

All India Aakash Test Series for NEET - 2025

OPEN MOCK TEST - 3[Click here for Code-F sol.](#)

Test Date : 20/04/2025

ANSWERS

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

HINTS & SOLUTIONS**[PHYSICS]**

1. Answer (3)

Hint: L.C = MSD – VSD**Sol.:** L.C = MSD – VSD

$$25 \text{ VSD} = 20 \text{ MSD}$$

$$1 \text{ VSD} = \frac{20}{25} \text{ MSD}$$

Least count = 1 MSD – 1 VSD

$$\text{L.C} = \text{MSD} - \frac{20}{25} \text{MSD}$$

$$\text{L.C} = \text{MSD} \left[1 - \frac{20}{25} \right]$$

$$0.2 = \text{MSD} \left[\frac{1}{5} \right]$$

$$1 \text{ MSD} = 1 \text{ mm}$$

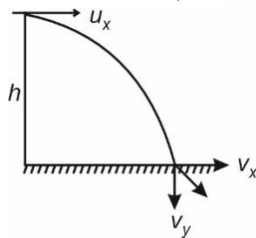
2. Answer (4)

Hint: $|a\hat{i} + b\hat{j}| = \sqrt{a^2 + b^2}$ **Sol.:** $|\hat{i} + \hat{j}| = \sqrt{1^2 + 1^2} = \sqrt{2}$

Sum of two-unit vectors is not necessarily a unit vector.

Hence both A and R are false.

3. Answer (3)

Hint: $v_x = u_x + a_x t$; $v_y = u_y + a_y t$ **Sol.:** $v_x = u_x$, $v_y = gt$ 

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 20}{10}} = 2 \text{ s}$$

$$v_x = 20 \text{ m/s}$$

$$v_y = 10(2) = 20 \text{ m/s}$$

$$\therefore \vec{v} = (20\hat{i} - 20\hat{j}) \text{ m/s}$$

4. Answer (3)

Hint: Measurement having least percentage error is most accurate while measurement having maximum decimal resolution is most precise.**Sol.:** Among the given options 1.975 is the most accurate and precise measurement.

5. Answer (4)

Hint: Conservation of linear momentum**Sol.:** $mv - mv = 2mv'$

$$v' = 0$$

6. Answer (1)

Hint: $v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

$$v_{\text{mps}} = \sqrt{\frac{2RT}{M}}$$

Sol.: $\frac{v_{\text{rms}}}{v_{\text{mps}}} = \sqrt{\frac{3}{2}}$

$$\sqrt{600} \times \frac{\sqrt{2}}{\sqrt{3}} = v_{\text{mps}}$$

$$v_{\text{mps}} = 20 \text{ m/s}$$

7. Answer (2)

Hint: $v_{\text{max}} = A\omega$

$$a_{\text{max}} = \omega^2 A$$

Sol.: $\frac{v_{\text{max}}}{a_{\text{max}}} = \frac{A\omega}{\omega^2 A} = \frac{1}{\omega}$

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

8. Answer (4)

Hint: Use Newton's law of cooling

$$\frac{T_1 - T_2}{\text{time}} = K \left[\frac{T_1 + T_2}{2} - T_0 \right]$$

Sol.: As per Newton's law of cooling

$$\frac{60 - 40}{10} = K \left[\frac{60 + 40}{2} - T_0 \right]$$

$$\frac{40 - 28}{10} = K \left[\frac{40 + 28}{2} - T_0 \right]$$

On solving

$$T_0 = 10^\circ\text{C}$$

9. Answer (1)

Hint: Efficiency $\eta = \frac{W.D}{\text{Input}} = \frac{Q_1 - Q_2}{Q_1}$

Sol.: Given, $Q_1 - Q_2 = \frac{1}{4}Q_2$

$$Q_1 = \frac{5}{4}Q_2$$

Hence, $\eta = \frac{1}{4} \frac{Q_2}{Q_1} \times 100 = \frac{1}{4} \left(\frac{4}{5}\right) \times 100 = \frac{1}{5} \times 100 = 20\%$

10. Answer (2)

Hint: Common potential $V_{\text{common}} = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$

Sol.: $V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$

$$= \frac{20 \times 100 + 20 \times 0}{40} = 50 \text{ V}$$

11. Answer (2)

Hint: $M = \frac{q}{2m}L$, M is magnetic moment and L is angular momentum

$$L = mvr$$

Sol.: $M = \frac{q}{2m}L$

$$= \frac{q}{2m} m \cdot v \cdot r = \frac{q}{2m} m(\omega r)r$$

$$M = \frac{q}{2} \omega r^2$$

12. Answer (3)

Hint: $P_{\text{developed}} = \frac{V_{\text{applied}}^2}{R}$

Sol.: $P = \frac{V^2}{R}$

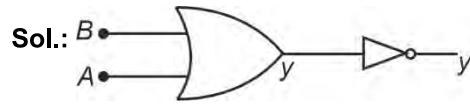
$$R = \frac{V^2}{P} = \frac{220 \times 220}{1000}$$

$$P_{\text{developed}} = \frac{V_{\text{applied}}^2}{R} = \frac{110 \times 110}{220 \times 220} \times 1000$$

Power developed = 250 W

13. Answer (4)

Hint: $y' = \overline{A+B}$



A	B	y	y'
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

14. Answer (3)

Hint: End correction $e = (0.6)$ radius

Sol.: For a resonance tube

End correction $e = \frac{l_2 - 3l_1}{2}$

$$e = \frac{60 - 3(19.6)}{2} = 0.6$$

Now, $e = (0.6)$ radius

$$\frac{0.6}{0.6} = \text{radius} = 1 \text{ cm}$$

15. Answer (2)

Hind & Sol.: Area enclosed by a hysteresis loop is a measure of energy loss per unit volume per cycle of magnetisation demagnetisation.

16. Answer (2)

Hint: $I_0 = \frac{E_0}{Z}$

$$Z = \sqrt{X_L^2 + R^2}$$

Sol.: $X_L = \omega L = 1000(4 \times 10^{-3}) = 4 \Omega$

$$R = 3 \Omega$$

$$Z = \sqrt{X_L^2 + R^2} = \sqrt{4^2 + 3^2} = 5 \Omega$$

$$I_0 = \frac{E_0}{Z} = \frac{10}{5} = 2 \text{ A}$$

17. Answer (4)

Hint: $M = K\sqrt{L_1L_2}$, where K denotes coefficient of coupling

Sol.: $M = K\sqrt{L_1L_2} \Rightarrow 6 = K \times 8 \Rightarrow K = \frac{6}{8} = \frac{3}{4}$

18. Answer (1)

Hint: Loss in kinetic energy = gain in potential energy

$$\text{Sol.: } \frac{1}{2}M[v^2 - u^2] = \frac{1}{2}kx^2$$

$$\frac{1}{2} \times 1 [25 - 9] = \frac{1}{2} \times 10000x^2$$

$$16 \times 10^{-4} = x^2$$

$$x = 4 \times 10^{-2} \text{ m} = 4 \text{ cm}$$

19. Answer (4)

Hint: Velocity after collision is $v = eu$

Sol.: After collision $v = eu = 0.5(4) = 2 \text{ m/s}$

$$|\vec{v}_A| = |\vec{v}_B| = 2 \text{ m/s}$$

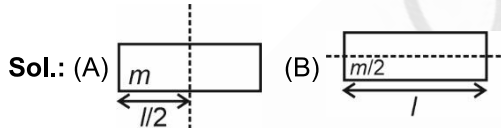
$$KE_A = \frac{1}{2}m_A v_A^2 = \frac{1}{2} \times (1) \times (2)^2 = 2 \text{ J}$$

$$KE_B = \frac{1}{2}m_B v_B^2 = \frac{1}{2} \times (1) \times (2)^2 = 2 \text{ J}$$

20. Answer (3)

Hint: Magnetic moment = Pole strength \times length

$$M = ml$$



$$M_A = \frac{ml}{2}$$

$$M_B = \frac{m}{2}l$$

$$\frac{M_A}{M_B} = \frac{1}{1}$$

21. Answer (1)

Hint: $\vec{F} = q(\vec{v} \times \vec{B})$ $\vec{F} \perp \vec{B}$

$$\vec{a} \cdot \vec{B} = 0$$

Sol.: $\vec{F} = q(\vec{v} \times \vec{B})$

$$\vec{a} \cdot \vec{B} = 0$$

$$(\hat{i} - x\hat{j}) \cdot (2\hat{i} - 4\hat{j}) = 0$$

$$2 - 4x = 0$$

$$x = 0.5 = \frac{1}{2}$$

22. Answer (2)

Hint & Sol.:

- Zener diode is used as voltage regulator.
- Photodiode is used as optical detector.
- Solar cell is used for supply power to satellites.

23. Answer (1)

Hint: Apply energy conservation

Sol.: By energy conservation

$$T.E_i = T.E_f$$

$$PE_i + KE_i = 0$$

$$-2000 + \frac{1}{2} \times 40v_e^2 = 0$$

$$20v_e^2 = 2000$$

$$v_e = 10 \text{ m/s}$$

24. Answer (1)

Hint: Use $h\nu = \phi_0 + K.E_{\text{max}}$

Sol.: As per Einstein's photoelectric equation

$$hf = \phi_0 + K.E_{\text{max}}$$

$$\frac{hf}{h} = \frac{\phi_0 + 4}{h} \times \frac{1}{2}$$

$$2\phi_0 + 2 = \phi_0 + 4$$

$$\phi_0 = 2 \text{ eV}$$

25. Answer (3)

Hint: $E_n = -\frac{13.6}{n^2} \text{ eV}$

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

Sol.: $E = -\frac{13.6}{n^2} \text{ eV}$

$$-0.85 = -\frac{13.6}{n^2}, n = 4$$

$$L = \text{angular momentum} = \frac{nh}{2\pi}$$

$$= \frac{4h}{2\pi} = \frac{2h}{\pi}$$

26. Answer (3)

Hint: For polytropic process, $C = C_v + \frac{R}{1-N}$

Sol.: $PV^N = \text{constant}$

Molar heat capacity of the gas

$$C = C_v + \frac{R}{1-N}$$

As per equation $P \propto V^{2/3}$

$$PV^{-\frac{2}{3}} = \text{Constant}$$

$$N = -\frac{2}{3}$$

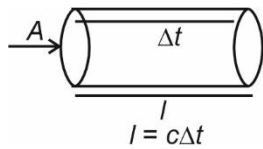
$$\therefore C = \frac{3}{2}R + \frac{R}{1 + \frac{2}{3}} = \frac{3}{2}R + \frac{3}{5}R = \frac{21R}{10}$$

27. Answer (4)

Hint: Intensity = $\frac{\text{Energy}}{\text{Area} \times \text{time}}$

Sol.: Energy density = $\frac{1}{2}\epsilon_0 E_0^2 = \frac{1}{2}\frac{B_0^2}{\mu_0}$

Intensity is energy crossing per unit area per second normally to the direction of propagation.



$$I = \frac{\frac{1}{2}\epsilon_0 E_0^2 \times \text{Volume}}{\text{Area} \Delta t}$$

$$= \frac{\frac{1}{2}\epsilon_0 E_0^2 \times A c \Delta t}{A \Delta t}$$

$$I = \frac{1}{2}\epsilon_0 E_0^2 c$$

28. Answer (2)

Hint: $\frac{E_S}{E_P} = \frac{N_S}{N_P}$

Sol.: $\frac{E_S}{E_P} = \frac{N_S}{N_P}$

$$\frac{110}{220} = \frac{50}{N_P}$$

$$N_P = 100$$

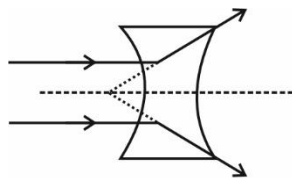
29. Answer (3)

Hint & Sol.: For formation of real image through convex lens, $d \geq 4f$

$$d = 40 \text{ cm or } 60 \text{ cm}$$

30. Answer (2)

Hint & Sol.: Concave lens is diverging lens also



Diverging spherical

31. Answer (1)

Hint: Law of Malus

$$I = I_0(\cos\theta)^2$$

Sol.: Intensity of light transmitted through analyser is

$$I' = \frac{I_0}{2} \cos^2 60^\circ = \frac{I_0}{2} \left(\frac{1}{2}\right) = \frac{I_0}{8}$$

32. Answer (3)

Hint: $L = f_o + f_e$ at normal adjustment

Sol.: Separation in case of normal adjustment

$$L = f_o + f_e = 100 + 5 = 105 \text{ cm}$$

33. Answer (1)

Hint: $\phi = \int \vec{E} \cdot d\vec{A}$

Sol.: For a closed surface in uniform electric field, net flux is zero. As input flux is equal to output flux for closed surface

34. Answer (3)

Hint: $I_{\text{rms}} = \sqrt{\frac{I_1^2 + I_2^2}{2}}$

Sol.: $I_{\text{rms}} = \sqrt{\frac{I_1^2 + I_2^2}{2}} = \sqrt{\frac{5^2 + 12^2}{2}} = \frac{13}{\sqrt{2}} \text{ A}$

35. Answer (2)

Hint: $\frac{V_{\text{immersed}}}{\text{Total volume}} = \frac{\text{Density of body}}{\text{Density of liquid}}$

Sol.: $\frac{V_{\text{immersed}}}{\text{Total volume}} = \frac{\rho_B}{\rho_L}$

$$\frac{2}{5} = \frac{\rho_B}{\rho_{\text{H}_2\text{O}}} \quad \dots(i)$$

$$\frac{3}{5} = \frac{\rho_B}{\rho_L} \quad \dots(ii)$$

$$\frac{2}{3}\rho_{\text{H}_2\text{O}} = \rho_L \Rightarrow \rho_L = \frac{2}{3} \text{ g/cm}^3$$

36. Answer (2)

Hint: Centripetal acceleration $a_c = \frac{v^2}{r}$

Sol.: $a_c = \frac{v^2}{r}$

$$a'_c = \frac{\left(\frac{v}{2}\right)^2}{\left(\frac{r}{2}\right)} = \frac{2v^2}{4r} = \frac{v^2}{2r} = \frac{a_c}{2}$$

37. Answer (1)

Hint: stopping potential $V_0 = \frac{K.E_{(Max)}}{e}$

Sol.: $KE_{(max)} = eV_0$

$$KE = h\nu - \phi_0$$

$$= 3.5 \text{ eV} - 2.4 \text{ eV}$$

$$eV_0 = 1.1 \text{ eV}$$

$$V_0 = 1.1 \text{ V}$$

38. Answer (1)

Hint: Apparent depth = $\frac{\text{Real depth}}{\mu}$

Sol.: Thickness of glass slab = $\mu[AD_1 + AD_2]$

$$= 1.5 \times [2 + 3] = 1.5 \times 5 = 7.5 \text{ cm.}$$

39. Answer (4)

Hind & Sol.: The moment of inertia of body depends on mass of the body, axis of rotation of the body, and distribution of mass of the body about axis of rotation.

40. Answer (1)

Hint: $Q = mL + mC_w\Delta T$

Sol.: $Q = mL + mC_w\Delta T$

$$= 10(80) + 10(1)(40) = 1200 \text{ cal}$$

41. Answer (3)

Hint & Sol.: Absolute pressure = Atmospheric pressure + gauge pressure

42. Answer (3)

Hint: $v = \sqrt{\frac{T}{\mu}}$

Sol.: Velocity of transverse wave in a wire is

$$v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{T}{M/L}}$$

$$300 = \sqrt{\frac{T \times 5}{5 \times 10^{-3}}}$$

$$9 \times 10^4 = \frac{T}{10^{-3}}$$

$$T = 90 \text{ N}$$

43. Answer (1)

Hint: Distance \geq |Displacement|

Sol.: If distance is zero then displacement is also zero.

44. Answer (1)

Hint: Use $v = u + gt$ and $s = ut + \frac{1}{2}gt^2$

Sol.: Distance travelled in 2 s while falling freely.

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

$$s_1 = \frac{1}{2} \times 10 \times (2)^2 = 20 \text{ m}$$

Velocity at the end of 2 s is

$$v = u + gt$$

$$10(2) = 20 \text{ m/s}$$

For remaining 60 m, time taken

$$t = \frac{60}{20} = 3 \text{ s}$$

Hence total time taken to reach ground = 2 s + 3 s = 5 s.

45. Answer (2)

Hint: For adiabatic process $PT^{\frac{\gamma}{1-\gamma}} = c$

Sol.: $P \propto T^x$

$$PT^{-x} = C$$

By comparing

$$\frac{\gamma}{1-\gamma} = -x$$

$$\gamma = \frac{C_p}{C_v} = \frac{5/2R}{3/2R} = \frac{5}{3}$$

$$\frac{5/3}{1-5/3} = -x, \quad x = \frac{5}{2}$$

[CHEMISTRY]

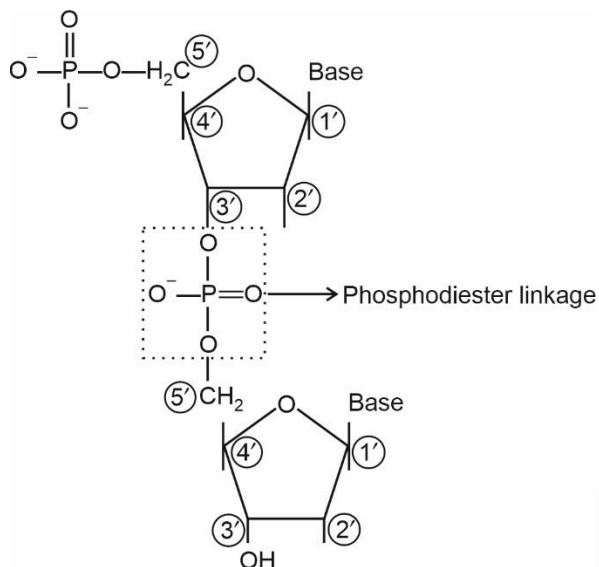
46. Answer (4)

Hint & Sol.: In aqueous phase, order of basic strength is $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N}$

47. Answer (1)

Hint: Nucleoside when linked to phosphoric acid at 5'-position of sugar moiety gives nucleotide.

Sol.:



48. Answer (2)

Hint: Work done for isothermal and reversible process is $-nRT \ln \frac{V_2}{V_1}$

Sol.: Work = $-nRT \ln \frac{V_2}{V_1}$
 $= -2 \times 8.314 \times 400 \times 2.303 \log \frac{10}{1}$

$= -15.317 \text{ kJ}$

49. Answer (2)

Hint: The shape of molecules are defined by VSEPR theory

Sol.:



Square pyramidal Trigonal pyramidal

50. Answer (2)

Hint: Values of $l = 0$ to $n - 1$

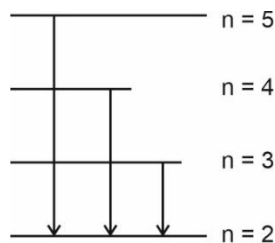
Values of $m = -l$ to $+l$

Sol.: $m \neq 2$ for $l = 1$

51. Answer (2)

Hint: Spectral lines of Balmer series lies in visible region.

Sol.: For visible lines electron falls to $n = 2$

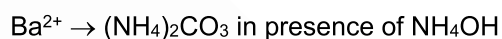
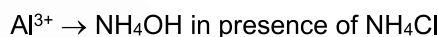


Number of visible lines = 3

52. Answer (4)

Hint: Al^{3+} belongs to group III, Ni^{2+} belongs to group IV.

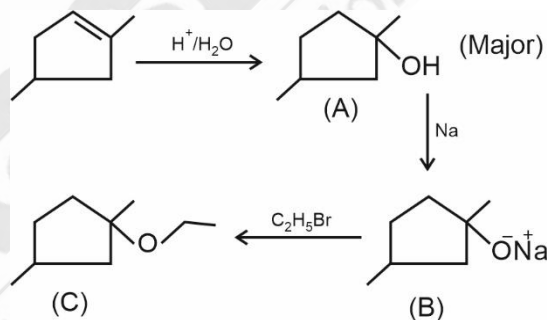
Sol.: Cations and their group reagents:



53. Answer (3)

Hint: Acid catalysed hydration of alkene passes through carbocation intermediate

Sol.:



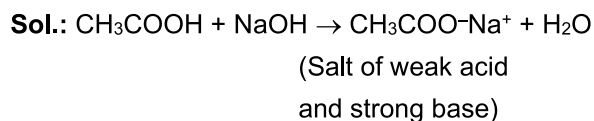
54. Answer (3)

Hint & Sol.: For hydrolysis of salt of weak acid and weak base degree of hydrolysis

$$h = \sqrt{\frac{K_w}{K_a \cdot K_b}}$$

55. Answer (1)

Hint: $pH = pK_a + \log \frac{[Salt]}{[Acid]}$ (for acidic buffer)



Millimoles	10	5	
t = t	5	—	5
conc.	$\frac{5}{150}$	—	$\frac{5}{150}$

$$\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$$

$$\text{pH} = 4.8 + \log \frac{5/150}{5/150}$$

$$\text{pH} = 4.8$$

56. Answer (3)

Hint: q and w are path functions.

Sol.: $\Delta U = q + w$; ΔU is a state function

57. Answer (3)

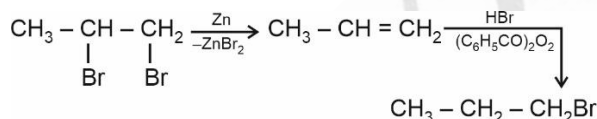
Hint: When red phosphorous is heated under high pressure, a series of phases of black phosphorous is formed

Sol.: Red phosphorous is obtained by heating white phosphorous at 573 K.

58. Answer (2)

Hint: Addition of HBr on alkene in presence of peroxide gives anti-Markovnikov addition.

Sol.:



59. Answer (4)

Hint : Molecular mass of $\text{O}_2 = 32 \text{ u}$

Sol.: Number of molecules

$$\text{of } \text{O}_2 = \frac{320}{32} = 10$$

Number of atoms of oxygen = $10 \times 2 = 20$

60. Answer (1)

Hint: Number of electrons in $\text{Ca}^{2+} = 20 - 2 = 18$

$$\text{Sol.: Number of moles of Ca^{2+} ions = $\frac{8.0 \times 10^{-3}}{40}$$$

$$= 2 \times 10^{-4}$$

Total number of electrons in Ca^{2+}

$$= 2 \times 10^{-4} \times 6.022 \times 10^{23} \times 18$$

$$= 216.792 \times 10^{19}$$

$$= 2.16 \times 10^{21}$$

61. Answer (4)

Hint: Noble gases have completely filled ns^2np^6 electronic configuration except helium ($1s^2$).

Sol.: Noble gases have positive electron gain enthalpy

62. Answer (3)

Hint: Magnetic moment $\mu = \sqrt{n(n+2)} \text{ BM}$

n = number of unpaired electron(s)

Sol.: Co^{3+} with H_2O gets d^6 (Low spin) configuration having 0 unpaired electron

Fe^{3+} with CN^- gets d^5 (Low spin) configuration having 1 unpaired electron

$$\mu = \sqrt{1(3)} = \sqrt{3} \text{ BM}$$

Fe^{2+} with H_2O (weak field ligand) gets d^6 configuration having 4 unpaired electrons,

$$\mu = \sqrt{4(6)} = \sqrt{24}$$

Mn^{2+} with H_2O gets d^5 configuration having 5 unpaired electrons

$$\mu = \sqrt{5 \times 7} = \sqrt{35}$$

63. Answer (2)

$$\text{Hint: } \frac{P^o - P_s}{P^o} = x_A$$

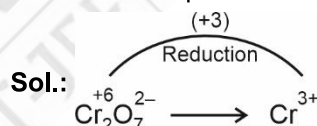
$$\text{Sol.} \frac{0.60 - 0.50}{0.60} = x_A \text{ (solute)}$$

$$x_A = \frac{0.1}{0.6} = \frac{1}{6}$$

$$\therefore x_B \text{ (solvent)} = 1 - \frac{1}{6} = \frac{5}{6}$$

64. Answer (2)

$$\text{Hint: } n \times n_F = \frac{q}{F}$$



$n_F = 6$ (for 1 mole of $\text{Cr}_2\text{O}_7^{2-}$)

$$0.5 \times 6 = \frac{q}{F}$$

$$3F = q$$

65. Answer (4)

Hint: Arrhenius equation $k = A e^{-E_a/RT}$

$$\text{Sol.} \ln k = \ln A - \frac{E_a}{RT}$$

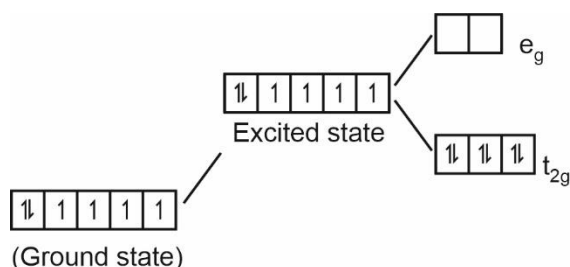
$$\log k = \log A - \frac{E_a}{2.303RT}$$

$$\text{Slope for } \log k \text{ vs } \frac{1}{T} \text{ is } \frac{-E_a}{2.303R}$$

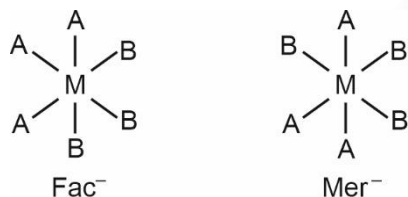
$$\frac{-E_a}{2.303R} = -11$$

$$E_a = 2.303 R \times 11$$

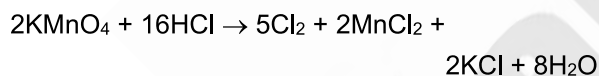
66. Answer (2)

Hint: $\text{Co}^{3+} = [\text{Ar}] 3d^6$ NH_3 will act as strong field ligand with Co^{3+} .**Sol.:**

67. Answer (1)

Hint: Tetrahedral complexes do not show geometrical isomerism because relative positions of the unidentate ligands are the same with respect to each other.**Sol.:** $[\text{MA}_3\text{B}_3]$ type complexes show geometrical isomerism.

68. Answer (4)

Hint & Sol.: The balanced chemical equation is

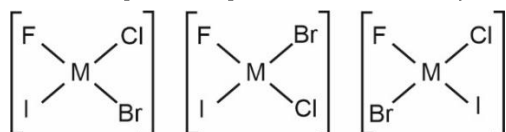
So, (c) and (d) respectively are 5 and 2

69. Answer (3)

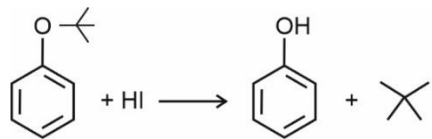
Hint & Sol.:

Compound	Boiling point
NH_3	238.5 K
PH_3	185.5 K
AsH_3	210.6 K
SbH_3	254.6 K

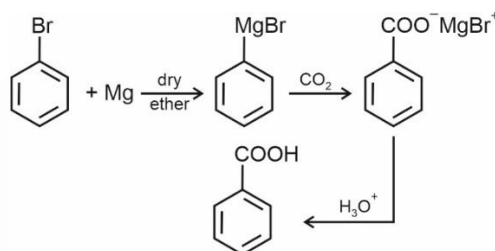
70. Answer (2)

Hint: In square planar complexes, only geometrical isomers are possible**Sol.:** For $[\text{MClBrFI}]$ three isomers are possible.

71. Answer (1)

Hint & Sol.:

72. Answer (3)

Hint: $\text{RX} + \text{Mg} \xrightarrow{\text{dry ether}} \text{RMgX}$ **Sol.:**

73. Answer (1)

Hint & Sol.:

Cr and Al do not dissolve in concentrated nitric acid because of the formation of a passive film of oxide on the surface.

74. Answer (1)

Hint: Percentage of sulphur

$$= \frac{\text{Mass of sulphur}}{\text{Mass of organic compound}} \times 100$$

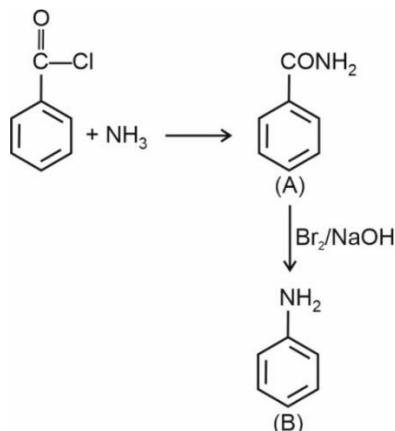
Sol.: 233 g of BaSO_4 contain 32 g of sulphur

$$0.233 \text{ g of } \text{BaSO}_4 \text{ contains } \frac{32}{233} \times 0.233$$

$$\% \text{ of sulphur} = \frac{32}{233} \times \frac{0.233}{0.4} \times 100$$

$$\% \text{ of sulphur} = 8\%$$

75. Answer (1)

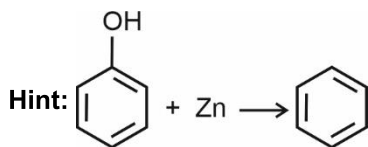
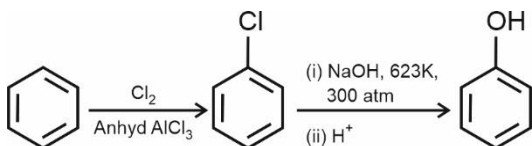
Hint & Sol.:

76. Answer (3)

Hint: NaBH₄ does not reduce the carboxyl group.**Sol.:**

- NaBH₄ reduces both aldehydes and ketones to alcohols.
- LiAlH₄ reduces carboxylic acids to primary alcohols.

77. Answer (3)

**Sol.:**

78. Answer (3)

Hint: $r_n = \frac{52.9n^2}{Z} \text{ pm}$

Sol.: $r_{\text{He}^+} = 52.9 \frac{(3)^2}{2}$ (for 3rd orbit of He⁺)

$$r_{\text{H}} = 52.9 \frac{(2)^2}{1}$$

$$\text{So, } \frac{r_{\text{He}^+}}{r_{\text{H}}} = \frac{52.9 \times (3)^2}{52.9 \times 2 \times (2)^2}$$

$$\frac{r_{\text{He}^+}}{r_{\text{H}}} = \frac{9}{8}$$

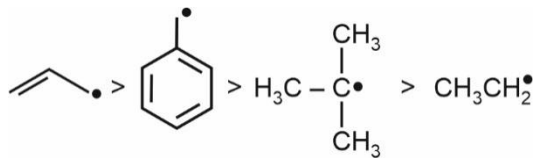
79. Answer (4)

Hint: ΔG is the net energy available to do useful work.**Sol.:** TΔS_{system} is the energy which is not available to do useful work

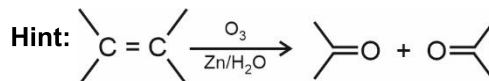
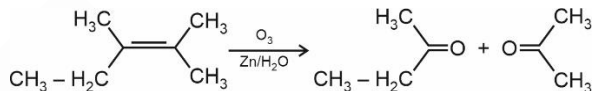
80. Answer (3)

Hint: Molecules having odd number of electrons are odd electron species**Sol.:** NO, NO₂ are odd electron species

81. Answer (3)

Hint: Allyl and benzyl radicals are stable due to resonance.**Sol.:** Order of stability is

82. Answer (2)

**Sol.:**

83. Answer (3)

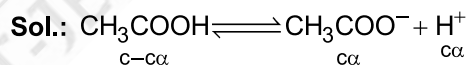
Hint & Sol.:

List-I	List-II
Epsom salt	MgSO ₄ ·7H ₂ O
Baryte	BaSO ₄
Copper pyrites	CuFeS ₂
Gypsum	CaSO ₄ ·2H ₂ O

84. Answer (3)

Hint & Sol.: NaSCN + 2Na → NaCN + Na₂S

85. Answer (1)

Hint: CH₃COOH is a weak acid, so its α << 1

$$\alpha = \sqrt{\frac{K_a}{c}} = \sqrt{\frac{1.74 \times 10^{-5}}{0.1}} = 0.0132$$

$$K_a = \alpha^2 \text{ as } \alpha \ll 1$$

$$[\text{H}^+] = \alpha c = c \sqrt{\frac{K_a}{c}} = \sqrt{K_a \cdot c}$$

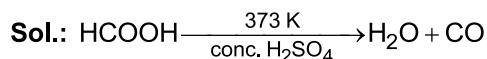
$$\text{pH} = \frac{-1}{2} (\log K_a + \log c)$$

$$\text{pH} = \frac{1}{2} (\text{p}K_a - \log c)$$

$$\text{pH} = \frac{1}{2} (4.76 - \log 10^{-1})$$

$$= \frac{1}{2} (4.76 + 1) = \frac{5.76}{2} = 2.88$$

86. Answer (3)

Hint: Conc. H₂SO₄ shows dehydration

87. Answer (2)

Hint & Sol.: Convulsions is caused by the deficiency of vitamin B₆

Scurvy is caused by the deficiency of vitamin C.

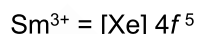
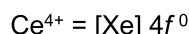
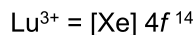
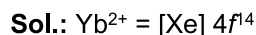
88. Answer (2)

Hint: Dipole moment = q × r**Sol.:**

Compound	Dipole moment
CH ₃ F	1.847

CH ₃ Cl	1.860
CH ₃ Br	1.830
CH ₃ I	1.636

89. Answer (3)

Hint: The ion which have unpaired electron is paramagnetic in nature.

90. Answer (2)

Hint: Cations are smaller than their parent atoms**Sol.:** Size of anion is larger than that of parent atom due to low effective nuclear charge.

[BIOLOGY]

91. Answer (3)

Hint: Prothallus is a gametophyte stage of pteridophytes.**Sol.:** Prothallus is multicellular free living, inconspicuous, small and photosynthetic gametophyte.

92. Answer (2)

Hint: *Spirogyra* and *Ulothrix*, both show isogamy.**Sol.:** *Ulothrix* has flagellated gametes and *Spirogyra* and *Polysiphonia* have non flagellated gametes. *Volvox* has flagella and shows oogamy.

93. Answer (2)

Hint: Members of Kingdom Monera are prokaryotes.**Sol.:** Most of the members of Kingdom Monera are heterotrophic in nature.

94. Answer (2)

Sol.: If one margin of the appendage overlaps that of the next one and so on, it is called twisted such as in China rose and cotton.

95. Answer (3)

Hint: The biological name of Mango is *Mangifera indica*.**Sol.:** The first word denoting the genus starts with a capital letter while the specific epithet starts with a small letter.

96. Answer (4)

Hint: Statins are blood cholesterol lowering agent produced by a fungus.**Sol.:** *Monascus purpureus* produced the statins commercially.

97. Answer (2)

Hint: Bast fibers are made up of sclerenchymatous cells.**Sol.:** Phloem fibres (bast fibres) are made up of sclerenchymatous cells and dead part of the phloem.

98. Answer (2)

Hint: Chromoplasts contain xanthophylls and carotenoids.**Sol.:** In the chromoplasts fat soluble carotenoid pigments like carotene, xanthophylls and others are present. This gives the part of the plant a yellow, orange or red colour.

99. Answer (2)

Hint: Slime moulds are non-photosynthetic.**Sol.:** Slime moulds are saprophytic protists.

100. Answer (3)

Hint: Trimerous flowers are the characteristic feature of monocot plants.**Sol.:** In *Allium cepa*, each flower has six stamens (3 + 3) and are epiphyllous

101. Answer (3)

Hint : Hilum is the junction between ovule and funicle.

Sol. : Opposite to the micropylar and that represents the basal part of ovule is called chalaza.

Funicle is the stalk of ovule. Nucellus is enclosed within the integuments and forms the body of ovule.

102. Answer (1)

Hint: In comparison between C_3 and C_4 cycle, regeneration of PEP from C_3 acid requires 2 ATP in C_4 cycle.

Sol.: There is no net gain or loss of $NADPH_2$ in C_4 cycle.

103. Answer (3)

Hint: It can be transmitted from parents to the offspring when both the partners are carrier for the gene (or heterozygous).

Sol.: Sickle-cell anaemia is an autosome-linked recessive disease. The mutated gene Hb^s causes one change in amino acid sequence of β -chain of haemoglobin. It replaces glutamic acid present at 6th position by valine.

104. Answer (3)

Hint: *Cis* and *trans* faces of a Golgi apparatus are interconnected.

Sol.: Vesicles are discharged from *trans* face of the Golgi apparatus.

105. Answer (2)

Hint: Mitochondria are semiautonomous cell organelles as they can synthesize some of their own proteins.

Sol.: Mitochondria can synthesize their proteins because they have DNA, RNA, ribosomes and components required for protein synthesis.

106. Answer (1)

Hint: Skin acts as the aquatic respiratory structure.

Sol.: Frogs respire on land and in water by two different methods. In water, skin acts as the aquatic respiratory organ (cutaneous respiration). Dissolved oxygen in the water is exchanged through the skin by diffusion.

On land, the buccal cavity (buccopharyngeal respiration), skin and lungs (pulmonary respiration) act as the respiratory organs.

Tadpoles mainly perform branchial respiration.

107. Answer (4)

Hint: Identify a phospholipid

Sol.: In lecithin, fatty acids are linked to glycerol via ester bonds. In nucleosides (eg. Adenosine), nitrogenous base is linked to sugar by N-glycosidic bond. Glycerol is trihydroxy propane; it does not contain any ester bond.

Haemoglobin is a protein molecule and it contains peptide bonds.

108. Answer (3)

Hint: Functional residual capacity

Sol.: Volume of air that will remain in the lungs after a normal expiration is known as functional residual capacity (FRC). It includes expiratory reserve volume and residual volume i.e. $ERV + RV$ (2100 – 2300 mL).

- $TV + IRV + ERV =$ Vital capacity
[4000 – 4600 mL]
- $TV + IRV + RV + ERV =$ Total lung capacity
[5100 – 5800 mL]
- $TV + IRV =$ Inspiratory capacity
[3000 – 3500 mL]

109. Answer (3)

Hint: Less than the per cent weight of nitrogen in humans

Sol.:

Element	% Weight of	
	Earth's crust	Human body
Hydrogen (H)	0.14	0.5
Carbon (C)	0.03	18.5
Oxygen (O)	46.6	65.0
Nitrogen (N)	very little	3.3
Sulphur (S)	0.03	0.3
Sodium (Na)	2.8	0.2
Calcium (Ca)	3.6	1.5
Magnesium (Mg)	2.1	0.1
Silicon (Si)	27.7	negligible

110. Answer (2)

Hint: Similar to what happens to 'I' bands during muscle contraction

Sol.: The 'Z' line attached to actins are pulled inwards, thereby causing a shortening of sarcomere, *i.e.*, contraction. During contraction, the 'I' bands get reduced, whereas the 'A' bands retain its length. The length of 'H' zone also decreases during muscle contraction.

111. Answer (3)

Hint: Includes universal donors.

Sol.: B^{-ve} individuals can receive blood from B^{-ve} and O^{-ve} blood group individuals.

Rh^{-ve} blood group individuals can receive blood only from Rh^{-ve} blood group individuals.

Blood Group	Antigens on RBCs	Antibodies in Plasma	Donor's Group
A	A	anti-B	A, O
B	B	anti-A	B, O
AB	A, B	nil	AB, A, B, O
O	nil	anti-A, B	O

112. Answer (3)

Hint: ADH prevents diuresis

Sol.: ADH/vasopressin acts at kidney and stimulates reabsorption of water and Na⁺ from latter parts of the distal tubules. It reduces loss of water through urine.

An excessive loss of fluid from the body can activate osmoreceptors which stimulate the hypothalamus to release vasopressin from the neurohypophysis.

113. Answer (2)

Hint: Counter current mechanism.

Sol.: Mammals have the ability to produce a concentrated urine. The Henle's loop and vasa recta play a significant role in this.

The proximity between the Henle's loop and vasa recta, as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium.

Bowman's capsule is associated with the process of ultrafiltration.

114. Answer (4)

Hint: Ribs that do not articulate directly with sternum.

Sol.: 8th, 9th and 10th pairs of ribs (six ribs) are vertebrochondral ribs; also known as false ribs.

Number of thoracic vertebrae = 12

Coxal bones = 2

Z-lines in one sarcomere = 2

Total number of bones present in both the girdles = 6 (Pectoral – 4; Pelvic – 2)

115. Answer (1)

Hint: Located in the portion of brain where corpora quadrigemina is also present

Sol.: The midbrain serves as the connection between the pons and the diencephalon. A canal called the cerebral aqueduct passes through the midbrain.

Cerebrum is a part of forebrain.

Pons, medulla oblongata and midbrain form the brain stem.

116. Answer (1)

Hint: Phragmoplast is formed by the Golgi complex and grows centrifugally to form cell plate during cytokinesis in plant cells.

Sol.: Cell plate formation starts at the centre of the cell and grows outward towards the lateral walls, dividing the plant cell into two halves. For cytokinesis in animal cells, furrow in plasma membrane starts from periphery and then moves inward.

117. Answer (1)

Hint: *Penicillium* belongs to the family Ascomycetes and its members exhibit dikaryophase during sexual reproduction.

Sol.: *Rhizopus* belongs to Phycomycetes. In members of Phycomycetes, plasmogamy is immediately followed by karyogamy and thus dikaryophase is not observed.

118. Answer (3)

Hint: Net primary productivity is the available biomass for next trophic level.

Sol.: As per law of 10% energy flow, only 10% energy transfers from one trophic level to another trophic level.

Given,

$$\text{Producer} = 2 \text{ kJ} = 2 \times 1000 = 2000 \text{ joule}$$

↓

$$\text{Primary consumer} = \frac{2000 \times 10}{100} = 200 \text{ joule}$$

↓

$$\text{Secondary consumer} = \frac{200 \times 10}{100} = 20 \text{ joule}$$

↓

$$\text{Tertiary consumer} = \frac{20 \times 10}{100} = 2 \text{ joule}$$

119. Answer (3)

Hint: Formation of interzonal fibres occurs in this stage.

Sol.: During anaphase, chromosomes move away from the equatorial plate. The centromere of the daughter chromosome moves towards the pole and arms of chromosome trail behind. The anaphase ends when the chromosomes reach the poles. It is the best stage to study the shape of chromosomes.

120. Answer (1)

Hint: Photorespiration is a process which involves the loss of fixed carbon as CO_2 in plants in the presence of light.

Sol.: In C_4 plant, photorespiration does not occur. This is because these plants have a mechanism that increases the concentration of CO_2 at the enzyme site.

121. Answer (2)

Hint: First stable product of the C_3 pathway is a 3 - carbon compound.

Sol.: In C_3 plants, first stable product of CO_2 fixation is 3-phosphoglycerate.

122. Answer (3)

Hint: RQ is the ratio of the volume of CO_2 evolved to the volume of O_2 consumed in respiration.

Sol.:

Substrate	RQ Value
(i) Carbohydrates	= 1
(ii) Protein	= 0.9
(iii) Oxalic acid	= 4
(iv) Malic acid	= 1.33

123. Answer (4)

Hint: Ethylene is a gaseous hormone. Flowering and fruit set up are synchronised by ethylene in pineapples.

Sol.: Apical dominance is the phenomenon by which the presence of apical bud does not allow the nearby lateral or axillary buds to grow. Apical bud secretes auxin which inhibits the growth of lateral buds.

Ethylene is used in fruit ripening, breaking of dormancy and sex expression.

124. Answer (4)

Hint: Hydrophily is a type of pollination in which water acts as a pollinating agent.

Sol.: *Hydrilla*, *Vallisneria* and sea grass are pollinated by water.

In a majority of aquatic plants, the flowers emerge above the level of water and are pollinated by insects or wind.


Water hyacinth and water lily are pollinated by insects.

125. Answer (2)


Hint: In some cereals, pollen grains lose viability within 30 minutes of their release.


Sol.: *Parthenium* or carrot grass came into India as a contaminant with imported wheat.

126. Answer (3)

Hint:  This symbol of pedigree represents five unaffected offspring.

Sol.:  – Consanguineous mating.

 – Sex unspecified

 – Parents with affected male child.

127. Answer (4)

Hint: Presence of more than two alleles for a gene is known as multiple allelism, e.g., ABO blood group in humans.

Sol.: Polygenic inheritance – Human skin color

Co-dominance – AB blood group

Flower color in snapdragon – Incomplete dominance.

128. Answer (2)

Hint: The term gene was given by Johannsen.

Sol.: Sutton united the knowledge of chromosomal segregation with Mendelian principles and called it the chromosomal theory of inheritance.

- Experimental verification of the chromosomal theory of inheritance was given by T.H. Morgan.
- Punnett square was developed by a British geneticist, Reginald C. Punnett.

129. Answer (3)

Hint: Human genome has 3.3×10^9 bp

Sol.: Lambda (λ) phage – 48502 base pairs.

$\phi \times 174$ bacteriophage – 5386 bases

E. coli – 4.6×10^6 bp

130. Answer (3)

Hint: As per Chargaff's rule

Amount of purine = Amount of pyrimidine

Sol.:

Given:

Adenine = 20%

Thymine = 20% ($\because A = T$)

Cytosine = x

Guanine = x

$A + T + x + x = 100\%$

$A + T + 2x = 100\%$

$2x = 100 - 40\%$

$2x = 60\%$

$x = 30\%$

So, Cytosine = Guanine = 30%

131. Answer (3)

Hint: Stimulates the release of bile juice.

Sol.: Secretin acts on the exocrine pancreas and stimulates secretion of water and bicarbonate ions. CCK acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juice, respectively.

ANF can cause vasodilation (dilation of blood vessels) and thereby decreases the blood pressure.

132. Answer (1)

Hint: Conversion of glucose to glycogen

Sol.: Glucocorticoids stimulate gluconeogenesis, lipolysis and proteolysis; and inhibit cellular uptake and utilisation of amino acids.

They are secreted from the adrenal cortex.

Insulin stimulates glycogenesis.

133. Answer (3)

Hint: An annelid

Sol.: Annelids possess longitudinal and circular muscles which help in locomotion.

Their neural system consists of paired ganglia connected by lateral nerves to a double ventral nerve cord. *Pennatula* and *Pleurobrachia* do not exhibit segmentation.

Organisms	Phylum
<i>Pheretima</i>	Annelida
<i>Petromyzon</i>	Chordata
<i>Pennatula</i>	Cnidaria
<i>Pleurobrachia</i>	Ctenophora

134. Answer (3)

Hint: *Cla* I site does not contain any antibiotic resistance gene.

Sol.: At *Cla* I site, *amp^R* or *tet^R* gene is not present, so non-recombinants or recombinants, all can grow in the medium containing ampicillin and tetracycline antibiotics, as they still contain resistance genes against these antibiotics.

135. Answer (2)

Hint: Neanderthal man used hides to protect their body.

Sol.: Two mya, *Australopithecines* probably lived in East African grasslands. Evidence shows they hunted with stone weapons but essentially ate fruit.

The Neanderthal man lived in near east and central Asia between 1,00,000 – 40,000 years back. They used hides to protect their body and buried their dead.

136. Answer (2)

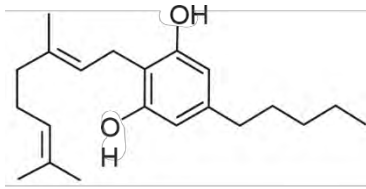
Hint: Deoxygenated blood

Sol.: pO_2 in systemic veins = 40 mm Hg

pCO_2 in systemic arteries = 40 mm Hg

Normal expiration is a passive process as external inter-costal muscles and diaphragm relax during this process.

137. Answer (3)

Hint: Its receptors are principally present in brain.**Sol.:**

Skeletal structure of cannabinoid molecule

Cannabinoids are abused by some sportsperson. Barbiturates, benzodiazepines, amphetamines help patients cope with mental illness like depression and insomnia.

Morphine is an effective sedative and painkiller and is very useful in patients who have undergone surgery.

Natural cannabinoids are obtained from the inflorescences of the plant *Cannabis sativa*.

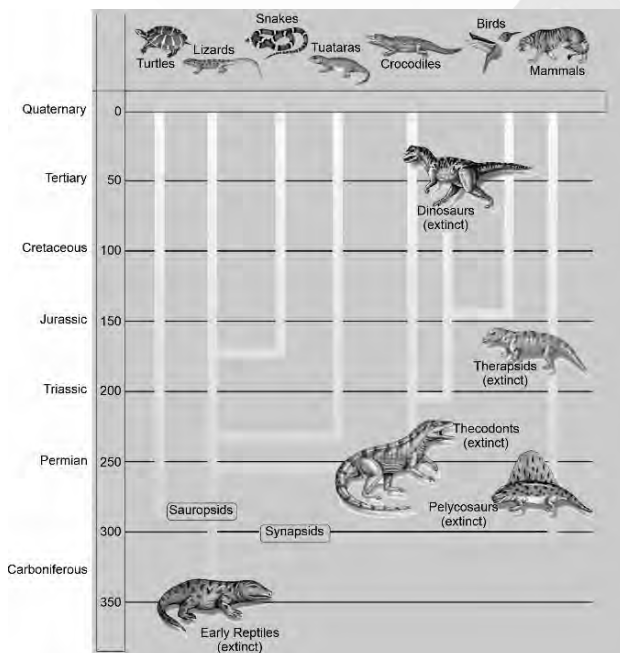
The flower tops, leaves and the resin of cannabis plant are used in various combinations to produce marijuana, hashish, charas and ganja.

Heroin is chemically diacetylmorphine.

138. Answer (1)

Hint: Pelycosaurs evolved from synapsids.

Sol.: The rate of appearance of new forms is linked to the life cycle or the life span. Microbes that divide fast have the ability to multiply and become millions of individuals within hours.



139. Answer (1)

Hint: Hormone also secreted by ovary**Sol.:** Hormones involved in the parturition are:-

- (a) Cortisol
- (b) Estrogen
- (c) Oxytocin

Cortisol is released from the adrenal cortex and oxytocin is released from pars nervosa. Estrogen is secreted by placenta.

hCG is also secreted by placenta but it does not participate in foetal ejection reflex.

Levels of thyroxine increase in blood during pregnancy.

140. Answer (4)

Hint: Inhibit both ovulation and implantation

Sol.: Except for genital herpes, hepatitis-B and AIDS, all sexually transmitted diseases are completely curable, if detected early and treated properly.

Steroidal oral contraceptive pills have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle.

Vaults are reusable and they are inserted into the female reproductive tract to cover the cervix during coitus.

Steroidal oral contraceptive pills, implants and contraceptive injections, all of them contain either progestogens or progestogen-estrogen combinations.

They all inhibit ovulation and implantation as well as alter the quality of cervical mucus.

141. Answer (3)

Hint: Feature of bony fishes

Sol.: Osteichthyes include both marine and fresh water fishes with bony endoskeleton. Their body is streamlined. Mouth is mostly terminal. They have four pairs of gills which are covered by an operculum on each side. Their skin is covered with cycloid/ctenoid scales.

In the members of the class Chondrichthyes, placoid scales are present. In males, pelvic fins bear claspers. Their endoskeleton is composed of cartilage.

142. Answer (4)

Hint: Few components of PCR master mix are DNA polymerase + dNTPs, etc.

Sol.: In PCR, multiple copies of gene (or DNA) of interest are synthesised *in vitro* using two sets of primers and the enzyme DNA polymerase.

- PCR is employed for early diagnosis of various diseases. It is also used to detect HIV.
- PCR involves 3 steps :

(a) Denaturation

(b) Annealing

(c) Extension

The extension step of PCR involves enzyme DNA polymerase and deoxynucleotides (dNTPs).

During PCR, in the annealing step, two sets of primers bind to their complementary template strands of DNA.

143. Answer (2)

Hint: Interchain disulphide bonds

Sol.: In a monomeric antibody molecule, number of disulphide bonds present between the heavy and light chains = 2

Types of barriers associated with innate immunity = 4

Number of ssRNA molecules in HIV genome = 2

Number of chambers in human heart = 4

Types of antibodies produced in the human body = 5 (IgG, IgA, IgM, IgD, IgE)

144. Answer (4)

Hint: Transposons are also called jumping genes.

Sol.:

1. Adenosine deaminase deficiency – Can be treated by gene therapy
2. Emphysema – α -1-antitrypsin
3. Transposons – Mobile genetic elements that replicate via an RNA intermediate.
4. RNAi – Cellular defence seen in eukaryotes

145. Answer (2)

Hint: Identify ctenophore and coelenterate.

Sol.: Ctenophores and cnidarians are radially symmetrical, diploblastic and acoelomate animals.

- *Locusta*, *Culex* and *Limulus* are arthropods and are bilaterally symmetrical.
- *Asterias* and *Cucumaria* (echinoderms)- Adult forms are radially symmetrical but larvae are bilaterally symmetrical.
- *Ascaris* (Aschelminthes) – Bilaterally symmetrical, triploblastic and pseudocoelomate.

146. Answer (3)

Hint: Nephron is also known as uriniferous tubules.

Sol.: In cockroaches, urecose glands, fat body and nephrocytes perform excretion. Nephrons are not present in cockroaches.

Malpighian tubules absorb nitrogenous waste products and convert them into uric acid which is excreted out through the hindgut.

147. Answer (3)

Hint: Hindbrain contains medulla oblongata and cerebellum.

Sol.: In *Rana tigrina*, pons is not present; only cerebellum and medulla oblongata are present in the hindbrain.

In frogs, a special venous connection exists between kidney and lower parts of the body. It is called the renal portal system.

Their RBCs are nucleated and carry haemoglobin. They have a bilobed tongue.

148. Answer (1)

Hint: Secondary immune response is also known as anamnestic response.

Sol.: The secondary or anamnestic response is highly intensified. This is due to the fact that our body has memory of the first encounter with the same pathogen.

149. Answer (2)

Hint: Primary structure of a protein is represented by a straight line.

Sol.: In proteins, the monomeric units are joined to each other by peptide bonds. Thus, this bond will be present in all the four different structural levels of protein.

The primary structure of protein is composed of a linear chain of amino acids; thus hydrogen bond is not necessarily present in the primary structure of a protein. Whereas, the secondary or tertiary structures contain regions of amino acid chains that are stabilized by hydrogen bonds.

Hydrogen bonds stabilise the α -helix and β -pleated sheet structure.

150. Answer (2)

Hint: Cardiac output = Stroke volume \times Heart beat

Sol.: Cardiac output = Stroke volume \times Heart beat

6.4 L/min = SV \times 80 beats/min

$$SV = \frac{6.4 \times 1000 \text{ mL/min}}{80 \text{ beats/min}}$$

$$= \frac{6400 \text{ mL/min}}{80 \text{ beats/min}}$$

Stroke volume = 80 mL

151. Answer (2)

Hint: Work oppositely

Sol.: As urine gets filled in the bladder, the stretch receptors present on the walls of the bladder send signals to the CNS.

The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

152. Answer (1)

Hint: Does not include energy currency of cell

Sol.: Hormones that interact *via* membrane-bound receptors generate second messengers such as cAMP, IP₃, Ca²⁺, etc.

ATP does not act as the second messenger.

153. Answer (3)

Hint: TCT is antagonistic to PTH.

Sol.: Hypothalamus

↓

Releases TRH

↓

Acts on adenohypophysis

↓

Releases TSH

↓

Acts on thyroid gland

↓

Secretes T₃, T₄

↓

Controls BMR; stimulate erythropoiesis, etc.

154. Answer (4)

Hint: Identify an arthropod

Sol.: *Anopheles* is an arthropod and it has an open circulatory system.

Fishes (*Trygon*), amphibians (*Hyla*) and reptiles (*Alligator*) have a closed circulatory system.

155. Answer (3)

Hint: Only sexual reproduction occurs in ctenophores.

Sol.: *Pleurobrachia* is a ctenophore and only sexual reproduction occurs in it.

Hemichordates (*Balanoglossus*) have a rudimentary structure in the collar region called stomochord, a structure similar to notochord.

156. Answer (3)

Hint: Euchromatin is the loosely packed chromatin.

Sol.: In prokaryotes, the DNA in nucleoid is organised in large loops held by proteins.

Both the amino acid residues, lysine and arginine carry positive charges in their side chain.

157. Answer (3)

Hint: Pith is not well developed in the roots of dicot plants.

Sol.: In dicot leaf, mesophyll is differentiated into two types of tissues, palisade and spongy parenchyma.

158. Answer (2)

Hint: Parasites have evolved high reproductive capacity.

Sol.: Presence of adhesive organs or suckers to cling onto the host is one of the adaptations shown by parasites.

159. Answer (1)

Hint: African catfish, *Clarias gariepinus*, for aquaculture purposes is posing a threat to the indigenous catfish in our rivers.

Sol.: Over-exploitation of a particular species reduces the size of its population to an extent so that it becomes vulnerable to extinction. Steller's sea cow has become extinct due to overexploitation by humans.

160. Answer (1)

Hint: Species diversity refers to the variety of species within a region.

Sol.: Western Ghats have greater amphibian species diversity as compared to Eastern Ghats.

161. Answer (3)

Hint: Anthropogenic ecosystem or man-made ecosystem is the one which is created and maintained by human beings, e.g., crop field.

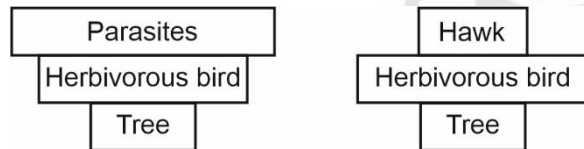
Sol.: Characteristics of anthropogenic ecosystem are as follows:

- (i) High productivity
- (ii) Simple food chain
- (iii) Lack of self-regulatory mechanism

162. Answer (4)

Hint: Pyramid of number in a grassland ecosystem is upright.

Sol.: Pyramid of number in a tree ecosystem may be inverted or spindle shaped.



163. Answer (1)

Hint: White rust of crucifers is caused by *Albugo candida*. *Xanthomonas citri* causes citrus canker.

Sol.:

- Early blight of potato – *Alternaria solani*
- Late blight of potato – *Phytophthora infestans*
- Loose smut of wheat – *Ustilago nuda*

164. Answer (1)

Hint: Phylogenetic classification systems are based on evolutionary relationships between the various organisms.

Sol.: Artificial systems involve the usage of few morphological characters for grouping of organisms.

165. Answer (3)

Hint: The C₃ and C₄ plants respond differently to CO₂ concentration. The latter show photosynthetic saturation at about 360 μl L⁻¹.

Sol.: Light duration does not affect the rate of photosynthesis.

166. Answer (1)

Hint: Mendel had selected 7 contrasting characters such as, seed colour and seed shape.

Sol.: Flower color and flower position was selected by Mendel.

167. Answer (3)

Hint: 18S rRNA is synthesised by RNA polymerase I.

Sol.: RNA polymerase I synthesises 5.8S, 18S and 28S rRNA.

168. Answer (4)

Hint: Ladybird, a beetle with red and black marking, is useful in controlling aphids.

Dragonflies are useful to get rid of mosquitoes

Sol.: *Aulosira* is non-symbiotic N₂ fixer of rice field.

Oscillatoria adds organic matter to the soil, increases its fertility and reduces the alkalinity of soil.

169. Answer (2)

Hint: Barnacles growing on the back of a whale benefits in the form of shelter. Whale remains unaffected.

Sol.: Protocooperation is an association between individuals of two species, each of which is benefitted by the presence of other but can live equally well without association.

170. Answer (3)

Sol.: The integral form of exponential growth equation is $N_t = N_0 \cdot e^{rt}$

Where, N_t = population density after time t

N_0 = Population density at time zero

e = The base of natural logarithms

171. Answer (3)

Hint: Steroidal hormone

Sol.: Estrogen peaks twice during the menstrual cycle in human females.

Progesterone stimulates the formation of mammary alveoli and milk secretion.

LH maintains the corpus luteum, formed from the remnants of the Graafian follicles after ovulation.

Testosterone produces anabolic effects on protein and carbohydrate metabolism in males.

172. Answer (2)

Hint: Number of cells increase but total cell mass remains constant upto morula stage.

Sol.: In humans, the size of zygote is equal to size of morula. During cleavage (occurs after the zygote is formed), the size of blastomeres keeps on decreasing, as there is no growth of blastomeres.

173. Answer (4)

Hint: End of contraction

Sol.: P-wave – Represents depolarisation of atria
QRS complex – Represents depolarisation of ventricles

T-wave – Represents repolarisation of ventricles

End of T-wave – Marks the end of ventricular systole

174. Answer (1)

Hint: Does not allow any movement

Sol.:

Fibrous joint – Between temporal and sphenoid bones of cranium

Ball and socket joint – Between humerus and pectoral girdle

Saddle joint – Between carpal and metacarpal of thumb

Pivot Joint – Between atlas and axis

175. Answer (3)

Hint: One dendrite is present in the retina of eye.

Sol.: Unipolar neurons have only one axon with a cell body but no dendrite. It is present in the embryonic stage of humans.

Transmission of an impulse across electrical synapses is very similar to impulse conduction along a single axon.

When a neuron is not conducting any impulse, the axonal membrane is comparatively more permeable to K^+ and nearly impermeable to Na^+ .

176. Answer (2)

Hint: Concentric rings are present in bones.

Sol.: The intercellular material of cartilage is solid and pliable and resists compression. Cells of this tissue (chondrocytes) are enclosed in small cavities (lacunae) within the matrix secreted by them.

Lamellae are absent in cartilage but present in bones. Collagen fibres are present in both bones and cartilage.

177. Answer (3)

Hint: Binding of O_2 with haemoglobin is primarily related to pO_2 .

Sol.: In tissues, low pO_2 , high pCO_2 , high H^+ concentration and higher temperature are favourable for the dissociation of oxygen from the oxyhaemoglobin.

178. Answer (3)

Hint: Haemodialysis is used for such patients.

Sol.:

Myasthenia gravis	–	Auto-immune disorder affecting neuromuscular junction leading to fatigue and paralysis of skeletal muscle
Heart attack	–	When heart muscle is suddenly damaged by an inadequate blood supply
Asthma	–	Difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles

179. Answer (3)

Hint: Lays eggs

Sol.: *Chelone* belongs to the class Reptilia. Reptiles are oviparous with direct development.

Betta belongs to class Osteichthyes.

Delphinus is a mammal.

Hyla is an amphibian.

180. Answer (4)

Hint: Reads the same when orientation of reading is same for both strands.

Sol.: The sequences reads the same on the two strands in $5' - 3'$ direction. A binds with T and G binds with C.



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Test Date : 20/04/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint: For adiabatic process $PT^{\frac{\gamma}{1-\gamma}} = c$

Sol.: $P \propto T^x$

$$PT^{-x} = C$$

By comparing

$$\frac{\gamma}{1-\gamma} = -x$$

$$\gamma = \frac{C_P}{C_V} = \frac{5/2R}{3/2R} = \frac{5}{3}$$

$$\frac{5/3}{1-5/3} = -x, \quad x = \frac{5}{2}$$

2. Answer (1)

Hint: Use $v = u + gt$ and $s = ut + \frac{1}{2}gt^2$

Sol.: Distance travelled in 2 s while falling freely.

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

$$s_1 = \frac{1}{2} \times 10 \times (2)^2 = 20 \text{ m}$$

Velocity at the end of 2 s is

$$v = u + gt$$

$$10(2) = 20 \text{ m/s}$$

For remaining 60 m, time taken

$$t = \frac{60}{20} = 3 \text{ s}$$

Hence total time taken to reach ground

$$= 2 \text{ s} + 3 \text{ s} = 5 \text{ s.}$$

3. Answer (1)

Hint: Distance \geq |Displacement|

Sol.: If distance is zero then displacement is also zero.

4. Answer (3)

Hint: $v = \sqrt{\frac{T}{\mu}}$

Sol.: Velocity of transverse wave in a wire is

$$v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{T}{M/L}}$$

$$300 = \sqrt{\frac{T \times 5}{5 \times 10^{-3}}}$$

$$9 \times 10^4 = \frac{T}{10^{-3}}$$

$$T = 90 \text{ N}$$

5. Answer (3)

Hint & Sol.: Absolute pressure = Atmospheric pressure + gauge pressure

6. Answer (1)

Hint: $Q = mL + mC_w\Delta T$

$$\begin{aligned} \text{Sol.} \quad Q &= mL + mC_w\Delta T \\ &= 10(80) + 10(1)(40) = 1200 \text{ cal} \end{aligned}$$

7. Answer (4)

Hind & Sol.: The moment of inertia of body depends on mass of the body, axis of rotation of the body, and distribution of mass of the body about axis of rotation.

8. Answer (1)

Hint: Apparent depth = $\frac{\text{Real depth}}{\mu}$

$$\begin{aligned} \text{Sol.} \quad \text{Thickness of glass slab} &= \mu[AD_1 + AD_2] \\ &= 1.5 \times [2 + 3] = 1.5 \times 5 = 7.5 \text{ cm.} \end{aligned}$$

9. Answer (1)

Hint: stopping potential $V_0 = \frac{K.E_{(\text{Max})}}{e}$

$$\text{Sol.} \quad KE_{(\text{max})} = eV_0$$

$$KE = h\nu - \phi_0$$

$$= 3.5 \text{ eV} - 2.4 \text{ eV}$$

$$eV_0 = 1.1 \text{ eV}$$

$$V_0 = 1.1 \text{ V}$$

10. Answer (2)

Hint: Centripetal acceleration $a_c = \frac{v^2}{r}$

$$\text{Sol.} \quad a_c = \frac{v^2}{r}$$

$$a_c = \frac{\left(\frac{v}{2}\right)^2}{\left(\frac{r}{2}\right)} = \frac{2v^2}{4r} = \frac{v^2}{2r} = \frac{a_c}{2}$$

11. Answer (2)

Hint: $\frac{V_{\text{immersed}}}{\text{Total volume}} = \frac{\text{Density of body}}{\text{Density of liquid}}$

Sol.: $\frac{V_{\text{immersed}}}{\text{Total volume}} = \frac{\rho_B}{\rho_L}$

$\frac{2}{5} = \frac{\rho_B}{\rho_{\text{H}_2\text{O}}}$... (i)

$\frac{3}{5} = \frac{\rho_B}{\rho_L}$... (ii)

$\frac{2}{3} \rho_{\text{H}_2\text{O}} = \rho_L \Rightarrow \rho_L = \frac{2}{3} \text{ g/cm}^3$

12. Answer (3)

Hint: $I_{\text{rms}} = \sqrt{\frac{I_1^2 + I_2^2}{2}}$

Sol.: $I_{\text{rms}} = \sqrt{\frac{I_1^2 + I_2^2}{2}} = \sqrt{\frac{5^2 + 12^2}{2}} = \frac{13}{\sqrt{2}} \text{ A}$

13. Answer (1)

Hint: $\phi = \int \vec{E} \cdot d\vec{A}$

Sol.: For a closed surface in uniform electric field, net flux is zero. As input flux is equal to output flux for closed surface

14. Answer (3)

Hint: $L = f_o + f_e$ at normal adjustment

Sol.: Separation in case of normal adjustment

$L = f_o + f_e = 100 + 5 = 105 \text{ cm}$

15. Answer (1)

Hint: Law of Malus

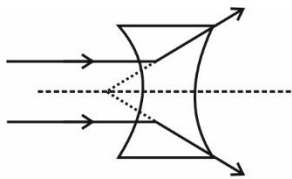
$I = I_o(\cos\theta)^2$

Sol.: Intensity of light transmitted through analyser is

$I' = \frac{I_o}{2} \cos^2 60^\circ = \frac{I_o}{2} \left(\frac{1}{4}\right) = \frac{I_o}{8}$

16. Answer (2)

Hint & Sol.: Concave lens is diverging lens also



Diverging spherical

17. Answer (3)

Hint & Sol.: For formation of real image through convex lens, $d \geq 4f$
 $d = 40 \text{ cm}$ or 60 cm

18. Answer (2)

Hint: $\frac{E_S}{E_P} = \frac{N_S}{N_P}$

Sol.: $\frac{E_S}{E_P} = \frac{N_S}{N_P}$

$\frac{110}{220} = \frac{50}{N_P}$

$N_P = 100$

19. Answer (4)

Hint: Intensity = $\frac{\text{Energy}}{\text{Area} \times \text{time}}$

Sol.: Energy density = $\frac{1}{2} \epsilon_0 E_0^2 = \frac{1}{2} \frac{B_0^2}{\mu_0}$

Intensity is energy crossing per unit area per second normally to the direction of propagation.



$I = \frac{1}{2} \epsilon_0 E_0^2 \times \text{Volume}$

$I = \frac{\frac{1}{2} \epsilon_0 E_0^2 \times \text{Volume}}{\text{Area} \Delta t}$

$= \frac{\frac{1}{2} \epsilon_0 E_0^2 \times A c \Delta t}{A \Delta t}$

$I = \frac{1}{2} \epsilon_0 E_0^2 c$

20. Answer (3)

Hint: For polytropic process, $C = C_v + \frac{R}{1-N}$

Sol.: $PV^N = \text{constant}$

Molar heat capacity of the gas

$C = C_v + \frac{R}{1-N}$

As per equation $P \propto V^{2/3}$

$PV^{-\frac{2}{3}} = \text{Constant}$

$N = -\frac{2}{3}$

$\therefore C = \frac{3}{2}R + \frac{R}{1+\frac{2}{3}} = \frac{3}{2}R + \frac{3}{5}R = \frac{21R}{10}$

21. Answer (3)

Hint: $E_n = -\frac{13.6}{n^2} \text{ eV}$

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

Sol.: $E = -\frac{13.6}{n^2} \text{ eV}$

$$-0.85 = -\frac{13.6}{n^2}, n = 4$$

$$L = \text{angular momentum} = \frac{nh}{2\pi}$$

$$= \frac{4h}{2\pi} = \frac{2h}{\pi}$$

22. Answer (1)

Hint: Use $h\nu = \phi_0 + K.E_{\text{max}}$

Sol.: As per Einstein's photoelectric equation

$$hf = \phi_0 + K.E_{\text{max}}$$

$$\frac{hf}{2} = \frac{\phi_0 + 4}{\phi_0 + 1}$$

$$2\phi_0 + 2 = \phi_0 + 4$$

$$\phi_0 = 2 \text{ eV}$$

23. Answer (1)

Hint: Apply energy conservation

Sol.: By energy conservation

$$T.E_i = T.E_f$$

$$PE_i + KE_i = 0$$

$$-2000 + \frac{1}{2} \times 40v_e^2 = 0$$

$$20v_e^2 = 2000$$

$$v_e = 10 \text{ m/s}$$

24. Answer (2)

Hint & Sol.:

- Zener diode is used as voltage regulator.
- Photodiode is used as optical detector.
- Solar cell is used for supply power to satellites.

25. Answer (1)

Hint: $\vec{F} = q(\vec{v} \times \vec{B}) \vec{F} \perp \vec{B}$

$$\vec{a} \cdot \vec{B} = 0$$

Sol.: $\vec{F} = q(\vec{v} \times \vec{B})$

$$\vec{a} \cdot \vec{B} = 0$$

$$(\hat{i} - x\hat{j}) \cdot (2\hat{i} - 4\hat{j}) = 0$$

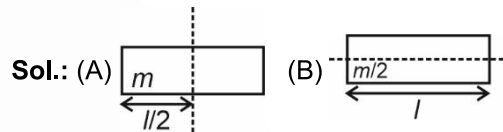
$$2 - 4x = 0$$

$$x = 0.5 = \frac{1}{2}$$

26. Answer (3)

Hint: Magnetic moment = Pole strength \times length

$$M = ml$$



$$M_A = \frac{ml}{2}$$

$$M_B = \frac{m}{2}l$$

$$\frac{M_A}{M_B} = \frac{1}{1}$$

27. Answer (4)

Hint: Velocity after collision is $v = eu$

Sol.: After collision $v = eu = 0.5(4) = 2 \text{ m/s}$

$$|\vec{v}_A| = |\vec{v}_B| = 2 \text{ m/s}$$

$$KE_A = \frac{1}{2} m_A v_A^2 = \frac{1}{2} \times (1) \times (2)^2 = 2 \text{ J}$$

$$KE_B = \frac{1}{2} m_B v_B^2 = \frac{1}{2} \times (1) \times (2)^2 = 2 \text{ J}$$

28. Answer (1)

Hint: Loss in kinetic energy = gain in potential energy

Sol.: $\frac{1}{2} M[v^2 - u^2] = \frac{1}{2} kx^2$

$$\frac{1}{2} \times 1[25 - 9] = \frac{1}{2} \times 10000x^2$$

$$16 \times 10^{-4} = x^2$$

$$x = 4 \times 10^{-2} \text{ m} = 4 \text{ cm}$$

29. Answer (4)

Hint: $M = K\sqrt{L_1 L_2}$, where K denotes coefficient of coupling

Sol.: $M = K\sqrt{L_1 L_2} \Rightarrow 6 = K \times 8 \Rightarrow K = \frac{6}{8} = \frac{3}{4}$

30. Answer (2)

Hint: $I_0 = \frac{E_0}{Z}$

$$Z = \sqrt{X_L^2 + R^2}$$

Sol.: $X_L = \omega L = 1000(4 \times 10^{-3}) = 4 \Omega$

$R = 3 \Omega$

$$Z = \sqrt{X_L^2 + R^2} = \sqrt{4^2 + 3^2} = 5 \Omega$$

$$I_0 = \frac{E_0}{Z} = \frac{10}{5} = 2 \text{ A}$$

31. Answer (2)

Hind & Sol.: Area enclosed by a hysteresis loop is a measure of energy loss per unit volume per cycle of magnetisation demagnetisation.

32. Answer (3)

Hint: End correction $e = (0.6)$ radius

Sol.: For a resonance tube

$$\text{End correction } e = \frac{l_2 - 3l_1}{2}$$

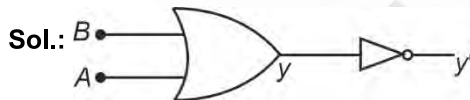
$$e = \frac{60 - 3(19.6)}{2} = 0.6$$

Now, $e = (0.6)$ radius

$$\frac{0.6}{0.6} = \text{radius} = 1 \text{ cm}$$

33. Answer (4)

Hint: $y' = \overline{A + B}$



A	B	y	y'
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

34. Answer (3)

Hint: $P_{\text{developed}} = \frac{V_{\text{applied}}^2}{R}$

Sol.: $P = \frac{V^2}{R}$

$$R = \frac{V^2}{P} = \frac{220 \times 220}{1000}$$

$$P_{\text{developed}} = \frac{V_{\text{applied}}^2}{R} = \frac{110 \times 110}{220 \times 220} \times 1000$$

Power developed = 250 W

35. Answer (2)

Hint: $M = \frac{q}{2m} L$, M is magnetic moment and L is angular momentum

$$L = mvr$$

Sol.: $M = \frac{q}{2m} L$

$$= \frac{q}{2m} m \cdot v \cdot r = \frac{q}{2m} m(\omega r)r$$

$$M = \frac{q}{2} \omega r^2$$

36. Answer (2)

Hint: Common potential $V_{\text{common}} = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$

Sol.: $V = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$

$$= \frac{20 \times 100 + 20 \times 0}{40} = 50 \text{ V}$$

37. Answer (1)

Hint: Efficiency $\eta = \frac{\text{W.D}}{\text{Input}} = \frac{Q_1 - Q_2}{Q_1}$

Sol.: Given, $Q_1 - Q_2 = \frac{1}{4} Q_2$

$$Q_1 = \frac{5}{4} Q_2$$

$$\text{Hence, } \eta = \frac{1}{4} \frac{Q_2}{Q_1} \times 100 = \frac{1}{4} \left(\frac{4}{5} \right) \times 100 = \frac{1}{5} \times 100 = 20\%$$

38. Answer (4)

Hint: Use Newton's law of cooling

$$\frac{T_1 - T_2}{\text{time}} = K \left[\frac{T_1 + T_2}{2} - T_0 \right]$$

Sol.: As per Newton's law of cooling

$$\frac{60 - 40}{10} = K \left[\frac{60 + 40}{2} - T_0 \right]$$

$$\frac{40 - 28}{10} = K \left[\frac{40 + 28}{2} - T_0 \right]$$

On solving

$$T_0 = 10^\circ \text{C}$$

39. Answer (2)

Hint: $v_{\max} = A\omega$

$$a_{\max} = \omega^2 A$$

Sol.:
$$\frac{v_{\max}}{a_{\max}} = \frac{A\omega}{\omega^2 A} = \frac{1}{\omega}$$

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

40. Answer (1)

Hint:
$$v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$$

$$v_{\text{mps}} = \sqrt{\frac{2RT}{M}}$$

Sol.:
$$\frac{v_{\text{rms}}}{v_{\text{mps}}} = \sqrt{\frac{3}{2}}$$

$$\sqrt{600} \times \frac{\sqrt{2}}{\sqrt{3}} = v_{\text{mps}}$$

$$v_{\text{mps}} = 20 \text{ m/s}$$

41. Answer (4)

Hint: Conservation of linear momentum

Sol.:
$$mv - mv' = 2mv'$$

$$v' = 0$$

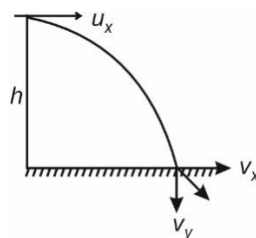
42. Answer (3)

Hint: Measurement having least percentage error is most accurate while measurement having maximum decimal resolution is most precise.**Sol.:** Among the given options 1.975 is the most accurate and precise measurement.

43. Answer (3)

Hint: $v_x = u_x + a_x t$; $v_y = u_y + a_y t$

Sol.: $v_x = u_x$, $v_y = gt$



$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 20}{10}} = 2 \text{ s}$$

$$v_x = 20 \text{ m/s}$$

$$v_y = 10(2) = 20 \text{ m/s}$$

$$\therefore \vec{v} = (20\hat{i} - 20\hat{j}) \text{ m/s}$$

44. Answer (4)

Hint: $|a\hat{i} + b\hat{j}| = \sqrt{a^2 + b^2}$

Sol.: $|\hat{i} + \hat{j}| = \sqrt{1^2 + 1^2} = \sqrt{2}$

Sum of two-unit vectors is not necessarily a unit vector.

Hence both A and R are false.

45. Answer (3)

Hint: L.C = MSD – VSD

Sol.: L.C = MSD – VSD

$$25 \text{ VSD} = 20 \text{ MSD}$$

$$1 \text{ VSD} = \frac{20}{25} \text{ MSD}$$

$$\text{Least count} = 1 \text{ MSD} - 1 \text{ VSD}$$

$$\text{L.C} = \text{MSD} - \frac{20}{25} \text{ MSD}$$

$$\text{L.C} = \text{MSD} \left[1 - \frac{20}{25} \right]$$

$$0.2 = \text{MSD} \left[\frac{1}{5} \right]$$

$$1 \text{ MSD} = 1 \text{ mm}$$

[CHEMISTRY]

46. Answer (2)

Hint: Cations are smaller than their parent atoms**Sol.:** Size of anion is larger than that of parent atom due to low effective nuclear charge.

47. Answer (3)

Hint: The ion which have unpaired electron is paramagnetic in nature.

Sol.: $\text{Yb}^{2+} = [\text{Xe}] 4f^{14}$

$$\text{Lu}^{3+} = [\text{Xe}] 4f^{14}$$

$$\text{Ce}^{4+} = [\text{Xe}] 4f^0$$

$$\text{Sm}^{3+} = [\text{Xe}] 4f^5$$

48. Answer (2)

Hint: Dipole moment = $q \times r$

Sol.:

Compound	Dipole moment
CH ₃ F	1.847
CH ₃ Cl	1.860
CH ₃ Br	1.830
CH ₃ I	1.636

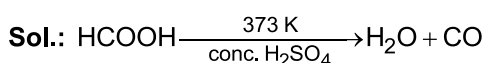
49. Answer (2)

Hint & Sol.: Convulsions is caused by the deficiency of vitamin B₆

Scurvy is caused by the deficiency of vitamin C.

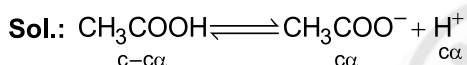
50. Answer (3)

Hint: Conc. H₂SO₄ shows dehydration



51. Answer (1)

Hint: CH₃COOH is a weak acid, so its $\alpha \ll 1$



$$\alpha = \sqrt{\frac{K_a}{c}} = \sqrt{\frac{1.74 \times 10^{-5}}{0.1}} = 0.0132$$

$$K_a = c\alpha^2 \text{ as } \alpha \ll 1$$

$$[\text{H}^+] = c\alpha = c \sqrt{\frac{K_a}{c}} = \sqrt{K_a \cdot c}$$

$$\text{pH} = \frac{-1}{2}(\log K_a + \log c)$$

$$\text{pH} = \frac{1}{2}(\text{p}K_a - \log c)$$

$$\begin{aligned} \text{pH} &= \frac{1}{2}(4.76 - \log 10^{-1}) \\ &= \frac{1}{2}(4.76 + 1) = \frac{5.76}{2} = 2.88 \end{aligned}$$

52. Answer (3)

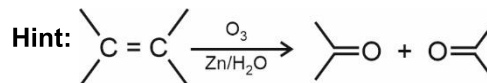
Hint & Sol.: NaSCN + 2Na → NaCN + Na₂S

53. Answer (3)

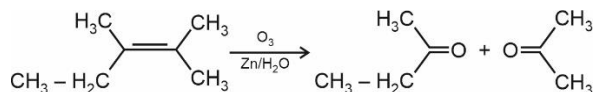
Hint & Sol.:

List-I	List-II
Epsom salt	MgSO ₄ ·7H ₂ O
Baryte	BaSO ₄
Copper pyrites	CuFeS ₂
Gypsum	CaSO ₄ ·2H ₂ O

54. Answer (2)



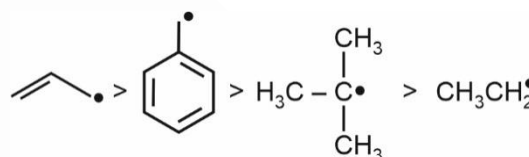
Sol.:



55. Answer (3)

Hint: Allyl and benzyl radicals are stable due to resonance.

Sol.: Order of stability is



56. Answer (3)

Hint: Molecules having odd number of electrons are odd electron species

Sol.: NO, NO₂ are odd electron species

57. Answer (4)

Hint: ΔG is the net energy available to do useful work.

Sol.: TΔS_{system} is the energy which is not available to do useful work

58. Answer (3)

$$\text{Hint: } r_n = \frac{52.9n^2}{Z} \text{ pm}$$

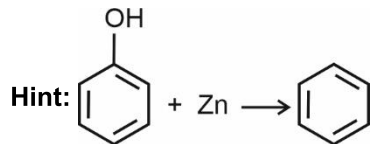
$$\text{Sol. } r_{\text{He}^+} = 52.9 \frac{(3)^2}{2} \text{ (for 3rd orbit of He}^+)$$

$$r_{\text{H}} = 52.9 \frac{(2)^2}{1}$$

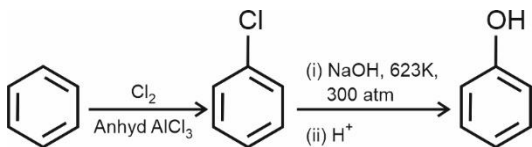
$$\text{So, } \frac{r_{\text{He}^+}}{r_{\text{H}}} = \frac{52.9 \times (3)^2}{52.9 \times 2 \times (2)^2}$$

$$\frac{r_{\text{He}^+}}{r_{\text{H}}} = \frac{9}{8}$$

59. Answer (3)



Sol.:



60. Answer (3)

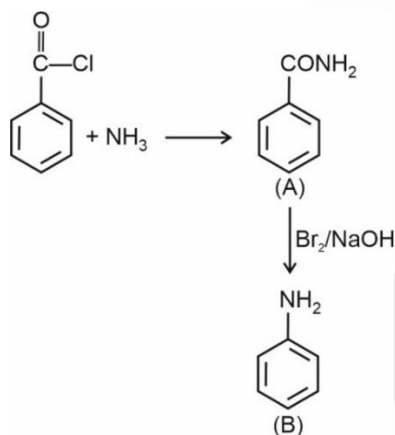
Hint: NaBH₄ does not reduce the carboxyl group.

Sol.:

- NaBH₄ reduces both aldehydes and ketones to alcohols.
- LiAlH₄ reduces carboxylic acids to primary alcohols.

61. Answer (1)

Hint & Sol.:



62. Answer (1)

Hint: Percentage of sulphur

$$= \frac{\text{Mass of sulphur}}{\text{Mass of organic compound}} \times 100$$

Sol.: 233 g of BaSO₄ contain 32 g of sulphur

$$0.233 \text{ g of BaSO}_4 \text{ contains } \frac{32}{233} \times 0.233$$

$$\% \text{ of sulphur} = \frac{32}{233} \times \frac{0.233}{0.4} \times 100$$

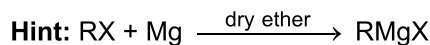
$$\% \text{ of sulphur} = 8\%$$

63. Answer (1)

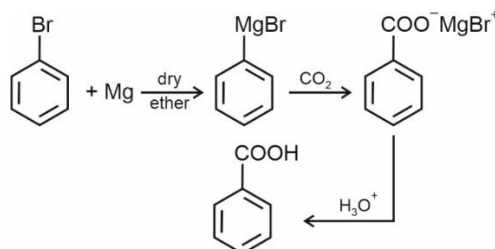
Hint & Sol.:

Cr and Al do not dissolve in concentrated nitric acid because of the formation of a passive film of oxide on the surface.

64. Answer (3)

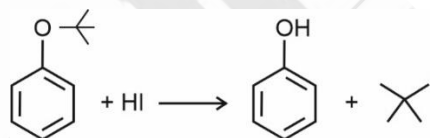


Sol.:



65. Answer (1)

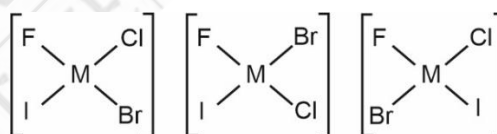
Hint & Sol.:



66. Answer (2)

Hint: In square planar complexes, only geometrical isomers are possible

Sol.: For [MClBrFI] three isomers are possible.



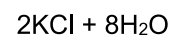
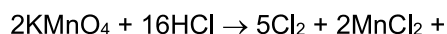
67. Answer (3)

Hint & Sol.:

Compound	Boiling point
NH ₃	238.5 K
PH ₃	185.5 K
AsH ₃	210.6 K
SbH ₃	254.6 K

68. Answer (4)

Hint & Sol.: The balanced chemical equation is

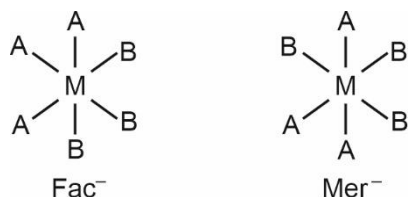


So, (c) and (d) respectively are 5 and 2

69. Answer (1)

Hint: Tetrahedral complexes do not show geometrical isomerism because relative positions of the unidentate ligands are the same with respect to each other.

Sol.: $[MA_3B_3]$ type complexes show geometrical isomerism.

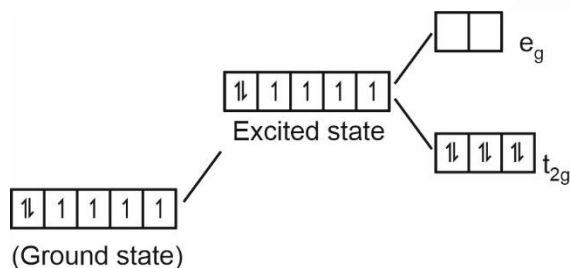


70. Answer (2)

Hint: $Co^{3+} = [Ar] 3d^6$

NH_3 will act as strong field ligand with Co^{3+} .

Sol.:



71. Answer (4)

Hint: Arrhenius equation $k = Ae^{-E_a/RT}$

Sol.: $\ln k = \ln A - \frac{E_a}{RT}$

$$\log k = \log A - \frac{E_a}{2.303RT}$$

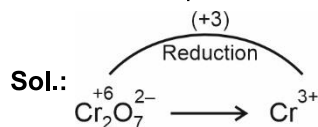
Slope for $\log k$ vs $\frac{1}{T}$ is $\frac{-E_a}{2.303R}$

$$\frac{-E_a}{2.303R} = -11$$

$$E_a = 2.303 R \times 11$$

72. Answer (2)

Hint: $n \times n_F = \frac{q}{F}$



$n_F = 6$ (for 1 mole of $Cr_2O_7^{2-}$)

$$0.5 \times 6 = \frac{q}{F}$$

$$3F = q$$

73. Answer (2)

Hint: $\frac{P^o - P_s}{P^o} = x_A$

Sol.: $\frac{0.60 - 0.50}{0.60} = x_A$ (solute)

$$x_A = \frac{0.1}{0.6} = \frac{1}{6}$$

$$\therefore x_B \text{ (solvent)} = 1 - \frac{1}{6} = \frac{5}{6}$$

74. Answer (3)

Hint: Magnetic moment $\mu = \sqrt{n(n+2)} BM$

n = number of unpaired electron(s)

Sol.: Co^{3+} with H_2O gets d^6 (Low spin) configuration having 0 unpaired electron

Fe^{3+} with CN^- gets d^5 (Low spin) configuration having 1 unpaired electron

$$\mu = \sqrt{1(3)} = \sqrt{3} BM$$

Fe^{2+} with H_2O (weak field ligand) gets d^6 configuration having 4 unpaired electrons,

$$\mu = \sqrt{4(6)} = \sqrt{24}$$

Mn^{2+} with H_2O gets d^5 configuration having 5 unpaired electrons

$$\mu = \sqrt{5 \times 7} = \sqrt{35}$$

75. Answer (4)

Hint: Noble gases have completely filled ns^2np^6 electronic configuration except helium ($1s^2$).

Sol.: Noble gases have positive electron gain enthalpy

76. Answer (1)

Hint: Number of electrons in $Ca^{2+} = 20 - 2 = 18$

Sol.: Number of moles of Ca^{2+} ions = $\frac{8.0 \times 10^{-3}}{40}$

$$= 2 \times 10^{-4}$$

Total number of electrons in Ca^{2+}

$$= 2 \times 10^{-4} \times 6.022 \times 10^{23} \times 18$$

$$= 216.792 \times 10^{19}$$

$$= 2.16 \times 10^{21}$$

77. Answer (4)

Hint: Molecular mass of $O_2 = 32 u$

Sol.: Number of molecules

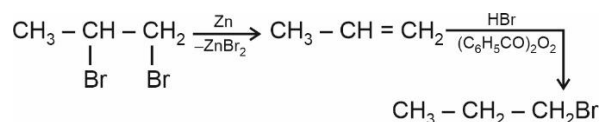
of $O_2 = \frac{320}{32} = 10$

Number of atoms of oxygen = $10 \times 2 = 20$

78. Answer (2)

Hint: Addition of HBr on alkene in presence of peroxide gives anti-Markovnikov addition.

Sol.:



79. Answer (3)

Hint: When red phosphorous is heated under high pressure, a series of phases of black phosphorous is formed

Sol.: Red phosphorous is obtained by heating white phosphorous at 573 K.

80. Answer (3)

Hint: q and w are path functions.

Sol.: $\Delta U = q + w$; ΔU is a state function

81. Answer (1)

Hint: $\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$ (for acidic buffer)

Sol.: $\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{CH}_3\text{COO}^-\text{Na}^+ + \text{H}_2\text{O}$
(Salt of weak acid and strong base)

Millimoles	10	5	
t = t	5	—	5
conc.	$\frac{5}{150}$	—	$\frac{5}{150}$

$$\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$$

$$\text{pH} = 4.8 + \log \frac{5/150}{5/150}$$

$$\text{pH} = 4.8$$

82. Answer (3)

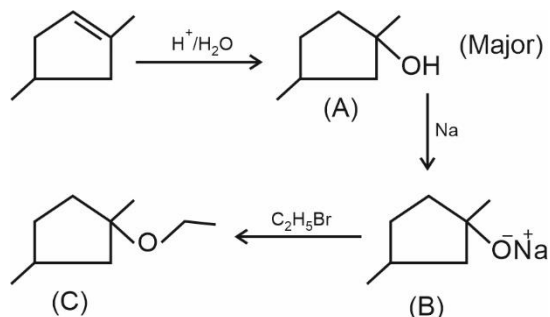
Hint & Sol.: For hydrolysis of salt of weak acid and weak base degree of hydrolysis

$$h = \sqrt{\frac{K_w}{K_a \cdot K_b}}$$

83. Answer (3)

Hint: Acid catalysed hydration of alkene passes through carbocation intermediate

Sol.:



84. Answer (4)

Hint: Al^{3+} belongs to group III, Ni^{2+} belongs to group IV.

Sol.: Cations and their group reagents:

$\text{Al}^{3+} \rightarrow \text{NH}_4\text{OH}$ in presence of NH_4Cl

$\text{Ni}^{2+} \rightarrow \text{H}_2\text{S}$ in presence of NH_4OH

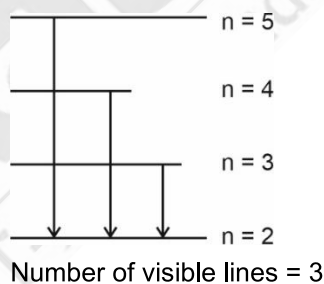
$\text{Ba}^{2+} \rightarrow (\text{NH}_4)_2\text{CO}_3$ in presence of NH_4OH

$\text{Cu}^{2+} \rightarrow \text{H}_2\text{S}$ gas in presence of dil HCl

85. Answer (2)

Hint: Spectral lines of Balmer series lies in visible region

Sol.: For visible lines electron falls to $n = 2$



86. Answer (2)

Hint: Values of $l = 0$ to $n - 1$

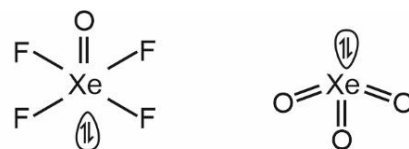
Values of $m = -l$ to $+l$

Sol.: $m \neq 2$ for $l = 1$

87. Answer (2)

Hint: The shape of molecules are defined by VSEPR theory.

Sol.:



Square pyramidal Trigonal pyramidal

88. Answer (2)

Hint: Work done for isothermal and reversible

process is $-nRT \ln \frac{V_2}{V_1}$

Sol.: Work = $-nRT \ln \frac{V_2}{V_1}$

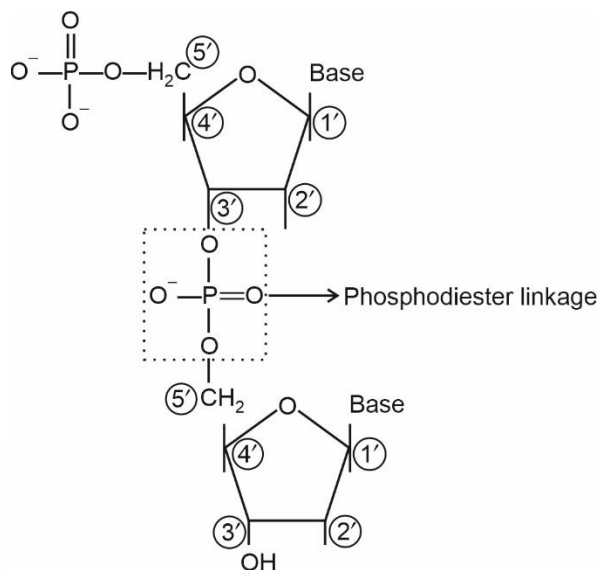
$$= -2 \times 8.314 \times 400 \times 2.303 \log \frac{10}{1}$$

$$= -15.317 \text{ kJ}$$

89. Answer (1)

Hint: Nucleoside when linked to phosphoric acid at 5'-position of sugar moiety gives nucleotide.

Sol.:



90. Answer (4)

Hint & Sol.: In aqueous phase, order of basic strength is $(\text{CH}_3)_2 \text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N}$

[BIOLOGY]

91. Answer (3)

Hint: Prothallus is a gametophyte stage of pteridophytes.

Sol.: Prothallus is multicellular free living, inconspicuous, small and photosynthetic gametophyte.

92. Answer (2)

Hint: *Spirogyra* and *Ulothrix*, both show isogamy.

Sol.: *Ulothrix* has flagellated gametes and *Spirogyra* and *Polysiphonia* have non flagellated gametes. *Volvox* has flagella and shows oogamy.

93. Answer (2)

Hint: Members of Kingdom Monera are prokaryotes.

Sol.: Most of the members of Kingdom Monera are heterotrophic in nature.

94. Answer (2)

Sol.: If one margin of the appendage overlaps that of the next one and so on, it is called twisted such as in China rose and cotton.

95. Answer (3)

Hint: The biological name of Mango is *Mangifera indica*.

Sol.: The first word denoting the genus starts with a capital letter while the specific epithet starts with a small letter.

96. Answer (4)

Hint : Statins are blood cholesterol lowering agent produced by a fungus.

Sol. : *Monascus purpureus* produced the statins commercially.

97. Answer (2)

Hint: Bast fibers are made up of sclerenchymatous cells.

Sol.: Phloem fibres (bast fibres) are made up of sclerenchymatous cells and dead part of the phloem.

98. Answer (2)

Hint: Chromoplasts contain xanthophylls and carotenoids.

Sol.: In the chromoplasts fat soluble carotenoid pigments like carotene, xanthophylls and others are present. This gives the part of the plant a yellow, orange or red colour.

99. Answer (2)

Hint: Slime moulds are non-photosynthetic.

Sol.: Slime moulds are saprophytic protists.

100. Answer (3)

Hint : Trimerous flowers are the characteristic feature of monocot plants.

Sol. : In *Allium cepa*, each flower has six stamens (3 + 3) and are epiphyllous

101. Answer (3)

Hint : Hilum is the junction between ovule and funicle.

Sol. : Opposite to the micropylar and that represents the basal part of ovule is called chalaza.

Funicle is the stalk of ovule. Nucellus is enclosed within the integuments and forms the body of ovule.

102. Answer (1)

Hint: In comparison between C₃ and C₄ cycle, regeneration of PEP from C₃ acid requires 2 ATP in C₄ cycle.

Sol.: There is no net gain or loss of NADPH₂ in C₄ cycle.

103. Answer (3)

Hint: It can be transmitted from parents to the offspring when both the partners are carrier for the gene (or heterozygous).

Sol.: Sickle-cell anaemia is an autosome-linked recessive disease. The mutated gene Hb^s causes one change in amino acid sequence of β-chain of haemoglobin. It replaces glutamic acid present at 6th position by valine.

104. Answer (3)

Hint: *Cis* and *trans* faces of a Golgi apparatus are interconnected.

Sol.: Vesicles are discharged from *trans* face of the Golgi apparatus.

105. Answer (2)

Hint: Mitochondria are semiautonomous cell organelles as they can synthesize some of their own proteins.

Sol.: Mitochondria can synthesize their proteins because they have DNA, RNA, ribosomes and components required for protein synthesis.

106. Answer (1)

Hint: Located in the portion of brain where corpora quadrigemina is also present

Sol.: The midbrain serves as the connection between the pons and the diencephalon. A canal called the cerebral aqueduct passes through the midbrain.

Cerebrum is a part of forebrain.

Pons, medulla oblongata and midbrain form the brain stem.

107. Answer (4)

Hint: Ribs that do not articulate directly with sternum.

Sol.: 8th, 9th and 10th pairs of ribs (six ribs) are vertebrochondral ribs; also known as false ribs.

Number of thoracic vertebrae = 12

Coxal bones = 2

Z-lines in one sarcomere = 2

Total number of bones present in both the girdles = 6 (Pectoral – 4; Pelvic – 2)

108. Answer (2)

Hint: Counter current mechanism.

Sol.: Mammals have the ability to produce a concentrated urine. The Henle's loop and vasa recta play a significant role in this.

The proximity between the Henle's loop and vasa recta, as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium.

Bowman's capsule is associated with the process of ultrafiltration.

109. Answer (3)

Hint: ADH prevents diuresis

Sol.: ADH/vasopressin acts at kidney and stimulates reabsorption of water and Na⁺ from latter parts of the distal tubules. It reduces loss of water through urine.

An excessive loss of fluid from the body can activate osmoreceptors which stimulate the hypothalamus to release vasopressin from the neurohypophysis.

110. Answer (3)

Hint: Includes universal donors.

Sol.: B^{-ve} individuals can receive blood from B^{-ve} and O^{-ve} blood group individuals.

Rh^{-ve} blood group individuals can receive blood only from Rh^{-ve} blood group individuals.

Blood Group	Antigens on RBCs	Antibodies in Plasma	Donor's Group
A	A	anti-B	A, O
B	B	anti-A	B, O
AB	A, B	nil	AB, A, B, O
O	nil	anti-A, B	O

111. Answer (2)

Hint: Similar to what happens to 'I' bands during muscle contraction

Sol.: The 'Z' line attached to actins are pulled inwards, thereby causing a shortening of sarcomere, *i.e.*, contraction. During contraction, the 'I' bands get reduced, whereas the 'A' bands retain its length. The length of 'H' zone also decreases during muscle contraction.

112. Answer (3)

Hint: Less than the per cent weight of nitrogen in humans

Sol.:

Element	% Weight of	
	Earth's crust	Human body
Hydrogen (H)	0.14	0.5
Carbon (C)	0.03	18.5
Oxygen (O)	46.6	65.0
Nitrogen (N)	very little	3.3
Sulphur (S)	0.03	0.3
Sodium (Na)	2.8	0.2
Calcium (Ca)	3.6	1.5
Magnesium (Mg)	2.1	0.1
Silicon (Si)	27.7	negligible

113. Answer (3)

Hint: Functional residual capacity

Sol.: Volume of air that will remain in the lungs after a normal expiration is known as functional residual capacity (FRC). It includes expiratory reserve volume and residual volume *i.e.* ERV + RV (2100 – 2300 mL).

- $TV + IRV + ERV = \text{Vital capacity}$
[4000 – 4600 mL]
- $TV + IRV + RV + ERV = \text{Total lung capacity}$
[5100 – 5800 mL]
- $TV + IRV = \text{Inspiratory capacity}$
[3000 – 3500 mL]

114. Answer (4)

Hint: Identify a phospholipid

Sol.: In lecithin, fatty acids are linked to glycerol *via* ester bonds. In nucleosides (*eg.* Adenosine), nitrogenous base is linked to sugar by N-glycosidic bond. Glycerol is trihydroxy propane; it does not contain any ester bond.

Haemoglobin is a protein molecule and it contains peptide bonds.

115. Answer (1)

Hint: Skin acts as the aquatic respiratory structure.

Sol.: Frogs respire on land and in water by two different methods. In water, skin acts as the aquatic respiratory organ (cutaneous respiration). Dissolved oxygen in the water is exchanged through the skin by diffusion.

On land, the buccal cavity (buccopharyngeal respiration), skin and lungs (pulmonary respiration) act as the respiratory organs.

Tadpoles mainly perform branchial respiration.

116. Answer (3)

Hint: As per Chargaff's rule

Amount of purine = Amount of pyrimidine

Sol.:

Given:

Adenine = 20%

Thymine = 20% ($\because A = T$)

Cytosine = x

Guanine = x

$A + T + x + x = 100\%$

$A + T + 2x = 100\%$

$2x = 100 - 40\%$

$2x = 60\%$

$x = 30\%$

So, Cytosine = Guanine = 30%

117. Answer (3)

Hint: Human genome has 3.3×10^9 bp

Sol.: Lambda (λ) phage – 48502 base pairs.

$\phi \times 174$ bacteriophage – 5386 bases

E. coli – 4.6×10^6 bp

118. Answer (2)

Hint: The term gene was given by Johannsen.

Sol.: Sutton united the knowledge of chromosomal segregation with Mendelian principles and called it the chromosomal theory of inheritance.

- Experimental verification of the chromosomal theory of inheritance was given by T.H. Morgan.
- Punnett square was developed by a British geneticist, Reginald C. Punnett.

119. Answer (4)


Hint: Presence of more than two alleles for a gene is known as multiple allelism, e.g., ABO blood group in humans.

Sol.: Polygenic inheritance – Human skin color


Co-dominance – AB blood group


Flower color in snapdragon – Incomplete dominance.

120. Answer (3)

Hint:  This symbol of pedigree represents five unaffected offsprings.

Sol.:  – Consanguineous mating.

 – Sex unspecified

 – Parents with affected male child.

121. Answer (2)

Hint: In some cereals, pollen grains lose viability within 30 minutes of their release.

Sol.: *Parthenium* or carrot grass came into India as a contaminant with imported wheat.

122. Answer (4)

Hint: Hydrophily is a type of pollination in which water acts as a pollinating agent.

Sol.: *Hydrilla*, *Vallisneria* and sea grass are pollinated by water.

In a majority of aquatic plants, the flowers emerge above the level of water and are pollinated by insects or wind.

Water hyacinth and water lily are pollinated by insects.

123. Answer (4)

Hint: Ethylene is a gaseous hormone. Flowering and fruit set up are synchronised by ethylene in pineapples.

Sol.: Apical dominance is the phenomenon by which the presence of apical bud does not allow the nearby lateral or axillary buds to grow. Apical bud secretes auxin which inhibits the growth of lateral buds.

Ethylene is used in fruit ripening, breaking of dormancy and sex expression.

124. Answer (3)

Hint: RQ is the ratio of the volume of CO_2 evolved to the volume of O_2 consumed in respiration.

Sol.:

Substrate	RQ Value
(i) Carbohydrates	= 1
(ii) Protein	= 0.9
(iii) Oxalic acid	= 4
(iv) Malic acid	= 1.33

125. Answer (2)

Hint: First stable product of the C_3 pathway is a 3 - carbon compound.

Sol.: In C_3 plants, first stable product of CO_2 fixation is 3-phosphoglycerate.

126. Answer (1)

Hint: Photorespiration is a process which involves the loss of fixed carbon as CO_2 in plants in the presence of light.

Sol.: In C_4 plant, photorespiration does not occur. This is because these plants have a mechanism that increases the concentration of CO_2 at the enzyme site.

127. Answer (3)

Hint: Formation of interzonal fibres occurs in this stage.

Sol.: During anaphase, chromosomes move away from the equatorial plate. The centromere of the daughter chromosome moves towards the pole and arms of chromosome trail behind. The anaphase ends when the chromosomes reach the poles. It is the best stage to study the shape of chromosomes.

128. Answer (3)

Hint: Net primary productivity is the available biomass for next trophic level.

Sol.: As per law of 10% energy flow, only 10% energy transfers from one trophic level to another trophic level.

Given,

Producer = 2 kJ = $2 \times 1000 = 2000$ joule

↓

Primary consumer = $\frac{2000 \times 10}{100} = 200$ joule

↓

Secondary consumer = $\frac{200 \times 10}{100} = 20$ joule

↓

Tertiary consumer = $\frac{20 \times 10}{100} = 2$ joule

129. Answer (1)

Hint: *Penicillium* belongs to the family Ascomycetes and its members exhibit dikaryophase during sexual reproduction.

Sol.: *Rhizopus* belongs to Phycomycetes. In members of Phycomycetes, plasmogamy is immediately followed by karyogamy and thus dikaryophase is not observed.

130. Answer (1)

Hint: Phragmoplast is formed by the Golgi complex and grows centrifugally to form cell plate during cytokinesis in plant cells.

Sol.: Cell plate formation starts at the centre of the cell and grows outward towards the lateral walls, dividing the plant cell into two halves. For cytokinesis in animal cells, furrow in plasma membrane starts from periphery and then moves inward.

131. Answer (3)

Hint: Only sexual reproduction occurs in ctenophores.

Sol.: *Pleurobrachia* is a ctenophore and only sexual reproduction occurs in it.

Hemichordates (*Balanoglossus*) have a rudimentary structure in the collar region called stomochord, a structure similar to notochord.

132. Answer (4)

Hint: Identify an arthropod

Sol.: *Anopheles* is an arthropod and it has an open circulatory system.

Fishes (*Trygon*), amphibians (*Hyla*) and reptiles (*Alligator*) have a closed circulatory system.

133. Answer (3)

Hint: TCT is antagonistic to PTH.

Sol.: Hypothalamus

↓

Releases TRH

↓

Acts on adenohypophysis

↓

Releases TSH

↓

Acts on thyroid gland

↓

Secretes T_3, T_4

↓

Controls BMR; stimulate erythropoiesis, etc.

134. Answer (1)

Hint: Does not include energy currency of cell

Sol.: Hormones that interact *via* membrane-bound receptors generate second messengers such as cAMP, IP_3 , Ca^{+2} , etc.

ATP does not act as the second messenger.

135. Answer (2)

Hint: Work oppositely

Sol.: As urine gets filled in the bladder, the stretch receptors present on the walls of the bladder send signals to the CNS.

The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

136. Answer (2)

Hint: Cardiac output = Stroke volume \times Heart beat

Sol.: Cardiac output = Stroke volume \times Heart beat

6.4 L/min = SV \times 80 beats/min

$$SV = \frac{6.4 \times 1000 \text{ mL/min}}{80 \text{ beats/min}}$$

$$= \frac{6400 \text{ mL/min}}{80 \text{ beats/min}}$$

Stroke volume = 80 mL

137. Answer (2)

Hint: Primary structure of a protein is represented by a straight line.

Sol.: In proteins, the monomeric units are joined to each other by peptide bonds. Thus, this bond will be present in all the four different structural levels of protein.

The primary structure of protein is composed of a linear chain of amino acids; thus hydrogen bond is not necessarily present in the primary structure of a protein. Whereas, the secondary or tertiary structures contain regions of amino acid chains that are stabilized by hydrogen bonds.

Hydrogen bonds stabilise the α -helix and β -pleated sheet structure.

138. Answer (1)

Hint: Secondary immune response is also known as anamnestic response.

Sol.: The secondary or anamnestic response is highly intensified. This is due to the fact that our body has memory of the first encounter with the same pathogen.

139. Answer (3)

Hint: Hindbrain contains medulla oblongata and cerebellum.

Sol.: In *Rana tigrina*, pons is not present; only cerebellum and medulla oblongata are present in the hindbrain.

In frogs, a special venous connection exists between kidney and lower parts of the body. It is called the renal portal system.

Their RBCs are nucleated and carry haemoglobin. They have a bilobed tongue.

140. Answer (3)

Hint: Nephron is also known as uriniferous tubules.

Sol.: In cockroaches, urecose glands, fat body and nephrocytes perform excretion. Nephrons are not present in cockroaches.

Malpighian tubules absorb nitrogenous waste products and convert them into uric acid which is excreted out through the hindgut.

141. Answer (2)

Hint: Identify ctenophore and coelenterate.

Sol.: Ctenophores and cnidarians are radially symmetrical, diploblastic and acoelomate animals.

• *Locusta*, *Culex* and *Limulus* are arthropods and are bilaterally symmetrical.

• *Asterias* and *Cucumaria* (echinoderms)- Adult forms are radially symmetrical but larvae are bilaterally symmetrical.

• *Ascaris* (Aschelminthes) – Bilaterally symmetrical, triploblastic and pseudocoelomate.

142. Answer (4)

Hint: Transposons are also called jumping genes.

Sol.:

1. Adenosine deaminase deficiency – Can be treated by gene therapy
2. Emphysema – α -1-antitrypsin
3. Transposons – Mobile genetic elements that replicate *via* an RNA intermediate.
4. RNAi – Cellular defence seen in eukaryotes

143. Answer (2)

Hint: Interchain disulphide bonds

Sol.: In a monomeric antibody molecule, number of disulphide bonds present between the heavy and light chains = 2

Types of barriers associated with innate immunity = 4

Number of ssRNA molecules in HIV genome = 2

Number of chambers in human heart = 4

Types of antibodies produced in the human body = 5 (IgG, IgA, IgM, IgD, IgE)

144. Answer (4)

Hint: Few components of PCR master mix are DNA polymerase + dNTPs, etc.

Sol.: In PCR, multiple copies of gene (or DNA) of interest are synthesised *in vitro* using two sets of primers and the enzyme DNA polymerase.

- PCR is employed for early diagnosis of various diseases. It is also used to detect HIV.
- PCR involves 3 steps :

- (a) Denaturation
 (b) Annealing
 (c) Extension

The extension step of PCR involves enzyme DNA polymerase and deoxynucleotides (dNTPs).

During PCR, in the annealing step, two sets of primers bind to their complementary template strands of DNA.

145. Answer (3)

Hint: Feature of bony fishes

Sol.: Osteichthyes include both marine and fresh water fishes with bony endoskeleton. Their body is streamlined. Mouth is mostly terminal. They have four pairs of gills which are covered by an operculum on each side. Their skin is covered with cycloid/ctenoid scales.

In the members of the class Chondrichthyes, placoid scales are present. In males, pelvic fins bear claspers. Their endoskeleton is composed of cartilage.

146. Answer (4)

Hint: Inhibit both ovulation and implantation

Sol.: Except for genital herpes, hepatitis-B and AIDS, all sexually transmitted diseases are completely curable, if detected early and treated properly.

Steroidal oral contraceptive pills have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle.

Vaults are reusable and they are inserted into the female reproductive tract to cover the cervix during coitus.

Steroidal oral contraceptive pills, implants and contraceptive injections, all of them contain either progestogens or progestogen-estrogen combinations.

They all inhibit ovulation and implantation as well as alter the quality of cervical mucus.

147. Answer (1)

Hint: Hormone also secreted by ovary

Sol.: Hormones involved in the parturition are:-

- (a) Cortisol
 (b) Estrogen
 (c) Oxytocin

Cortisol is released from the adrenal cortex and oxytocin is released from pars nervosa. Estrogen is secreted by placenta.

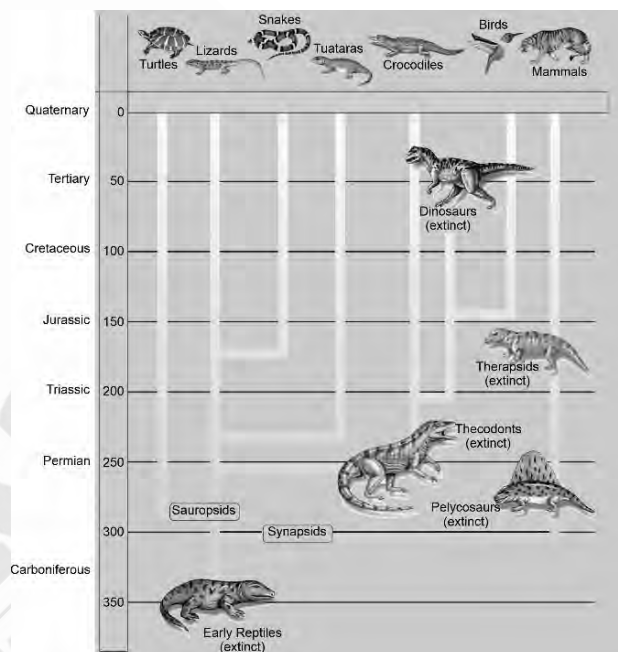
hCG is also secreted by placenta but it does not participate in foetal ejection reflex.

Levels of thyroxine increase in blood during pregnancy.

148. Answer (1)

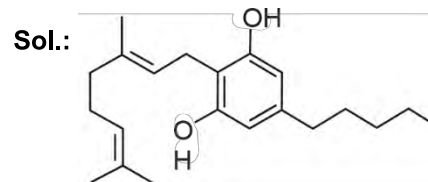
Hint: Pelycosaur evolved from synapsids.

Sol.: The rate of appearance of new forms is linked to the life cycle or the life span. Microbes that divide fast have the ability to multiply and become millions of individuals within hours.



149. Answer (3)

Hint: Its receptors are principally present in brain.



Skeletal structure of cannabinoid molecule

Cannabinoids are abused by some sportsperson. Barbiturates, benzodiazepines, amphetamines help patients cope with mental illness like depression and insomnia.

Morphine is an effective sedative and painkiller and is very useful in patients who have undergone surgery.

Natural cannabinoids are obtained from the inflorescences of the plant *Cannabis sativa*.

The flower tops, leaves and the resin of cannabis plant are used in various combinations to produce marijuana, hashish, charas and ganja.

Heroin is chemically diacetylmorphine.

150. Answer (2)

Hint: Deoxygenated blood

Sol.: pO_2 in systemic veins = 40 mm Hg

pCO_2 in systemic arteries = 40 mm Hg

Normal expiration is a passive process as external inter-costal muscles and diaphragm relax during this process.

151. Answer (2)

Hint: Neanderthal man used hides to protect their body.

Sol.: Two mya, *Australopithecines* probably lived in East African grasslands. Evidence shows they hunted with stone weapons but essentially ate fruit.

The Neanderthal man lived in near east and central Asia between 1,00,000 – 40,000 years back. They used hides to protect their body and buried their dead.

152. Answer (3)

Hint: *Clal* site does not contain any antibiotic resistance gene.

Sol.: At *Clal* site, *amp^R* or *tet^R* gene is not present, so non-recombinants or recombinants, all can grow in the medium containing ampicillin and tetracycline antibiotics, as they still contain resistance genes against these antibiotics.

153. Answer (3)

Hint: An annelid

Sol.: Annelids possess longitudinal and circular muscles which help in locomotion.

Their neural system consists of paired ganglia connected by lateral nerves to a double ventral nerve cord. *Pennatula* and *Pleurobrachia* do not exhibit segmentation.

Organisms	Phylum
<i>Pheretima</i>	Annelida
<i>Petromyzon</i>	Chordata
<i>Pennatula</i>	Cnidaria
<i>Pleurobrachia</i>	Ctenophora

154. Answer (1)

Hint: Conversion of glucose to glycogen

Sol.: Glucocorticoids stimulate gluconeogenesis, lipolysis and proteolysis; and inhibit cellular uptake and utilisation of amino acids.

They are secreted from the adrenal cortex.

Insulin stimulates glycogenesis.

155. Answer (3)

Hint: Stimulates the release of bile juice.

Sol.: Secretin acts on the exocrine pancreas and stimulates secretion of water and bicarbonate ions. CCK acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juice, respectively.

ANF can cause vasodilation (dilation of blood vessels) and thereby decreases the blood pressure.

156. Answer (3)

Sol.: The integral form of exponential growth equation is $N_t = N_0 \cdot e^{rt}$

Where, N_t = population density after time t

N_0 = Population density at time zero

e = The base of natural logarithms

157. Answer (2)

Hint: Barnacles growing on the back of a whale benefits in the form of shelter. Whale remains unaffected.

Sol.: Protocooperation is an association between individuals of two species, each of which is benefitted by the presence of other but can live equally well without association.

158. Answer (4)

Hint: Ladybird, a beetle with red and black marking, is useful in controlling aphids.

Dragonflies are useful to get rid of mosquitoes

Sol.: *Aulosira* is non-symbiotic N_2 fixer of rice field.

Oscillatoria adds organic matter to the soil, increases its fertility and reduces the alkalinity of soil.

159. Answer (3)

Hint: 18S rRNA is synthesised by RNA polymerase I.

Sol.: RNA polymerase I synthesises 5.8S, 18S and 28S rRNA.

160. Answer (1)

Hint: Mendel had selected 7 contrasting characters such as, seed colour and seed shape.

Sol.: Flower color and flower position was selected by Mendel.

161. Answer (3)

Hint: The C₃ and C₄ plants respond differently to CO₂ concentration. The latter show photosynthetic saturation at about 360 μl L⁻¹.

Sol.: Light duration does not affect the rate of photosynthesis.

162. Answer (1)

Hint: Phylogenetic classification systems are based on evolutionary relationships between the various organisms.

Sol.: Artificial systems involve the usage of few morphological characters for grouping of organisms.

163. Answer (1)

Hint: White rust of crucifers is caused by *Albugo candida*. *Xanthomonas citri* causes citrus canker.

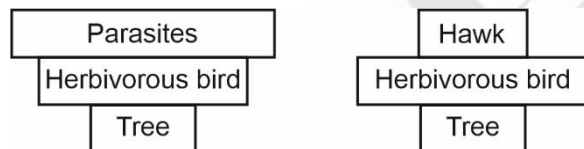
Sol.:

- Early blight of potato – *Alternaria solani*
- Late blight of potato – *Phytophthora infestans*
- Loose smut of wheat – *Ustilago nuda*

164. Answer (4)

Hint: Pyramid of number in a grassland ecosystem is upright.

Sol.: Pyramid of number in a tree ecosystem may be inverted or spindle shaped.



165. Answer (3)

Hint: Anthropogenic ecosystem or man-made ecosystem is the one which is created and maintained by human beings, e.g., crop field.

Sol.: Characteristics of anthropogenic ecosystem are as follows:

- High productivity
- Simple food chain
- Lack of self-regulatory mechanism

166. Answer (1)

Hint: Species diversity refers to the variety of species within a region.

Sol.: Western Ghats have greater amphibian species diversity as compared to Eastern Ghats.

167. Answer (1)

Hint: African catfish, *Clarias gariepinus*, for aquaculture purposes is posing a threat to the indigenous catfish in our rivers.

Sol.: Over-exploitation of a particular species reduces the size of its population to an extent so that it becomes vulnerable to extinction. Steller's sea cow has become extinct due to overexploitation by humans.

168. Answer (2)

Hint: Parasites have evolved high reproductive capacity.

Sol.: Presence of adhesive organs or suckers to cling onto the host is one of the adaptations shown by parasites.

169. Answer (3)

Hint: Pith is not well developed in the roots of dicot plants.

Sol.: In dicot leaf, mesophyll is differentiated into two types of tissues, palisade and spongy parenchyma.

170. Answer (3)

Hint: Euchromatin is the loosely packed chromatin.

Sol.: In prokaryotes, the DNA in nucleoid is organised in large loops held by proteins.

Both the amino acid residues, lysine and arginine carry positive charges in their side chain.

171. Answer (4)

Hint: Reads the same when orientation of reading is same for both strands.

Sol.: The sequences reads the same on the two strands in 5' – 3' direction. A binds with T and G binds with C.

172. Answer (3)

Hint: Lays eggs

Sol.: *Chelone* belongs to the class Reptilia. Reptiles are oviparous with direct development.

Betta belongs to class Osteichthyes.

Delphinus is a mammal.

Hyla is an amphibian.

173. Answer (3)

Hint: Haemodialysis is used for such patients.**Sol.:**

Myasthenia gravis	–	Auto-immune disorder affecting neuromuscular junction leading to fatigue and paralysis of skeletal muscle
Heart attack	–	When heart muscle is suddenly damaged by an inadequate blood supply
Asthma	–	Difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles

174. Answer (3)

Hint: Binding of O₂ with haemoglobin is primarily related to pO₂.**Sol.:** In tissues, low pO₂, high pCO₂, high H⁺ concentration and higher temperature are favourable for the dissociation of oxygen from the oxyhaemoglobin.

175. Answer (2)

Hint: Concentric rings are present in bones.**Sol.:** The intercellular material of cartilage is solid and pliable and resists compression. Cells of this tissue (chondrocytes) are enclosed in small cavities (lacunae) within the matrix secreted by them.

Lamellae are absent in cartilage but present in bones. Collagen fibres are present in both bones and cartilage.

176. Answer (3)

Hint: One dendrite is present in the retina of eye.**Sol.:** Unipolar neurons have only one axon with a cell body but no dendrite. It is present in the embryonic stage of humans.

Transmission of an impulse across electrical synapses is very similar to impulse conduction along a single axon.

When a neuron is not conducting any impulse, the axonal membrane is comparatively more permeable to K⁺ and nearly impermeable to Na⁺.

177. Answer (1)

Hint: Does not allow any movement**Sol.:**

Fibrous joint – Between temporal and sphenoid bones of cranium

Ball and socket joint – Between humerus and pectoral girdle

Saddle joint – Between carpal and metacarpal of thumb

Pivot Joint – Between atlas and axis

178. Answer (4)

Hint: End of contraction**Sol.:** P-wave – Represents depolarisation of atria

QRS complex – Represents depolarisation of ventricles

T-wave – Represents repolarisation of ventricles

End of T-wave – Marks the end of ventricular systole

179. Answer (2)

Hint: Number of cells increase but total cell mass remains constant upto morula stage.**Sol.:** In humans, the size of zygote is equal to size of morula. During cleavage (occurs after the zygote is formed), the size of blastomeres keeps on decreasing, as there is no growth of blastomeres.

180. Answer (3)

Hint: Steroidal hormone**Sol.:** Estrogen peaks twice during the menstrual cycle in human females.

Progesterone stimulates the formation of mammary alveoli and milk secretion.

LH maintains the corpus luteum, formed from the remnants of the Graafian follicles after ovulation.

Testosterone produces anabolic effects on protein and carbohydrate metabolism in males.

