carry impulses (electrical signals) from a receptor to the central nervous system (CNS).	These neurons are very short compared to the sensory and motor neurons. The connectors or interneurons connect a sensory neuron with a motor neuron. The impulse travels from the cell body at the head end along the short axon to the dendrites.	Motor neurons carry impulses from the CNS to muscles or glands. In most cases the motor neuron causes muscle contraction (movement), but motor neurons can also cause secretion of substances by glands. The motor neuron causes a response via chemicals known as neurotransmitters.

Nerve Tissue:

This tissue is responsible for the carrying of electrical and chemical signals and impulses from the brain and central nervous system to the periphery, and vice versa.

139. Answer: a

Explanation:

Melatonin is secreted by the Pineal body, also known as the pineal gland. Melatonin is a hormone that plays a crucial role in regulating the sleep-wake cycle and circadian rhythms. It is produced in response to darkness and helps signal the body that it is time to sleep.

So, the correct option is (A): Pineal body

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
-

140. Answer: d

Explanation:

If Henle's loop (loop of Henle) were absent from a mammalian nephron, it would have a significant impact on urine formation. Henle's loop plays a crucial role in the concentration of urine by creating an osmotic gradient in the renal medulla, which allows for the reabsorption of water from the collecting duct. Without Henle's loop, the urine would be more dilute because the nephron would not be able to concentrate it effectively.

So, the correct answer is (D): The urine will be more dilute.

Concepts:

1. Mechanism Human Excretory System:

Excretory System Organs

Kidneys- Kidneys are bean-shaped structures located on either side of the backbone. In human each adult kidney size is 10-12 cm with a width of 5-7 cm and weighs around 120-170g and it have an inner concave structure.

Ureter - A pair of thin muscular tubes called the ureter. Ureter comes out of each kidney extending from the renal pelvis and it carries urine from the kidney to the urinary bladder.

Urinary Bladder – muscular sac-like structure which stores urine. The urinary bladder is emptied by the process of micturition.

Urethra – This tube comes out from the urinary bladder and helps to expel urine out of the body. It acts as the common route for sperms and urine in males.

141. Answer: d

Explanation:

Retroviruses are a class of animal viruses characterized by a single-stranded RNA as their genetic material. They follow a unique replication process involving a DNA intermediate. These retroviruses carry two copies of single-stranded RNA molecules. The retrovirus life cycle begins with the reverse transcription of the RNA genome into double-stranded DNA. This newly formed DNA is then integrated into the host genome. Inside the cell's cytosol, the single-stranded RNA genome undergoes reverse transcription into double-stranded DNA, facilitated by an enzyme called reverse transcriptase. This enzyme, which acts as an RNA-dependent DNA polymerase, uses RNA as a template to synthesize DNA. Additionally, it possesses RNase H activity, which is responsible for degrading the RNA portion of the RNA-DNA hybrid. Native tRNA molecules serve as primers for reverse transcriptase. Once DNA synthesis is completed, the double-stranded DNA is integrated into the host genome. Retroviruses such as HIV are known to be associated with the development of diseases, including certain cancers like leukemia (specifically, HIV-1 is implicated in this context).

Concepts:

1. Antimicrobials:

Infections and diseases may be caused by different types of organisms like bacteria, fungi, and viruses, etc., in humans and animals. Antimicrobial agent is the drugs that are used to prevent the pathogenicity of microorganisms.

Examples: Antibiotics, antiseptics, and disinfectants.

It is used to prevent infections and diseases caused by pathogens.

Different types of antimicrobial drugs are commonly available. These are as follows:

1. **Antibacterial drug:** is a drug that are used to inhibit the pathogenic activity of bacteria. Example: Zithromax.
2. **Antifungal drug:** A drug that is used to prevent the fungal activity in the host is called an antifungal drug. Example: Miconazole
3. **Antiviral agent:** A drug which is used to stop the pathogenic action of a virus is called as antiviral agents. Example: Tamiflu.
4. **Antiparasitic drug:** is a drug that are used to prevent the growth of pathogenic parasites. Example: Anthelmintics

Read More: [Antimicrobial Resistance](#)

142. Answer: c

Explanation:

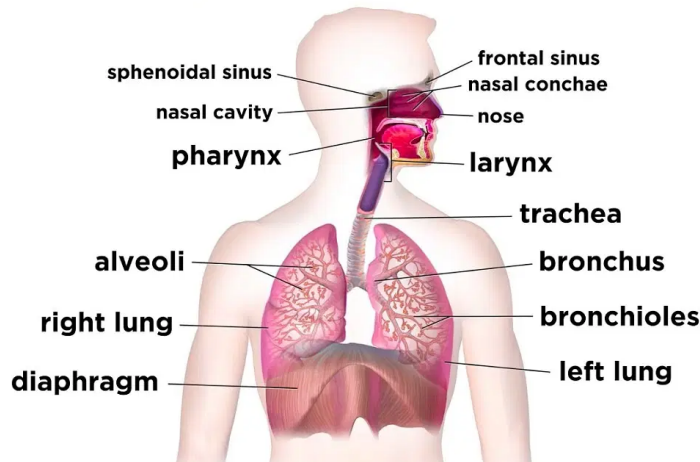
When the concentration of carbon dioxide (CO_2) in the blood increases, it leads to a faster and deeper breathing pattern. This response occurs because the higher CO_2 concentration reduces the affinity of hemoglobin (Hb) for oxygen (O_2). As a result, CO_2 is released more readily in the body's tissues, which in turn speeds up the delivery of oxygen (known as the Bohr effect). This heightened oxygen delivery triggers an increase in the rate and depth of breathing.

Concepts:

1. The Respiratory System:

Human Respiratory System is a compound biological system of organs and tissues that helps in gaseous exchange. The system includes airways, lungs, and blood vessels. Its core function is to introduce oxygen and expel carbon dioxide from the body. The atmospheric air is continuously pumped in and out through a system of pipes which are called the conducting airways. There are a great number of muscles and blood vessels involved in the whole process of respiration.

The Respiratory System



Features of Human Respiratory System:

- The respiratory system is essential for inhalation of oxygen and transportation of the same to the different parts of the body where it is used for cellular respiration.
- The design of the lungs is created in a manner that helps in gaseous exchange in an efficient manner. The other parts of the respiratory system such as the nose, pharynx, larynx, trachea, and bronchi help in the process of bringing in oxygen to the lungs and taking carbon dioxide out of it.
- There is an arrangement of muscles such as the diaphragm and intercostal muscles that aid in the process of human respiration.

143. Answer: d

Explanation:

The cells characteristic of the coelenterates include stinging cells (cnido-cytes or cnidoblasts or nematoblasts) for offence and defence. The stinging cells, when discharged, give out from a sac, the cnide or cnidocyst or nematocyst, a long thread-tube that may coil around the prey, or attach to it, or inject a toxin, called hypotoxin, into it to paralyse it.

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](#)

144. Answer: a

Explanation:

Diversification in plant life appeared due to long periods of evolutionary changes. Initially plants were thalloid. There were no differentiation among root, stem and leaves. Vascular tissues were absent.

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.

145. Answer: a

Explanation:

Inhibin hormone secreted by granulosa cell of ovary and inhibits the secretion of FSH from pituitary in female while in male it also secreted by sertoli cells of testis and inhibits the secretion of FSH of pituitary in male.

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.

146. Answer: a

Explanation:

Plasma membrane of eubacteria resembles plasma membrane of eukaryotic cell. But nucleus, ribosomes and cell wall are little different in eukaryotic cell in their structure and organization from eubacterial cell.

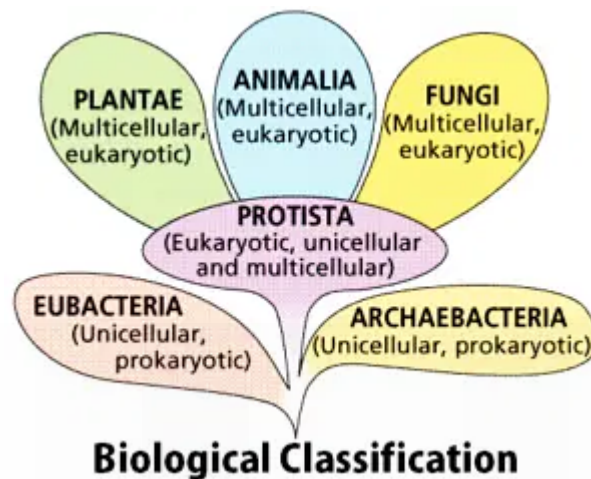
Concepts:

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



147. Answer: c

Explanation:

Interferons are a group of proteins that acts as an immune response in response to viral infection. They are released by the cells, in response to the viruses, double stranded RNA. They are the signaling molecules that help in activating the other cells, to activate against the pathogen.

These interferons are created by the infected cells that have been attacked by the viruses. The viruses infect the cells, they replicate in the cells and then the cell bursts. But before bursting interferons are released so that the immune system is activated.

There are three types of interferons:

- Type I: interferon alpha and beta
- Type II: interferon gamma
- Type III: interferon lambda

The antiviral defense induced by interferons are as follows:

- Inhibition of the viral replication
- Activation of immune cells
- Upregulation of the antiviral genes
- Modulation in the adaptive immunity
-

Concepts:

1. Human Health and Disease:

Health is described as a state of complete physical, mental and social well-being.

The **disease** is a circumstance where malfunctioning of the body organs occurs leading to uneasiness and discomfort.

Differences between Infectious Diseases and Non-Infectious Diseases:

Infectious diseases	Non-infectious diseases
•These diseases are easily transmitted from one person to another. •Examples: AIDS, Typhoid	•These diseases remain restricted to the person and are not easily transmitted from one person to another. •Examples: Diabetes, Cancer

Common Diseases in Humans:

Diseases	Pathogen	Signs and Symptoms
Typhoid	<i>Salmonella typhi</i>	High fever, low pulse rate, abdominal pain, frequent stools
Pneumonia	<i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i>	Lymph and mucus collect in the alveoli and bronchioles
Common cold	Viruses like <i>Rhino viruses</i>	Nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness
Malaria	<i>Plasmodium</i>	Fever, restlessness, less appetite, slight sleeplessness, muscular pains, headache and feeling of chilliness
Amoebiasis	<i>Entamoeba histolytica</i>	Blood along with faeces and abdominal pain
Ascariasis	<i>Ascaris</i>	Obstruction of intestinal passage, abdominal discomfort
Elephantiasis	<i>Wuchereria bancrofti</i>	Inflammation of lymphatic vessels of the lower limbs
Ringworms	<i>Microsporum</i> , <i>Trichophyton</i> , <i>Epidermophyton</i>	Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp

Read More: [Human Health and Disease](#)

148. Answer: a

Explanation:

Halophytes growing in saline soils show

- (i) Vivipary which is in-situ seed germination
- (ii) Pneumatophores for gaseous exchange

149. Answer: c

Explanation:

The Wharton's ducts are associated with submaxillary glands that lie at the angles of the lower jaw. These ducts open under the tongue. Ducts of Rivinus are associated with sublingual salivary gland. Stenson's duct is associated with parotid gland. Brunner's glands are present in the intestine.

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.

150. Answer: a

Explanation:

Cardiac output = stroke volume $\times$ Heart rate

$\Rightarrow$ Cardiac output = 5L or 5000 ml

$\Rightarrow$ Blood volume in ventricles at the end of diastole = 100 ml

$\Rightarrow$ Blood volume in ventricles at the end of systole = 50 ml

Stroke volume = 100 - 50

= 50 ml.

So,

5000 ml = 50 ml $\times$ Heart rate

So, Heart rate = 100 beats per minute.

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
-

151. Answer: d

Explanation:

Biological names are derived either from Latin language or are latinised. This is because Latin language is a dead language and therefore it will not change in form or spellings with the passage of time.

152. Answer: b

Explanation:

Methanogens are any of various archaebacteria that produce methane; they include genera such as Methanobacillus and Methanothrix. Methanogens are obligate anaerobes found in oxygen-deficient environments, such as marshes, swamps, sludge and the digestive systems of ruminants.

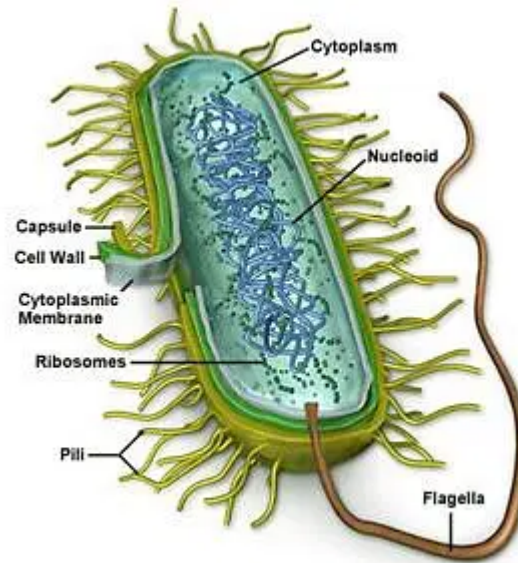
Concepts:

1. Kingdom Monera:

Characteristics of Monera Kingdom

The organisms in this kingdom have the following characteristics: –

- Monerans are single-celled creatures.
- The cell wall is made up of peptidoglycan and is stiff.
- Binary fission is asexual reproduction.
- They have 70S ribosomes in them.
- The locomotory organ is the flagella.
- Organelles such as mitochondria, lysosomes, plastids, Golgi bodies, endoplasmic reticulum, centrosome, and others are not present.
- These are decomposers and mineralizers for the environment
-



153. Answer: d

Explanation:

Tomato is a berry. It is one to many seeded fleshy fruit developing usually from a multicarpellary, syncarpous and superior or inferior ovary. The pericarp of berries is differentiated into epicarp, mesocarp and endocarp but the endocarp is not stony. In tomato pericarp, placenta and seeds are edible. Maize fruit is caryopsis and edible part is endosperm and embryo. Date palm fruit is berry and its mesocarp is edible. Guava fruit is berry and its pericarp and placenta is edible.

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.

154. Answer: d

Explanation:

Root is not common between Funaria and Selaginella. Funaria is a bryophyte and have archegonium, embryo, flagellated sperms which are also present in Selaginella. Selaginella is a pteridophyte and it has root which is absent in Funaria.

Concepts:

1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.

- They have branches that expanded and green leaves due to the presence of **chlorophyll**. They are an **autotrophic mode of nutrition** that simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They secure their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

155. Answer: c

Explanation:

Pollen grains are believed to be rich in nutrients (protein 7-26 % carbohydrates 24-48%, fats 0.9-14.5%). They are taken as tablets or syrups to improve health. They also enhance performance of athletes and race horses.

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
-

156. Answer: c

Explanation:

Mitochondrion is the organelle which bears various enzymes participating in Krebs' cycle. Each mitochondrion is covered by double membrane. The inner membrane is selectively permeable and forms foldings called cristae. The inner membrane bears oxysomes, enzymes of fatty acids, succinate dehydrogenase (of Krebs' cycle) and electron transport system. All other enzymes of Krebs' cycle are present in the mitochondrial matrix.

Concepts:

1. Respiration in Plants:

Respiration in plants is a process that entails the production of energy in **plants**. This process can simply be described as the intake of Oxygen and the release of Carbon Dioxide as an outcome of the oxidation of complex organic compounds. Though plants do not have any specific organ to balance the process of respiration, their stems, roots, and leaves do this work at a very low rate than other living beings. The process of respiration is very crucial for the plants to sustain the growth of the plant tissues.

This process can be stated as–



157. Answer: b

Explanation:

Chlorophyll is the green pigment present in plants and some photosynthetic bacteria. The empirical formula of chlorophyll-a molecule is $C_{55}H_{72}O_5N_4Mg$. It consists of a porphyrin head and a phytol tail. Porphyrin is a cyclic tetrapyrrole structure, having a magnesium atom in the centre. Tail is consisted of phytol alcohol and it is attached with one of the pyrrole rings. The chlorophyll has empirical formula of $C_{55}H_{72}O_5N_4Mg$. Its molecular structure is comparable with chlorophyll-a.

Concepts:**1. Photosynthesis in Higher Plants:****Processes Of Photosynthesis in Higher Plants:**

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen,
- and formation of ATP and NADPH.

Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C₃ Cycle)
2. C₄ Cycle (Hatch and Slack Pathway)

Explanation:

The biological Act provides for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected there with or incidental there to. The biological act of India was passed in 2002. This act of parliament received the assent of President of India on the 5th February 2003.

Concepts:

1. Biodiversity and Conservation:

The term 'biodiversity' is derived from the two words- 'bios' which means life and 'diversity' i.e, differentiation or variation. Edward Wilson, the sociobiologist was the first to popularise the term 'biodiversity' in the year 1992. The term implies the occurrence of various plants and animals along with their variants such as biotypes, ecotypes and genes on earth. In our biosphere, the immense diversity or heterogeneity remains not only at the species level but also, at every level of biological organization that ranges from macromolecules in the cells to biomes.

[Biodiversity and Conservation](#) is a topic covered under the fifteenth chapter and Unit 5 of NCERT class 12 biology.

159. Answer: d

Explanation:

Boron occurs in the soil as a part of silicates, | boric acid, calcium borate and magnesium borate. It is available to the plants as boric acid and borates of calcium and magnesium. It plays a role in carbohydrate metabolism and translocation of sugar is facilitated through the cell membrane through the agency of borate ion as it forms complexes with the carbohydrates.

Concepts:

1. Mineral Nutrition:

The naturally occurring inorganic nutrient found in the soil and food that is necessary for the proper functioning of animal and plant bodies is defined as nutrition. [Minerals](#) are vital elements essential for the body.

Read More: [Mineral Nutrition](#)

Role of Nutrients:

1. Balancing function
2. Maintenance of osmotic pressure
3. Influencing the pH of the cell sap
4. Construction of the plant body
5. Catalysis of the biochemical reaction
6. Effects of Toxicity

160. Answer: c

Explanation:

The growth movement in response to touch, or contact of a foreign body, in plants is called thigmotropism or thigmotropic movement. The stems and tendrils of the climbers are positively thigmotropic in their response. The coiling of garden pea tendrils around any support is an example of thigmotropism. Thigmonastic (haptanastic) movements are induced by some external stimuli. For example tentacles of *Drosera* leaf curve and the lamina lobes of *Dionaea* fold on coming in contact with an insect.

161. Answer: b

Explanation:

Compared to a bull a bullock is docile because of lower levels of blood testosterone. A bullock is a castrated bull. Bulls have castrated to make them more meek and docile. Castration is any action, surgical, chemical, or otherwise, by which a male loses the functions of the testes or a female loses the functions of the ovaries. Castration is the removal or destruction of one or both testicles and results in sterility, decreased sexual desire, and inhibition of secondary sex characteristics. It is

performed for the purpose of improving the quality of meat and decreasing the aggressiveness of farm animals; in pet animals it prevents unwanted mating behaviour, reproduction, and wandering.

Concepts:

1. Strategies For Enhancement in Food Production:

Animal Husbandry

The raising and breeding of livestock are known as animal husbandry. Dairy farm management and fisheries are also included under animal husbandry and responsible for the selection of good breeds for better yield, maintaining a well-ventilated house and proper cleanliness and hygiene, and regulating proper [disposal of waste](#).

Read More: [Strategies for Enhancement in Food Production](#)

Animal Breeding

The practice of raising a group of animals belonging to a common species. Inbreeding and outbreeding are the two types of animal breeding.

1. Animals of superior male and female breed are made to mate for 4 to 6 generations. According to Mendel's experiment, true-breeding species or pure lines are created by [Inbreeding](#) which results in homozygosity.
2. The breeding involving animals that are not related is known as outbreeding.
3. Bee-keeping: The rearing of bees for the production of honey and ~~beeswax~~ is known as ~~apiculture~~. One of the most common species of the honey bee is *Apis indica*. Beeswax is used to prepare polish, cosmetics, etc.
4. Fisheries: Cultivation or breeding of aquatic flora and fauna for a commercial ~~purpose~~ is known as aquaculture. Fish and fish products for consumption are known as pisciculture.

Plant Breeding

In order to get rid of [nutrient deficiency diseases](#), crops need to have a specific nutrient value besides disease resistance, pest resistance, and high yield capacity. There are many strategies for enhancing food production through plant breeding.

1. Somatic Hybrids
2. Totipotency
3. Biofortification

Plant Breeding for Disease Resistance

Plant Breeding for Pest Resistance

Plant Breeding for Improved Food Quality

Single-Cell Protein

One of the ways to meet the growing demand of nutrients in plants and animals is a single-cell protein which is biomass that is rich in protein. microbes are produced on an industrial scale to get single-cell protein.

162. Answer: c

Explanation:

Biotic or ecological succession is the natural development of a series of biotic communities at the same site, one after the other till a climax community develops which does not change further because it is in perfect harmony with the environment of the area. The change is orderly and sequential. There is a parallel change in the physical environment. During an ecological succession, the numbers and types of animals go on increasing with time. The community that is in near equilibrium with the environment is called climax community. The establishment of a new biotic community is slow in its primary phase but gradually becomes fast in its secondary phase.

Concepts:

1. Ecosystem:

An [ecosystem](#) is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

Structure of the Ecosystem:

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

163. Answer: a

Explanation:

Stomata are the main organs for transpiration. The stem and leaf epidermis are provided with numerous stomata. Diffusion of water vapour through the stomatal pores is known as stomatal transpiration. Transpiration occurs while the stomata are open for the passage of carbon dioxide and oxygen during photosynthesis. Stomatal opening and closing is regulated by the movement of guard cells.

164. Answer: b

Explanation:

The cell of the cork cambium divide to produce an outer corky tissue (cork or phellem) and an inner secondary cortex (phelloderm). Cork, cork cambium, and phelloderm together make up the periderm, an impermeable outer layer that protects the inner stem tissues if the outer tissues split as the stem girth increases with age.

165. Answer: b

Explanation:

Aerosols can cause various problems to agriculture through its direct or indirect effects on plants. However continually increasing air pollution may represent a persistent and largely irreversible threat to agriculture in the future.

166. Answer: d

Explanation:

One hypodermal nucellar cell of the micropylar region of ovule differentiates as the sporogenous cell. It forms a diploid megaspore mother cell or megasporocyte. The megaspore mother cell undergoes meiosis and forms a row of four haploid megaspores. Only the chalazal megaspore remains functional while the other three degenerate.

Concepts:

1. Meiosis:

Meiosis is a process in which a single cell, a diploid cell, undergoes division twice to produce four haploid daughter cells, and the cells produced are known as the sex cells or gametes (sperms in males and egg in females). It contains half of the original amount of genetic information. The haploids only have half the number of chromosomes of the parent cell.

Features of Meiosis:

- It results in the formation of four daughter cells in each cycle of cell division.
- The daughter cells are identical to the mother cell in shape and size but different in chromosome number.
- The daughter cells are haploid.
- Recombination and segregation take place in meiosis.
- The process occurs in the reproductive organs and results in the formation of gametes.
- The process is divided into two types—Meiosis-I reduces the chromosome number to half and is known as reductional division. Meiosis-II is just like the mitotic division.

Phases of Meiosis

Meiosis can be divided into nine stages. The process is usually divided into two parts. The first time a cell divides (meiosis I) and the second time it divides (meiosis II). The phases are as follows –

Meiosis 1 Stages

The different stages of meiosis 1 can be explained by the following phases :

- Prophase 1
- Metaphase 1
- Anaphase 1
- Telophase 1
-

Meiosis 2 Stages

The different stages of meiosis 1 can be explained by the following phases :

- Prophase 2
- Metaphase 2
- Anaphase 2
- Telophase 2
-

167. **Answer: a**

Explanation:

Ectocarpus produces biflagellate gametes. Anabaena is a cyanobacteria and does not reproduce sexually. Spirogyra produces non-flagellated male gamete during conjugation, where entire cell content functions as gamete. Polysiphonia also produces non- flagellated spermatia.

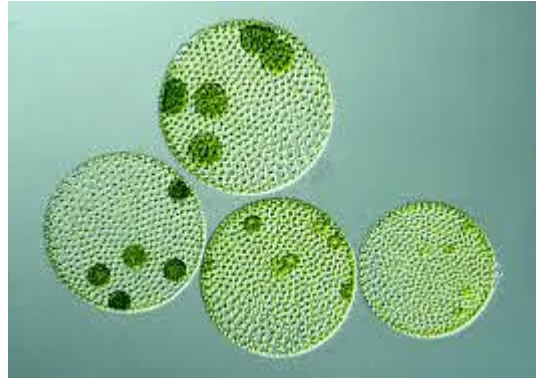
Concepts:

1. Algae:

An Algae is a term mentioning a group of photosynthetic eukaryotic organisms. It has chlorophyll and nucleus but no root, stem, leaves and many features like normal land plants. Algae is both unicellular (e.g. Euglenophyta) and multicellular (e.g. seaweeds). Algae do photosynthesis and help in oxygen production

Algae can live in various habitats like moist rocks, soils, water bodies (both freshwater and marine) and in some animals (e.g. Sloth). Unicellular Algae belong to the Protista Kingdom and Multicellular algae belong to the Plantae Kingdom, but formerly all algae are categorized under kingdom Plantae for their photosynthetic nature.

Also Read: [Difference Between Algae and Fungi](#)



168. Answer: d

Explanation:

Darwin published his observations and conclusions regarding evolution in the book 'Origin of Species' in 1859. Darwin's this book became very popular and changed people's thinking about organic evolution.

169. Answer: a

Explanation:

Oscillatoria is a filamentous Gram-ve cyanobacteria which perform oxygenic photosynthesis because of the presence of chlorophyll-a like eukaryotic algae and higher plants.

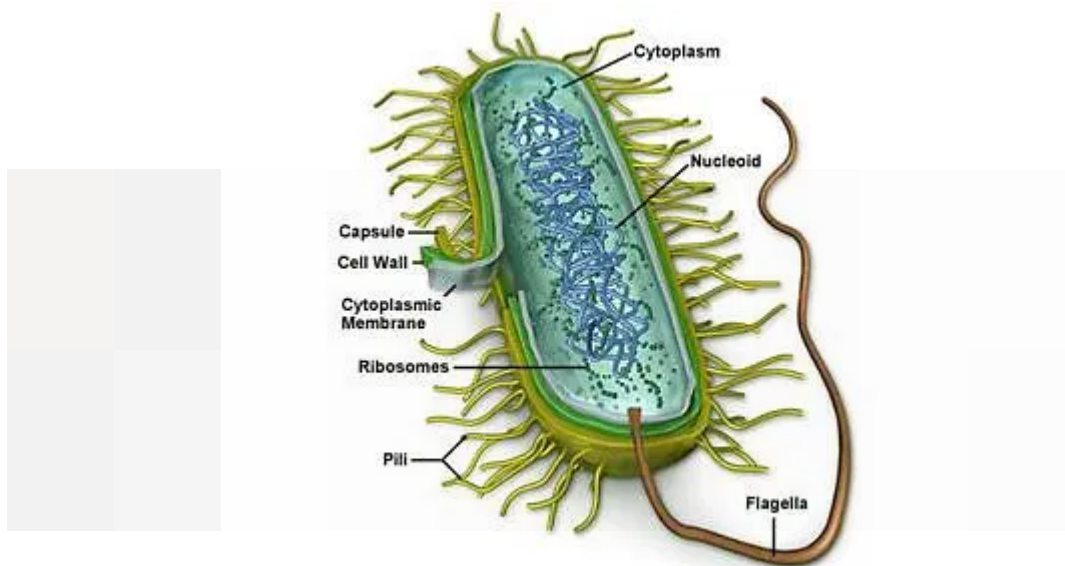
Concepts:

1. Kingdom Monera:

Characteristics of Monera Kinadom

The organisms in this kingdom have the following characteristics: -

- Monerans are single-celled creatures.
- The cell wall is made up of peptidoglycan and is stiff.
- Binary fission is asexual reproduction.
- They have 70S ribosomes in them.
- The locomotory organ is the flagella.
- Organelles such as mitochondria, lysosomes, plastids, Golgi bodies, endoplasmic reticulum, centrosome, and others are not present.
- These are decomposers and mineralizers for the environment



170. Answer: d

Explanation:

Coconut fruit is a drupe. A drupe develops from monocarpellary superior ovary and are one seeded.

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.

171. Answer: c

Explanation:

Bryophytes are the plants which produces spores and embryos but they do not have vascular tissue system. While rhodophytes and phaeophytes are algae and produces spores (no embryos) only and pteridophytes produces spores, embryo and well developed vascular tissue system.

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](#)

172. Answer: c

Explanation:

Presence of more than one embryo inside the seed is called polyembryony. It is more common in gymnosperms than angiosperms. In angiosperms, it is generally present as an unusual feature in few cases like Citrus, mango etc. In Citrus many embryos are formed from the structures outside the embryo (like nucellus). This is commonly called adventive polyembryony. In Citrus upto 10 nucellar embryos are formed.

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
-

173. Answer: c

Explanation:

Chemiosmotic coupling hypothesis, proposed by Peter Mitchell (1961, 66) (Nobel Prize in 1978), is the most widely accepted theory for oxidative phosphorylation. Reduced NAD (i.e., $NADH$), released from Krebs' cycle, when enters in the ETS , transports three pairs of H^+ across the inner mitochondrial membrane to the intermembrane space. Similarly, $NADH$ from glycolysis and $FADH_2$ from Krebs' cycle also transport pairs of H^+ into intermembrane space. Each molecule of $NADH$ released from glycolysis or $FADH_2$ from Krebs' cycle transports two pairs of protons into intermembrane space. This unidirectional flow of protons results in the accumulation of protons in the intermembrane space.

Concepts:

1. Respiration in Plants:

Respiration in plants is a process that entails the production of energy in **plants**. This process can simply be described as the intake of Oxygen and the release of Carbon Dioxide as an outcome of the oxidation of complex organic compounds. Though plants do not have any specific organ to balance the process of respiration, their stems, roots, and leaves do this work at a very low rate than other living beings. The process of respiration is very crucial for the plants to sustain the growth of the plant tissues.

This process can be stated as–



174. Answer: b

Explanation:

Biodiversity (biological diversity) is the existence of a wide variety of species (species diversity) or other taxa of plants, animals and microorganisms in a natural community or habitat, or of communities within a particular environment (ecological diversity), or of genetic variation within a species (genetic diversity). The maintenance of a high level of biodiversity is important for the stability of ecosystems.

Concepts:

1. Biodiversity and Conservation:

The term 'biodiversity' is derived from the two words– 'bios' which means life and 'diversity' i.e, differentiation or variation. Edward Wilson, the sociobiologist was the first to popularise the term 'biodiversity' in the year 1992. The term implies the occurrence of various plants and animals along with their variants such as biotypes, ecotypes and genes on earth. In our biosphere, the immense diversity or heterogeneity remains not only at the species level but also, at every level of biological organization that ranges from macromolecules in the cells to biomes.

[Biodiversity and Conservation](#) is a topic covered under the fifteenth chapter and Unit 5 of NCERT class 12 biology.

175. Answer: d

Explanation:

C4 plants show kranz type of anatomy. In kranz anatomy, the mesophyll is undifferentiated and its cells occur in concentric layers around vascular bundles. The vascular bundles are surrounded by large sized bundle sheath cells which are arranged in wreath like manner in one to several layers. In C4 plants there are two carboxylation reactions, first in mesophyll chloroplast and second in bundle sheath chloroplast. RuBP is present in bundle sheath chloroplasts where C3 cycle takes place.

Concepts:

1. Photosynthesis in Higher Plants:

Processes Of Photosynthesis in Higher Plants:

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction
-

Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen,
- and formation of ATP and NADPH.

Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C3 Cycle)

2. C4 Cycle (Hatch and Slack Pathway)

176. Answer: a

Explanation:

Monoculture describes systems that have very low diversity. Monoculture is the destruction of a diverse ecosystem and replacement with a single species or crop. It depletes the soil, fruits and vegetables become more susceptible to pests and diseases than those grown in a diverse crop environment, thus requiring larger amount of chemical spray.

Concepts:

1. Strategies For Enhancement in Food Production:

Animal Husbandry

The raising and breeding of livestock are known as animal husbandry. Dairy farm management and fisheries are also included under animal husbandry and responsible for the selection of good breeds for better yield, maintaining a well-ventilated house and proper cleanliness and hygiene, and regulating proper [disposal of waste](#).

Read More: [Strategies for Enhancement in Food Production](#)

Animal Breeding

The practice of raising a group of animals belonging to a common species. Inbreeding and outbreeding are the two types of animal breeding.

1. Animals of superior male and female breed are made to mate for 4 to 6 generations. According to Mendel's experiment, true-breeding species or pure lines are created by [Inbreeding](#) which results in homozygosity.
2. The breeding involving animals that are not related is known as outbreeding.
3. Bee-keeping: The rearing of bees for the production of honey and ~~beeswax~~ is known as ~~apiculture~~. One of the most common species of the honey bee is *Apis indica*. Beeswax is used to prepare polish, cosmetics, etc.

4. Fisheries: Cultivation or breeding of aquatic flora and fauna for a commercial purpose is known as aquaculture. Fish and fish products for consumption are known as pisciculture.

Plant Breeding

In order to get rid of [nutrient deficiency diseases](#), crops need to have a specific nutrient value besides disease resistance, pest resistance, and high yield capacity. There are many strategies for enhancing food production through plant breeding.

1. Somatic Hybrids
2. Totipotency
3. Biofortification

Plant Breeding for Disease Resistance

Plant Breeding for Pest Resistance

Plant Breeding for Improved Food Quality

Single-Cell Protein

One of the ways to meet the growing demand of nutrients in plants and animals is a single-cell protein which is biomass that is rich in protein. microbes are produced on an industrial scale to get single-cell protein.

177. Answer: c

Explanation:

Richmond and Land, 1967 observed that degradation of protein and chlorophyll was delayed in the detached leaves, if there was cytokinin in the medium. The senescence in the detached leaves was controlled by cytokinin first by keeping the stomata open thus allowing more CO₂ to enter. This suppresses the action of ethylene which promotes senescence.

178. Answer: a

Explanation:

Deficiency symptoms appear first in young leaves and young tissues in case of elements which are relatively immobile inside the plant e.g., Ca, S. For mobile elements like N and K, deficiency symptoms first appear in old and senescent leaves as the elements are mobilised from senescing regions for supply to young tissues.

Concepts:

1. Mineral Nutrition:

The naturally occurring inorganic nutrient found in the soil and food that is necessary for the proper functioning of animal and plant bodies is defined as nutrition. [Minerals](#) are vital elements essential for the body.

Read More: [Mineral Nutrition](#)

Role of Nutrients:

1. Balancing function
2. Maintenance of osmotic pressure
3. Influencing the pH of the cell sap
4. Construction of the plant body
5. Catalysis of the biochemical reaction
6. Effects of Toxicity

179. Answer: a

Explanation:

Answer (a) root pressure

180. Answer: b

Explanation:

Consumers are heterotrophs, mostly animals which feed on other organisms. Herbivores feed on producers. This is because the herbivores obtain their food directly from plants. The carnivores which feed on herbivores are called as primary carnivores or second order consumers. The animals which feed on primary carnivores are called secondary carnivores. Omnivores eat both plants and animals therefore they are called third order consumers. Detritivores or scavengers are animals which feed on dead bodies of other organisms.

Concepts:

1. Ecosystem:

An **ecosystem** is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

Structure of the Ecosystem:

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components
-

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

181. Answer: b

Explanation:

Tracheids are elongated, dead cells with hard lignified walls, wide lumens and narrow walls with spiral, annular, reticulate, scalariform and pitted thickening but without perforated end walls of septa. That is, they have intact end walls unlike vessels. Vessels are long cylindrical tube like structures made of many cells, called vessel

members, each with lignified walls and a large central cavity. Vessel members are interconnected through perforation in their common walls.

182. Answer: b

Explanation:

Particulate matter consists of soot, fly ash, dust, spores, pollen grains etc. Particulate matter is differentiated into settleable (larger than 10 μm and remaining in air for less than one day) and suspended (less than 10 μm and remaining in air for more than one day to several weeks). Particles of 2.5 μm and lesser diameter (PM 2.5) are the most harmful to human health (as per Central Pollution Control Board or CPCB). They pass deep into the lungs causing breathing and respiratory problems, irritation, inflammation and damage to lungs resulting in pre-mature death. It cannot directly enter circulatory system but indirectly through respiratory system.

183. Answer: d

Explanation:

Synaptonemal complex disintegrates. Terminalisation begins at diplotene stage i.e. chiasmata start to shift towards end.

Concepts:

1. Meiosis:

Meiosis is a process in which a single cell, a diploid cell, undergoes division twice to produce four haploid daughter cells, and the cells produced are known as the sex cells or gametes (sperms in males and egg in females). It contains half of the original amount of genetic information. The haploids only have half the number of chromosomes of the parent cell.

Features of Meiosis:

- It results in the formation of four daughter cells in each cycle of cell division.

- The daughter cells are identical to the mother cell in shape and size but different in chromosome number.
- The daughter cells are haploid.
- Recombination and segregation take place in meiosis.
- The process occurs in the reproductive organs and results in the formation of gametes.
- The process is divided into two types–Meiosis-I reduces the chromosome number to half and is known as reductional division. Meiosis-II is just like the mitotic division.

Phases of Meiosis

Meiosis can be divided into nine stages. The process is usually divided into two parts. The first time a cell divides (meiosis I) and the second time it divides (meiosis II). The phases are as follows –

Meiosis 1 Stages

The different stages of meiosis 1 can be explained by the following phases :

- Prophase 1
- Metaphase 1
- Anaphase 1
- Telophase 1
-

Meiosis 2 Stages

The different stages of meiosis 1 can be explained by the following phases :

- Prophase 2
- Metaphase 2
- Anaphase 2
- Telophase 2
-

184. Answer: a

Explanation:

In the pollen sac (microsporangium) of the anther, haploid microspores are formed by mitosis. Mitosis then follows to produce a two-celled pollen grain with a small generative cell and a large vegetative cell. This generative cell will undergo further mitosis to form two male gametes (nuclei). The pollen tube grows through a spore in the pollen grain, with the tube (vegetative) nucleus at its tips and the male nuclei behind.

Concepts:

1. Algae:

An Algae is a term mentioning a group of photosynthetic eukaryotic organisms. It has chlorophyll and nucleus but no root, stem, leaves and many features like normal land plants. Algae is both unicellular (e.g. Euglenophyta) and multicellular (e.g. seaweeds). Algae do photosynthesis and help in oxygen production

Algae can live in various habitats like moist rocks, soils, water bodies (both freshwater and marine) and in some animals (e.g. Sloth). Unicellular Algae belong to the Protista Kingdom and Multicellular algae belong to the Plantae Kingdom, but formerly all algae are categorized under kingdom Plantae for their photosynthetic nature.

Also Read: [Difference Between Algae and Fungi](#)



185. Answer: a

Explanation:

: Chromatophore is a pigmented lamellar or vesicular structure that can be isolated from disrupted photosynthetic bacteria or cyanobacteria. Their plasma membrane

may be projected in folds into the cytoplasm forming lamellae that have, therefore, double unit- membrane structure. The pigments and most of the enzymes required for the light-induced electron transport and phosphorylation processes of photosynthesis, are located in the plasma membrane and lamellae.

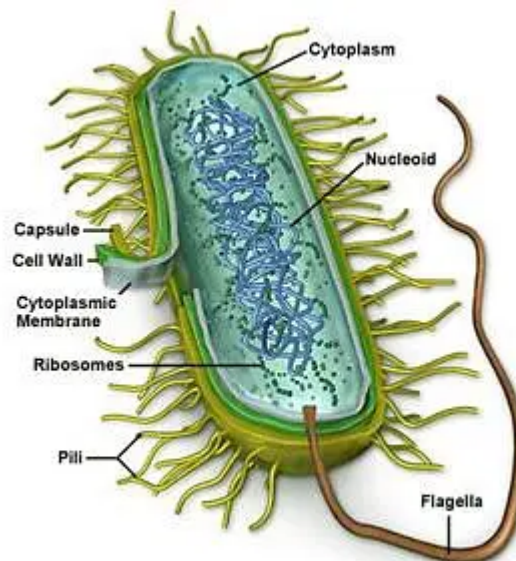
Concepts:

1. Kingdom Monera:

Characteristics of Monera Kingdom

The organisms in this kingdom have the following characteristics: -

- Monerans are single-celled creatures.
- The cell wall is made up of peptidoglycan and is stiff.
- Binary fission is asexual reproduction.
- They have 70S ribosomes in them.
- The locomotory organ is the flagella.
- Organelles such as mitochondria, lysosomes, plastids, Golgi bodies, endoplasmic reticulum, centrosome, and others are not present.
- These are decomposers and mineralizers for the environment



Explanation:

Answer (b) Passive transport requires a concentration gradient across a biological membrane whereas active transport requires energy to move solutes

Concepts:**1. Active Transport:**

Active transport is a type of cellular transport in which molecules (such as glucose, ions, and amino acids) are transferred across a biological **membrane** to a place where there are already enough of them. As a result, molecules are moved across concentration gradients using chemical energy (for instance, ATP). Root hair cells and the small intestine wall are persistent active transport sites (villi).

Types of Active Transport:

There are two types of active transportation mechanisms such as;

Primary Active Transport

1. The sodium-potassium pump, which transports Na^+ and K^+ into animal cells, is one of the most necessary pumps.
2. The transport process is assorted as primary active transport since it uses ATP as an energy source.
3. Also, there are the types of Primary Active Transporters:
 - P-ATPase: sodium-potassium pump, calcium pump, proton pump
 - F-ATPase: mitochondrial ATP synthase, chloroplast ATP synthase
 - V-ATPase: vacuolar ATPase
 - ABC-Transporter (ATP binding tape): MDR, CFTR, and so on.
 - _____

Secondary Active Transport

1. Primary active transport creates electrochemical gradients that store energy that can be released as the ions plunged their gradients.
2. Secondary active transport harnesses the energy stored in these gradients to move other substances in the opposite direction of their own gradients.

187. Answer: b

Explanation:

In one turn of citric acid cycle (Kreb's cycle), substrate level phosphorylation occurs at one step when succinyl CoA is converted into succinic acid.

Concepts:

1. Aerobic respiration:

It is the release of a relatively large amount of energy in cells by the breakdown of food substances in the presence of oxygen

Glucose + Oxygen → Carbon Dioxide + Water.

188. Answer: d

Explanation:

Plum, peach and rose flowers are perigynous and ovary is half inferior.

189. Answer: b

Explanation:

The Calvin cycle is also known as C₃ cycle because CO₂ reduction is cyclic process and first stable product in this cycle is a 3-C compound (i.e., 3-phosphoglyceric acid or 3-PGA). In this cycle, CO₂ acceptor molecule is RuBP or RuDP (i.e., Ribulose 1, 5-biphosphate or Ribulose 1, 5-diphosphate). There occurs covalent bonding of CO₂ to RuBP and the enzyme catalyzing this reaction is RuBP-carboxylase/oxygenase (RuBisCO).

Concepts:

1. Calvin Cycle:

The **Calvin cycle** is a process that plants and algae use to turn carbon dioxide from the air into sugar, the food autotrophs need to grow.

Every living thing on Earth depends on the Calvin cycle. Plants depend on the Calvin cycle for energy and food. Other organisms, including herbivores, also depend on it indirectly because they depend on plants for food. Even organisms that eat other organisms, such as carnivores, depend on the Calvin cycle. Without it, they wouldn't have the food, energy, and nutrients they need to survive.

Stages of C3 Cycle:

It is divided into three main stages:

Carbon fixation

In this stage the carbon dioxide combines with RuBP, to be reduced and attached to an organic molecule. It forms 2 molecules of 3-PGA (3-phosphoglyceric acid). The **enzyme** which is used in this process to catalyse the reaction is ribulose biphosphate carboxylase/oxygenase. The enzyme works rather slowly and processes only 3 molecules of RuBP per second. The process is called carbon fixation because carbon dioxide is fixed from an inorganic form to organic molecules.

Reduction

In this step, 3-PGA (3-phosphoglyceric acid) is converted into simple sugar- G3P (Glyceraldehyde-3 phosphate). ATP and NADPH is utilized in this stage as energy sources and the energy is transferred to sugar molecules for long storage purposes.

Regeneration

It is the third stage of the Calvin cycle and is a complex process that requires ATP. In this stage, some of the G3P molecules are used to produce glucose, while others are recycled to regenerate the RuBP acceptor.

Explanation:

Phytochrome is the photoreceptor pigment that controls flowering. It has two forms as P and Pfr. Pr is bluish phytochrome and it absorbs light at 660 to 680 nm of wavelength. P is (far red) yellowish green and absorbs light at 730 nm of wavelength.

Concepts:

1. Plant Growth Regulators:

What is a plant growth regulator?

Plant growth regulators (PGRs) are chemicals used to modify plant growth such as increasing branching, suppressing shoot growth, increasing return bloom, removing excess fruit, or altering fruit maturity.

Types of Plant Growth:

There are the following types of plant growth.

- **Primary and Secondary Growth:** The growth of a plant is termed primary when the same happens through the mitotic division of the meristematic cells which are present at the root and the shoot of the plants.

Whereas, the secondary growth in a plant takes place through the division of the secondary meristem, which, in turn increases the diameter of the body of the plants.

- **Primary and Secondary Plant Growth**
- ~~Unlimited Growth~~
- ~~Limited Growth~~
- ~~Vegetative Growth~~
- ~~Reproductive Growth~~
- ~~_____~~

The five groups of plant growth regulators used in fruit crops include:

1. **Auxins** are one of the most important plant hormones. The chief naturally occurring auxin is indole-3 acetic acid – IAA and other related

compounds.

2. **Gibberellins:** [Gibberellins](#) are an extensive chemical family based on the ent-gibberellane structure. The first gibberellin to be discovered was gibberellic acid. Now there are more than 100 types of gibberellins.
3. **Cytokinins:** These are produced in the regions where cell division occurs; mostly in the roots and shoots. They help in the production of new leaves, lateral shoot growth, chloroplasts in leaves etc.
4. **Abscissic Acid:** Abscissic acid controls the dormancy of buds and seeds, inhibits shoot growth and is involved in regulating water loss from plants.
5. **Ethylene:** Ethylene is a simple, gaseous plant growth regulator, synthesised by most of the plant organs includes ripening fruits and ageing tissues.

191. Answer: d

Explanation:

Most cultivated soils have a pH range between 4.5 and 8.5. However most plants grow best in soils with a neutral or slightly acidic pH.

192. Answer: b

Explanation:

In ETC of respiration, oxidation of one molecule of $NADH + H^+$ gives rise 3 ATP and $FADH_2$ produces 2 ATP.

Concepts:

1. Electron Transport System :

The [electron transport chain or system](#) is the sequence of electron carriers, enzymes, and cytochrome that passes electrons from one to another through the redox reaction. It is electron transport-linked phosphorylation.

It contains flavin nucleotides (FAD), nicotinamide adenine dinucleotide (NAD), coenzyme Q, and cytochromes localized in F1 particles of mitochondria. It occurs in the inner mitochondrial membrane along with cristae.

In this process five (5) complexes are involved namely, I- NADH-UQ reductase, II- Succinate-UQ reductase, III- UQH₂ -cytochrome C reductase, IV- Cytochrome C oxidase, and V is connected with F₀-F₁ particles.

In this process, NAD and FAD are minimized.

Steps:

- **Redox at complex I:** Four (4) protons are pumped from the matrix to intermembrane space.
- **Redox at complex II:** Coenzyme Q collects the electrons from complex I and II, and goes to complex III.
- **Redox of complex III:** Four (4) protons are again pumped from matrix to intermembrane space and cytochrome C transports electrons to the complex IV.
- **Redox of complex IV:** Two (2) protons are pumped from the matrix to intermembrane space and the formation of water occurs in the matrix.
- **ATP synthase action:** It pumps protons from intermembrane space to matrix and generates ATP. It is associated with oxidative phosphorylation.

193. Answer: d

Explanation:

A bicollateral vascular bundles is characterised by xylem being sandwiched between phloem. Here there are two cambium rings e.g., Cucurbita.

194. Answer: b

Explanation:

ICBN stands for

International Code of Botanical Nomenclature (ICBN).

ICBN is a set of rules and recommendations that deals with the formal botanical naming of plants. ICBN is independent of zoological nomenclature. The foundations of ICBN are given in a book written by C. Linnaeus named Philosophia Botanica. The rank of species is the basic and relative order of the ranks of taxa are as: genus, tribe, family, order, series, class, division, and kingdom. The different ranks or

categories have the following specific endings of their names division – phyla, class-ae, family-aceae.

International Code of Botanical Nomenclature (ICBN) is now known as 'The International Code of Nomenclature for algae, fungi, and plants' (ICN). The name was changed at the International Botanical Congress in Melbourne in July 2011.

Read More: [Taxonomy](#)

Concepts:

1. The Living World:

- The living world includes a vast variety of [living organisms](#) like [plants](#), animals, and even [microorganisms](#) that exist on the earth.
- These [organisms](#) also differ in size, color, habitat, physiology, and morphology.
- Biologists have developed certain rules and principles supplementary which are helpful in the identification, nomenclature, and classification of organisms. Such rules and principles lie in [Taxonomy](#).
- The taxonomic studies are very helpful and useful in specific fields like forestry, industry, agriculture, and for knowing our bio-resources.
- All discovered living organisms are being named so that they are known by the same name throughout the world.
- Each biological name is a collection of a generic name indicating the genus of an organism and a specific name that indicates the [species](#).

195. Answer: c

Explanation:

Lichens are very sensitive to SO₂ pollution. They are completely destroyed at places where there is SO₂ pollution in atmosphere. Therefore, they act as very good indicators of SO₂ pollution. In predator fish and 124 ppm in fish eating birds like Sea Gulls. So the maximum biomagnification occurs in fishes in case of aquatic, ecosystem.

Explanation:

PEP is 3C compound which serves as primary CO_2 acceptor in the mesophyll cell cytoplasm of C_4 plants like maize, sugarcane, Sorghum etc.

Concepts:

1. C4 Pathway:

- Every photosynthetic plant moves according to the Calvin cycle, but in some plants, there is a primary stage to the Calvin Cycle called the C4 pathway. Plants in tropical desert regions commonly move accordingly to the C4 pathway. Here, a 4-carbon compound called oxaloacetic acid (OAA) is the first product of carbon fixation. Such plants are special and have specific adaptations as well.
- The C4 pathway commences with a molecule called phosphoenolpyruvate (PEP) which is a three-carbon molecule. This is the primary CO_2 acceptor and the carboxylation, that takes place with the help of an enzyme called PEP carboxylase. They yield a 4-C molecule known as oxaloacetic acid (OAA). In due course, it is converted into another 4-carbon compound called malic acid. Later, they are shifted from mesophyll cells to bundle sheath cells. Here, OAA is crumbled to yield carbon dioxide and a 3-C molecule.
- The CO_2 thus formed, is utilized in the Calvin cycle, whereas the 3-C molecule is shifted back to mesophyll cells for regeneration of PEP.
- Sugarcane, corn, and shrubs are some examples of plants that follow the C4 pathway. Calvin pathway is a very common pathway in both [C3 plants and C4 plants](#), but it takes place only in the mesophyll cells of the ~~C3 Plants and not in the C4 Plants~~.

197. Answer: c

Explanation:

Red data book contains list of threatened species

Concepts:

1. Loss of Biodiversity:

The reduction in the number, genetic variability, and the variety of species and the biological community of a place is known as the [Loss of Biodiversity](#). By humans, due to the colonization of the tropical Pacific Island, there has been a deprivation of more than 2000 species. Present data evaluates that around 15,500 species are endangered. Presently the loss of biodiversity is evaluated at – 23% of all mammal species, 12% of all bird species, 32% of all amphibian species, and 31% of gymnosperm species on the planet are facing the threat or warning of extinction.

Loss of Biodiversity: Causes

1. Loss of Habitat and Fragmentation
2. Over Exploitation of Natural Resources
3. Alien Species Invasion
4. Co-Extinction

198. Answer: d

Explanation:

By convention, the water potential of pure water at standard temperature, which is not under any pressure, is taken to be zero.

Concepts:

1. Transport of Water and Minerals in Plants:

Transportation is the process of [movement of water and minerals](#) to all parts of the plant body. Plants have a specialized system that enables them to distribute water and nutrients throughout their body. They use several processes such as translocation, absorption, storage and utilization of water.

Transportation in Plants:

The water and minerals are [transported in plants](#) by two types of conducting tissues:

- **Xylem:** The xylem distributes water and dissolved minerals upward through the plant, from the roots to the leaves.
- **Phloem:** The phloem carries food downward from the leaves to the roots.

The three modes of transportation:

- **Diffusion:** The molecules in this system travel from a high-concentration region to a low-concentration region. This procedure does not necessitate the use of any energy.
- **Facilitated diffusion:** With the help of a carrier, usually a protein, the mechanism transports molecules from an area of higher concentration to a region of lower concentration. Because this process does not require any energy, it is referred to as a passive process.
- **Active Transport:** With the help of membrane [proteins](#), this mechanism transports molecules from a lower to a higher concentration region. Because it requires ATP to function, this system is referred to as active transport.

199. Answer: b

Explanation:

In human beings, after one month of pregnancy, the embryo's heart is formed. By the end of the second month of pregnancy, the fetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed. The first movements of the fetus and appearance of hair on the head are usually observed during the fifth month. By the end of 24 weeks (second trimester), the body is covered with fine hair, eye-lids separate, and eyelashes are formed. By the end of nine months of pregnancy, the fetus is fully developed and is ready for delivery.

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.

200. **Answer: a**

Explanation:

The initiation of protein synthesis or mRNA translation occurs when the mRNA molecule is encountered by the small subunit of the ribosome.

Concepts:

1. Vernalisation:

The term "[vernalization](#)" comes from the Latin word "vernus," which simply means "spring." It ~~directly means~~ "to make spring-like." Vernalisation is described as a plant's qualitative or quantitative dependency on subjection to low temperatures to blossom. Metabolic activities, flowering, and [seed](#) germination in plants are all pompoused by temperature.

Types of Vernalisation:

Vernalisation can be classified into the following types:

1. **Obligate Vernalisation:** Plants must be exposed to lower temperatures for a set amount of time. For instance, Cabbage.
2. **Facultative Vernalisation:** Flowering takes place earlier in plants when they are exposed to lower temperatures. For instance, Annual winter triticale.