All India Aakash Test Series for NEET - 2026

OPEN MOCK TEST - 3

Click here for Code-B Sol.

Test Date : 05/04/2026

ANSWERS

1. (3)	37. (4)	73. (1)	109. (4)	145. (2)
2. (2)	38. (1)	74. (1)	110. (2)	146. (2)
3. (3)	39. (2)	75. (2)	111. (3)	147. (3)
4. (1)	40. (2)	76. (4)	112. (4)	148. (3)
5. (2)	41. (1)	77. (4)	113. (2)	149. (2)
6. (3)	42. (4)	78. (3)	114. (2)	150. (1)
7. (4)	43. (4)	79. (1)	115. (2)	151. (1)
8. (1)	44. (3)	80. (2)	116. (3)	152. (3)
9. (3)	45. (3)	81. (2)	117. (4)	153. (1)
10. (4)	46. (2)	82. (3)	118. (2)	154. (2)
11. (3)	47. (4)	83. (2)	119. (3)	155. (4)
12. (2)	48. (4)	84. (3)	120. (2)	156. (1)
13. (3)	49. (3)	85. (2)	121. (4)	157. (2)
14. (4)	50. (3)	86. (3)	122. (2)	158. (2)
15. (2)	51. (2)	87. (4)	123. (1)	159. (3)
16. (3)	52. (1)	88. (1)	124. (2)	160. (3)
17. (2)	53. (1)	89. (1)	125. (3)	161. (1)
18. (2)	54. (4)	90. (1)	126. (3)	162. (2)
19. (2)	55. (3)	91. (4)	127. (3)	163. (1)
20. (1)	56. (1)	92. (4)	128. (2)	164. (3)
21. (1)	57. (3)	93. (3)	129. (2)	165. (1)
22. (3)	58. (4)	94. (3)	130. (4)	166. (4)
23. (2)	59. (1)	95. (3)	131. (4)	167. (4)
24. (2)	60. (3)	96. (3)	132. (3)	168. (4)
25. (4)	61. (2)	97. (1)	133. (3)	169. (3)
26. (2)	62. (3)	98. (3)	134. (3)	170. (4)
27. (3)	63. (3)	99. (4)	135. (4)	171. (2)
28. (3)	64. (1)	100. (3)	136. (3)	172. (2)
29. (4)	65. (4)	101. (3)	137. (3)	173. (4)
30. (4)	66. (1)	102. (2)	138. (3)	174. (1)
31. (3)	67. (2)	103. (4)	139. (3)	175. (1)
32. (4)	68. (3)	104. (3)	140. (2)	176. (2)
33. (3)	69. (4)	105. (2)	141. (4)	177. (3)
34. (2)	70. (3)	106. (2)	142. (4)	178. (2)
35. (2)	71. (1)	107. (3)	143. (3)	179. (3)
36. (3)	72. (1)	108. (2)	144. (2)	180. (4)

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Total energy of ideal fluid per unit volume, as per Bernoulli's theorem is $\frac{\rho v^2}{2} + \rho gh + P$ = constant

Sol.: $\frac{v^2}{2} + gh + \frac{P}{\rho}$ = constant (per unit mass)

$\frac{v^2}{2g} + h + \frac{P}{\rho g}$ = constant (per unit weight)

2. Answer (2)

Hint: Gravitational potential energy of a body of mass m in the gravitational field of earth of mass M, at distance r will be $U = \frac{-GMm}{r}$

Sol.: $r_i = R$ and $r_f = R + h = R + \frac{R}{4} = \frac{5R}{4}$

$$\frac{GMm}{R^2} = 100 \Rightarrow \frac{GMm}{R} = 100R$$

$$U_f - U_i = GMm\left(\frac{1}{r_i} - \frac{1}{r_f}\right) = GMm\left(\frac{1}{R} - \frac{4}{5R}\right)$$

$$= \frac{GMm}{5R} = \frac{100R}{5} = 20R$$

3. Answer (3)

Hint: Fission takes place for heavy element (C).

Sol.: $C \rightarrow D + B$ reaction is feasible because the product nuclei are more stable due to higher binding energy per nucleon.

4. Answer (1)

Hint: Any charge inside solid conductor will reside on its outer surface.

Sol.: Electric field inside conductor = zero

ΔV = Zero

$\therefore$ Work done = Zero

5. Answer (2)

Hint: According to Faraday's law of induction, the magnitude of induced emf in the coil, $|\varepsilon| = N\frac{d(\phi)}{dt} = N\frac{d(\vec{B}\cdot\vec{A})}{dt}$

Sol.: $|\varepsilon| = N\frac{d}{dt}(BA\cos 60^\circ) = N\frac{B}{2}\frac{dA}{dt}$

$\therefore$ Induced current $i = \frac{|\varepsilon|}{R} = \frac{NB}{2R}\frac{dA}{dt}$

$$= \frac{10 \times 10 \times 10^{-4}}{2 \times 0.1} = \frac{0.1}{2} = 0.05 \text{ A} = 50 \text{ mA}$$

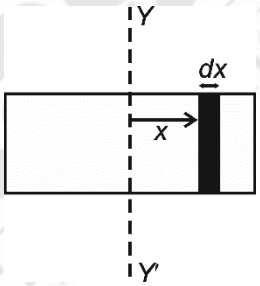
6. Answer (3)

Hint: Moment of inertia of body about given axis = MK^2, where K = radius of gyration of body.

Sol.: Consider an element of mass dm at distance x from axis YY'.

$$\frac{dm}{dx} = \frac{M}{2} \Rightarrow dm = \frac{Mdx}{2}$$

$$dI = x^2 dm = \frac{M}{2}x^2 dx$$



Integrating, $\int dI = \frac{M}{2}\int_{-1}^{+1} x^2 dx$

$$\Rightarrow I = \frac{M}{2}\frac{x^3}{3}\Big|_{-1}^{+1} = \frac{M}{2} \times \frac{2}{3} = \frac{M}{3} = MK^2 \Rightarrow K = \frac{1}{\sqrt{3}}$$

7. Answer (4)

Hint: Power delivered to particle is given by $P = Fv$, where F is force acting in the direction of velocity v.

Sol.: Centripetal acceleration

$$= a_c = \frac{v^2}{r} = \frac{(crt)^2}{r} = c^2 rt^2$$

Tangential acceleration $= a_t = \frac{dv}{dt} = \frac{d}{dt}(crt) = cr$

Power $P = F_t v = ma_t v = m(cr)(crt) = mc^2 r^2 t$

8. Answer (1)

Hint: When object is placed between focus and centre of curvature of concave mirror, then image is real and inverted.

Sol.: The image of object (A) (which is closer to the focus, will be formed further away from mirror and of larger size.

9. Answer (3)

Hint: All balls strike the ground with same speed at different times irrespective of their initial direction.

Sol.: Time of flight would be minimum for ball S which was thrown vertically downward.

Time of flight would be maximum for ball *P* which was thrown vertically upward.

10. Answer (4)

Hint: Use De-Morgan's theorem, $\overline{A \cdot B} = \bar{A} + \bar{B}$

Sol.: $Y = \bar{A} + \bar{B} = \overline{A \cdot B}$

11. Answer (3)

Hint: Use Ampere-Maxwell law

Sol.: $\oint \vec{B} \cdot d\vec{l} = \mu_0 (i_c + i_d) = \mu_0 \left(i_c + \varepsilon_0 \frac{d\phi_E}{dt} \right)$

where electric flux $\phi_E = \vec{E} \cdot \vec{A}$

12. Answer (2)

Hint & Sol.: Charle's law states that for a fixed pressure, the volume of an ideal gas is proportional to its absolute temperature *T*.

$\therefore V \propto T$ (or) $T \propto V$

13. Answer (3)

Hint: When two long straight wires carry current in the opposite direction, they will repel each other.

Sol.: Wires *B* and *C* repel each other.

Wires *B* and *D* also repel each other.

$\therefore$ Net force on wire *B* is towards left.

14. Answer (4)

Hint: Electric potential of a small dipole, $V = \frac{kp\cos\theta}{r^2}$

Sol.: At axial position, $\theta = 0° \Rightarrow V = \frac{kp}{r^2} = \frac{p}{4\pi\varepsilon_0 r^2}$

At equatorial position, $\theta = 90° \Rightarrow V$ = zero

15. Answer (2)

Hint & Sol.: In the absence of an external magnetic field, the dipole moment of each atom of paramagnetic material is randomly oriented.

16. Answer (3)

Hint & Sol.: Average power dissipated across capacitor and inductor in one cycle is zero.

17. Answer (2)

Hint & Sol.: The magnifying power (*M*) of compound microscope is large when both f_0 and f_e are small.

$M = M_0 \times M_e = \frac{L}{f_0} \cdot \frac{D}{f_e}$

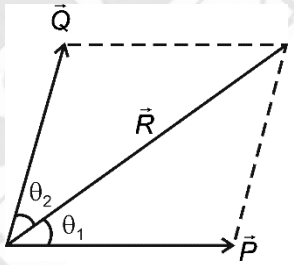
$\therefore$ Both (A) and (R) are true but (R) does not explain (A).

18. Answer (2)

Hint: Resultant $R = \sqrt{P^2 + Q^2 + 2PQ\cos(2\theta)}$

Sol.: As $\theta_1 = \theta_2 = \theta \Rightarrow P = Q$

$\therefore R = 2P\cos\left(\frac{2\theta}{2}\right) = 2P\cos\theta$



19. Answer (2)

Hint: If a number is less than one, the zeros on the left of the first non-zero digit are not significant.

Sol.: The trailing zeros after '4' are significant.

$\therefore$ Four significant figures are there.

20. Answer (1)

Hint: Limiting friction on block of mass *m* is given by $f_{max} = \mu N = \mu mg$

Sol.: F_{ext}(towards right) = 10 – 2 = 8 N

Maximum retarding force (towards left) on whole system = $(f_1)_{max} + (f_2)_{max}$

= 0.4 × 1 × 10 + 0.3 × 2 × 10 = 4 + 6 = 10 N

$\because$ 8 N < 10 N

$\therefore$ System will remain in equilibrium.

21. Answer (1)

Hint & Sol.: Ductile materials have large plastic region while for brittle materials, it is small.

There is no well-defined plastic region in an elastomer.

22. Answer (3)

Hint: For $V_A > V_B$, diode D_1 is forward biased with zero resistance and diode D_2 is reverse biased with infinite resistance. For $V_A < V_B$, D_1 is RB while D_2 is FB.

Sol.: If $V_A > V_B$, then $R_{eq} = \frac{10}{2} = 5\ \Omega$

($\because$ D_2 blocks current)

If $V_A < V_B$, then $R_{eq} = \frac{10}{2} = 5\ \Omega$

($\because$ D_1 blocks current)

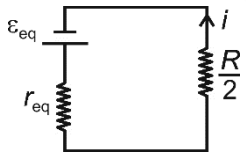
23. Answer (2)

Hint: When 2 cells of emf ε_1, ε_2 and internal resistances r_1, r_2 respectively are connected in parallel, then

$$\frac{\varepsilon_{eq}}{r_{eq}} = \frac{\varepsilon_1}{r_1} + \frac{\varepsilon_2}{r_2} \text{ and } \frac{1}{r_{eq}} = \frac{1}{r_1} + \frac{1}{r_2}$$

Sol.: $r_1 = r_2 = 2R + R = 3R$ and $\varepsilon_1 = 10$ V, $\varepsilon_2 = -5$ V

$$r_{eq} = \frac{3R}{2} \text{ and } \frac{\varepsilon_{eq}}{\frac{3R}{2}} = \frac{10}{3R} - \frac{5}{3R} = \frac{5}{3R} \Rightarrow \varepsilon_{eq} = \frac{5}{2}\text{ V}$$



$$\therefore \text{ Current } i = \frac{\varepsilon_{eq}}{r_{eq} + \frac{R}{2}} = \frac{2.5}{2R} = 0.25\text{ A}$$

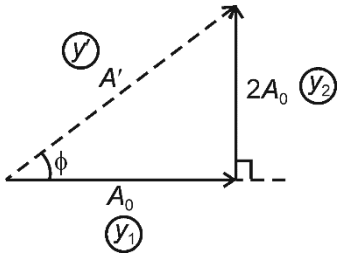
24. Answer (2)

Hint: At the time of collision, both colliding bodies are deformed.

Sol.: Total linear momentum of both bodies is conserved at each instant of any collision because forces involved during the collision are internal and net force on the system is zero.

25. Answer (4)

Hint:



Sol.: $y_2 = 2A_0 \sin\left(kx - \omega t + \frac{\pi}{2}\right)$ leads y_1 by $\frac{\pi}{2}$

$$\tan\phi = \frac{2A_0}{A_0} = 2 \quad \Rightarrow \quad \phi = \tan^{-1}(2)$$

$$A' = \sqrt{A_0^2 + (2A_0)^2} = \sqrt{5}A_0$$

$\therefore$ $y' = y_1 + y_2 = A'\sin[kx - \omega t + \phi]$

$= \sqrt{5}A_0 \sin\left[kx - \omega t + \tan^{-1}(2)\right]$

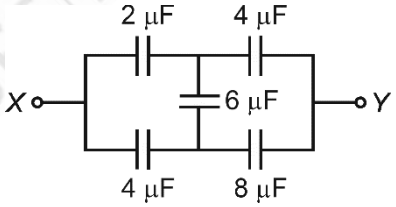
26. Answer (2)

Hint & Sol.: $C_P = \left(\frac{f}{2} + 1\right)R$ and $C_V = \frac{fR}{2}$

$$\therefore \frac{C_P}{C_V} = \frac{f+2}{f} = 1 + \frac{2}{f}$$

27. Answer (3)

Hint:



This above portion of the circuit acts like a balanced wheatstone bridge because $\frac{2}{4} = \frac{4}{8} = \frac{1}{2}$, thereby we can ignore 6 μF capacitor.

Sol.: 2 μF and 4 μF in series $\Rightarrow$ $C_1 = \frac{2\times 4}{2+4} = \frac{4}{3}\ \mu\text{F}$

4 μF and 8 μF in series $\Rightarrow$ $C_2 = \frac{8\times 4}{8+4} = \frac{8}{3}\ \mu\text{F}$

$\therefore$ C_1, C_2 and 4 μF are in parallel connection

$$\Rightarrow C_{eq} = C_1 + C_2 + 4 = \frac{12}{3} + 4 = 8\ \mu\text{F}$$

28. Answer (3)

Hint: Angular momentum of rigid body (with z-axis as axis of rotation), $\vec{L} = \vec{L}_{\perp} + \vec{L}_Z$ where $\vec{L}_{\perp}$ and $\vec{L}_Z$ are components of $\vec{L}$ perpendicular to z-axis and along the z-axis respectively.

Sol.: For every particle (on the rigid body) with velocity $\vec{v}_i$, there is another particle of velocity $-\vec{v}_i$ located diametrically opposite on the circle described by the particle. Together, such pairs will contribute zero to $\vec{L}_{\perp}$.

Symmetric body about axis $L_{\perp} = 0$, $L_{||} \neq 0$

The magnitude and direction of $\vec{a}_{CM}$ is determined solely by net external force, regardless of where it is applied on the object.

29. Answer (4)

Hint & Sol.: Using Gauss's law, electric flux (ϕ) through spherical surface, due to a charge q enclosed inside it = $\frac{q}{\varepsilon_0}$

30. Answer (4)

Hint & Sol.: If velocity $\vec{v}$ is such that $\vec{E} = -(\vec{v} \times \vec{B})$, then net force on the charge $= q\vec{E} + q(\vec{v} \times \vec{B})$ = Zero

$\Rightarrow$ Speed remains same $\Rightarrow$ Option (1) is true.

If $E = 0$ and velocity $\vec{v} \perp \vec{B}$, then the charge moves in a circle without change in speed $\Rightarrow$ Option (2) is true.

31. Answer (3)

Hint: In nth orbit, $E_n = \frac{-13.6\,Z^2}{n^2} = \frac{-13.6 \times 2^2}{n^2}$

Sol.: $E_n = -3.4 = \frac{-13.6 \times 4}{n^2} \Rightarrow n^2 = 4^2 \Rightarrow n = 4$

Angular momentum = $\frac{nh}{2\pi} = \frac{4h}{2\pi} = \frac{2h}{\pi}$

32. Answer (4)

Hint: For minima, path difference $\Delta x = d\sin\theta = \left(n - \frac{1}{2}\right)\lambda$ where $n = 1, 2, 3 \ldots$

Sol.: $\sin\theta = \left(\frac{2n-1}{2}\right)\frac{\lambda}{d} = \frac{2n-1}{2} \times \frac{3000}{6000} = \frac{2n-1}{4}$

Now, $0 < \sin\theta < +1 \Rightarrow 0 < 2n - 1 < +4$

$\Rightarrow \frac{1}{2} < n < \frac{5}{2} \Rightarrow 0.5 < n < 2.5 \Rightarrow n = 1, 2$

$\therefore$ 4 minima overall on either side of central fringe.

33. Answer (3)

Hint: β-plus decay involves a proton converting into a neutron, thus emitting a positron and neutrino.

Sol.: $^{23}_{12}\text{Mg} \longrightarrow {}^{23}_{11}\text{Na} + e^+ + \nu$

A and *B* represent position and neutrino.

34. Answer (2)

Hint: Time taken to reach the topmost point, $t = \frac{u}{g}$

Sol.: $t = \frac{45}{10}$ = 4.5 s

Distance travelled in first 0.5 second of downward journey = $d = \frac{1}{2}g(0.5)^2 = \frac{g}{2} \times \frac{1}{4} = \frac{10}{8}$ m

$\therefore$ Distance travelled by the ball in 5th second

$= 2d = 2 \times \frac{10}{8} = \frac{5}{2} = 2.5$ m

35. Answer (2)

Hint: Using 1st law of thermodynamics,

$Q = \Delta U + W$

Sol.: At *a*, $P_0V_0 = nRT_A = 2RT_A$ (ideal gas equation)

At *c*, $(3P_0)(3V_0) = 2RT_C$

$\Rightarrow \frac{T_C}{T_A} = \frac{9P_0V_0}{P_0V_0} = 9 \Rightarrow T_C = 9\,T_A$

Process $c \rightarrow$ a, $\Delta U = nC_v\Delta T = 2 \times \frac{3R}{2} \times (T_A - T_C)$

$= 3R(-8T_A) = -24RT_A$

$\Rightarrow \Delta U_{ca} = -12(2RT_A) = -12P_0V_0$

W_{ca} = area under the graph =

$\frac{1}{2} \times (V_0 - 3V_0)(P_0 + 3P_0)$

$\Rightarrow W = -4P_0V_0$

$\therefore Q_{ca} = \Delta U_{ca} + W_{ca} = -12P_0V_0 - 4P_0V_0 = -16P_0V_0$

36. Answer (3)

Hint: Slope of tangent $= \frac{dy}{dx}$

Sol.: $\left.\frac{dy}{dx}\right|_{x=-1} = (4x - 4)\big|_{x=-1} = -4 - 4 = -8$

37. Answer (4)

Hint: Use principle of homogeneity

Sol.: [*B*] = [T] = [time]

$\therefore\ [x] = \dfrac{[A][T^3]}{[T]} \Rightarrow [A] = [LT^{-2}]$ = [acceleration]

38. Answer (1)

Hint & Sol.: Newton's law of cooling states that the rate of fall of temperature of a body is directly proportional to the excess of temperature ($T - T_0$) of the body with respect to surroundings.

39. Answer (2)

Hint: Work done, W = force × (d), where d = displacement in the direction of the force.

Sol.: A. $W_F = \vec{F}\cdot\vec{S} = 200$ J

B. $W_{mg} = mg \times (-10) = -200$ J

C. $W_N = N \times$ zero = zero

40. Answer (2)

Hint: In interaction of radiation with matter, radiation behaves as if it is made up of particles called photons.

Sol.: Photons are not deflected by electric and magnetic fields.

Momentum of each photon = $\dfrac{h\nu}{c} = \dfrac{h}{\lambda}$

Energy of each photon = $h\nu = \dfrac{hc}{\lambda}$

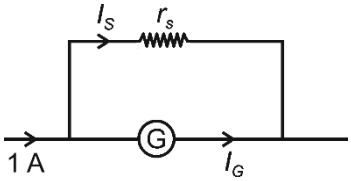
41. Answer (1)

Hint: Potential difference across r_s

= Potential difference across R_G because both r_s and R_G are connected in parallel $\Rightarrow$ $I_s r_s = I_G r_G$

Sol.: As $r_s << R_G \Rightarrow I_G << I_S$

$\Rightarrow I_S \approx 1$ A



$\therefore\ I_G\,90 = 1 \times 0.03$

$\Rightarrow I_G = \dfrac{1}{3000} = 0.33$ mA

42. Answer (4)

Hint: Draw F.B.D. of 4 kg block and use Newton's 2nd law.

Sol.: $F - kx = 4a$

$\Rightarrow 21 - 10x = 4 \times 3$

$\Rightarrow 10x = 9$

$\therefore\ x = 0.9$ m = 90 cm

43. Answer (4)

Hint: At $t = 0$; y-projection = $A\sin60°$ = positive because radius vector makes 60° with negative x-axis.

Sol.: $y = A\sin(\omega t + 60°)$

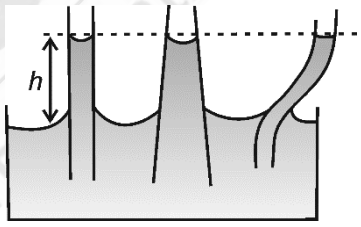
where $\omega = \dfrac{2\pi}{T} = \dfrac{2\pi}{6} = \dfrac{\pi}{3}$ rad/s

At $t = 0$, $\dfrac{dy}{dt} = A\omega\cos60°$ = positive because P moves towards positive y-axis.

$\therefore\ y = A\sin\left(\dfrac{\pi}{3}t + \dfrac{\pi}{3}\right)$

44. Answer (3)

Hint & Sol.:



$h = \dfrac{2S}{\rho g R}$

$\therefore$ Statement I is correct

Statement II is also correct because $h = \dfrac{2S\cos\theta}{\rho g r} \Rightarrow h \propto \dfrac{1}{r}$

45. Answer (3)

Hint: Mutual inductance $M = \dfrac{\phi_{12}}{i_2}$, where ϕ_{12} is flux through loop 1 due to current i_2 in loop 2.

Sol.: B_2 = Magnetic field at centre $= \dfrac{\mu_0 i_2}{2R}$

$\phi_{12} = B_2 \cdot A_1 = \dfrac{\mu_0 i_2}{2R}\cdot\pi r^2$

$\therefore\ M = \dfrac{\phi_{12}}{i_2} = \dfrac{\mu_0 \pi r^2}{2R}$

[CHEMISTRY]

46. Answer (2)

Hint: Number of moles $= \frac{\text{Weight (in g)}}{\text{Molar mass (in g)}}$

Sol.:

- In 1 g of O_3, number of electrons

$$\frac{1}{48} = \frac{\text{Number of electrons}}{24 \times N_A}$$

Number of electrons = $0.5\ N_A$

- In 34 g of H_2S, number of atoms

$$\frac{34}{34} = \frac{x}{3\ N_A}$$

$x = 3\ N_A$ atoms

- In 17 g of NH_3, number of atoms

$$\frac{17}{17} = \frac{\text{Number of atoms}}{4\ N_A}$$

Number of atoms = $4\ N_A$

- In 30 g of NaOH, number of protons

$$\frac{30}{40} \times N_A \times 20 \text{ protons}$$

$= 15\ N_A$ protons

47. Answer (4)

Hint: $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

$$\% \text{ purity} = \frac{\text{Weight of pure substance}}{\text{Weight of sample}} \times 100$$

Sol.: $90 = \frac{\text{Weight of pure NaCl}}{130} \times 100$

Weight of pure NaCl = 117 g

Mole of NaCl = $\frac{117}{58.5} \Rightarrow 2$ mol

2 mol NaCl produces 1 mol Na_2SO_4

$W_{Na_2SO_4} = 142\ g\ Na_2SO_4$

$$71 = \frac{142}{x} \times 100$$

x = 200 g

48. Answer (4)

Hint: de Broglie wavelength, $\lambda = \frac{h}{mv}$

$$mvr = \frac{nh}{2\pi}$$

Sol.: In 4th orbit, angular momentum $= \frac{4h}{2\pi}$

$$= \frac{2h}{\pi}$$

$n\lambda = 2\pi r$

$$\lambda = \frac{2\pi \times a_0 \times n}{Z} \qquad \left(\text{as } r = a_0 \frac{n^2}{z}\right)$$

$\lambda = 6\pi a_0$

49. Answer (3)

Hint: n > l (always)

Sol.: For n = 3

l = 0, 1, 2

For n = 3; l cannot be 3

50. Answer (3)

Hint: In general, moving from left to right along the period in periodic table, atomic radii decreases and ionization enthalpy increases

Sol.:

Atomic Number	Oxide	Nature
13	Al_2O_3	Amphoteric
50	SnO, SnO_2	Amphoteric

51. Answer (2)

Hint: Size increases, van der waals attraction also increases and boiling point increases

Sol.:

Species	Boiling point/K
NH_3	238.5
PH_3	185.5
AsH_3	210.6
SbH_3	254.6

52. Answer (1)

Hint: The species which have unpaired electron(s) are known as paramagnetic species.

Sol.: $O_2 \Rightarrow \sigma 1s^2, \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \sigma 2p_z^2, \pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^1 = \pi^* 2p_y^1$

$O_2^+ \Rightarrow \sigma 1s^2, \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \sigma 2p_z^2, \pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^1 = \pi^* 2p_y^0$

$C_2^{2-} \Rightarrow \sigma 1s^2, \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \pi 2p_x^2 = \pi 2p_y^2, \sigma 2p_z^2$

$Li_2 \Rightarrow \sigma 1s^2, \sigma^*1s^2, \sigma 2s^2$

$B_2 \Rightarrow \sigma 1s^2, \sigma^*1s^2, \sigma 2s^2, \sigma^*2s^2, \pi 2p_x^1 = \pi 2p_y^1$

53. Answer (1)

Hint: $\Delta H = \Delta U + \Delta n_g RT$

Δn_g = Gaseous moles of products – Gaseous moles of reactants

Sol.: • $C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

$\Delta H = \Delta U + \Delta n_g RT$

$\Delta n_g = 2 - \frac{9}{2}$

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

$\Delta H = -x - \frac{5}{2}RT$

$= -\frac{(2x + 5RT)}{2}$

54. Answer (4)

Hint: Those properties which depend on the quantity or size of matter present are known as extensive properties.

Sol.: Internal energy, Gibb's energy and volume are extensive properties.

55. Answer (3)

Hint : In the presence of common ion, the solubility of a salt generally decreases.

Sol.: $\underset{S}{Ni(OH)_2} \rightleftharpoons \underset{S}{Ni^{2+}} + \underset{2S+0.1}{2OH^-}$

$K_{sp} = [Ni^{2+}][OH^-]^2$

$= [S][2S + 0.1]^2 \quad 2S << 0.1$

$2 \times 10^{-15} = 0.01\ S$

$S = \frac{2 \times 10^{-15}}{0.01} = 2 \times 10^{-13}\ M$

56. Answer (1)

Hint: $AB_2(g) \rightleftharpoons A(g) + 2B(g)$

$K_P = \frac{P_A \times (P_B)^2}{(P_{AB_2})}$

Sol.:

	$AB_2(g)$	$\longrightarrow$	$A(g)$	+	$2B(g)$
Initial	1 mol		0		0
	1 – x		x		2x

Total moles at equilibrium = 1 – x + x + 2x

= 1 + 2x

$1 + 2x = \frac{PV}{RT} = \frac{2 \times 20}{0.0821 \times 300} = 1.62$

$\Rightarrow$ 1 + 2x = 1.62

x = 0.31

$P_{AB_2} = \frac{0.69}{1.62} \times 2 \Rightarrow 0.85$ atm

$P_A = \frac{0.31}{1.62} \times 2 = 0.38$ atm

$P_B = \frac{2 \times 0.31 \times 2}{1.62} = 0.76$ atm

$K_P = \frac{0.38 \times 0.76 \times 0.76}{0.85} \Rightarrow \frac{0.219}{0.85}$

$K_P = 2.5 \times 10^{-1}$

57. Answer (3)

Hint & Sol.:

$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

$\log 4 \frac{k_1}{k_1} = \frac{E_a}{2.303 \times 8.314}\left[\frac{1}{310} - \frac{1}{320}\right]$

$E_a = 2 \times 0.3010 \times 2.303 \times 8.314 \times 310 \times 32$

$= 114.34\ kJ\ mol^{-1}$

58. Answer (4)

Hint: For basic buffer solution

Sol.: $pOH = pK_b + \log \frac{Salt}{Base}$

	NH_3	+	HCl	$\longrightarrow$	NH_4Cl
Initial	10 mmol		2.5 mmol		0 mmol
Final	7.5 mmol		0 mmol		2.5 mmol

$pOH = 4.75 + \log \frac{2.5}{7.5}$

pOH = 4.75 + log1 – log3

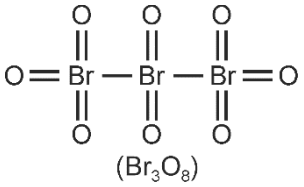
pOH = 4.27

pH = 14 – 4.27

= 9.73

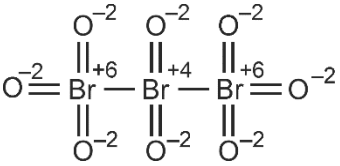
59. Answer (1)

Hint:



(Br_3O_8)

Sol.:



60. Answer (3)

Hint: Disproportionation reactions are a special type of redox reactions in which the same element gets oxidised as well as reduced simultaneously.

Sol.: $CH_4(g) + 2O_2(g) \xrightarrow{\Delta} CO_2(g) + 2H_2O(l)$; Combination redox reaction

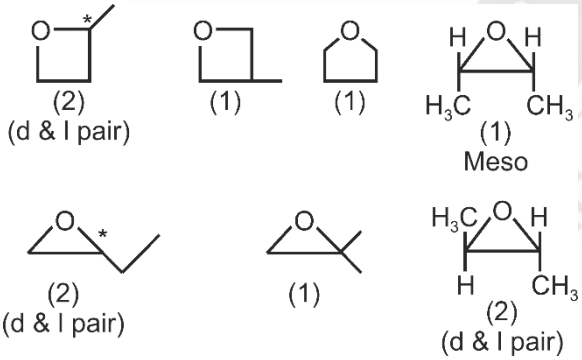
$2H_2O(l) \xrightarrow{\Delta} 2H_2(g) + O_2(g)$; Decomposition redox reaction

$V_2O_5(s) + 5Ca(s) \xrightarrow{\Delta} 2V(s) + 5CaO(s)$; Metal displacement redox reaction

61. Answer (2)

Hint: For cyclic ethers oxygen atom should be in ring

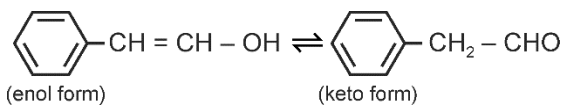
Sol.: Total 10 isomers

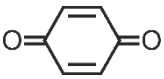


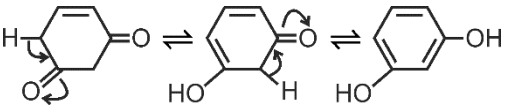
62. Answer (3)

Hint: For a carbonyl compound to show tautomerism, it must have at least one H at the sp^3 hybridised carbon atom.

Sol.:

- 

-  ; Tautomerism is not possible

- 

63. Answer (3)

Hint:

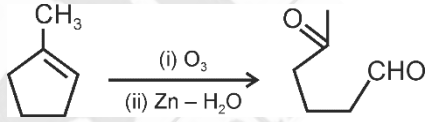
$$S^{2-} + [Fe(CN)_5NO]^{2-} \rightarrow \underset{\text{Violet}}{[Fe(CN)_5NOS]^{4-}}$$

Sol.: Distillation under reduced pressure method is used to purify liquids having very high boiling points and those, which decompose at or below their boiling points.

64. Answer (1)

Hint: On reductive ozonolysis alkene gives aldehyde or ketone

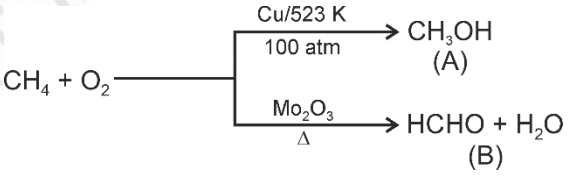
Sol.:



65. Answer (4)

Hint: Alkanes on heating with a regulated supply of O_2 or air at high pressure and in the presence of suitable catalysts give a variety of oxidation products.

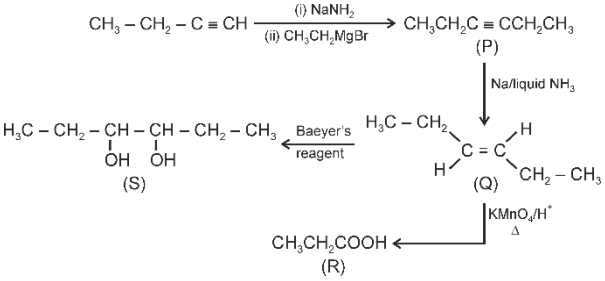
Sol.:



66. Answer (1)

Hint: Reduction of alkynes with Na and liquid NH_3 give trans-alkenes.

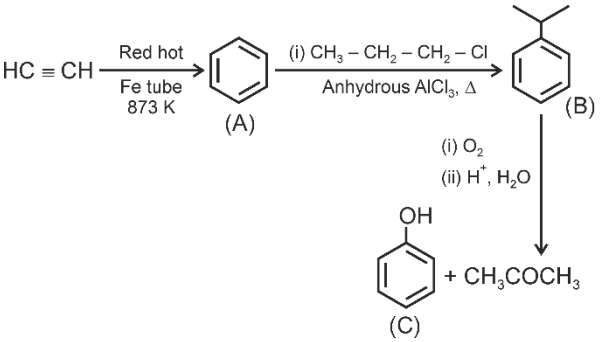
Sol.:



67. Answer (2)

Hint: Phenol gives violet coloration with freshly prepared $FeCl_3$ solution.

Sol.:



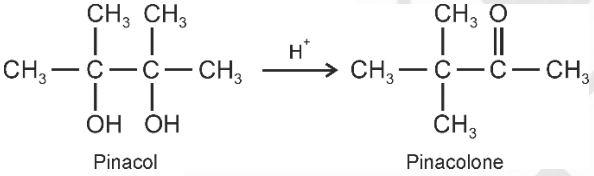
68. Answer (3)

Hint: Ester having α-hydrogen on treatment with a strong base undergo self condensation to produce β-ketoesters.

Sol.: $2CH_3COOC_2H_5 \xrightarrow[(ii)\ H^+, H_2O]{(i)\ C_2H_5O^-Na^+}$

$CH_3COCH_2COOC_2H_5$

is Claisen Ester condensation



is Pinacol-Pinacolone rearrangement

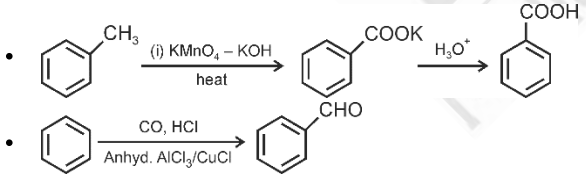
$CH_3 - CH_2 - COOH \xrightarrow[(ii)\ H_2O]{(i)\ Red\ P/Cl_2} CH_3 - \underset{Cl}{CH} - COOH$

is Hell-Volhard Zelinsky reaction.

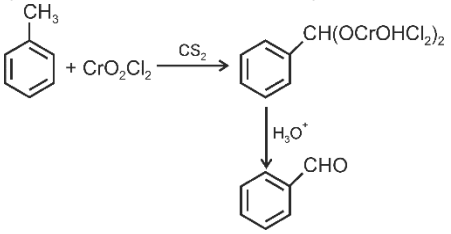
69. Answer (4)

Hint: Acyl halide (acid chloride) is hydrogenated over catalyst, palladium on barium sulphate. This reaction is known as Rosenmund reduction.

Sol.:



(Gatterman-Koch reaction)

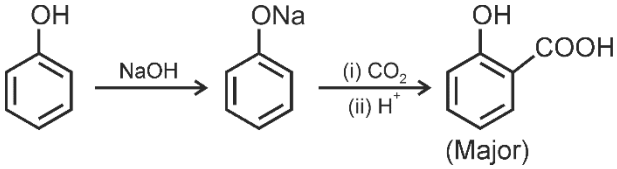


(Etard reaction)

70. Answer (3)

Hint: In Kolbe's reaction, ortho hydroxybenzoic acid is formed as major product.

Sol.:



71. Answer (1)

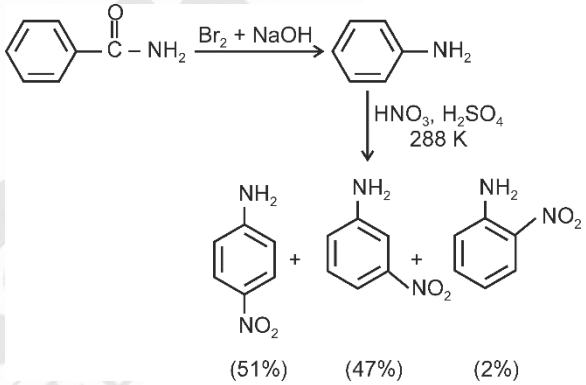
Hint: Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

Sol.: Chlorobenzene does not undergo nucleophilic substitution reaction with anion formed by phthalimide

72. Answer (1)

Hint: In direct nitration of aniline significant amount of m-nitro derivative is formed.

Sol.:



73. Answer (1)

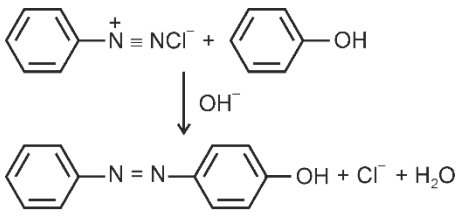
Hint: Aliphatic amines are stronger bases than aromatic amines.

Sol.: Amine	**pK_b value**
Benzenamine	9.38
Phenylmethanamine	4.70
N-Methylaniline	9.30
N, N-Dimethylaniline	8.92

74. Answer (1)

Hint: p-Hydroxyazobenzene dye is orange in colour while p-Aminoazobenzene dye is yellow in colour

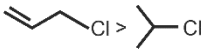
Sol.:



p-Hydroxyazobenzene (orange dye)

75. Answer (2)

Hint: The electron withdrawing groups (–I effect) stabilise the transition state formed in the rate determing step of S_N2 reaction.

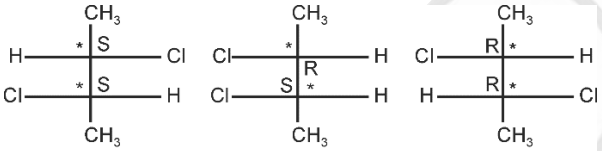
Sol.: Compounds CH_3-Cl >  >

Relative rate with respect to n-BuCl towards S_N2 reaction	200	79	0.02

76. Answer (4)

Hint: In order to convert a molecule with two stereogenic centers to its enantiomer, the configuration at both centres must be reversed. Reversing the configuration at only one stereogenic centre converts it to a diastereomeric structure.

Sol.:



(I) (II) (III)

77. Answer (4)

Hint: Ionisation isomerism arises when the counter ion in a complex salt is itself a potential ligand and can displace a ligand which can then become the counter ion.

Sol.:

Complex	Magnetic character	Isomerism
$[Cr(NH_3)_4Br_2]Br$	Cr^{3+} is d^3, hence paramagnetic	Cis-trans
$[Ti(H_2O)_5Br](NO_3)_2$	Ti^{3+} is d^1, hence paramagnetic	Ionization
$[Pt(en)(NH_3)Br]NO_3$	Pt^{2+} is d^8, complex is square planar, all electrons are paired	Ionization
$[Co(NH_3)_4(NO_3)_2]NO_3$	Co^{3+} is d^6, hence diamagnetic	Cis-trans

78. Answer (3)

Hint: Complexes in which a metal is bound to only one kind of donor groups are known as homoleptic complexes.

Sol.: $[Co(NH_3)_6]^{3+}$ is a homoleptic complex.

79. Answer (1)

Hint: The greater the positive charge on the central metal atom, the less readily the metal can donate electrons into the π^* orbitals of the carbon monoxide ligands to weaken the C–O bond.

Sol.:

Complex	C–O stretching frequency (cm^{-1})
$[Ti(CO)_6]^{2-}$	1748
$[Ni(CO)_4]$	2060
$[Mn(CO)_6]^+$	2090
$[Co(CO)_4]^-$	1890

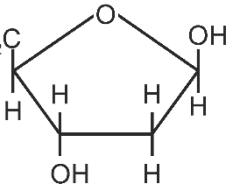
80. Answer (2)

Hint: Thiamine is also known as vitamin B_1

Sol.:

Vitamin	Deficiency disease
Thiamine	Beri beri
Riboflavin	Cheilosis
Pyridoxine	Convulsions
Ascorbic acid	Scurvy

81. Answer (2)

Hint: 

β-D-2-deoxyribose

Sol.: Lactose is a reducing sugar while sucrose is a non reducing sugar.

82. Answer (3)

Hint: In qualitative analysis of cations, Pb^{2+} belongs to both group-I and group-II

Group	Cation
Group-II	Pb^{2+}
Group-III	Al^{3+}
Group-IV	Co^{2+}
Group-V	Sr^{2+}

83. Answer (2)

Hint: $\Delta T_b = iK_bm$

$\Delta T_b = T_b - T_b^0$

ΔT_b increases, T_b also increases

Sol.: For $Al_2(SO_4)_3$

$i = 1 - \alpha + n\alpha$

$i = 1 - 0.5 + 5 \times 0.5$

$= 3.0$

For Na_2SO_4

$i = 1 - 0.2 + 5 \times 0.2$

$= 1.4$

For $Ca_3(PO_4)_2$

$i = 1 - 0.5 + 5 \times 0.5$

$i = 3.0$

For NaCl

$i = 1 - 0.8 + 2 \times 0.8$

$= 1.8$

84. Answer (3)

Hint: For isotonic solution

$\pi_1 = \pi_2$

Sol.: $C_1 = C_2$

$$\frac{0.45 \times 1000}{(MM)_A \times 250} = \frac{0.9 \times 1000}{(MM)_B \times 100}$$

$$\frac{1.8}{(MM)_A} = \frac{9}{(MM)_B}$$

$$\frac{(MM)_B}{(MM)_A} = \frac{9}{1.8} \Rightarrow \frac{5}{1}$$

85. Answer (2)

Hint: For first order reaction, $t_{\frac{1}{2}} = \frac{0.693}{k}$

Sol.: $t_{75\%} = \frac{2.303}{k}\log\frac{100}{25}$

$$= \frac{2.303 \times 2 \times 0.3010}{k}$$

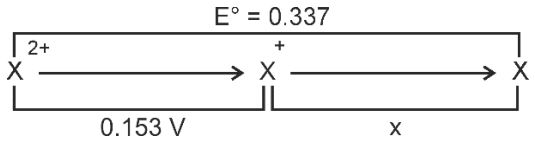
$$= \frac{0.693 \times 2}{k}$$

$$= 2t_{\frac{1}{2}}$$

86. Answer (3)

Hint: $\Delta G_3 = \Delta G_1 + \Delta G_2$

Sol.:



$-n_3FE_3 = -n_1FE_1 - n_2FE_2$

$2 \times 0.337 = 0.153 + X$

$X = 0.521$ V

87. Answer (4)

Hint: According to first law of Faraday, w = zIt

Sol.: $w = \frac{MM}{nF} \times It$

$$\frac{w}{MM} = \frac{It}{nF}$$

$$n = \frac{0.2 \times F}{2 \times F}$$

$= 0.1$ mol

88. Answer (1)

Hint: Due to lanthanoid contraction, ionic radii from La^{3+} to Lu^{3+} decreases

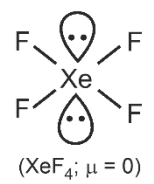
Sol.: The correct order of ionic radii of given species is

$Pr^{3+} > Gd^{3+} > Ho^{3+} > Tm^{3+}$

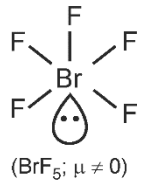
89. Answer (1)

Hint: The species which have zero dipole moment are known as non polar.

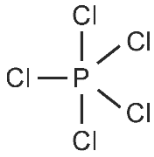
Sol.:



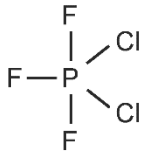
(XeF_4; $\mu = 0$)



(BrF_5; $\mu \neq 0$)



(PCl_5; $\mu = 0$)



(PCl_2F_3; $\mu \neq 0$)

90. Answer (1)

Hint: In Deacon's process, $CuCl_2$ is used as a catalyst.

Sol.:

$$6XeF_4 + 12H_2O \longrightarrow 4Xe + 2XeO_3 + 24\,HF + 3O_2$$

[BIOLOGY]

91. Answer (4)

Hint: In unicellular organisms, reproduction is synonymous with growth.

Sol.: Consciousness is the most obvious and technically complicated property of living beings.

92. Answer (4)

Hint: In Monera, mode of nutrition can be autotrophic or heterotrophic.

Sol.: In five kingdom classification, kingdoms Fungi and Animalia have organisms exhibiting heterotrophic mode of nutrition.

93. Answer (3)

Hint: Amoeboid protozoans use pseudopodia for capturing prey.

Sol.: Ciliated protozoans have two types of nuclei macro and micro.

94. Answer (3)

Hint: Oxygen is evolved during photosynthesis in cyanobacteria.

Sol.: Cyanobacteria perform oxygenic photosynthesis and show nitrogenase activity in heterocyst.

95. Answer (3)

Hint: Bryophytes are non-vascular plants.

Sol.: Bryophytes rarely achieve great height.

96. Answer (3)

Hint: *Marsilea* produces two types of spores.

Sol.: *Marsilea* is heterosporous.

97. Answer (1)

Hint: Epiphyllous condition is seen in lily.

Sol.:

Gamosepalous	–	Brinjal
Diadelphous	–	Lupin
Apocarpous	–	Lotus

98. Answer (3)

Hint: Members of family Solanaceae have pentamerous flowers.

Sol.: Flowers in the members of Solanaceae are pentamerous, bisexual, actinomorphic and hypogynous.

99. Answer (4)

Hint: Aestivation is seen in the floral diagram.

Sol.: Placentation and aestivation are not represented in floral formula.

100. Answer (3)

Hint: In axile placentation, the placenta is present in the axial position and the ovules are attached to it in a multilocular ovary.

Sol.: Axile placentation occurs in the members of Solanaceae and Liliaceae.

101. Answer (3)

Hint: Meristematic tissue is a group of actively dividing cells.

Sol.: Plant retain the capacity for unlimited growth due to meristematic tissue.

Cells of secondary meristem are dedifferentiated.

102. Answer (2)

Hint: Xylem fibres have highly thickened walls and obliterated central lumens.

Sol.:

Sieve tubes elements	–	These are long, tube-like structures, arranged longitudinally and are associated with the companion cells.
Tracheids	–	These are elongated or tube like cells with thick and lignified walls and tapering ends.
Bast fibres	–	These are made up of sclerenchymatous cells and are generally absent in primary phloem but are found in the secondary phloem.

103. Answer (4)

Hint: In monocot stems, hypodermis is made up of dead cells.

Sol.: Phloem parenchyma is absent in most of monocotyledonous plants.

104. Answer (3)

Hint: The cells of the human cheek have an outer membrane which is plasma membrane.

Sol.: Plasma membrane is selectively permeable to some molecules present on either side of it.

105. Answer (2)

Hint: Chitin is present in the cell wall of fungi.

Sol.: Algae have cell wall made of mannans, cellulose, galactans and minerals like calcium carbonate.

106. Answer (2)

Hint: Identify a flatworm.

Sol.: Both *Fasciola* and *Planaria* are triploblastic acoelomate organisms and belong to the phylum Platyhelminthes. *Planaria* possesses high regeneration capacity. *Ancylostoma* is a triploblastic pseudocoelomate organism, while *Nereis* is a triploblastic coelomate organism, *Ancylostoma* belongs to the phylum Aschelminthes while *Nereis* belongs to the phylum Annelida.

107. Answer (3)

Hint: Shows convergent evolution with flying phalanger

Sol.: Spotted cuscus, flying phalanger and numbat are Australian marsupials while flying squirrel is a placental mammal that shows convergent evolution with flying phalanger.

108. Answer (2)

Hint: Select the one with IUDs only

Sol.: IUDs like CuT, Cu7, Multiload 375, progestasert, lippes loop, *etc*. are required to be inserted by the doctors and expert nurses in the uterus through vagina. Implants are placed under skin. Vaults and diaphragms are barriers and can be self-inserted by the users.

109. Answer (4)

Hint: Terminal method of contraception

Sol.: Injections having progestogen only, steroidal oral contraceptive pills and implants contain progestogen alone or in combination with estrogen that inhibit ovulation and implantation. Vasectomy is a terminal method of contraception for human males.

110. Answer (2)

Hint: Miller created electric discharge in a closed flask

Sol.: Oparin of Russia and Haldane of England proposed that the first form of life could have come from pre-existing non-living organic molecules and that formation of life was preceded by chemical evolution. S.L. Miller provided good experimental support to chemical evolution theory proposed by Oparin and Haldane.

111. Answer (3)

Hint: Sponges show cellular level of body organisation.

Sol.: Water vascular system – Helps in locomotion of animals whose larvae are bilaterally symmetrical.

Statocysts – Act as balancing organ in aquatic arthropods.

Water transport system – Present in animals having only cellular level of body organisation.

Stomochord – A rudimentary structure similar to notochord.

112. Answer (4)

Hint: *Homo habilis* came after *Australopithecus*

Sol.: The correct chronological order of human evolution is

Ramapithecus → *Australopithecus* → *Homo habilis* → *Homo erectus* → *Homo sapiens*

113. Answer (2)

Hint: Feature of subphyla to which *Salpa* belongs to

Sol.: *Branchiostoma* is a cephalochordate in which notochord extends from head to tail region and is persistent throughout their life. In urochordate such as *Salpa*, notochord is present only in larval tail.

All living members of the class Cyclostomata are ectoparasites on some fishes. Cyclostomes are marine but migrate for spawning to fresh water.

114. Answer (2)

Hint: Adipocytes are present in adipose tissue.

Sol.: The excess of nutrients which are not used immediately are converted into fats and are stored in adipose tissue.

Tight junctions help to stop substances from leaking across a tissue. Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules.

115. Answer (2)

Hint: Compound epithelium covers the dry surface of the skin.

Sol.: The compound epithelium is made of more than one layer of cells and thus has limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses. The simple squamous epithelium is involved in functions like forming a diffusion boundary. The function of ciliated epithelium is to move particles or mucus in a specific direction.

116. Answer (3)

Hint: Oxysomes are found in the inner membrane of mitochondria.

Sol.: In mitochondria, the outer membrane forms the continuous limiting boundary of the organelle.

The inner membrane forms a number of infoldings called the cristae towards the matrix.

117. Answer (4)

Hint: Camillio Golgi first observed densely stained reticular structures near the nucleus. These were later named Golgi bodies after him.

Sol.: Golgi bodies consist of cisternae that are concentrically arranged near the nucleus with distinct convex *cis* or the forming face and concave *trans* or the maturing face. They are in close association with ER.

118. Answer (2)

Hint: Due to complete disintegration of nuclear envelope, chromosomes are spread through the cytoplasm of the cell.

Sol.: The complete disintegration of nuclear envelope marks the start of the second phase of mitosis, hence, the chromosomes are spread through the cytoplasm of the cell.

119. Answer (3)

Hint: The non-dividing cell enters the quiescent stage from G_1 phase.

Sol.: G_0 cells will not directly go into synthesis phase, they will re-enter the G_1 phase and prepare themselves for S phase.

120. Answer (2)

Hint: The plane of alignment of the chromosomes at metaphase is referred to as the metaphase plate.

Sol.: At the onset of anaphase, each chromosome arranged at the metaphase plate split simultaneously and the two daughter chromatids, now referred to as daughter chromosomes of the future daughter nuclei, begin their migration towards the opposite poles.

121. Answer (4)

Hint: The final stage of prophase I is diakinesis.

Sol.: Diakinesis is marked by terminalisation of chiasmata.

122. Answer (2)

Hint: With increase in the protons in the lumen of thylakoids, the pH decreases.

Sol.: As electrons move through the photosystems, protons are transported across the membrane.

Within the chloroplast, protons in the stroma decrease in number, while in the lumen of thylakoid, there is increase in protons.

123. Answer (1)

Hint: C_4 plants are adapted to dry tropical regions.

Sol.: It is the relative concentration of O_2 and CO_2 that determines which of the two will bind to the RuBisCO enzyme.

124. Answer (2)

Hint: Complex V of ETS is ATP synthase.

Sol.: Complex V of ETS, transports protons from intermembrane space to matrix of mitochondria.

125. Answer (3)

Hint: Glycolysis occurs in both prokaryotes and eukaryotes.

Sol.: Glycolysis is a common pathway in fermentation and aerobic respiration.

126. Answer (3)

Hint: Auxins promote apical dominance.

Sol.: Cytokinins are synthesised in regions where rapid cell division occurs.

ABA stimulates closure of stomata in water stress conditions.

127. Answer (3)

Hint: Abscission II is a kind of plant growth inhibitor.

Sol.: Inhibitor-B, abscission II and dormin are proved to be chemically identical and it was named abscisic acid (ABA).

128. Answer (2)

Hint: This tissue is able to give rise to microspore tetrad.

Sol.: When the anther is young, a group of compactly arranged homogenous cells is called sporogenous tissue present in the centre of microsporangium.

129. Answer (2)

Hint: Wind pollinated flowers have light and non-sticky pollen grains.

Sol.: Wind pollinated flowers often have a single ovule in each ovary and numerous flowers packed into an inflorescence.

130. Answer (4)

Hint: Epicotyl is the portion of the embryonal axis above the level of attachment of scutellum in monocot seed.

Sol.:

Aleurone layer	–	Outermost layer of the endosperm in maize seed
Coleoptile	–	Hollow foliar structure that encloses the leaf primordia.
Coleorhiza	–	An undifferentiated sheath at lower end of the embryonal axis

131. Answer (4)

Hint: Optimum growth conditions include all the favourable factors

Sol.: A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions that include temperature, pH, substrate, salts, vitamin, oxygen, *etc*.

132. Answer (3)

Hint: Form one or more coordination bonds with substrate.

Sol.: Organic compounds or metal ions or coenzymes which are tightly bound to the apoenzyme are called prosthetic group. Co-enzymes are also organic compounds but their association with apoenzyme is only transient. Haem is the prosthetic group of enzymes named peroxidase and catalase.

133. Answer (3)

Hint: Flattened cells are present in alveoli.

Sol.: In humans, the respiratory diffusion membrane is made up of three major layers, namely the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance [composed of a thin basement membrane supporting the squamous epithelium and the basement membrane surrounding the single layer endothelial cells of alveolar capillaries] in between them.

134. Answer (3)

Hint: Volume of air a person can forcefully expire after a normal inspiration.

Sol.: Inspiratory capacity = TV + IRV

= 3000-3500 mL

Functional residual capacity = ERV + RV

= 2100-2300 mL

Vital Capacity = ERV + TV + IRV

= 4000-4600 mL

135. Answer (4)

Hint: Regulates BMR

Sol.: Chemically steroid and iodothyronine hormones interact with intra-cellular receptors and mostly regulate gene expression or chromosome function by the interaction of hormone-receptor complex, while peptide hormones interact with membrane bound receptors and normally do not enter the target cell, but generate second messengers in turn to regulate cellular metabolism. Thyroxine is an iodothyronine, progesterone is steroidal in nature, insulin is a peptide hormone and epinephrine is an amino-acid derivative hormone.

136. Answer (3)

Hint: Function of glucagon

Sol.: The β-cells of pancreas secrete insulin which mainly acts on hepatocytes and adipocytes and enhance cellular glucose uptake and utilisation. It lowers the blood glucose levels. Glucagon secreted from α-cells of pancreas stimulates glycogenolysis.

137. Answer (3)

Hint: TCT decreases blood Ca^{++} levels.

Sol.: PTH increases blood Ca^{++} levels. It acts on bones and stimulates the process of bone resorption. PTH also stimulates reabsorption of Ca^{++} by the renal tubules. Thus, PTH is a hypercalcemic hormone.

138. Answer (3)

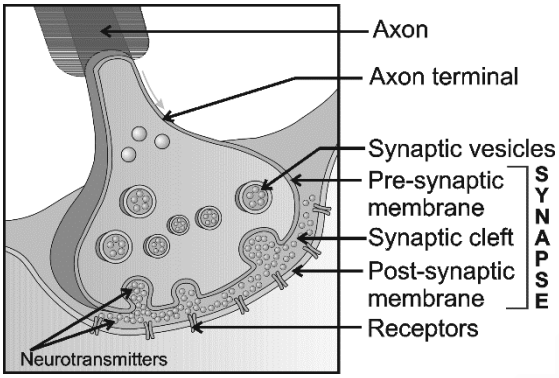
Hint: Function of a component of brain stem

Sol.: Hypothalamus lies at the base of thalamus. It contains several groups of neurosecretory cells, which secrete hormones called hypothalamic hormones. Hypothalamus is also involved in regulation of sexual behaviour, expression of emotional reactions, *etc*. The medulla oblongata of hindbrain contains centre which controls cardiovascular reflexes.

139. Answer (3)

Hint: Include synaptic cleft

Sol.: A synapse is formed by the membranes of a pre-synaptic neuron and a post-synaptic neuron, which may or may not be separated by a gap called synaptic cleft.



140. Answer (2)

Hint: Exclude the clones

Sol.: Any part of plant taken out to regenerate the whole plant is called explant. The capacity to regenerate a whole plant from explant is called totipotency. The method of producing thousands of plants through tissue culture is called micro-propagation.

141. Answer (4)

Hint: Arthropods have open circulatory system

Sol.: Silkworm is an arthropod and they possess open type of circulatory system. Earthworms have closed type of circulatory system where blood is carried through a network of blood vessels of varying diameters.

142. Answer (4)

Hint: Smooth muscle is present in the middle layer of the wall of blood vessels

Sol.: The wall of blood vessels has three layers. Tunica externa is made up of fibrous connective tissue with collagen fibres. Tunica media made up of smooth muscles and elastic fibres. Tunica intima made of squamous endothelium.

143. Answer (3)

Hint: Flagella develops to facilitate the movement of sperms.

Sol.: The transformation of spermatids into spermatozoa is called spermiogenesis. The process of formation of sperms from spermatogonia is called spermatogenesis.

144. Answer (2)

Hint: Duration of luteal phase is fixed.

Sol.: The duration of luteal phase is fixed for each menstrual cycle. Hence, in a 34 days menstrual cycle, ovulation will occur on (34 – 14) = 20th day of menstrual cycle.

145. Answer (2)

Hint: Fertilisation occurs in fallopian tube.

Sol.: All copulations do not lead to fertilisation and pregnancy because fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary region of the oviduct.

146. Answer (2)

Hint: During second trimester

Sol.: The first movement of the foetus and appearance of hair on the head are usually observed during the fifth month of the pregnancy.

147. Answer (3)

Hint: Commonly called roundworms

Sol.: Ascariasis is a helminthic disease characterised by the symptoms mentioned. Ascariasis is caused by *Ascaris* that belongs to the phylum Aschelminthes.

148. Answer (3)

Hint: Allergens cause allergy.

Sol.: For determining the cause of allergy, the patient is exposed to very small dose of possible allergens, and the reactions are studied.

149. Answer (2)

Hint: Masculinisation is observed in females

Sol.: Increased aggressiveness, mood swings and depression are common side effects observed in both human male and female due to use of anabolic steroids. Breast enlargement can be observed in males while deepening of voice in females is seen as side-effects of misuse of anabolic steroids.

150. Answer (1)

Hint: Both ventricles of heart pump out approximately 10 L of blood in a minute.

Sol.: On an average, 1100-1200 mL of blood is filtered by the kidneys per minute which constitute roughly 1/5th of the blood pumped out by each ventricle of heart in a minute.

151. Answer (1)

Hint: Exclude vertebrates

Sol.: Aquatic arthropods are ammonotelic, hence they excrete ammonia as their major nitrogenous waste. Birds and reptiles are uricotelic, while mammals are ureotelic.

152. Answer (3)

Hint: Flame cells

Sol.: Protonephridia or flame cells are the excretory structures in platyhelminths, rotifers, some annelids and cephalochordates (*Amphioxus*). Malpighian tubules are present in insects while green glands in prawns. Gills are respiratory structures in many aquatic animals.

153. Answer (1)

Hint: Equal to the number of ear ossicles in one ear of humans.

Sol.: Anal cerci, Malpighian tubules, and antennae are found in both male and female cockroaches. Anal style and titillator are found only in male cockroaches while spermathecae are present only in female cockroaches.

154. Answer (2)

Hint: Conus arteriosus is present on ventral side of heart.

Sol.: A triangular structure sinus venosus joins the right atrium. It receives blood through vena cava. The ventricle opens into conus arteriosus on the ventral side of the heart. The forebrain of frogs include olfactory lobes, paired cerebral hemispheres and unpaired diencephalon. The duodenum receives bile from gall bladder and pancreatic juices from pancreas through a common bile duct.

155. Answer (4)

Hint: Molecular weights of lipids do not exceed beyond 800 Da.

Sol.: The molecular weights of lipids do not exceed 800 daltons. Arachidonic acid, palmitic acid, trihydroxypropane are lipids. The molecular weights of proteins, nucleic acids and polysaccharides are in the range of 10,000 daltons and above. Collagen, cellulose and DNA are protein, polysaccharide and nucleic acid respectively.

156. Answer (1)

Hint: Thalassemia is an autosomal recessive blood disease.

Sol.: α and β Thalassemia are autosomal recessive disorders, meaning a person needs two mutated alleles of a gene to be affected. Since the child will inherit one normal allele for alpha and beta chain synthesising gene, he can only be a carrier of both conditions but will not have the disease.

157. Answer (2)

Hint: Turner's syndrome is caused due to aneuploidy.

Sol.: Turner's syndrome is caused due to the absence of one of the X-chromosomes, *i.e.*, 45 with X0. Such females are sterile as ovaries are rudimentary. Besides other features including lack of other secondary sexual character.

158. Answer (2)

Hint: In a polygenic trait, the phenotype reflects the contribution of each allele, *i.e.*, the effect of each allele is additive.

Sol.: Human skin colour is an example of polygenic inheritance.

159. Answer (3)

Hint: The DNA sequence coding for tRNA or rRNA molecules also define a gene.

Sol.: *E. coli* completes the process of replication within 18 minutes and average rate of polymerisation has to be approximately 2000 bp per second.

160. Answer (3)

Hint: Number of phosphodiester bonds depends on the circular or linear nature of genetic material.

Sol.: Number of phosphodiester bonds in a linear dsDNA molecule = number of total nucleotides – 2.

161. Answer (1)

Hint: *lac* z, *y* and *a* are structural genes in *lac* operon.

Sol.: Repressor protein is coded by inhibitor gene *i*. It is not a structural gene.

162. Answer (2)

Hint: hnRNA contains non-coding base sequence (introns) and coding base sequence (exons).

Sol.: RNA polymerase II catalyses the synthesis of hnRNA or primary transcript in eukaryotes.

163. Answer (1)

Hint: Till date, no man-made technology has been able to rival the microbial treatment of sewage.

Sol.: An important part of the biological farming approach is to become familiar with the various life forms that inhabit the field, predators as well as pests and also their life cycles, patterns of feeding and the habitats that they prefer.

164. Answer (3)

Hint: Statins have been commercialised as blood-cholesterol lowering agents.

Sol.: *Monascus purpureus* produces statins.

165. Answer (1)

Hint: Predators help in maintaining the species diversity in a community.

Sol.: In the rocky intertidal communities of the American Pacific coast, the starfish *Pisaster* is an important predator. In a field experiment, when all the starfish were removed from an enclosed intertidal area, more than 10 species of invertebrates became extinct within a year because of inter-specific competition.

166. Answer (4)

Hint: *Cuscuta* has lost its chlorophyll and leaves in the course of evolution.

Sol.: *Cuscuta,* a parasitic plant, is commonly found on hedge plants. It derives its nourishment from the host plant on which it parasitizes.

167. Answer (4)

Hint: Except for the deep sea hydro-thermal ecosystem, sun is the only source of energy for all ecosystem on earth.

Sol.: The rate of biomass production is called productivity and expressed in terms of $gm^{-2}\ yr^{-1}$.

168. Answer (4)

Hint: Ecological pyramids in most ecosystems are upright

Sol.: In most ecosystem, all the pyramids, of number, of energy and biomass are upright.

In sea ecosystem, pyramid of biomass is usually inverted.

169. Answer (3)

Hint: Fig species co-evolve with wasp species to get pollinated.

Sol.: Steller's sea cow got extinct due to human overexploitation.

170. Answer (4)

Hint: The reasons for the conservation of biodiversity can be grouped into three categories : narrowly utilitarian, broadly utilitarian and ethical.

Sol.: We should conserve our biodiversity for economic benefit (narrowly utilitarian), ecosystem services (broadly utilitarian) and ethical reasons.

171. Answer (2)

Hint: Consecutive digits.

Sol.: Carbohydrates constitute 3 per cent and lipids constitute 2 per cent of the total cellular mass of a living tissue.

172. Answer (2)

Hint: Most of them have Rhesus antigen

Sol.: RBCs *i.e.*, erythrocytes of mammals are biconcave in shape and lack nucleus in its mature form. They contain iron containing pigment and enzyme named carbonic anhydrase. Their average life span is of 120 days. Platelets/thrombocytes play major role in blood clotting. WBCs play role in immunity.

173. Answer (4)

Hint: α-1 antitrypsin is used to treat emphysema.

Sol.: Today the transgenic models exist for many human diseases such as cancer, cystic fibrosis, rheumatoid arthritis, Alzheimer's, emphysema, *etc.*

174. Answer (1)

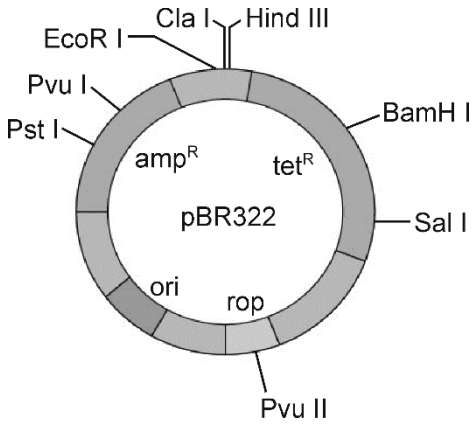
Hint: High H^+ indicates higher concentration of CO_2

Sol.: In the tissues, low pO_2, high pCO_2, high H^+ and higher temperature favour the dissociation of oxygen from oxyhaemoglobin. In the alveoli, high pO_2, low pCO_2, lesser H^+ concentration, and lower temperature, favour the formation of oxyhaemoglobin.

175. Answer (1)

Hint: Same site where *Pst* I site is also present.

Sol.:



176. Answer (2)

Hint: Cut between two purines

Sol.: For *Eco*RI to act upon the correct recognition sequence is

5′ – G↓AATTC – 3′
3′ – CTTAA↑G – 5′

177. Answer (3)

Hint: Isolation of DNA is followed by its fragmentation

Sol.: The correct order of steps involved in recombinant DNA technology is

- Isolation of DNA
- Fragmentation of DNA by restriction endonuclease
- Isolation of desired DNA fragment
- Ligation of DNA fragment into vector
- Transfer of recombinant DNA into the host.

178. Answer (2)

Hint: Jaw bone

Sol.: Mandible is an unpaired facial bone. Skull bones include cranial bones and facial bones.

179. Answer (3)

Hint: Low estrogen level can lead to osteoporosis in menopausal women

Sol.: Gout:- Arthritis due to deposition of uric acid crystals in joints.

Osteoporosis:- An age related disorder caused due to hormonal imbalance.

Tetany:- Rapid spasms in skeletal muscles due to low blood calcium levels.

Muscular dystrophy:- Genetic disorder in which progressive degeneration of skeletal muscle is observed.

180. Answer (4)

Hint: Atlas and axis

Sol.: Cartilaginous joint is present between adjacent vertebrae, which allow limited movement. First cervical vertebra is atlas and second cervical vertebra is axis. Pivot joint, a type of synovial joint, is present between atlas and axis. This joint allows considerable movement in one plane.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2026

OPEN MOCK TEST - 3

Click here for Code-A Sol.

Test Date : 05/04/2026

ANSWERS

1. (3)	37. (4)	73. (3)	109. (4)	145. (4)
2. (2)	38. (3)	74. (3)	110. (3)	146. (2)
3. (3)	39. (3)	75. (2)	111. (2)	147. (3)
4. (1)	40. (2)	76. (3)	112. (4)	148. (3)
5. (2)	41. (4)	77. (1)	113. (2)	149. (3)
6. (3)	42. (2)	78. (4)	114. (3)	150. (3)
7. (4)	43. (2)	79. (3)	115. (2)	151. (4)
8. (1)	44. (3)	80. (1)	116. (4)	152. (3)
9. (3)	45. (1)	81. (3)	117. (2)	153. (3)
10. (4)	46. (1)	82. (4)	118. (2)	154. (3)
11. (3)	47. (1)	83. (1)	119. (3)	155. (4)
12. (2)	48. (1)	84. (1)	120. (3)	156. (4)
13. (3)	49. (4)	85. (2)	121. (3)	157. (3)
14. (4)	50. (3)	86. (3)	122. (2)	158. (4)
15. (2)	51. (2)	87. (3)	123. (1)	159. (4)
16. (3)	52. (3)	88. (4)	124. (2)	160. (4)
17. (2)	53. (2)	89. (4)	125. (4)	161. (1)
18. (2)	54. (3)	90. (2)	126. (2)	162. (3)
19. (2)	55. (2)	91. (2)	127. (3)	163. (1)
20. (1)	56. (2)	92. (3)	128. (2)	164. (2)
21. (3)	57. (1)	93. (4)	129. (4)	165. (1)
22. (3)	58. (3)	94. (2)	130. (3)	166. (3)
23. (4)	59. (4)	95. (3)	131. (4)	167. (3)
24. (4)	60. (4)	96. (3)	132. (2)	168. (2)
25. (1)	61. (2)	97. (4)	133. (1)	169. (2)
26. (2)	62. (1)	98. (3)	134. (3)	170. (1)
27. (2)	63. (1)	99. (1)	135. (1)	171. (4)
28. (1)	64. (1)	100. (3)	136. (1)	172. (3)
29. (4)	65. (1)	101. (3)	137. (2)	173. (2)
30. (3)	66. (3)	102. (3)	138. (3)	174. (3)
31. (2)	67. (4)	103. (3)	139. (3)	175. (2)
32. (2)	68. (3)	104. (4)	140. (2)	176. (1)
33. (3)	69. (2)	105. (4)	141. (2)	177. (1)
34. (4)	70. (1)	106. (2)	142. (2)	178. (4)
35. (3)	71. (4)	107. (2)	143. (3)	179. (2)
36. (4)	72. (1)	108. (2)	144. (4)	180. (2)

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Total energy of ideal fluid per unit volume, as per Bernoulli's theorem is $\frac{\rho v^2}{2} + \rho gh + P$ = constant

Sol.: $\frac{v^2}{2} + gh + \frac{P}{\rho}$ = constant (per unit mass)

$\frac{v^2}{2g} + h + \frac{P}{\rho g}$ = constant (per unit weight)

2. Answer (2)

Hint: Gravitational potential energy of a body of mass m in the gravitational field of earth of mass M, at distance r will be $U = \frac{-GMm}{r}$

Sol.: $r_i = R$ and $r_f = R + h = R + \frac{R}{4} = \frac{5R}{4}$

$\frac{GMm}{R^2} = 100 \Rightarrow \frac{GMm}{R} = 100R$

$U_f - U_i = GMm\left(\frac{1}{r_i} - \frac{1}{r_f}\right) = GMm\left(\frac{1}{R} - \frac{4}{5R}\right)$

$= \frac{GMm}{5R} = \frac{100R}{5} = 20R$

3. Answer (3)

Hint: Fission takes place for heavy element (C).

Sol.: $C \rightarrow D + B$ reaction is feasible because the product nuclei are more stable due to higher binding energy per nucleon.

4. Answer (1)

Hint: Any charge inside solid conductor will reside on its outer surface.

Sol.: Electric field inside conductor = zero

ΔV = Zero

$\therefore$ Work done = Zero

5. Answer (2)

Hint: According to Faraday's law of induction, the magnitude of induced emf in the coil, $|\varepsilon| = N\frac{d(\phi)}{dt} = N\frac{d(\vec{B}\cdot\vec{A})}{dt}$

Sol.: $|\varepsilon| = N\frac{d}{dt}(BA\cos 60^\circ) = N\frac{B}{2}\frac{dA}{dt}$

$\therefore$ Induced current $i = \frac{|\varepsilon|}{R} = \frac{NB}{2R}\frac{dA}{dt}$

$= \frac{10 \times 10 \times 10^{-4}}{2 \times 0.1} = \frac{0.1}{2} = 0.05 \text{ A} = 50 \text{ mA}$

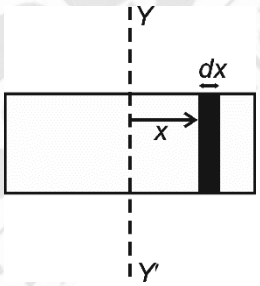
6. Answer (3)

Hint: Moment of inertia of body about given axis = MK^2, where K = radius of gyration of body.

Sol.: Consider an element of mass dm at distance x from axis YY'.

$\frac{dm}{dx} = \frac{M}{2} \Rightarrow dm = \frac{Mdx}{2}$

$dI = x^2 dm = \frac{M}{2}x^2 dx$



Integrating, $\int dI = \frac{M}{2}\int_{-1}^{+1} x^2 dx$

$\Rightarrow I = \frac{M}{2}\frac{x^3}{3}\Big|_{-1}^{+1} = \frac{M}{2} \times \frac{2}{3} = \frac{M}{3} = MK^2 \Rightarrow K = \frac{1}{\sqrt{3}}$

7. Answer (4)

Hint: Power delivered to particle is given by $P = Fv$, where F is force acting in the direction of velocity v.

Sol.: Centripetal acceleration

$= a_c = \frac{v^2}{r} = \frac{(crt)^2}{r} = c^2 rt^2$

Tangential acceleration $= a_t = \frac{dv}{dt} = \frac{d}{dt}(crt) = cr$

Power $P = F_t v = ma_t v = m(cr)(crt) = mc^2 r^2 t$

8. Answer (1)

Hint: When object is placed between focus and centre of curvature of concave mirror, then image is real and inverted.

Sol.: The image of object (A) (which is closer to the focus, will be formed further away from mirror and of larger size.

9. Answer (3)

Hint: All balls strike the ground with same speed at different times irrespective of their initial direction.

Sol.: Time of flight would be minimum for ball S which was thrown vertically downward.

Time of flight would be maximum for ball *P* which was thrown vertically upward.

10. Answer (4)

Hint: Use De-Morgan's theorem, $\overline{A \cdot B} = \bar{A} + \bar{B}$

Sol.: $Y = \bar{A} + \bar{B} = \overline{A \cdot B}$

11. Answer (3)

Hint: Use Ampere-Maxwell law

Sol.: $\oint \vec{B} \cdot d\vec{l} = \mu_0 (i_c + i_d) = \mu_0 \left(i_c + \varepsilon_0 \frac{d\phi_E}{dt} \right)$

where electric flux $\phi_E = \vec{E} \cdot \vec{A}$

12. Answer (2)

Hint & Sol.: Charle's law states that for a fixed pressure, the volume of an ideal gas is proportional to its absolute temperature *T*.

$\therefore V \propto T$ (or) $T \propto V$

13. Answer (3)

Hint: When two long straight wires carry current in the opposite direction, they will repel each other.

Sol.: Wires *B* and *C* repel each other.

Wires *B* and *D* also repel each other.

$\therefore$ Net force on wire *B* is towards left.

14. Answer (4)

Hint: Electric potential of a small dipole, $V = \frac{kp\cos\theta}{r^2}$

Sol.: At axial position, $\theta = 0° \Rightarrow V = \frac{kp}{r^2} = \frac{p}{4\pi\varepsilon_0 r^2}$

At equatorial position, $\theta = 90° \Rightarrow V$ = zero

15. Answer (2)

Hint & Sol.: In the absence of an external magnetic field, the dipole moment of each atom of paramagnetic material is randomly oriented.

16. Answer (3)

Hint & Sol.: Average power dissipated across capacitor and inductor in one cycle is zero.

17. Answer (2)

Hint & Sol.: The magnifying power (*M*) of compound microscope is large when both f_0 and f_e are small.

$M = M_0 \times M_e = \frac{L}{f_0} \cdot \frac{D}{f_e}$

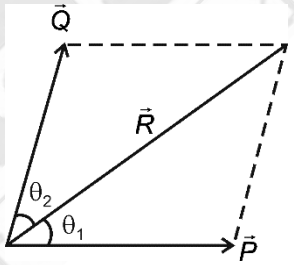
$\therefore$ Both (A) and (R) are true but (R) does not explain (A).

18. Answer (2)

Hint: Resultant $R = \sqrt{P^2 + Q^2 + 2PQ\cos(2\theta)}$

Sol.: As $\theta_1 = \theta_2 = \theta \Rightarrow P = Q$

$\therefore R = 2P\cos\left(\frac{2\theta}{2}\right) = 2P\cos\theta$



19. Answer (2)

Hint: If a number is less than one, the zeros on the left of the first non-zero digit are not significant.

Sol.: The trailing zeros after '4' are significant.

$\therefore$ Four significant figures are there.

20. Answer (1)

Hint: Limiting friction on block of mass *m* is given by $f_{max} = \mu N = \mu mg$

Sol.: F_{ext}(towards right) = 10 – 2 = 8 N

Maximum retarding force (towards left) on whole system = $(f_1)_{max} + (f_2)_{max}$

= 0.4 × 1 × 10 + 0.3 × 2 × 10 = 4 + 6 = 10 N

$\because$ 8 N < 10 N

$\therefore$ System will remain in equilibrium.

21. Answer (3)

Hint: Mutual inductance $M = \frac{\phi_{12}}{i_2}$, where ϕ_{12} is flux through loop 1 due to current i_2 in loop 2.

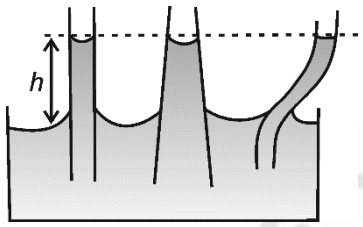
Sol.: B_2 = Magnetic field at centre $= \frac{\mu_0 i_2}{2R}$

$$\phi_{12} = B_2 \cdot A_1 = \frac{\mu_0 i_2}{2R} \cdot \pi r^2$$

$$\therefore\ M = \frac{\phi_{12}}{i_2} = \frac{\mu_0 \pi r^2}{2R}$$

22. Answer (3)

Hint & Sol.:



$$h = \frac{2S}{\rho g R}$$

$\therefore$ Statement I is correct

Statement II is also correct because $h = \frac{2S\cos\theta}{\rho g r} \Rightarrow h \propto \frac{1}{r}$

23. Answer (4)

Hint: At t = 0; y-projection = $A\sin60°$ = positive because radius vector makes 60° with negative x-axis.

Sol.: $y = A\sin(\omega t + 60°)$

where $\omega = \frac{2\pi}{T} = \frac{2\pi}{6} = \frac{\pi}{3}$ rad/s

At t = 0, $\frac{dy}{dt}$ = $A\omega\cos60°$ = positive because P moves towards positive y-axis.

$$\therefore\ y = A\sin\left(\frac{\pi}{3}t + \frac{\pi}{3}\right)$$

24. Answer (4)

Hint: Draw F.B.D. of 4 kg block and use Newton's 2nd law.

Sol.: $F - kx = 4a$

$\Rightarrow 21 - 10x = 4 \times 3$

$\Rightarrow 10x = 9$

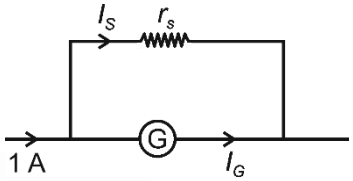
$\therefore\ x = 0.9$ m = 90 cm

25. Answer (1)

Hint: Potential difference across r_s = Potential difference across R_G because both r_s and R_G are connected in parallel $\Rightarrow\ I_s r_s = I_G r_G$

Sol.: As $r_s << R_G \Rightarrow I_G << I_S$

$\Rightarrow I_S \approx 1$ A



$\therefore\ I_G\,90 = 1 \times 0.03$

$$\Rightarrow I_G = \frac{1}{3000} = 0.33\text{ mA}$$

26. Answer (2)

Hint: In interaction of radiation with matter, radiation behaves as if it is made up of particles called photons.

Sol.: Photons are not deflected by electric and magnetic fields.

Momentum of each photon = $\frac{h\nu}{c} = \frac{h}{\lambda}$

Energy of each photon = $h\nu = \frac{hc}{\lambda}$

27. Answer (2)

Hint: Work done, W = force × (d), where d = displacement in the direction of the force.

Sol.: A. $W_F = \vec{F} \cdot \vec{S} = 200$ J

B. $W_{mg} = mg \times (-10) = -200$ J

C. $W_N = N \times$ zero = zero

28. Answer (1)

Hint & Sol.: Newton's law of cooling states that the rate of fall of temperature of a body is directly proportional to the excess of temperature ($T - T_0$) of the body with respect to surroundings.

29. Answer (4)

Hint: Use principle of homogeneity

Sol.: [B] = [T] = [time]

$$\therefore\ [x] = \frac{[A][T^3]}{[T]} \Rightarrow [A] = [LT^{-2}] = \text{[acceleration]}$$

30. Answer (3)

Hint: Slope of tangent $= \frac{dy}{dx}$

Sol.: $\left.\frac{dy}{dx}\right|_{x=-1} = (4x-4)\big|_{x=-1} = -4-4 = -8$

31. Answer (2)

Hint: Using 1st law of thermodynamics,

$Q = \Delta U + W$

Sol.: At a, $P_0V_0 = nRT_A = 2RT_A$

(ideal gas equation)

At c, $(3P_0)(3V_0) = 2RT_C$

$$\Rightarrow \frac{T_C}{T_A} = \frac{9P_0V_0}{P_0V_0} = 9 \Rightarrow T_C = 9T_A$$

Process $c \rightarrow a$, $\Delta U = nC_v\Delta T = 2 \times \frac{3R}{2} \times (T_A - T_C)$

$= 3R(-8T_A) = -24RT_A$

$\Rightarrow \Delta U_{ca} = -12(2RT_A) = -12P_0V_0$

W_{ca} = area under the graph =

$\frac{1}{2} \times (V_0 - 3V_0)(P_0 + 3P_0)$

$\Rightarrow W = -4P_0V_0$

$\therefore Q_{ca} = \Delta U_{ca} + W_{ca} = -12P_0V_0 - 4P_0V_0 = -16P_0V_0$

32. Answer (2)

Hint: Time taken to reach the topmost point, $t = \frac{u}{g}$

Sol.: $t = \frac{45}{10} = 4.5$ s

Distance travelled in first 0.5 second of downward journey = $d = \frac{1}{2}g(0.5)^2 = \frac{g}{2} \times \frac{1}{4} = \frac{10}{8}$ m

$\therefore$ Distance travelled by the ball in 5th second

$= 2d = 2 \times \frac{10}{8} = \frac{5}{2} = 2.5$ m

33. Answer (3)

Hint: β-plus decay involves a proton converting into a neutron, thus emitting a positron and neutrino.

Sol.: $^{23}_{12}\text{Mg} \longrightarrow {}^{23}_{11}\text{Na} + e^+ + \nu$

A and B represent position and neutrino.

34. Answer (4)

Hint: For minima, path difference $\Delta x = d\sin\theta = \left(n - \frac{1}{2}\right)\lambda$ where $n = 1, 2, 3 \ldots$

Sol.: $\sin\theta = \left(\frac{2n-1}{2}\right)\frac{\lambda}{d} = \frac{2n-1}{2} \times \frac{3000}{6000} = \frac{2n-1}{4}$

Now, $0 < \sin\theta < +1 \Rightarrow 0 < 2n - 1 < +4$

$\Rightarrow \frac{1}{2} < n < \frac{5}{2} \Rightarrow 0.5 < n < 2.5 \Rightarrow n = 1, 2$

$\therefore$ 4 minima overall on either side of central fringe.

35. Answer (3)

Hint: In nth orbit, $E_n = \frac{-13.6\,Z^2}{n^2} = \frac{-13.6 \times 2^2}{n^2}$

Sol.: $E_n = -3.4 = \frac{-13.6 \times 4}{n^2} \Rightarrow n^2 = 4^2 \Rightarrow n = 4$

Angular momentum = $\frac{nh}{2\pi} = \frac{4h}{2\pi} = \frac{2h}{\pi}$

36. Answer (4)

Hint & Sol.: If velocity $\vec{v}$ is such that $\vec{E} = -(\vec{v} \times \vec{B})$, then net force on the charge $= q\vec{E} + q(\vec{v} \times \vec{B})$ = Zero

$\Rightarrow$ Speed remains same $\Rightarrow$ Option (1) is true.

If $E = 0$ and velocity $\vec{v} \perp \vec{B}$, then the charge moves in a circle without change in speed $\Rightarrow$ Option (2) is true.

37. Answer (4)

Hint & Sol.: Using Gauss's law, electric flux (ϕ) through spherical surface, due to a charge q enclosed inside it = $\frac{q}{\varepsilon_0}$

38. Answer (3)

Hint: Angular momentum of rigid body (with z-axis as axis of rotation), $\vec{L} = \vec{L}_\perp + \vec{L}_Z$ where $\vec{L}_\perp$ and $\vec{L}_Z$ are components of $\vec{L}$ perpendicular to z-axis and along the z-axis respectively.

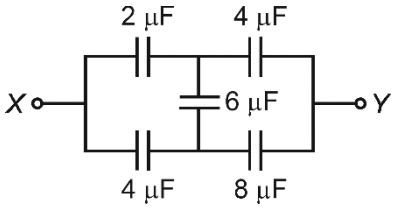
Sol.: For every particle (on the rigid body) with velocity $\vec{v}_i$, there is another particle of velocity $-\vec{v}_i$ located diametrically opposite on the circle described by the particle. Together, such pairs will contribute zero to $\vec{L}_\perp$.

Symmetric body about axis $L_\perp = 0$, $L_{||} \neq 0$

The magnitude and direction of $\vec{a}_{CM}$ is determined solely by net external force, regardless of where it is applied on the object.

39. Answer (3)

Hint:



This above portion of the circuit acts like a balanced wheatstone bridge because $\frac{2}{4}=\frac{4}{8}=\frac{1}{2}$, thereby we can ignore 6 μF capacitor.

Sol.: 2 μF and 4 μF in series $\Rightarrow C_1=\frac{2\times4}{2+4}=\frac{4}{3}\,\mu F$

4 μF and 8 μF in series $\Rightarrow C_2=\frac{8\times4}{8+4}=\frac{8}{3}\,\mu F$

$\therefore$ C_1, C_2 and 4 μF are in parallel connection

$\Rightarrow C_{eq}=C_1+C_2+4=\frac{12}{3}+4=8\,\mu F$

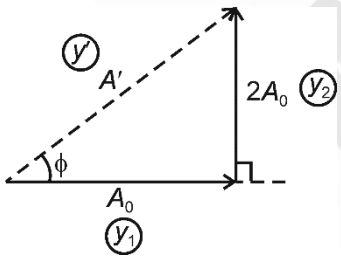
40. Answer (2)

Hint & Sol.: $C_P=\left(\frac{f}{2}+1\right)R$ and $C_V=\frac{fR}{2}$

$\therefore \frac{C_P}{C_V}=\frac{f+2}{f}=1+\frac{2}{f}$

41. Answer (4)

Hint:



Sol.: $y_2=2A_0\sin\left(kx-\omega t+\frac{\pi}{2}\right)$ leads y_1 by $\frac{\pi}{2}$

$\tan\phi=\frac{2A_0}{A_0}=2 \quad\Rightarrow\quad \phi=\tan^{-1}(2)$

$A'=\sqrt{A_0^2+(2A_0)^2}=\sqrt{5}A_0$

$\therefore$ $y'=y_1+y_2=A'\sin[kx-\omega t+\phi]$

$=\sqrt{5}A_0\sin\left\lfloor kx-\omega t+\tan^{-1}(2)\right\rfloor$

42. Answer (2)

Hint: At the time of collision, both colliding bodies are deformed.

Sol.: Total linear momentum of both bodies is conserved at each instant of any collision because forces involved during the collision are internal and net force on the system is zero.

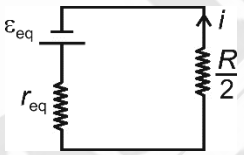
43. Answer (2)

Hint: When 2 cells of emf ε_1, ε_2 and internal resistances r_1, r_2 respectively are connected in parallel, then

$\frac{\varepsilon_{eq}}{r_{eq}}=\frac{\varepsilon_1}{r_1}+\frac{\varepsilon_2}{r_2}$ and $\frac{1}{r_{eq}}=\frac{1}{r_1}+\frac{1}{r_2}$

Sol.: $r_1=r_2=2R+R=3R$ and $\varepsilon_1=10$ V, $\varepsilon_2=-5$ V

$r_{eq}=\frac{3R}{2}$ and $\frac{\varepsilon_{eq}}{\frac{3R}{2}}=\frac{10}{3R}-\frac{5}{3R}=\frac{5}{3R} \Rightarrow \varepsilon_{eq}=\frac{5}{2}$ V



$\therefore$ Current $i=\frac{\varepsilon_{eq}}{r_{eq}+\frac{R}{2}}=\frac{2.5}{2R}=0.25$ A

44. Answer (3)

Hint: For $V_A > V_B$, diode D_1 is forward biased with zero resistance and diode D_2 is reverse biased with infinite resistance. For $V_A < V_B$, D_1 is RB while D_2 is FB.

Sol.: If $V_A > V_B$, then $R_{eq}=\frac{10}{2}=5\,\Omega$

($\because$ D_2 blocks current)

If $V_A < V_B$, then $R_{eq}=\frac{10}{2}=5\,\Omega$

($\because$ D_1 blocks current)

45. Answer (1)

Hint & Sol.: Ductile materials have large plastic region while for brittle materials, it is small.

There is no well-defined plastic region in an elastomer.

[CHEMISTRY]

46. Answer (1)

Hint: In Deacon's process, $CuCl_2$ is used as a catalyst.

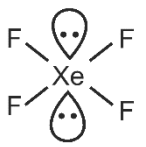
Sol.:

$$6XeF_4 + 12H_2O \longrightarrow 4Xe + 2XeO_3 + 24\,HF + 3O_2$$

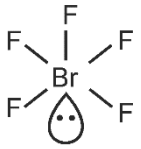
47. Answer (1)

Hint: The species which have zero dipole moment are known as non polar.

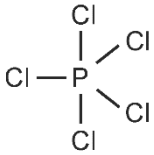
Sol.:



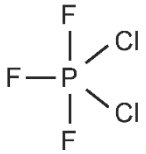
(XeF_4; $\mu = 0$)



(BrF_5; $\mu \neq 0$)



(PCl_5; $\mu = 0$)



(PCl_2F_3; $\mu \neq 0$)

48. Answer (1)

Hint: Due to lanthanoid contraction, ionic radii from La^{3+} to Lu^{3+} decreases

Sol.: The correct order of ionic radii of given species is

$Pr^{3+} > Gd^{3+} > Ho^{3+} > Tm^{3+}$

49. Answer (4)

Hint: According to first law of Faraday, w = zIt

Sol.: $w = \frac{MM}{nF} \times It$

$$\frac{w}{MM} = \frac{It}{nF}$$

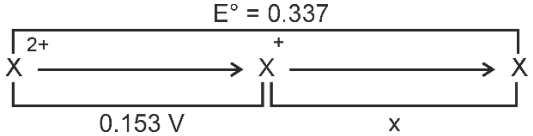
$$n = \frac{0.2 \times F}{2 \times F}$$

= 0.1 mol

50. Answer (3)

Hint: $\Delta G_3 = \Delta G_1 + \Delta G_2$

Sol.:



$-n_3FE_3 = -n_1FE_1 - n_2FE_2$

$2 \times 0.337 = 0.153 + X$

$X = 0.521$ V

51. Answer (2)

Hint: For first order reaction, $t_{\frac{1}{2}} = \frac{0.693}{k}$

Sol.: $t_{75\%} = \frac{2.303}{k}\log\frac{100}{25}$

$$= \frac{2.303 \times 2 \times 0.3010}{k}$$

$$= \frac{0.693 \times 2}{k}$$

$$= 2t_{\frac{1}{2}}$$

52. Answer (3)

Hint: For isotonic solution

$\pi_1 = \pi_2$

Sol.: $C_1 = C_2$

$$\frac{0.45 \times 1000}{(MM)_A \times 250} = \frac{0.9 \times 1000}{(MM)_B \times 100}$$

$$\frac{1.8}{(MM)_A} = \frac{9}{(MM)_B}$$

$$\frac{(MM)_B}{(MM)_A} = \frac{9}{1.8} \Rightarrow \frac{5}{1}$$

53. Answer (2)

Hint: $\Delta T_b = iK_bm$

$\Delta T_b = T_b - T_b^0$

ΔT_b increases, T_b also increases

Sol.: For $Al_2(SO_4)_3$

$i = 1 - \alpha + n\alpha$

$i = 1 - 0.5 + 5 \times 0.5$

= 3.0

For Na_2SO_4

$i = 1 - 0.2 + 5 \times 0.2$

= 1.4

For $Ca_3(PO_4)_2$

$i = 1 - 0.5 + 5 \times 0.5$

i = 3.0

For NaCl

$i = 1 - 0.8 + 2 \times 0.8$

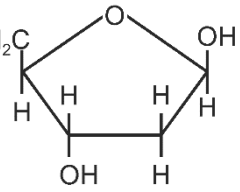
= 1.8

54. Answer (3)

Hint: In qualitative analysis of cations, Pb^{2+} belongs to both group-I and group-II

Group	Cation
Group-II	Pb^{2+}
Group-III	Al^{3+}
Group-IV	Co^{2+}
Group-V	Sr^{2+}

55. Answer (2)

Hint: 

β-D-2-deoxyribose

Sol.: Lactose is a reducing sugar while sucrose is a non reducing sugar.

56. Answer (2)

Hint: Thiamine is also known as vitamin B_1

Sol.:

Vitamin	Deficiency disease
Thiamine	Beri beri
Riboflavin	Cheilosis
Pyridoxine	Convulsions
Ascorbic acid	Scurvy

57. Answer (1)

Hint: The greater the positive charge on the central metal atom, the less readily the metal can donate electrons into the π^* orbitals of the carbon monoxide ligands to weaken the C–O bond.

Sol.:

Complex	C–O stretching frequency (cm^{-1})
$[Ti(CO)_6]^{2-}$	1748
$[Ni(CO)_4]$	2060
$[Mn(CO)_6]^{+}$	2090
$[Co(CO)_4]^{-}$	1890

58. Answer (3)

Hint: Complexes in which a metal is bound to only one kind of donor groups are known as homoleptic complexes.

Sol.: $[Co(NH_3)_6]^{3+}$ is a homoleptic complex.

59. Answer (4)

Hint: Ionisation isomerism arises when the counter ion in a complex salt is itself a potential ligand and can displace a ligand which can then become the counter ion.

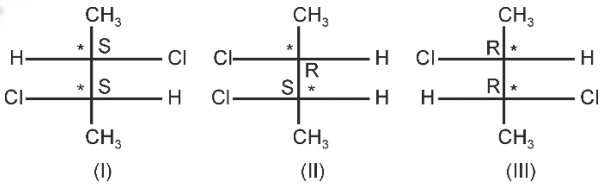
Sol.:

Complex	Magnetic character	Isomerism
$[Cr(NH_3)_4Br_2]Br$	Cr^{3+} is d^3, hence paramagnetic	Cis-trans
$[Ti(H_2O)_5Br](NO_3)_2$	Ti^{3+} is d^1, hence paramagnetic	Ionization
$[Pt(en)(NH_3)Br]NO_3$	Pt^{2+} is d^8, complex is square planar, all electrons are paired	Ionization
$[Co(NH_3)_4(NO_3)_2]NO_3$	Co^{3+} is d^6, hence diamagnetic	Cis-trans

60. Answer (4)

Hint: In order to convert a molecule with two stereogenic centers to its enantiomer, the configuration at both centres must be reversed. Reversing the configuration at only one stereogenic centre converts it to a diastereomeric structure.

Sol.:

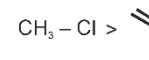


(I) (II) (III)

61. Answer (2)

Hint: The electron withdrawing groups (–I effect) stabilise the transition state formed in the rate determing step of S_N2 reaction.

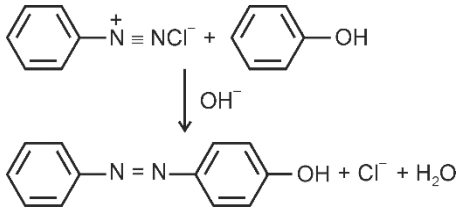
Sol.:

Compounds	CH_3-Cl		
Relative rate with respect to n-BuCl towards S_N2 reaction	200	79	0.02

62. Answer (1)

Hint: p-Hydroxyazobenzene dye is orange in colour while p-Aminoazobenzene dye is yellow in colour

Sol.:



p-Hydroxyazobenzene (orange dye)

63. Answer (1)

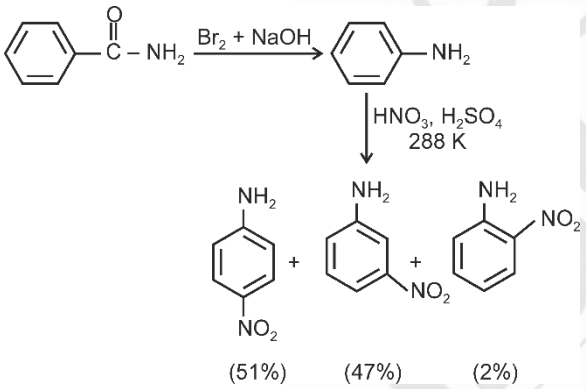
Hint: Aliphatic amines are stronger bases than aromatic amines.

Sol.: Amine	**pK_b value**
Benzenamine	9.38
Phenylmethanamine	4.70
N-Methylaniline	9.30
N, N-Dimethylaniline	8.92

64. Answer (1)

Hint: In direct nitration of aniline significant amount of m-nitro derivative is formed.

Sol.:



65. Answer (1)

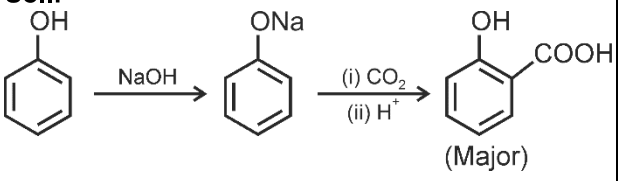
Hint: Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

Sol.: Chlorobenzene does not undergo nucleophilic substitution reaction with anion formed by phthalimide

66. Answer (3)

Hint: In Kolbe's reaction, ortho hydroxybenzoic acid is formed as major product.

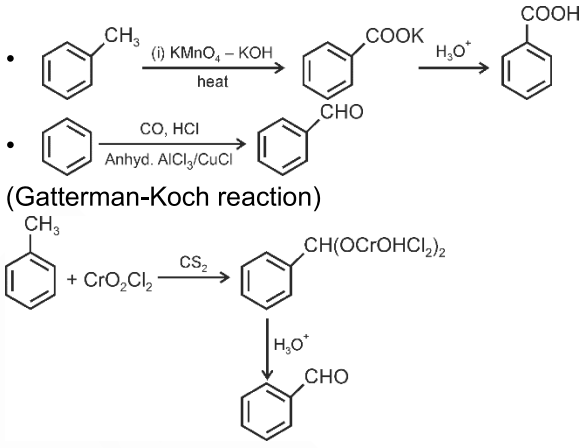
Sol.:



67. Answer (4)

Hint: Acyl halide (acid chloride) is hydrogenated over catalyst, palladium on barium sulphate. This reaction is known as Rosenmund reduction.

Sol.:



(Gatterman-Koch reaction)

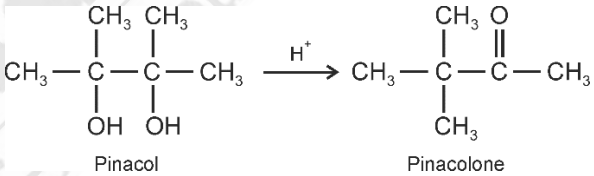
(Etard reaction)

68. Answer (3)

Hint: Ester having α-hydrogen on treatment with a strong base undergo self condensation to produce β-ketoesters.

Sol.: $2CH_3COOC_2H_5 \xrightarrow[(ii)\ H^+, H_2O]{(i)\ C_2H_5O^-Na^+} CH_3COCH_2COOC_2H_5$

is Claisen Ester condensation



Pinacol Pinacolone

is Pinacol-Pinacolone rearrangement

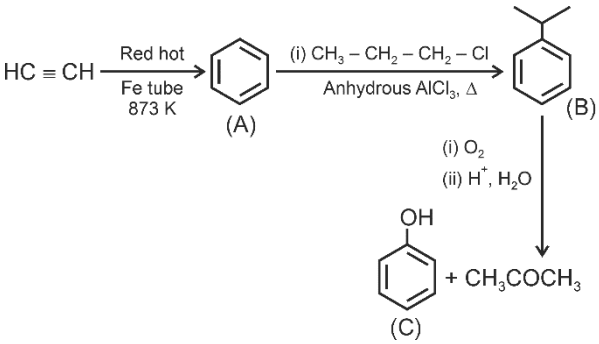
$CH_3 - CH_2 - COOH \xrightarrow[(ii)\ H_2O]{(i)\ Red\ P/Cl_2} CH_3 - \underset{Cl}{CH} - COOH$

is Hell-Volhard Zelinsky reaction.

69. Answer (2)

Hint: Phenol gives violet coloration with freshly prepared $FeCl_3$ solution.

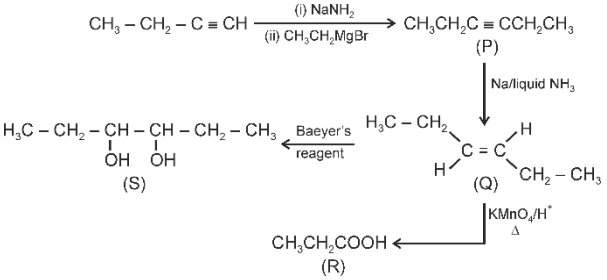
Sol.:



70. Answer (1)

Hint: Reduction of alkynes with Na and liquid NH_3 give trans-alkenes.

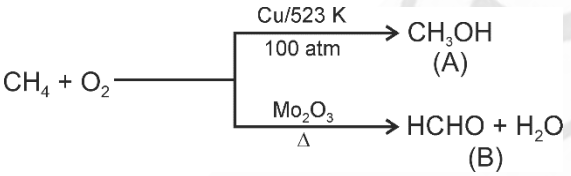
Sol.:



71. Answer (4)

Hint: Alkanes on heating with a regulated supply of O_2 or air at high pressure and in the presence of suitable catalysts give a variety of oxidation products.

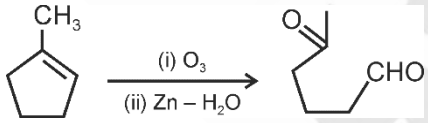
Sol.:



72. Answer (1)

Hint: On reductive ozonolysis alkene gives aldehyde or ketone

Sol.:



73. Answer (3)

Hint:

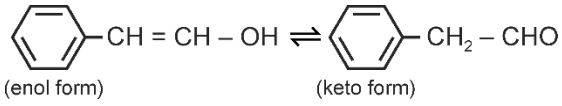
$$S^{2-} + [Fe(CN)_5NO]^{2-} \rightarrow \underset{\text{Violet}}{[Fe(CN)_5NOS]^{4-}}$$

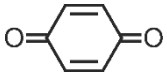
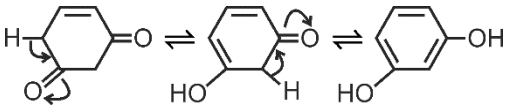
Sol.: Distillation under reduced pressure method is used to purify liquids having very high boiling points and those, which decompose at or below their boiling points.

74. Answer (3)

Hint: For a carbonyl compound to show tautomerism, it must have at least one H at the sp^3 hybridised carbon atom.

Sol.:

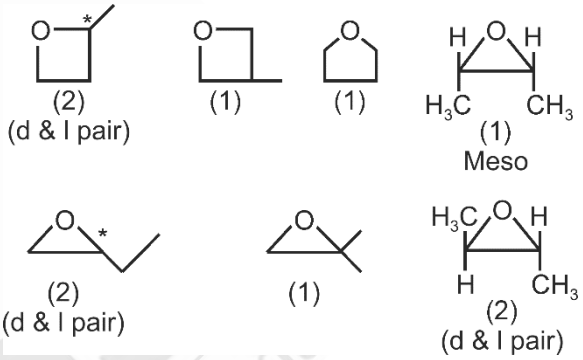
- 

-  ; Tautomerism is not possible
- 

75. Answer (2)

Hint: For cyclic ethers oxygen atom should be in ring

Sol.: Total 10 isomers



76. Answer (3)

Hint: Disproportionation reactions are a special type of redox reactions in which the same element gets oxidised as well as reduced simultaneously.

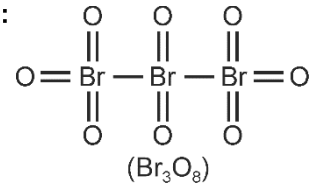
Sol.: $CH_4(g) + 2O_2(g) \xrightarrow{\Delta} CO_2(g) + 2H_2O(l)$; Combination redox reaction

$2H_2O(l) \xrightarrow{\Delta} 2H_2(g) + O_2(g)$; Decomposition redox reaction

$V_2O_5(s) + 5Ca(s) \xrightarrow{\Delta} 2V(s) + 5CaO(s)$; Metal displacement redox reaction

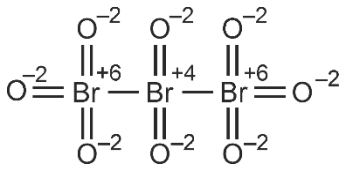
77. Answer (1)

Hint:



(Br_3O_8)

Sol.:



78. Answer (4)

Hint: For basic buffer solution

Sol.: $pOH = pK_b + \log\frac{Salt}{Base}$

	NH_3	+ HCl	⟶	NH_4Cl
Initial	10 mmol	2.5 mmol		0 mmol
Final	7.5 mmol	0 mmol		2.5 mmol

$pOH = 4.75 + \log\frac{2.5}{7.5}$

pOH = 4.75 + log1 – log3

pOH = 4.27

pH = 14 – 4.27

= 9.73

79. Answer (3)

Hint & Sol.:

$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

$\log 4\frac{k_1}{k_1} = \frac{E_a}{2.303 \times 8.314}\left[\frac{1}{310} - \frac{1}{320}\right]$

E_a = 2 × 0.3010 × 2.303 × 8.314 × 310 × 32

= 114.34 kJ mol^{-1}

80. Answer (1)

Hint: $AB_2(g) \rightleftharpoons A(g) + 2B(g)$

$K_P = \frac{P_A \times (P_B)^2}{(P_{AB_2})}$

Sol.:

	$AB_2(g)$	⟶	A(g)	+	2B(g)
Initial	1 mol		0		0
	1 – x		x		2x

Total moles at equilibrium = 1 – x + x + 2x

= 1 + 2x

$1 + 2x = \frac{PV}{RT} = \frac{2 \times 20}{0.0821 \times 300} = 1.62$

⇒ 1 + 2x = 1.62

x = 0.31

$P_{AB_2} = \frac{0.69}{1.62} \times 2$ ⇒ 0.85 atm

$P_A = \frac{0.31}{1.62} \times 2$ = 0.38 atm

$P_B = \frac{2 \times 0.31 \times 2}{1.62} = 0.76$ atm

$K_P = \frac{0.38 \times 0.76 \times 0.76}{0.85} \Rightarrow \frac{0.219}{0.85}$

$K_P = 2.5 \times 10^{-1}$

81. Answer (3)

Hint : In the presence of common ion, the solubility of a salt generally decreases.

Sol.: $\underset{S}{Ni(OH)_2} \rightleftharpoons \underset{S}{Ni^{2+}} + \underset{2S+0.1}{2OH^-}$

$K_{sp} = [Ni^{2+}][OH^-]^2$

$= [S][2S + 0.1]^2$ 2S < < < 0.1

$2 \times 10^{-15} = 0.01\ S$

$S = \frac{2 \times 10^{-15}}{0.01} = 2 \times 10^{-13}$ M

82. Answer (4)

Hint: Those properties which depend on the quantity or size of matter present are known as extensive properties.

Sol.: Internal energy, Gibb's energy and volume are extensive properties.

83. Answer (1)

Hint: $\Delta H = \Delta U + \Delta n_g RT$

Δn_g = Gaseous moles of products – Gaseous moles of reactants

Sol.: • $C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

$\Delta H = \Delta U + \Delta n_g RT$

$\Delta n_g = 2 - \frac{9}{2}$

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

$\Delta H = -x - \frac{5}{2}RT$

$= -\frac{(2x + 5RT)}{2}$

84. Answer (1)

Hint: The species which have unpaired electron(s) are known as paramagnetic species.

Sol.: $O_2 \Rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2, \pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^1 = \pi^* 2p_y^1$

$O_2^+ \Rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2, \pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^1 = \pi^* 2p_y^0$

$C_2^{2-} \Rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^2 = \pi 2p_y^2, \sigma 2p_z^2$

$Li_2 \Rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2$

$B_2 \Rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^1 = \pi 2p_y^1$

85. Answer (2)

Hint: Size increases, van der waals attraction also increases and boiling point increases

Sol.:

Species	Boiling point/K
NH_3	238.5
PH_3	185.5
AsH_3	210.6
SbH_3	254.6

86. Answer (3)

Hint: In general, moving from left to right along the period in periodic table, atomic radii decreases and ionization enthalpy increases

Sol.:

Atomic Number	Oxide	Nature
13	Al_2O_3	Amphoteric
50	SnO, SnO_2	Amphoteric

87. Answer (3)

Hint: n > l (always)

Sol.: For n = 3

l = 0, 1, 2

For n = 3; l cannot be 3

88. Answer (4)

Hint: de Broglie wavelength, $\lambda = \frac{h}{mv}$

$mvr = \frac{nh}{2\pi}$

Sol.: In 4th orbit, angular momentum $= \frac{4h}{2\pi}$

$= \frac{2h}{\pi}$

$n\lambda = 2\pi r$

$\lambda = \frac{2\pi \times a_0 \times n}{Z} \qquad \left(\text{as } r = a_0 \frac{n^2}{z}\right)$

$\lambda = 6\pi a_0$

89. Answer (4)

Hint: $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

$\%\ \text{purity} = \frac{\text{Weight of pure substance}}{\text{Weight of sample}} \times 100$

Sol.: $90 = \frac{\text{Weight of pure NaCl}}{130} \times 100$

Weight of pure NaCl = 117 g

Mole of NaCl = $\frac{117}{58.5} \Rightarrow 2$ mol

2 mol NaCl produces 1 mol Na_2SO_4

$W_{Na_2SO_4} = 142\ g\ Na_2SO_4$

$71 = \frac{142}{x} \times 100$

x = 200 g

90. Answer (2)

Hint: Number of moles $= \frac{\text{Weight (in g)}}{\text{Molar mass (in g)}}$

Sol.:

- In 1 g of O_3, number of electrons

  $\frac{1}{48} = \frac{\text{Number of electrons}}{24 \times N_A}$

  Number of electrons = 0.5 N_A

- In 34 g of H_2S, number of atoms

  $\frac{34}{34} = \frac{x}{3\,N_A}$

  x = 3 N_A atoms

- In 17 g of NH_3, number of atoms

  $\frac{17}{17} = \frac{\text{Number of atoms}}{4\,N_A}$

  Number of atoms = 4 N_A

- In 30 g of NaOH, number of protons

  $\frac{30}{40} \times N_A \times 20$ protons

  = 15 N_A protons

[BIOLOGY]

91. Answer (2)

Hint: Chitin is present in the cell wall of fungi.

Sol.: Algae have cell wall made of mannans, cellulose, galactans and minerals like calcium carbonate.

92. Answer (3)

Hint: The cells of the human cheek have an outer membrane which is plasma membrane.

Sol.: Plasma membrane is selectively permeable to some molecules present on either side of it.

93. Answer (4)

Hint: In monocot stems, hypodermis is made up of dead cells.

Sol.: Phloem parenchyma is absent in most of monocotyledonous plants.

94. Answer (2)

Hint: Xylem fibres have highly thickened walls and obliterated central lumens.

Sol.:

Sieve tubes elements	–	These are long, tube-like structures, arranged longitudinally and are associated with the companion cells.
Tracheids	–	These are elongated or tube like cells with thick and lignified walls and tapering ends.
Bast fibres	–	These are made up of sclerenchymatous cells and are generally absent in primary phloem but are found in the secondary phloem.

95. Answer (3)

Hint: Meristematic tissue is a group of actively dividing cells.

Sol.: Plant retain the capacity for unlimited growth due to meristematic tissue.

Cells of secondary meristem are dedifferentiated.

96. Answer (3)

Hint: In axile placentation, the placenta is present in the axial position and the ovules are attached to it in a multilocular ovary.

Sol.: Axile placentation occurs in the members of Solanaceae and Liliaceae.

97. Answer (4)

Hint: Aestivation is seen in the floral diagram.

Sol.: Placentation and aestivation are not represented in floral formula.

98. Answer (3)

Hint: Members of family Solanaceae have pentamerous flowers.

Sol.: Flowers in the members of Solanaceae are pentamerous, bisexual, actinomorphic and hypogynous.

99. Answer (1)

Hint: Epiphyllous condition is seen in lily.

Sol.:

Gamosepalous	–	Brinjal
Diadelphous	–	Lupin
Apocarpous	–	Lotus

100. Answer (3)

Hint: *Marsilea* produces two types of spores.

Sol.: *Marsilea* is heterosporous.

101. Answer (3)

Hint: Bryophytes are non-vascular plants.

Sol.: Bryophytes rarely achieve great height.

102. Answer (3)

Hint: Oxygen is evolved during photosynthesis in cyanobacteria.

Sol.: Cyanobacteria perform oxygenic photosynthesis and show nitrogenase activity in heterocyst.

103. Answer (3)

Hint: Amoeboid protozoans use pseudopodia for capturing prey.

Sol.: Ciliated protozoans have two types of nuclei macro and micro.

104. Answer (4)

Hint: In Monera, mode of nutrition can be autotrophic or heterotrophic.

Sol.: In five kingdom classification, kingdoms Fungi and Animalia have organisms exhibiting heterotrophic mode of nutrition.

105. Answer (4)

Hint: In unicellular organisms, reproduction is synonymous with growth.

Sol.: Consciousness is the most obvious and technically complicated property of living beings.

106. Answer (2)

Hint: Compound epithelium covers the dry surface of the skin.

Sol.: The compound epithelium is made of more than one layer of cells and thus has limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses. The simple squamous epithelium is involved in functions like forming a diffusion boundary. The function of ciliated epithelium is to move particles or mucus in a specific direction.

107. Answer (2)

Hint: Adipocytes are present in adipose tissue.

Sol.: The excess of nutrients which are not used immediately are converted into fats and are stored in adipose tissue.

Tight junctions help to stop substances from leaking across a tissue. Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules.

108. Answer (2)

Hint: Feature of subphyla to which *Salpa* belongs to

Sol.: *Branchiostoma* is a cephalochordate in which notochord extends from head to tail region and is persistent throughout their life. In urochordate such as *Salpa*, notochord is present only in larval tail.

All living members of the class Cyclostomata are ectoparasites on some fishes. Cyclostomes are marine but migrate for spawning to fresh water.

109. Answer (4)

Hint: *Homo habilis* came after *Australopithecus*

Sol.: The correct chronological order of human evolution is

Ramapithecus → *Australopithecus* → *Homo habilis* → *Homo erectus* → *Homo sapiens*

110. Answer (3)

Hint: Sponges show cellular level of body organisation.

Sol.: Water vascular system – Helps in locomotion of animals whose larvae are bilaterally symmetrical.

Statocysts – Act as balancing organ in aquatic arthropods.

Water transport system – Present in animals having only cellular level of body organisation.

Stomochord – A rudimentary structure similar to notochord.

111. Answer (2)

Hint: Miller created electric discharge in a closed flask

Sol.: Oparin of Russia and Haldane of England proposed that the first form of life could have come from pre-existing non-living organic molecules and that formation of life was preceded by chemical evolution. S.L. Miller provided good experimental support to chemical evolution theory proposed by Oparin and Haldane.

112. Answer (4)

Hint: Terminal method of contraception

Sol.: Injections having progestogen only, steroidal oral contraceptive pills and implants contain progestogen alone or in combination with estrogen that inhibit ovulation and implantation. Vasectomy is a terminal method of contraception for human males.

113. Answer (2)

Hint: Select the one with IUDs only

Sol.: IUDs like CuT, Cu7, Multiload 375, progestasert, lippes loop, *etc*. are required to be inserted by the doctors and expert nurses in the uterus through vagina. Implants are placed under skin. Vaults and diaphragms are barriers and can be self-inserted by the users.

114. Answer (3)

Hint: Shows convergent evolution with flying phalanger

Sol.: Spotted cuscus, flying phalanger and numbat are Australian marsupials while flying squirrel is a placental mammal that shows convergent evolution with flying phalanger.

115. Answer (2)

Hint: Identify a flatworm.

Sol.: Both *Fasciola* and *Planaria* are triploblastic acoelomate organisms and belong to the phylum Platyhelminthes. *Planaria* possesses high regeneration capacity. *Ancylostoma* is a triploblastic pseudocoelomate organism, while *Nereis* is a triploblastic coelomate organism, *Ancylostoma* belongs to the phylum Aschelminthes while *Nereis* belongs to the phylum Annelida.

116. Answer (4)

Hint: Epicotyl is the portion of the embryonal axis above the level of attachment of scutellum in monocot seed.

Sol.:

Aleurone layer	–	Outermost layer of the endosperm in maize seed
Coleoptile	–	Hollow foliar structure that encloses the leaf primordia.
Coleorhiza	–	An undifferentiated sheath at lower end of the embryonal axis

117. Answer (2)

Hint: Wind pollinated flowers have light and non-sticky pollen grains.

Sol.: Wind pollinated flowers often have a single ovule in each ovary and numerous flowers packed into an inflorescence.

118. Answer (2)

Hint: This tissue is able to give rise to microspore tetrad.

Sol.: When the anther is young, a group of compactly arranged homogenous cells is called sporogenous tissue present in the centre of microsporangium.

119. Answer (3)

Hint: Abscission II is a kind of plant growth inhibitor.

Sol.: Inhibitor-B, abscission II and dormin are proved to be chemically identical and it was named abscisic acid (ABA).

120. Answer (3)

Hint: Auxins promote apical dominance.

Sol.: Cytokinins are synthesised in regions where rapid cell division occurs.

ABA stimulates closure of stomata in water stress conditions.

121. Answer (3)

Hint: Glycolysis occurs in both prokaryotes and eukaryotes.

Sol.: Glycolysis is a common pathway in fermentation and aerobic respiration.

122. Answer (2)

Hint: Complex V of ETS is ATP synthase.

Sol.: Complex V of ETS, transports protons from intermembrane space to matrix of mitochondria.

123. Answer (1)

Hint: C_4 plants are adapted to dry tropical regions.

Sol.: It is the relative concentration of O_2 and CO_2 that determines which of the two will bind to the RuBisCO enzyme.

124. Answer (2)

Hint: With increase in the protons in the lumen of thylakoids, the pH decreases.

Sol.: As electrons move through the photosystems, protons are transported across the membrane.

Within the chloroplast, protons in the stroma decrease in number, while in the lumen of thylakoid, there is increase in protons.

125. Answer (4)

Hint: The final stage of prophase I is diakinesis.

Sol.: Diakinesis is marked by terminalisation of chiasmata.

126. Answer (2)

Hint: The plane of alignment of the chromosomes at metaphase is referred to as the metaphase plate.

Sol.: At the onset of anaphase, each chromosome arranged at the metaphase plate split simultaneously and the two daughter chromatids, now referred to as daughter chromosomes of the future daughter nuclei, begin their migration towards the opposite poles.

127. Answer (3)

Hint: The non-dividing cell enters the quiescent stage from G_1 phase.

Sol.: G_0 cells will not directly go into synthesis phase, they will re-enter the G_1 phase and prepare themselves for S phase.

128. Answer (2)

Hint: Due to complete disintegration of nuclear envelope, chromosomes are spread through the cytoplasm of the cell.

Sol.: The complete disintegration of nuclear envelope marks the start of the second phase of mitosis, hence, the chromosomes are spread through the cytoplasm of the cell.

129. Answer (4)

Hint: Camillio Golgi first observed densely stained reticular structures near the nucleus. These were later named Golgi bodies after him.

Sol.: Golgi bodies consist of cisternae that are concentrically arranged near the nucleus with distinct convex *cis* or the forming face and concave *trans* or the maturing face. They are in close association with ER.

130. Answer (3)

Hint: Oxysomes are found in the inner membrane of mitochondria.

Sol.: In mitochondria, the outer membrane forms the continuous limiting boundary of the organelle.

The inner membrane forms a number of infoldings called the cristae towards the matrix.

131. Answer (4)

Hint: Molecular weights of lipids do not exceed beyond 800 Da.

Sol.: The molecular weights of lipids do not exceed 800 daltons. Arachidonic acid, palmitic acid, trihydroxypropane are lipids. The molecular weights of proteins, nucleic acids and polysaccharides are in the range of 10,000 daltons and above. Collagen, cellulose and DNA are protein, polysaccharide and nucleic acid respectively.

132. Answer (2)

Hint: Conus arteriosus is present on ventral side of heart.

Sol.: A triangular structure sinus venosus joins the right atrium. It receives blood through vena cava. The ventricle opens into conus arteriosus on the ventral side of the heart. The forebrain of frogs include olfactory lobes, paired cerebral hemispheres and unpaired diencephalon. The duodenum receives bile from gall bladder and pancreatic juices from pancreas through a common bile duct.

133. Answer (1)

Hint: Equal to the number of ear ossicles in one ear of humans.

Sol.: Anal cerci, Malpighian tubules, and antennae are found in both male and female cockroaches. Anal style and titillator are found only in male cockroaches while spermathecae are present only in female cockroaches.

134. Answer (3)

Hint: Flame cells

Sol.: Protonephridia or flame cells are the excretory structures in platyhelminths, rotifers, some annelids and cephalochordates (*Amphioxus*). Malpighian tubules are present in insects while green glands in prawns. Gills are respiratory structures in many aquatic animals.

135. Answer (1)

Hint: Exclude vertebrates

Sol.: Aquatic arthropods are ammonotelic, hence they excrete ammonia as their major nitrogenous waste. Birds and reptiles are uricotelic, while mammals are ureotelic.

136. Answer (1)

Hint: Both ventricles of heart pump out approximately 10 L of blood in a minute.

Sol.: On an average, 1100-1200 mL of blood is filtered by the kidneys per minute which constitute roughly $1/5^{th}$ of the blood pumped out by each ventricle of heart in a minute.

137. Answer (2)

Hint: Masculinisation is observed in females

Sol.: Increased aggressiveness, mood swings and depression are common side effects observed in both human male and female due to use of anabolic steroids. Breast enlargement can be observed in males while deepening of voice in females is seen as side-effects of misuse of anabolic steroids.

138. Answer (3)

Hint: Allergens cause allergy.

Sol.: For determining the cause of allergy, the patient is exposed to very small dose of possible allergens, and the reactions are studied.

139. Answer (3)

Hint: Commonly called roundworms

Sol.: Ascariasis is a helminthic disease characterised by the symptoms mentioned. Ascariasis is caused by *Ascaris* that belongs to the phylum Aschelminthes.

140. Answer (2)

Hint: During second trimester

Sol.: The first movement of the foetus and appearance of hair on the head are usually observed during the fifth month of the pregnancy.

141. Answer (2)

Hint: Fertilisation occurs in fallopian tube.

Sol.: All copulations do not lead to fertilisation and pregnancy because fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary region of the oviduct.

142. Answer (2)

Hint: Duration of luteal phase is fixed.

Sol.: The duration of luteal phase is fixed for each menstrual cycle. Hence, in a 34 days menstrual cycle, ovulation will occur on (34 – 14) = 20^{th} day of menstrual cycle.

143. Answer (3)

Hint: Flagella develops to facilitate the movement of sperms.

Sol.: The transformation of spermatids into spermatozoa is called spermiogenesis. The process of formation of sperms from spermatogonia is called spermatogenesis.

144. Answer (4)

Hint: Smooth muscle is present in the middle layer of the wall of blood vessels

Sol.: The wall of blood vessels has three layers. Tunica externa is made up of fibrous connective tissue with collagen fibres. Tunica media made up of smooth muscles and elastic fibres. Tunica intima made of squamous endothelium.

145. Answer (4)

Hint: Arthropods have open circulatory system

Sol.: Silkworm is an arthropod and they possess open type of circulatory system. Earthworms have closed type of circulatory system where blood is carried through a network of blood vessels of varying diameters.

146. Answer (2)

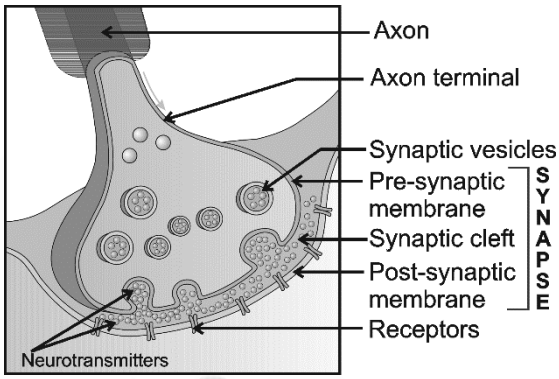
Hint: Exclude the clones

Sol.: Any part of plant taken out to regenerate the whole plant is called explant. The capacity to regenerate a whole plant from explant is called totipotency. The method of producing thousands of plants through tissue culture is called micro-propagation.

147. Answer (3)

Hint: Include synaptic cleft

Sol.: A synapse is formed by the membranes of a pre-synaptic neuron and a post-synaptic neuron, which may or may not be separated by a gap called synaptic cleft.



148. Answer (3)

Hint: Function of a component of brain stem

Sol.: Hypothalamus lies at the base of thalamus. It contains several groups of neurosecretory cells, which secrete hormones called hypothalamic hormones. Hypothalamus is also involved in regulation of sexual behaviour, expression of emotional reactions, *etc*. The medulla oblongata of hindbrain contains centre which controls cardiovascular reflexes.

149. Answer (3)

Hint: TCT decreases blood Ca^{++} levels.

Sol.: PTH increases blood Ca^{++} levels. It acts on bones and stimulates the process of bone resorption. PTH also stimulates reabsorption of Ca^{++} by the renal tubules. Thus, PTH is a hypercalcemic hormone.

150. Answer (3)

Hint: Function of glucagon

Sol.: The β-cells of pancreas secrete insulin which mainly acts on hepatocytes and adipocytes and enhance cellular glucose uptake and utilisation. It lowers the blood glucose levels. Glucagon secreted from α-cells of pancreas stimulates glycogenolysis.

151. Answer (4)

Hint: Regulates BMR

Sol.: Chemically steroid and iodothyronine hormones interact with intra-cellular receptors and mostly regulate gene expression or chromosome function by the interaction of hormone-receptor complex, while peptide hormones interact with membrane bound receptors and normally do not enter the target cell, but generate second messengers in turn to regulate cellular metabolism. Thyroxine is an iodothyronine, progesterone is steroidal in nature, insulin is a peptide hormone and epinephrine is an amino-acid derivative hormone.

152. Answer (3)

Hint: Volume of air a person can forcefully expire after a normal inspiration.

Sol.: Inspiratory capacity = TV + IRV

= 3000-3500 mL

Functional residual capacity = ERV + RV

= 2100-2300 mL

Vital Capacity = ERV + TV + IRV

= 4000-4600 mL

153. Answer (3)

Hint: Flattened cells are present in alveoli.

Sol.: In humans, the respiratory diffusion membrane is made up of three major layers, namely the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance [composed of a thin basement membrane supporting the squamous epithelium and the basement membrane surrounding the single layer endothelial cells of alveolar capillaries] in between them.

154. Answer (3)

Hint: Form one or more coordination bonds with substrate.

Sol.: Organic compounds or metal ions or coenzymes which are tightly bound to the apoenzyme are called prosthetic group. Co-enzymes are also organic compounds but their association with apoenzyme is only transient. Haem is the prosthetic group of enzymes named peroxidase and catalase.

155. Answer (4)

Hint: Optimum growth conditions include all the favourable factors

Sol.: A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions that include temperature, pH, substrate, salts, vitamin, oxygen, *etc*.

156. Answer (4)

Hint: The reasons for the conservation of biodiversity can be grouped into three categories : narrowly utilitarian, broadly utilitarian and ethical.

Sol.: We should conserve our biodiversity for economic benefit (narrowly utilitarian), ecosystem services (broadly utilitarian) and ethical reasons.

157. Answer (3)

Hint: Fig species co-evolve with wasp species to get pollinated.

Sol.: Steller's sea cow got extinct due to human overexploitation.

158. Answer (4)

Hint: Ecological pyramids in most ecosystems are upright

Sol.: In most ecosystem, all the pyramids, of number, of energy and biomass are upright.

In sea ecosystem, pyramid of biomass is usually inverted.

159. Answer (4)

Hint: Except for the deep sea hydro-thermal ecosystem, sun is the only source of energy for all ecosystem on earth.

Sol.: The rate of biomass production is called productivity and expressed in terms of $gm^{-2}\ yr^{-1}$.

160. Answer (4)

Hint: *Cuscuta* has lost its chlorophyll and leaves in the course of evolution.

Sol.: *Cuscuta,* a parasitic plant, is commonly found on hedge plants. It derives its nourishment from the host plant on which it parasitizes.

161. Answer (1)

Hint: Predators help in maintaining the species diversity in a community.

Sol.: In the rocky intertidal communities of the American Pacific coast, the starfish *Pisaster* is an important predator. In a field experiment, when all the starfish were removed from an enclosed intertidal area, more than 10 species of invertebrates became extinct within a year because of inter-specific competition.

162. Answer (3)

Hint: Statins have been commercialised as blood-cholesterol lowering agents.

Sol.: *Monascus purpureus* produces statins.

163. Answer (1)

Hint: Till date, no man-made technology has been able to rival the microbial treatment of sewage.

Sol.: An important part of the biological farming approach is to become familiar with the various life forms that inhabit the field, predators as well as pests and also their life cycles, patterns of feeding and the habitats that they prefer.

164. Answer (2)

Hint: hnRNA contains non-coding base sequence (introns) and coding base sequence (exons).

Sol.: RNA polymerase II catalyses the synthesis of hnRNA or primary transcript in eukaryotes.

165. Answer (1)

Hint: *lac* z, *y* and *a* are structural genes in *lac* operon.

Sol.: Repressor protein is coded by inhibitor gene *i*. It is not a structural gene.

166. Answer (3)

Hint: Number of phosphodiester bonds depends on the circular or linear nature of genetic material.

Sol.: Number of phosphodiester bonds in a linear dsDNA molecule = number of total nucleotides – 2.

167. Answer (3)

Hint: The DNA sequence coding for tRNA or rRNA molecules also define a gene.

Sol.: *E. coli* completes the process of replication within 18 minutes and average rate of polymerisation has to be approximately 2000 bp per second.

168. Answer (2)

Hint: In a polygenic trait, the phenotype reflects the contribution of each allele, *i.e.*, the effect of each allele is additive.

Sol.: Human skin colour is an example of polygenic inheritance.

169. Answer (2)

Hint: Turner's syndrome is caused due to aneuploidy.

Sol.: Turner's syndrome is caused due to the absence of one of the X-chromosomes, *i.e.*, 45 with X0. Such females are sterile as ovaries are rudimentary. Besides other features including lack of other secondary sexual character.

170. Answer (1)

Hint: Thalassemia is an autosomal recessive blood disease.

Sol.: α and β Thalassemia are autosomal recessive disorders, meaning a person needs two mutated alleles of a gene to be affected. Since the child will inherit one normal allele for alpha and beta chain synthesising gene, he can only be a carrier of both conditions but will not have the disease.

171. Answer (4)

Hint: Atlas and axis

Sol.: Cartilaginous joint is present between adjacent vertebrae, which allow limited movement. First cervical vertebra is atlas and second cervical vertebra is axis. Pivot joint, a type of synovial joint, is present between atlas and axis. This joint allows considerable movement in one plane.

172. Answer (3)

Hint: Low estrogen level can lead to osteoporosis in menopausal women

Sol.: Gout:- Arthritis due to deposition of uric acid crystals in joints.

Osteoporosis:- An age related disorder caused due to hormonal imbalance.

Tetany:- Rapid spasms in skeletal muscles due to low blood calcium levels.

Muscular dystrophy:- Genetic disorder in which progressive degeneration of skeletal muscle is observed.

173. Answer (2)

Hint: Jaw bone

Sol.: Mandible is an unpaired facial bone. Skull bones include cranial bones and facial bones.

174. Answer (3)

Hint: Isolation of DNA is followed by its fragmentation

Sol.: The correct order of steps involved in recombinant DNA technology is

- Isolation of DNA
- Fragmentation of DNA by restriction endonuclease
- Isolation of desired DNA fragment
- Ligation of DNA fragment into vector
- Transfer of recombinant DNA into the host.

175. Answer (2)

Hint: Cut between two purines

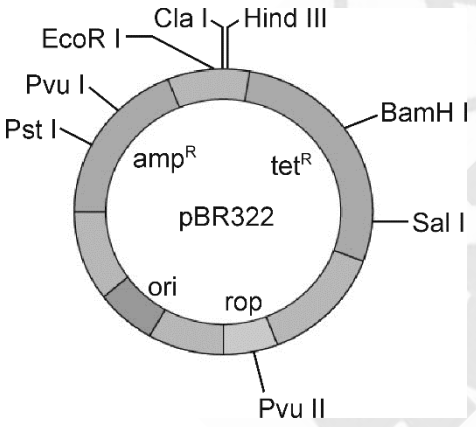
Sol.: For *Eco*RI to act upon the correct recognition sequence is

5′ – G↓AATTC – 3′
3′ – CTTAA↑G – 5′

176. Answer (1)

Hint: Same site where *Pst* I site is also present.

Sol.:



177. Answer (1)

Hint: High H^+ indicates higher concentration of CO_2

Sol.: In the tissues, low pO_2, high pCO_2, high H^+ and higher temperature favour the dissociation of oxygen from oxyhaemoglobin. In the alveoli, high pO_2, low pCO_2, lesser H^+ concentration, and lower temperature, favour the formation of oxyhaemoglobin.

178. Answer (4)

Hint: α-1 antitrypsin is used to treat emphysema.

Sol.: Today the transgenic models exist for many human diseases such as cancer, cystic fibrosis, rheumatoid arthritis, Alzheimer's, emphysema, *etc.*

179. Answer (2)

Hint: Most of them have Rhesus antigen

Sol.: RBCs *i.e.*, erythrocytes of mammals are biconcave in shape and lack nucleus in its mature form. They contain iron containing pigment and enzyme named carbonic anhydrase. Their average life span is of 120 days. Platelets/thrombocytes play major role in blood clotting. WBCs play role in immunity.

180. Answer (2)

Hint: Consecutive digits.

Sol.: Carbohydrates constitute 3 per cent and lipids constitute 2 per cent of the total cellular mass of a living tissue.

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