# All India Aakash Test Series for NEET - 2025

## TEST - 5 (Code-A)

Click here for Code-B Sol.

**Test Date : 05/01/2025**

## ANSWERS

| | | | | |
|---|---|---|---|---|
| 1. (1) | 41. (4) | 81. (2) | 121. (4) | 161. (4) |
| 2. (2) | 42. (4) | 82. (3) | 122. (4) | 162. (4) |
| 3. (3) | 43. (4) | 83. (4) | 123. (4) | 163. (3) |
| 4. (2) | 44. (4) | 84. (3) | 124. (1) | 164. (2) |
| 5. (3) | 45. (3) | 85. (3) | 125. (3) | 165. (3) |
| 6. (1) | 46. (3) | 86. (1) | 126. (1) | 166. (3) |
| 7. (3) | 47. (3) | 87. (1) | 127. (1) | 167. (3) |
| 8. (2) | 48. (1) | 88. (2) | 128. (3) | 168. (3) |
| 9. (1) | 49. (3) | 89. (3) | 129. (3) | 169. (1) |
| 10. (1) | 50. (3) | 90. (3) | 130. (1) | 170. (1) |
| 11. (3) | 51. (3) | 91. (3) | 131. (3) | 171. (2) |
| 12. (3) | 52. (4) | 92. (1) | 132. (1) | 172. (1) |
| 13. (4) | 53. (3) | 93. (1) | 133. (4) | 173. (4) |
| 14. (3) | 54. (4) | 94. (3) | 134. (4) | 174. (4) |
| 15. (2) | 55. (2) | 95. (4) | 135. (2) | 175. (2) |
| 16. (2) | 56. (2) | 96. (1) | 136. (4) | 176. (2) |
| 17. (1) | 57. (1) | 97. (3) | 137. (2) | 177. (2) |
| 18. (4) | 58. (3) | 98. (3) | 138. (4) | 178. (3) |
| 19. (3) | 59. (4) | 99. (4) | 139. (3) | 179. (3) |
| 20. (3) | 60. (3) | 100. (1) | 140. (1) | 180. (3) |
| 21. (3) | 61. (3) | 101. (1) | 141. (1) | 181. (3) |
| 22. (3) | 62. (3) | 102. (3) | 142. (4) | 182. (4) |
| 23. (4) | 63. (1) | 103. (4) | 143. (3) | 183. (4) |
| 24. (3) | 64. (1) | 104. (4) | 144. (1) | 184. (4) |
| 25. (3) | 65. (4) | 105. (1) | 145. (4) | 185. (3) |
| 26. (2) | 66. (1) | 106. (1) | 146. (2) | 186. (4) |
| 27. (3) | 67. (1) | 107. (3) | 147. (2) | 187. (4) |
| 28. (4) | 68. (4) | 108. (2) | 148. (4) | 188. (3) |
| 29. (1) | 69. (4) | 109. (4) | 149. (3) | 189. (4) |
| 30. (2) | 70. (1) | 110. (2) | 150. (2) | 190. (2) |
| 31. (3) | 71. (2) | 111. (4) | 151. (2) | 191. (3) |
| 32. (3) | 72. (3) | 112. (3) | 152. (3) | 192. (2) |
| 33. (2) | 73. (2) | 113. (3) | 153. (3) | 193. (3) |
| 34. (2) | 74. (1) | 114. (3) | 154. (3) | 194. (2) |
| 35. (3) | 75. (4) | 115. (3) | 155. (3) | 195. (3) |
| 36. (2) | 76. (1) | 116. (3) | 156. (4) | 196. (2) |
| 37. (3) | 77. (1) | 117. (4) | 157. (4) | 197. (2) |
| 38. (3) | 78. (2) | 118. (2) | 158. (3) | 198. (1) |
| 39. (4) | 79. (3) | 119. (4) | 159. (2) | 199. (3) |
| 40. (1) | 80. (1) | 120. (2) | 160. (4) | 200. (2) |

# HINTS & SOLUTIONS

## [PHYSICS]

### SECTION-A

1. Answer (1)

**Hint:** $\theta$ (in rad) $= \dfrac{\text{Arc}}{\text{Radius}}$

**Sol.:** If $l = r$

*i.e.* arc length = Radius of circle, then $\theta$ = 1 radian

2. Answer (2)

**Hint:** Use relation $n_1u_1 = n_2u_2$

**Sol.:** Energy = $[ML^2T^{-2}]$

$a = 1, b = 2, c = -2$

$$n_2 = n_1\left(\frac{M_1}{M_2}\right)^a\left(\frac{L_1}{L_2}\right)^b\left(\frac{T_1}{T_2}\right)^c$$

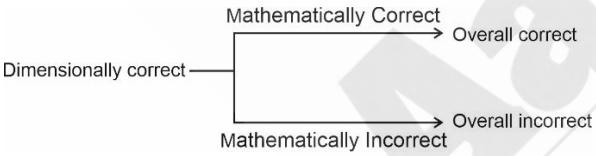
$$= 1\left(\frac{\text{kg}}{100\text{ g}}\right)^1\left(\frac{\text{m}}{10\text{ cm}}\right)^2\left(\frac{\text{s}}{5\text{ s}}\right)^{-2}$$

$$= \left(\frac{1000\text{ g}}{100\text{ g}}\right)\left(\frac{100\text{ cm}}{10\text{ cm}}\right)^2\left(\frac{1}{5}\right)^{-2}$$

$= 10 \times 100 \times (5)^2 = 25000$

3. Answer (3)

**Hint & Sol.:**




Dimensionally incorrect $\Rightarrow$ Overall incorrect

4. Answer (2)

**Hint & Sol.:** When number is expressed in exponential form, the exponential term does not affect the number of significant figures, so given value has 3 significant figures.

5. Answer (3)

**Hint:** Rise in temperature $\theta = \theta_2 - \theta_1$

**Sol.:** $\theta_1 = (20.6 \pm 0.2)°C$

$\theta_2 = (80 \pm 0.3)°C$

$\theta = \theta_2 - \theta_1$

$= 80 - 20.6 = 59.4°C$

$\Delta\theta = \pm (\Delta\theta_1 + \Delta\theta_2)$

$= \pm(0.2 + 0.3) = \pm 0.5°C$

$\therefore$ Rise in temperature = $(59.4 \pm 0.5)°C$

6. Answer (1)

**Hint:** Angular speed, $\omega = \dfrac{2\pi}{T}$

**Sol.:** $T = \pi$ s

$\omega = \dfrac{2\pi}{\pi} = 2$ rad/s

7. Answer (3)

**Hint:** Density $= \dfrac{\text{Mass}}{\text{Volume}}$

**Sol.:** $d = \dfrac{m}{\pi r^2 l}$

$$\frac{\Delta d}{d} = \frac{\Delta m}{m} + \frac{2\Delta r}{r} + \frac{\Delta l}{l}$$

$$\Rightarrow \frac{\Delta d}{d} = \frac{0.003}{0.3}2\times\frac{0.005}{5} + \frac{0.06}{6}$$

$= 0.01 + 0.02 + 0.01 = 0.04$

% error in density = $0.04 \times 100 = 4\%$

8. Answer (2)

**Hint & Sol:** Distance is the actual path length between two points of a body and displacement is the vector from initial position to final position. So both assertion and reason are true but reason is not the correct explanation of assertion.

9. Answer (1)

**Hint & Sol:** Dimensional analysis does not give any information about dimensionless constants.

10. Answer (1)

**Hint :** L.C = MSD – VSD

**Sol:** $N$ VSD = $(N - 1)$ MSD

L.C = MSD – VSD

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

$$\text{L.C} = \frac{\text{MSD}}{N} = \frac{1}{100N}$$

11. Answer (3)

**Hint :** Use concept of dimensional analysis

**Sol.:** Dimensions of a physical quantity are the powers to which base quantities are raised to express that quantity. For example [F] = [MLT$^{-2}$]

According to principle of homogeneity

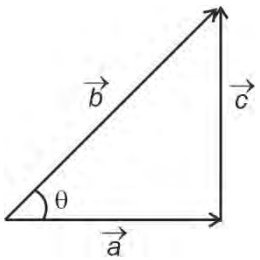
If $x + y = z$

Then $[x] = [y] = [z]$

12. Answer (3)

**Hint:** $\vec{a} - \vec{b} + \vec{c} = \vec{0}$

$\Rightarrow \vec{a} + \vec{c} = \vec{b}$




**Sol.:**

$\vec{a} + \vec{c} = \vec{b}$

$\cos\theta = \dfrac{\sqrt{3}c}{2c}$

$\theta = 30°$

13. Answer (4)

**Hint:** If initial and final position is same then displacement is zero.

**Sol.:** In 1 min 5 s

Number of revolution = 5

Displacement = Zero

14. Answer (3)

**Hint:** Velocity is a vector quantity

**Sol.:** As velocity is a vector quantity so it can be positive, negative or zero

$\vec{v}_{avg} = \dfrac{\text{Displacement}}{\text{Total time}} = \dfrac{\Delta\vec{r}}{\Delta t}$

$\therefore$ Direction is along net displacement

15. Answer (2)

**Hint:** $v = \dfrac{dr}{dt}$ and $a = \dfrac{dv}{dt}$

**Sol.:** $r \propto t^{\frac{5}{2}}$

$r = k\, t^{\frac{5}{2}}$

$\dfrac{dr}{dt} = k \times \dfrac{5}{2} t^{\frac{3}{2}}$

$v \propto t^{\frac{3}{2}}$ ...(i)

$v = k' t^{\frac{3}{2}}$

$\dfrac{dv}{dt} = k' \times \dfrac{3}{2} t^{\frac{1}{2}} \Rightarrow a \propto t^{\frac{1}{2}}$ ...(ii)

From (i) & (ii), we get $v \propto a^3$

16. Answer (2)

**Hint:** Average velocity = $\dfrac{\text{Total displacement}}{\text{Total time}}$

Average speed = $\dfrac{\text{Total distance}}{\text{Total time}}$

**Sol.:** As after each lap initial and final position is same.

So displacement is zero

$\therefore$ Average velocity = 0

Now, total distance in one lap = $2\pi r$

$= 2 \times \pi \times 20$

$= 40\ \pi$

Average speed = $\dfrac{\text{Total distance}}{\text{Total time}}$

$= \dfrac{40 \times 3.14}{6.28} = 20$ m/s

17. Answer (1)

**Hint:** Area under *v-t* curve gives change in position.

**Sol.:** Area above time axis is positive and area below time axis is negative, then displacement = (4 – 4) = 0

While for distance take all areas as positive, distance covered = (4 + 4) = 8 m

18. Answer (4)

**Hint:** $\tan\alpha = \dfrac{Q\sin\theta}{P + Q\cos\theta}$ and

$R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$

**Sol.:** $\tan 90° = \dfrac{Q\sin\theta}{P + Q\cos\theta}$ or $P + Q\cos\theta = 0$

$\Rightarrow \cos\theta = \dfrac{-P}{Q}$

$$R = \frac{Q}{2} = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$$

$$\frac{Q^2}{4} = P^2 + Q^2 + 2PQ \times \frac{-P}{Q}$$

On solving

$$\frac{P}{Q} = \frac{\sqrt{3}}{2}$$

$$\cos\theta = \frac{-\sqrt{3}}{2} = \cos 150^\circ$$

$\theta = 150^\circ$

19. Answer (3)

**Hint & Sol:**

$$\frac{\text{joule ohm}}{\text{second} \times \text{volt}} = \frac{\text{joule}}{\text{second} \times \text{ampere}} = \frac{\text{joule}}{\text{coulomb}} = \text{volt}$$

20. Answer (3)

**Hint:** $a = v\dfrac{dv}{dx}$

**Sol.:** As $a = v\dfrac{dv}{dx}$

$a = 15(5) = 75$ m/s$^2$

21. Answer (3)

**Hint & Sol.:** At maximum height angle between velocity and acceleration is 90°.

22. Answer (3)

**Hint:** $y = x\tan\theta\left[1 - \dfrac{x}{R}\right]$

**Sol.:** $y = x\sqrt{3}\left[1 - \dfrac{x}{\sqrt{3}\,7}\right]$

Comparing with

$$y = x\tan\theta\left[1 - \frac{x}{R}\right]$$

$$\therefore\ R = \frac{\sqrt{3}}{7}$$

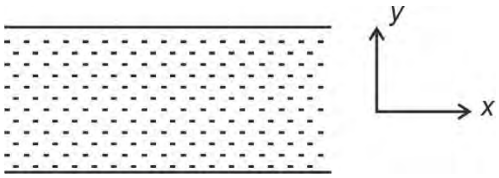
23. Answer (4)

**Hint:** $\vec{V}_{m/b} = \vec{V}_{m/w} - \vec{V}_{b/w}$

**Sol.:** $\vec{V}_{m/w} = 3\hat{j}$

$\vec{V}_{b/w} = -4\hat{i}$

$\vec{V}_{m/b} = 3\hat{j} - (-4\hat{i}) = 3\hat{j} + 4\hat{i}$




$|\vec{V}_{m/b}| = \sqrt{9+16}$ = 5 km/h

Direction $\theta = \tan^{-1}\left(\dfrac{3}{4}\right)$

$\theta = 37^\circ$, with the river flow.

24. Answer (3)

**Hint:** $v_{avg} = \dfrac{\text{Total displacement}}{\text{Total time taken}}$

**Sol.:** Displacement = $AB = R\sqrt{2} = 2\sqrt{2}$

$\Rightarrow V_{avg} = \dfrac{2\sqrt{2}}{2} = \sqrt{2}$ m/s

25. Answer (3)

**Hint & Sol:** Since they are always pointing towards the next, they will meet at centroid of triangle by symmetry.


26. Answer (2)

**Hint:** $D$ = Sum of horizontal distances covered by ball thrown by Prateek and Rohan.

**Sol.:** $x_1 + x_2 = D$

$u\cos\theta \times t + u' \times t = D$

$20\sqrt{2} \times \dfrac{1}{\sqrt{2}} \times 5 + 20 \times 5 = D$

$100 + 100 = D$

$D = 200$ m

27. Answer (3)

**Hint:** $\vec{P} + \vec{Q} = \hat{i}$

**Sol.:** $\vec{P} + \vec{Q} = \hat{i}$

$\vec{Q} = \hat{i} - (\hat{i} + 2\hat{j} - 3\hat{k})$

$= \hat{i} - \hat{i} - 2\hat{j} + 3\hat{k}$

$\vec{Q} = -2\hat{j} + 3\hat{k}$

$|\vec{Q}| = \sqrt{4+9} = \sqrt{13}$ units

28. Answer (4)

**Hint:** Time of flight $(T) = \frac{2u_y}{g}$

**Sol.:** $T = \frac{2 \times 8}{10} = 1.6$ s

29. Answer (1)

**Hint:** At origin x-coordinate = 0

**Sol.:** $x = \sin t - \sqrt{3}\cos t$

$\sin t = \sqrt{3}\cos t$

$\tan t = \sqrt{3}$

$t = \frac{\pi}{3}$ s

30. Answer (2)

**Hint :** Centripetal acceleration $a_c = \omega^2 r$

**Sol.:** $a_c = \omega^2 r \Rightarrow a_c \propto \omega^2 r$ and $\omega = 2\pi f$

$\Rightarrow a_c \propto f^2$

If frequency is made thrice, acceleration becomes 9 times

31. Answer (3)

**Hint:** $\vec{v}_{r/w} = \vec{v}_r - \vec{v}_w$

**Sol.:** $\vec{v}_r = -6\hat{j}$

$\vec{v}_w = 8\hat{i}$

$\vec{v}_{r/w} = -6\hat{j} - 8\hat{j}$

$|\vec{v}_{r/w}| = \sqrt{36+64} = \sqrt{100}$ = 10 m/s

32. Answer (3)

**Hint:** Slope of $v$-$t$ curve = $\frac{\text{Change in velocity}}{\text{time}}$

**Sol.:** $\tan\theta = \frac{\text{Change in velocity}}{\text{time}} = \text{acceleration}$

33. Answer (2)

**Hint:** Time taken to reach ground $t = \sqrt{\frac{2h}{g}}$

**Sol.:** A heavy and a light body when released from the same height, reach the ground simultaneously and with same velocity.

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

34. Answer (2)

**Hint & Sol:** $v = u + at$

$v = 2 \times 2 = 4$ m/s

35. Answer (3)

**Hint:** $v = u + at$

**Sol.:** $t = \frac{u}{a} \Rightarrow t \propto u$

$\frac{t}{t'} = \frac{u}{2u}$

$t' = 2t$

## SECTION-B

36. Answer (2)

**Hint & Sol:** Momentum $\rightarrow$ [MLT$^{-1}$]

Work $\rightarrow$ [ML$^2$T$^{-2}$]

Angle $\rightarrow$ Dimensionless

Pressure $\rightarrow$ [ML$^{-1}$T$^{-2}$]

37. Answer (3)

**Hint & Sol:** $\vec{v} = 2\hat{i}$

$\vec{a} = 2\hat{i} + 3\hat{j} - 5\hat{k}$

Component of $\vec{a}$ along $\vec{v}$ is 2 m/s$^2$

38. Answer (3)

**Hint:** For parabolic curve $a \propto x^2 \Rightarrow a = kx^2$

**Sol.:** $\frac{da}{dx} = 2kx \quad \left[\text{given } \frac{da}{dx} = 1 \text{ at } x = 1\right]$

$1 = 2k \times 1 \Rightarrow k = \frac{1}{2}$ so $a = \frac{1}{2}x^2$

At $x = 3 \Rightarrow a = \frac{9}{2} = 4.5$ m/s$^2$

39. Answer (4)

**Hint:** Trigonometric functions are dimensionless

**Sol.:** $[Y] = \frac{[F]}{[A]} = \left[\frac{(\tau\cos\theta)\,t^x}{l^3}\right] = \left[\frac{Frt^x}{l^3}\right]$

$\Rightarrow \left[\frac{F}{l^2}\right] = \left[\frac{F}{l^2}t^x\right]$

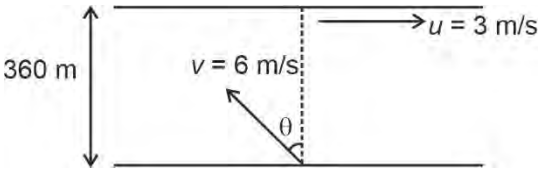
$t^x = 1$

$x = 0$

40. Answer (1)

**Hint:** For $t_{min}$, boat should be steered perpendicularly to the flow of river

**Sol.:**




To cross the river in minimum time, $\theta = 0°$

$$t_{min} = \frac{d}{v} = \frac{360}{6} = 60 \text{ s}$$

Drift = 3 × 60 = 180 m

41. Answer (4)

**Hint & Sol:** All the statements are correct.

42. Answer (4)

**Hint:** $|\vec{P}| = \sqrt{x^2 + y^2}$

**Sol.:** $P = \sqrt{1^2 + 1^2} = \sqrt{2}$ units

43. Answer (4)

**Hint:** $R = \frac{u^2 \sin 2\theta}{g}$, $H_{max} = \frac{u^2 \sin^2 \theta}{2g}$

**Sol.:** $\frac{u^2 \times 2 \times \sin\theta \times \cos\theta}{g} = \frac{u^2 \times \sin\theta \times \sin\theta}{2g}$

$\tan\theta = 4$

$\theta = \tan^{-1}(4)$

44. Answer (4)

**Hint: & Sol:** Velocity is vector so even if magnitude of velocity does not change but direction changes.

Increment or decrement in speed depends on direction of $\vec{v}$ and $\vec{a}$

45. Answer (3)

**Hint:** $S = ut + \frac{1}{2}at^2$

$S_n^{th} = u + \frac{a}{2}(2n - 1)$

**Sol.:** $S_7 = 10 \times 7 + \frac{1}{2} \times 2 \times 49 = 70 + 49 = 119$ m

$S_{7^{th}} = 10 + \frac{2}{2}(2 \times 7 - 1) = 10 + 13 = 23$

Ratio = $\frac{119}{23}$

46. Answer (3)

**Hint:** $S = ut + \frac{1}{2}at^2$

**Sol.:** $h = ut + \frac{1}{2}at^2$

$h = \frac{1}{2} \times 2 \times 100 = 100$ m


47. Answer (3)

**Hint & Sol:** According to Galileo ratio

Distance travelled in successive time is in ratio

1 : 3 : 5 : ...


48. Answer (1)

**Hint & Sol.:** $\vec{v}_{Q/P} = \vec{v}_Q - \vec{v}_P$

$\vec{v}_{Q/P} = 50\hat{i} - 10\hat{i}$

$\vec{v}_{Q/P} = 40\hat{i}$

49. Answer (3)

**Hint:** $R = u_x \times T$

**Sol.:** $R = \frac{2u_x u_y}{g} = \frac{2u^2 \sin\theta \cos\theta}{g} = \frac{u^2 \sin 2\theta}{g}$

50. Answer (3)

**Hint & Sol:** The area under acceleration-time curve gives the change in velocity.

# [CHEMISTRY]

## SECTION-A

51. Answer (3)

**Hint:** In case of polyatomic molecules the dipole moment not only depend upon individual dipole moments of bonds but also on the spatial arrangement of various bonds in the molecule.

**Sol.:** For $BeF_2$, $BF_3$, $CO_2$ and $CH_4$ the dipole moment, $\mu_{net}$ = 0 because of symmetrical structure.

52. Answer (4)

**Hint:** Molecules with bond order zero do not exist.

Bond order = $\frac{1}{2}(N_b - N_a)$

**Sol.:**

Bond order of $H_2 = \frac{1}{2}(2-0) = 1$

Bond order of $C_2 = \frac{1}{2}(8-4) = 2$

Bond order of $N_2 = \frac{1}{2}(10-4) = 3$

Bond order of $Be_2 = \frac{1}{2}(2-2) = 0$

So $Be_2$ does not exist

53. Answer (3)

**Hint:** Bond angle and shape of molecule depends upon repulsive interaction of electron pairs.

**Sol.:**

| Molecule | Bond angle |
|---|---|
| $BF_3$ | 120° |
| $CH_4$ | 109.5° |
| $NH_3$ | 107° |
| $H_2O$ | 104.5° |

54. Answer (4)

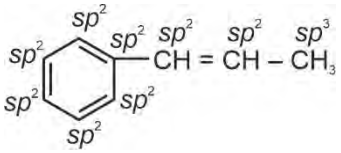
**Hint:** The species which has unpaired electron are paramagnetic in nature.

**Sol.:**

| Species | Magnetic nature |
|---|---|
| $H_2$ | Diamagnetic |
| $O_2^+$ | Paramagnetic |
| $N_2$ | Diamagnetic |
| $O_2$ | Paramagnetic |
| $F_2$ | Diamagnetic |
| $H_2^+$ | Paramagnetic |
| $O_2^-$ | Paramagnetic |

55. Answer (2)

**Hint:** C with one double bond is $sp^2$ hybridised.

**Sol.:** 


Total number of $sp^2$ hybridised carbon atoms is 8.

56. Answer (2)

**Hint & Sol.:** Double bond in $C_2$ consists of both $\pi$ bonds because of presence of four electrons in two $\pi$ molecular orbitals. ($\pi$ $2p_x$ and $\pi 2p_y$)

57. Answer (1)

**Hint:** n $\rightarrow$ Principal quantum number

l $\rightarrow$ Azimuthal quantum number

**Sol.:**

n = 3, l = 1 $\rightarrow$ 3*p*

n = 2, l = 0 $\rightarrow$ 2*s*

n = 3, l = 0 $\rightarrow$ 3*s*

n = 2, l = 1 $\rightarrow$ 2*p*

58. Answer (3)

**Hint:** Higher charge increases the energy and decreases stability of the species.

**Sol.:** Formal charge helps in the selection of lowest energy structure from a number of possible Lewis structures. Generally the lowest energy structure is the one with the smallest formal charges on atoms.

59. Answer (4)

**Hint:** Orbital dipole due to lone pair has to be considered in both $NH_3$ and $NF_3$.

**Sol.:** In case of $NH_3$ the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N–H bonds, whereas in $NF_3$ the orbital dipole is in the direction opposite to the resultant dipole moment of three N–F bonds.

60. Answer (3)

**Hint:** Metals have low electronegativity while non-metals have high electronegativity.

**Sol.:** Electronegativity is directly related to that non-metallic properties of elements. Thus, the increase in electronegativities across a period is accompanied by an increase in non metallic properties.

Electronegativity is a non-measurable quantity. Pauling assigned arbitrarily value of 4.0 to fluorine.

61. Answer (3)

**Hint:** Cerium (Ce) is *f*-block element

**Sol.:**

- *s* and *p* block elements are called representative elements. Bismuth (Bi) and rubidium (Rb) are *p* and *s* block elements respectively.
- Ge and Sb are semi-metals or metalloids.
- Ti is *d* block element.

62. Answer (3)

**Hint:** Ionization enthalpy generally increases across the period.

**Sol.:** $1s^2 2s^2 2p^3$ represents electronic configuration of N and it has stable half-filled configuration of *p*-orbital so it has maximum ionization enthalpy.

63. Answer (1)

**Hint:** Electron gain enthalpy generally becomes less negative on moving down the group.

**Sol.:** Due to smaller size of 2p orbitals, the upcoming electron experiences repulsion with valence electrons and hence O has least negative electron gain enthalpy among group 16 elements.

64. Answer (1)

**Hint:** $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

**Sol.:** Mole of $C_2H_6$ (ethane) = $\frac{180}{30} = 6$

Mole of $O_2$ required = $\frac{7}{2} \times 6 = 21$

Volume of $O_2$ required at STP

= 21 × 22.4 = 470.4 L

65. Answer (4)

**Hint:** Boron does not have d-orbital.

**Sol.:** For alkali metals, as the shell size for valence electron increases the ionisation energy decreases.

66. Answer (1)

**Hint:** A chemical reactions follows conservation of mass.

**Sol.:** Reaction involved in Haber's process:

$N_2 + 3H_2 \longrightarrow 2NH_3$

Moles of hydrogen molecules required = $\frac{3}{2} \times 30 = 45$

67. Answer (1)

**Hint:** Mole of $HNO_3$ in the given solution

= 900 × 4 × $10^{-3}$

**Sol.:** Mass of $HNO_3$ in the given solution = 900 × 4 × $10^{-3}$ × 63 g = 226.8 g

Mass of concentrated $HNO_3$ solution required

= $\frac{100}{70} \times 226.8 = 324$ g

68. Answer (4)

**Hint & Sol.:**

| | IUPAC name | | IUPAC official name |
|---|---|---|---|
| a. | Unnilunium | → | Mendelevium |
| b. | Unnilbium | → | Nobelium |
| c. | Unniltrium | → | Lawrencium |
| d. | Unnilquadium | → | Rutherfordium |

69. Answer (4)

**Hint:** Molecular formula is integral multiple of empirical formula

**Sol.:**

| | % | Mole | Mole ratio |
|---|---|---|---|
| C | 80 | $\frac{80}{12} = 6.67$ | $\frac{6.67}{6.67} = 1$ |
| H | 20 | $\frac{20}{1} = 20$ | $\frac{20}{6.67} = 3$ |

Empirical formula of the compound = $CH_3$

Molecular formula could be = $(CH_3)_n$ (n = 1, 2, 3…)

$(CH_3)_{\times 2} = C_2H_6$

70. Answer (1)

**Hint:** Zeros preceding to first non-zero digit are not significant.

**Sol.:** 0.0034 has 2 significant figures.

71. Answer (2)

**Hint:** Weighted average atomic mass

= $\frac{1}{100}\sum p_i M_i$

**Sol.:** Weighted average atomic mass

= $\frac{1}{100}\sum p_i M_i$ ($p_i$ = Percentage, $M_i$ = Atomic mass)

= $\frac{1}{100}(100 \times 90 + 99 \times 8 + 102 \times 2)$ = 99.96 amu

72. Answer (3)

**Hint:** Molarity is defined as number of moles (n) of solute dissolved in one litre of solution.

**Sol.:** Molarity $= \frac{n \times 1000}{V\,(mL)}$

$$= \frac{\frac{6.02 \times 10^{21}}{6.02 \times 10^{23}} \times 1000}{100} = 10^{-2} \times 10 = 10^{-1}M = 0.1\ M$$

73. Answer (2)

**Hint:** 1 molecule of $O_3$ has 3 O atoms.

**Sol.:** Total number of O atoms in 0.1 mol of $O_3$ = $0.1 \times 3 \times 6.02 \times 10^{23} = 1.806 \times 10^{23}$

74. Answer (1)

**Hint:** Mole of molecules

$$= \frac{\text{Given mass of molecule}}{\text{Molar Mass}}$$

**Sol.:** 4g $H_2$ = 2 moles

$$32\ g\ SO_2 = \frac{32}{64} = 0.5\ mole$$

$$22\ g\ CO_2 = \frac{22}{44} = 0.5\ mole$$

$$24\ g\ O_3 = \frac{24}{48} = 0.5\ mole$$

75. Answer (4)

**Hint & Sol.:** $r_n = \frac{a_0 n^2}{Z} = \frac{0.53 \times (2)^2}{1} = 2.12\ Å$

76. Answer (1)

**Hint:** $\frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

**Sol.:** For shortest wavelength in Lyman series $n_1 = 1, n_2 = \infty$

$$\frac{1}{\lambda} = R_H$$

$$\lambda = \frac{1}{R_H}$$

77. Answer (1)

**Hint:** $n\lambda = 2\pi r$

**Sol.:** $r_3 = a_0 n^3 = 52.9 \times 3^2$

$$\lambda = \frac{2\pi r}{n} = \frac{2\pi \times 52.9 \times 3^2}{3}$$

$\lambda = 317.4\pi$

78. Answer (2)

**Hint & Sol:** Lyman series for hydrogen atom falls in UV region.

79. Answer (3)

**Hint:** Bohr's theory could not explain ability of atoms to form molecules by chemical bonds

**Sol.:** Bohr's theory was unable to explain the splitting of spectral lines in the presence of magnetic field or an electric field.

80. Answer (1)

**Hint:** Kinetic energy of electrons increases with the increase of frequency of light.

**Sol.:** The number of electrons ejected is proportional to the intensity of light.

81. Answer (2)

**Hint:** Energy of photon = $h\nu$

**Sol.:** Power of bulb = 100 $Js^{-1}$

Energy of one photon = $E = \frac{hc}{\lambda}$

$$= \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{6.626 \times 10^{-12}} = \frac{10^{-34} \times 3 \times 10^8}{10^{-9}}$$

$= 3 \times 10^{-17}$ J

Number of photons emitted = $\frac{100}{3 \times 10^{-17}}$

$= 33.33 \times 10^{17}$

$= 3.33 \times 10^{18} s^{-1}$

82. Answer (3)

**Hint:** Number of protons = Atomic number

Number of nucleons = Mass number

**Sol.:** Number of proton = 90

Number of electron = 90

Number of neutrons = 232 – 90 = 142

83. Answer (4)

**Hint:** Bohr's theory is applicable to single electronic system.

**Sol.:** $Be^{2+}$ has 2 electrons so Bohr's theory is not applicable to it.

84. Answer (3)

**Hint:** n, l and m together denotes an orbital

**Sol.:** An orbital can have maximum of 2 electrons

85. Answer (3)

**Hint & Sol.:** $d_{z^2}$ and $d_{x^2-y^2}$ have electron density along axes.

## SECTION-B

86. Answer (1)

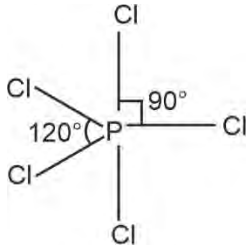
**Hint:** Intermolecular hydrogen bond is formed between two different molecules of the same or different compounds.

**Sol.:** Intramolecular hydrogen bond is formed when hydrogen atom is in between two highly electronegative atoms present within the same molecule. o-nitrophenol forms intramolecular H-bond, while ethanol forms intermolecular hydrogen bond.

87. Answer (1)

**Hint:** Hybridisation of P in $PCl_5$ is $sp^3d$.

**Sol.:**




Hybridisation : $sp^3d$ ; shape : Trigonal bipyramidal

In $PCl_5$ the axial bonds are longer and weaker than equatorial bonds.

88. Answer (2)

**Hint:** Hybridisation of Ni in $[Ni(CN)_4]^{2-}$ is $dsp^2$ and its shape is square planar.

**Sol.:**

| Molecules/ions | Hybridisation type | Shape |
|---|---|---|
| $[Ni(CN)_4]^{2-}$ | $dsp^2$ | Square planar |
| $PF_5$ | $sp^3d$ | Trigonal bipyramidal |
| $BrF_5$ | $sp^3d^2$ | Square pyramidal |
| $SF_6$ | $sp^3d^2$ | Octahedral |

89. Answer (3)

**Hint:** The greater the charge on the cation, the greater the covalent character of the ionic bond.

**Sol.:** The polarising power of cation increases with increase in charge, hence covalent character of ionic bond increases.

So increasing order of covalent character is

$NaCl < MgCl_2 < AlCl_3$

90. Answer (3)

**Hint:** 1 mole of C-12 has $6.022 \times 10^{23}$ atoms.

**Sol.:** Mass of one C-12 atom = $\frac{12}{6.022 \times 10^{23}}$

$= 1.99 \times 10^{-23}$ g

91. Answer (3)

**Hint:** Amphoteric oxides behaves as acidic compound with bases and as basic compound with acid.

**Sol.:** $Na_2O$ = Basic

$Cl_2O_7$ = Acidic

$N_2O$ = Neutral

$Al_2O_3$ = Amphoteric

92. Answer (1)

**Hint:** Molar mass × mole = Given mass

**Sol.:** Let, atomic mass of element X be 'a' u and atomic mass of element Y be 'b' u

$0.2 (a + 2b) = 20$

$a + 2b = 100$ …(i)

$0.1 (3a + 2b) = 18$

$3a + 2b = 180$ …(ii)

Solving (i) & (ii) will give

$a = 40$ u and $b = 30$ u

93. Answer (1)

**Sol.:** Molarity is number of moles of solute present in 1 litre of solution. As the volume of solution changes with temperature, the molarity is temperature dependent.

94. Answer (3)

**Hint :** Molality = $\frac{\text{Mole of solute}}{\text{Mass of solvent in kg}}$

**& Sol.:** Let volume of solution = 1 litre

Moles of NaOH = 1

Mass of NaOH solution = $1000 \times 1.20 = 1200$ g

Mass of $H_2O = 1200 - 40 = 1160$ g

Molality = $\frac{\text{Mole of NaOH}}{\text{Mass of solvent in kg}}$

$= \frac{1}{1.16} = 0.86$ m

95. Answer (4)

**Hint :** 100 L of air contains 20 L of $O_2$

**Sol. :** Volume of $O_2$ in 56 L air

$= \frac{20}{100} \times 56 = 11.2$ L

Number of $O_2$ molecule

$= \frac{11.2}{22.4} \times 6.02 \times 10^{23} = 3.01 \times 10^{23}$

96. Answer (1)

**Hint:** As the bond order increases the stability of species increases.

**Sol.:**

| Species | Bond Order |
|---|---|
| $O_2$ | 2 |
| $O_2^+$ | 2.5 |
| $O_2^-$ | 1.5 |
| $O_2^{2-}$ | 1 |

97. Answer (3)
**Hint:** For multi-electronic species, higher is the value of (n + l) higher is the energy of orbital.
**Sol.:**
$5p \rightarrow n + l = 6$
$5s \rightarrow n + l = 5$
$4p \rightarrow n + l = 5$
$3d \rightarrow n + l = 5$
If (n + l) value is same, higher is value of n higher is energy
So correct order
$5p > 5s > 4p > 3d$

98. Answer (3)
**Hint:** For a given value of n,
l = 0, 1, 2… (n – 1)
**Sol.:** for n = 5
l can have value = 0, 1, 2, 3, 4
Hence for n = 5, $l \neq 5$

99. Answer (4)
**Hint:** $\lambda = \frac{h}{mv}$
**Sol.:** $\lambda = \frac{h}{mv} = \frac{6.6\times10^{-34}}{0.66\times10^{3}} = 1\times10^{-36}\text{m}$

100. Answer (1)
**Hint:** E is inversely proportional to $\lambda$
**Sol.:** $\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$
$\frac{25}{100} = \frac{\lambda_2}{\lambda_1}$
$\lambda_1 = 4\lambda_2$

# [BOTANY]

## SECTION - A

101. Answer (1)
**Hint:** Anton von Leeuwenhoek observed few living cells capable of moving *e.g.* Protozoa, bacteria, etc.
**Sol.:** Robert Hooke studied and discovered the cell from a thin slice of cork.
Robert Brown discovered the nucleus of a cell. Rudolf Virchow first explained that cells divided and new cells are formed from pre-existing cells (*Omnis cellula-e cellula*).

102. Answer (3)
**Hint:** R.B.C. are round and biconcave in shape.
**Sol.:** White blood cells – amoeboid.
Mesophyll cells – round and oval.
Nerve cells – branched and long.

103. Answer (4)
**Hint:** Anything less than a complete structure of a cell does not ensure independent living.
**Sol.:** Matthias Schleiden, a German botanist studied a large number of plants and observed that all plants are composed of different kinds of cells which form the tissue of the plants.

104. Answer (4)
**Hint:** Some of the organelles function in a co-ordinated manner and constitute an endomembrane system.
**Sol.:** The organelles included in the endomembrane system are Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles.

105. Answer (1)
**Hint:** International Code of Zoological Nomenclature set rules for scientific naming of animals.
**Sol.:** International Code of Botanical Nomenclature set rules for scientific naming of plants.

106. Answer (1)
**Hint:** Liquid endosperm in coconut represents multinucleate condition
**Sol.:** Liquid endosperm in coconut is an example of syncytium.

107. Answer (3)
**Hint:** In the taxonomic hierarchy species serve as the basic and lowest category.
**Sol.:** Arrangement of taxonomic categories in descending order in animal is
Kingdom, Phylum, Class, Order, Family, Genus, Species.

108. Answer (2)
**Hint:** It is the phase where actual cell division occurs.
**Sol.:** M-phase is the most dramatic period of the cell cycle which involves a major reorganisation of virtually all components of the cell.

109. Answer (4)

**Hint:** This phase is also known as quiescent stage.

**Sol.:** In $G_0$ phase the cells do not appear to exhibit division.

110. Answer (2)

**Hint:** This organelle is not bound by a membrane.

**Sol.:** Centriole lacks DNA but can perform its duplication during S-phase.

111. Answer (4)

**Hint:** $G_1$ phase is post-mitotic phase. This phase is the interval between mitosis and initiation of DNA replication.

**Sol.:** Tubulin protein is synthesised in $G_2$ phase.

112. Answer (3)

**Hint :** In this stage, splitting of centromere takes place.

**Sol.:** Anaphase is the best stage to study shape of chromosomes.

113. Answer (3)

**Hint:** Mesosomes are formed by the invagination of plasma membrane into the cell.

**Sol.:** Chromatophores are the membranous extensions into the cytoplasm which contain pigments.

114. Answer (3)

**Hint:** Plasmid is a extra-chromosomal double stranded circular DNA.

**Sol.:** Plasmid DNA is used to monitor bacterial transformation with foreign DNA and it also confers certain unique phenotypic characters to bacteria.

115. Answer (3)

**Hint:** Fimbriae are known to help in attaching the bacteria to rocks in streams.

**Sol.:** Flagella help bacteria in motility and it is made up of flagellin protein. Cell wall prevent the bacterium from bursting or collapsing.

116. Answer (3)

**Hint:** Adjacent cells in a plant tissue are held together by a thin, sticky, amorphous layer of cementing material called middle lamella.

**Sol.:** Middle lamella is chiefly made up of calcium and magnesium pectate.

117. Answer (4)

**Hint:** Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies.

**Sol.:** Inclusion bodies are not bound by any membrane systems and lie free in the cytoplasm.

*e.g.*- Phosphate granules

Cyanophycean granules

Glycogen granules.

118. Answer (2)

**Hint:** The correct sequence of different stages of prophase I is as follows:

Leptotene $\rightarrow$ Zygotene $\rightarrow$ Pachytene $\rightarrow$ Diplotene $\rightarrow$ Diakinesis.

**Sol:**

(1) Condensation and coiling of chromatin fibres begins during leptotene.

(2) Synapsis of homologous chromosomes occur during zygotene.

(3) Exchange of genetic material between non-sister chromatids of homologous chromosomes occurs during pachytene.

(4) Chiasmata can be observed during diplotene.

(5) Disintegration of nuclear envelope can be observed during diakinesis.

119. Answer (4)

**Hint:** Cell wall is non-living, rigid structure and its composition varies in different groups.

**Sol.:** Algal cell wall is made up of cellulose, galactans, mannans and minerals like calcium carbonate.

Fungal cell wall is composed of chitin.

120. Answer (2)

**Hint:** Plastids are present in plant cells and absent in animal cells.

**Sol.:** Almost all plant cells lack centrosome and centrioles.

121. Answer (4)

**Hint:** The fluid nature of the membrane is important for the functions like cell growth, secretion, endocytosis, etc.

**Sol.:** Quasi-fluid nature of lipids, enables lateral movement of protein within the overall bilayer and this ability to move within the membrane is measured as fluidity.

122. Answer (4)

**Hint:** SER is associated with muscle contraction by release and uptake of $Ca^{+2}$ ions.

**Sol.:** Golgi-apparatus is the important site of formation of glycoproteins and glycolipids.

123. Answer (4)

**Hint:** Mitochondria is a double membrane bound organelles.

**Sol.:** Ribosomes are non-membrane bound organelles found in all cells.

124. Answer (1)

**Hint:** Leucoplasts are colourless plastids which generally occur near the nucleus in non-green cells.

**Sol.:** Aleuroplast store proteins while elaioplasts store fats and oils.

125. Answer (3)

**Hint:** Metacentric chromosomes appear V shaped.

**Sol.:** During anaphase, acrocentric chromosomes appear J shaped.

126. Answer (1)

**Hint:** Each centrosome radiates out microtubules called asters.

**Sol.:** The two asters together with spindle fibres forms mitotic apparatus.

127. Answer (1)

**Hint:** In this phase of karyokinesis, chromosomes appear like a ball of wool. It is also called spireme stage.

**Sol.:** Prophase is the first stage of karyokinesis of mitosis.

128. Answer (3)

**Hint:** 4 microspores are produced from 1 microspore mother cell after one meiosis.

**Sol.:** Number of meiotic divisions required to make x number of seeds

$= x + \frac{x}{4} = 100 + \frac{100}{4} = 125$

129. Answer (3)

**Hint:** Interkinesis is a gap which exists between meiosis I and meiosis II.

**Sol.:** During interkinesis, there is no replication of DNA occur.

130. Answer (1)

**Hint:** Recombinase enzyme is required in pachytene stage.

**Sol.:** The site where crossing over occurs forms a recombination nodule. The recombination is an enzyme-mediated process, an enzyme called recombinase is involved during this process.

131. Answer (3)

**Hint:** Telophase is the last stage of karyokinesis.

**Sol.:** If APC is defective in a human cell, separation of sister chromatids, decondensation of chromosomes and reassembly of nuclear membrane will get affected. Histone proteins are synthesised during S-phase.

132. Answer (1)

**Hint:** Systematics include characterisation, identification, nomenclature, classification and phylogeny of organisms.

**Sol.:** Systematics is more wider field of science as it involves identification, nomenclature and classification. It also takes into account evolutionary relationships between various organisms.

133. Answer (4)

**Hint:** Mitosis maintains the size of the cell.

**Sol.:** Meiosis provides a chance for the formation of new combinations of chromosomes. This brings out variations.

134. Answer (4)

**Hint:** This figure is representing the cell in metaphase I.

**Sol.:** In metaphase I, the microtubules of the spindle fibres from opposite poles attach to the centromere of the chromosome facing towards it.

135. Answer (2)

**Hint:** Dictyotene stage can be seen in some female vertebrates.

**Sol.:** In oocytes of some vertebrates, diplotene lasts for month or years. It is called dictyotene stage.

## SECTION - B

136. Answer (4)

**Hint:** Many membrane bound minute vesicles called microbodies contain various enzymes.

**Sol.:** Microbodies are present in both plant and animal cells. They lack DNA.

137. Answer (2)

**Hint :** It is the second stage of karyokinesis.

**Sol.:** The complete disintegration of nuclear envelope marks the beginning of metaphase.

138. Answer (4)

**Hint:** The *Cis* and *Trans* faces of the Golgi complex are entirely different, but interconnected.

**Sol.:** *Trans* face of Golgi complex gives rise to the secretory vesicles.

139. Answer (3)

**Hint:** Nucleolus is a spherical structure found in the nucleoplasm.

**Sol.:** Nucleolus is not bounded by any membrane.

140. Answer (1)

**Hint:** Ribosomes was discovered by George Palade.

**Sol.:** An improved model of the structure of the cell membrane was proposed by Singer and Nicolson widely accepted as Fluid Mosaic model.

141. Answer (1)

**Hint:** Centriole gives a cartwheel appearance.

**Sol.:** (i) Mitochondria – Possess oxysomes

(ii) Lysosomes – Also known as Suicidal bag

(iii) Microfilaments – Involve in cytoplasmic streaming

142. Answer (4)

**Hint :** Human's cell cycle machinery is more complex than yeast.

**Sol.:** Period of cell cycle varies from organism to organism and also from cell to cell. Yeast cell divides once in 90 minutes and a typical human cell divides in every 24 hours.

143. Answer (3)

**Hint:** All the chromosomes align themselves at the equator in metaphase stage.

**Sol:** Nucleolus, ER, Golgi bodies and other organelles reappear in telophase. Centrosome begins to move towards opposite poles of the cell during prophase.

144. Answer (1)

**Hint:** In animal cells, cytokinesis is achieved by the formation of a furrow.

**Sol.:** Phragmoplast is formed by the Golgi complex and grows centrifugally to form cell plate.

145. Answer (4)

**Hint:** This diagram shows the internal structure of cilia/flagella.

**Sol.:** Label A represents central microtubules. This structure's core is called axoneme which is surrounded by plasma membrane (Label C). This structure has 9 radial spokes and interdoublet linkers.

146. Answer (2)

**Hint:** The phenomenon of bringing the chromosome on the equator of spindle is called congression. It occurs in metaphase.

**Sol.:** Anaphase – Formation of interzonal fibres.

Metaphase – Congression of chromosomes.

Telophase – Reassembly of nuclear membrane.

147. Answer (2)

**Hint:** This organelle is membrane bound.

**Sol.:** In *Amoeba*, contractile vacuole is important for osmoregulation and excretion.

148. Answer (4)

**Hint:** The outer membrane forms the continuous limiting boundary of the mitochondria.

**Sol.:** Each mitochondria is a double membrane-bound structure with the outer membrane and the inner membrane dividing its lumen distinctly into two aqueous compartments.

149. Answer (3)

**Hint:** DNA replication takes place in 'S' phase.

**Sol.:** Egg of an organism has 10 pg DNA.

In $G_1$ phase the amount of DNA would be 20 pg

After the completion of 'S' phase it will be 40 pg DNA.

$\therefore$ The amount of DNA in $G_2$ phase = 40 pg.

150. Answer (2)

**Hint:** Wheat belongs to Poaceae family.

**Sol.:** Polymoniales is an order of dicot plants such as brinjal.

# [ZOOLOGY]

## SECTION - A

151. Answer (2)

**Hint:** An enzyme present in plants.

**Sol.:** Chitin is present in the exoskeleton of arthropods. Collagen is the most abundant protein in the animal world while Ribulose bisphosphate Carboxylase-Oxygenase (RuBisCO) is the most abundant protein in whole of the biosphere.

152. Answer (3)

**Hint:** Salivary gland is an exocrine gland.

**Sol.:** Some of the columnar or cuboidal cells get specialised for secretion and are called glandular epithelium. They are mainly of two types : unicellular, consisting of isolated glandular cells (goblet cells of the alimentary canal) and multicellular, consisting of cluster of cells (salivary glands). Salivary glands are exocrine glands. Endocrine glands are also known as ductless glands.

153. Answer (3)

**Hint:** Derived from monocytes

**Sol.:** Areolar connective tissue serves as a support framework for epithelium. It contains fibroblasts, macrophages and mast cells.

Macrophages are phagocytic cells.

Fibroblast cells produce fibres.

Mast cells secrete histamine and serotonin in case of allergic reactions.

154. Answer (3)

**Hint:** Dehydration reaction includes removal of a $H_2O$ molecule.

**Sol.:** Molecular formula of glucose – $C_6H_{12}O_6$

2 molecules of glucose form 'X' after dehydration reaction which involves removal of a $H_2O$ molecule.

So, $C_{12}H_{24}O_{12} - H_2O = C_{12}H_{22}O_{11}$

Therefore, molecular formula for 'X' is $C_{12}H_{22}O_{11}$.

155. Answer (3)

**Hint:** Temperature gets reduced by 10°C.

**Sol.:** A general rule of thumb is that rate doubles or decreases by half for every 10°C change in temperature in either direction.

In the mentioned case, temperature decreases by 10°C, for which the rate of reaction decreases by half means from 2X to X.

156. Answer (4)

**Hint:** Endocrine gland.

**Sol.:** On the basis of mode of pouring of their secretions, glands are divided into two categories namely exocrine and endocrine glands. Exocrine glands secrete mucus, saliva, earwax, oil, milk, digestive enzymes (*e.g.* trypsin) and other cell products. These products are released from ducts or tubes.

In contrast, endocrine glands do not have ducts. Their products, called hormones (*e.g.* insulin), are secreted directly into the fluid bathing the gland.

157. Answer (4)

**Hint:** Haematopoiesis

**Sol.:** The intercellular material of cartilage is solid and pliable and resists compression. Cartilage is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.

The bone marrow in some bones is the site of production of blood cells.

158. Answer (3)

**Hint:** Monomer of inulin is also known as fruit sugar.

**Sol.:** Inulin is a polymer of fructose.

Insulin is a hormone and is proteinaceous in nature and made up of amino acid residues.

Cellulose is a homopolymer of glucose. Ribose is a pentose sugar and is present in RNA.

159. Answer (2)

**Hint:** Proteins constitute 10-15% of the total cellular mass.

**Sol.:**

| Component | % of the total cellular mass |
|---|---|
| Water | 70-90 |
| Proteins | 10-15 |
| Carbohydrates | 3 |
| Lipids | 2 |
| Nucleic acids | 5-7 |
| Ions | 1 |

Collagen – Protein, Glycogen – Carbohydrate, Palmitic acid-Lipid, DNA-Nucleic acid, Calcium-Ion.

160. Answer (4)

**Hint:** Cell junctions are absent in skeletal muscles.

**Sol.:** Connective tissues are the most abundant and widely distributed tissues in the body of complex animals.

In a typical skeletal muscle such as the biceps, striated/striped muscle fibres are bundled together in a parallel fashion. Cell junctions hold the smooth muscle fibres together and they are bundled together in a connective tissue sheath.

In heart, cardiac muscle fibres are present which are uninucleated.

161. Answer (4)

**Hint:** Present in the walls of stomach and intestine

**Sol.:** Non-striated muscles are also called involuntary muscles as their functioning cannot be directly controlled. Skeletal and cardiac muscles are striated muscles. Smooth muscle fibres taper at both ends (fusiform) and do not show striations. These are uninucleated and unbranched.

162. Answer (4)

**Hint:** Polymeric substances (exception : lipids) are present in acid-insoluble fraction.

**Sol.:** The acid insoluble fraction has only four types of organic compounds *i.e.,* proteins (*e.g.*, Haemoglobin, Insulin, Collagen), nucleic acids (*e.g.,* DNA, RNA), polysaccharides (*e.g.*, Glycogen, Inulin) and lipids.

Tryptophan is an amino acid; glucose is a monosaccharide and adenine is a nitrogenous base and will be found in the acid- soluble fraction.

163. Answer (3)

**Hint:** Main tissue that provides structural frame to the body.

**Sol.:** Bones have a hard and non-pliable ground substance rich in calcium salts and collagen fibres which give bone its strength. The intercellular material of cartilage is solid and pliable and resists compression.

Both bone and cartilage are specialised connective tissues.

164. Answer (2)

**Hint:** Nerve impulse initiates from dendrites of a neuron.

**Sol.:** In a neuron, upon stimulation, the nerve impulses travel in the following direction:

Dendrites → Cell body → Axon

165. Answer (3)

**Hint:** Fat storage tissue

**Sol.:** The given figure represents a fat cell, abundantly present in adipose tissue which is a type of loose connective tissue. It is located mainly beneath the skin. The cells of this tissue are specialised to store fats. The excess of nutrients which are not used immediately are converted into fats and are stored in this tissue.

Orientation of fibres show a regular or irregular pattern in dense regular and irregular connective tissue respectively.

166. Answer (3)

**Hint:** Primary metabolites have identifiable functions.

**Sol.:** Organic compounds including amino acids, sugars *etc*., are called primary metabolites. Primary metabolites have identifiable functions and play known roles in normal physiological processes.

At present, roles and functions of secondary metabolites are unknown.

The acid insoluble fraction has only four types of organic compounds *i.e.,* proteins, nucleic acids, polysaccharides and lipids. These classes of compounds with the exception of lipids, have molecular weights in the range of 10,000 Da and above.

167. Answer (3)

**Hint:** Columnar cells

**Sol.:** If the columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium. Ciliated epithelium is present in the lining of fallopian tube in human females and bronchioles.

168. Answer (3)

**Hint:** Most abundant protein in an animal world

**Sol.:**

| **Protein** | **Function** |
|---|---|
| Collagen | Intercellular ground substance |
| Trypsin | Enzyme |
| Receptor | Sensory reception |

169. Answer (1)

**Hint:** An unicellular organism

**Sol.:** In the complex body of multicellular animals, the basic functions are carried out by different groups of cells in a well-organised manner.

Division of labour is present in multicellular organisms in which tissue, organ system level organisation is present, eg., *Hydra, Periplaneta, Homo sapiens.* It is absent in unicellular organisms like *Paramoecium*.

170. Answer (1)

**Hint:** On the basis of number of layers, two types of this tissues are found.

**Sol.:** Epithelial tissue has a free surface, which faces either a body fluid or the outside environment and thus, provides a covering or a lining for some part of the body.

Connective tissues have special function of linking and supporting other tissues/organs of the body.

Muscles play an active role in all the movements of the body. Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

171. Answer (2)

**Hint:** These cells have least regeneration capacity.

**Sol.:** Neural tissue exerts the greatest control over the body's responsiveness to changing conditions. Neurons, the unit of neural system, are excitable cells.

Muscle cells are the part of muscular tissue.

Neuroglial cells are not excitable cells. Mast cells are present in areolar connective tissue.

172. Answer (1)

**Hint:** Exclude aliphatic amino acids.

**Sol.:** Based on the number of amino and carboxyl groups, there are acidic (*e.g.* glutamic acid), basic (lysine) and neutral (valine) amino acids. Similarly, there are aromatic amino acids (tyrosine, phenylalanine and tryptophan).

173. Answer (4)

**Hint:** Some nucleic acids behave like enzymes.

**Sol.:** Almost all enzymes are proteins. There are some nucleic acids that behave like enzymes. These are called ribozymes.

174. Answer (4)

**Hint:** Intercalated discs are communication/gap junctions.

**Sol.:** Intercalated discs (gap/communication junctions) facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells. These allow the cells to contract as a unit.

Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep neighbouring cells together.

Block of fibrous cartilage is present between adjacent vertebrae as intervertebral disc.

175. Answer (2)

**Hint:** Bone marrow produces blood cells.

**Sol.:** Blood is a fluid connective tissue containing plasma, RBCs, WBCs and platelets. The bone marrow in some bones is the site of production of blood cells. If bone marrow gets damaged, production of blood cells would get hampered.

176. Answer (2)

**Hint:** The cells that secrete collagen or elastin are absent in blood.

**Sol.:** In all connective tissues, except blood, the cells secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the tissues.

177. Answer (2)

**Hint:** Class III of enzymes

**Sol.:** Following are the classes of enzymes:-

(I) Oxidoreductases/dehydrogenases

(II) Transferases

(III) Hydrolases

(IV) Lyases

(V) Isomerases

(VI) Ligases

Hydrolases are the enzymes that catalyse hydrolysis of ester, ether, peptide, glycosidic, C – C, C-halide or P-N bonds. Ester bond is present between ribose sugar and phosphate in a nucleotide.

178. Answer (3)

**Hint:** Epithelium which bears cilia is present in the inner surface of hollow organs.

**Sol.:** Goblet cells of alimentary canal are included in unicellular glandular epithelium.

Tubular parts of nephrons in the kidney have cuboidal epithelium. Compound epithelium is present in the inner lining of ducts of salivary glands. Ciliated epithelium is present in the inner surface of bronchioles

179. Answer (3)

**Hint:** More than half

**Sol.:** Neuroglial cells which make up more than one half the volume of neural tissue in human body are the cells which protect and support neurons.

Neuroglial cells are specialised cells found in the brain and spinal cord. They are non-excitable cells of neural tissue.

180. Answer (3)

**Hint:** Composed of a single layer of cube-like cells.

**Sol.:** Cuboidal epithelium has cells in which nucleus is present at central position. The columnar epithelium is composed of a single layer of tall and slender cells. Their nuclei are located at the base. Free surface may have microvilli.

Compound epithelium is made of more than one layer of cells and thus has a limited role in secretion and absorption.

181. Answer (3)

**Hint:** Concanavalin-A

**Sol.:** Curcumin and vinblastin are drugs whereas concanavalin-A belongs to the category of lectins.

Carotenoids and anthocyanins are pigments, morphine and codeine are alkaloids.

182. Answer (4)

**Hint:** Possess basal nuclei.

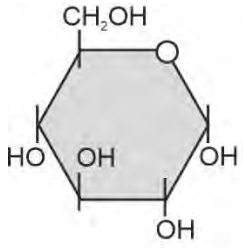
**Sol.:** Squamous epithelium forms diffusion boundary. Ciliated epithelium allows movement of particles or mucus in a specific direction over the epithelium. Cuboidal and columnar epithelium help in secretion and absorption of certain substances.

Compound epithelium is made of more than one layer of cells and thus has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses.

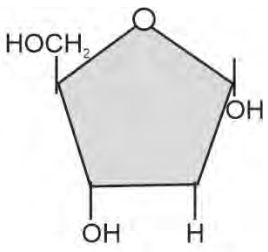
183. Answer (4)

**Hint:** OH group at 2′ position is absent in deoxyribose sugar.

**Sol.:**




(Glucose)




(2′deoxyribose)

The sugar found in polynucleotides is either ribose (a monosaccharide pentose) or 2′ deoxyribose. A nucleic acid containing deoxyribose is called deoxyribonucleic acid (DNA) while that which contains ribose is called ribonucleic acid (RNA).

184. Answer (4)

**Hint:** Collagen fibres are arranged in a regular pattern in dense regular connective tissue.

**Sol.:** Fibres and fibroblasts are compactly packed in the dense connective tissues. Orientation of fibres show a regular or irregular pattern and form dense regular and dense irregular connective tissues respectively.

185. Answer (3)

**Hint:** Homopolymer of glucose

**Sol.:** Cellulose is a polymeric polysaccharide consisting of only one type of monosaccharide units *i.e.,* glucose. Cellulose is a homopolymer. Cellulose does not contain complex helices and hence, cannot hold $I_2$.

Starch forms helical secondary structures and it can hold $I_2$ molecules in the helical portion. The starch $–I_2$ complex is blue in colour.

**SECTION - B**

186. Answer (4)

**Hint:** Bond that joins two cysteine residues together.

**Sol.:** Glycosidic bonds are present in sugars, phosphodiester and hydrogen bonds are found in nucleic acids. Only peptide bonds are present in primary structure of protein.

Hydrogen bonds stabilize the tertiary structure of protein. In a nucleic acid, the bond formed between the phosphate and hydroxyl group of sugar is an ester bond.

187. Answer (4)

**Hint:** Bone cells are enclosed in fluid-filled cavities.

**Sol.:** In the dense regular connective tissue, the collagen fibres are present in rows between many parallel bundles of fibres.

Tendons which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of this tissue.

Dense irregular connective tissue is present in skin. Osteocytes are present in the spaces called lacunae.

188. Answer (3)

**Hint:** Without C=C bond

**Sol.:** Arachidonic acid is an unsaturated fatty acid and has 20-C atoms including the carboxyl carbon. Glycerol is trihydroxy propane. Lecithin is a phospholipid found in the cell membranes of living organisms. Palmitic acid possesses 16 carbons including carboxyl carbon.

189. Answer (4)

**Hint:** Prosthetic group.

**Sol.:** In 'peroxidase' and 'catalase', which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.

Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme.

190. Answer (2)

**Hint:** Exclude the ion required for blood clotting.

**Sol.:** A number of enzymes require metal ions for their activity which form coordination bonds with side chains at the active site and at the same time form one or more coordination bonds with the substrate, *e.g.*, zinc is a cofactor for the proteolytic enzyme, 'carboxypeptidase'.

191. Answer (3)

**Hint:** An energy requiring reaction.

**Sol.:** If product is at a lower level than substrate in terms of potential energy, the reaction would be an exothermic reaction.

One need not supply energy (by heating) in order to form the product.

192. Answer (2)

**Hint:** Equal to the number of OH groups in a molecule of glycerol.

**Sol.:** Heterocyclic ring means presence of any other atom apart from carbon in that ring.

From the mentioned compounds, ribose, adenylic acid and uracil possess heterocyclic ring.

Serine is an amino acid and does not possess cyclic ring.

Glycerol is trihydroxy propane.

Cholesterol has homocyclic ring.

193. Answer (3)

**Hint:** Zwitterionic form of an amino acid.

**Sol.:** A particular property of an amino acid is the ionizable nature of $–NH_2$ and –COOH groups. Hence, in solutions of different pH, the structure of an amino acid changes.

194. Answer (2)

**Hint:** Possess hydrogen bond

**Sol.:** Exoskeleton of arthropods is made up of chitin (monomer is N-acetyl glucosamine). Water is the most abundant chemical in living organisms.

Each amino acid has its own unique pH at which it exists in zwitterionic form.

Sulphur is present in the structure of cysteine.

195. Answer (3)

**Hint:** Cytosine and thymine are substituted pyrimidines present in DNA.

**Sol.:** Substituted purines : Adenine and guanine

Substituted pyrimidines : Cytosine and thymine

Given, guanine = 35%

According to Chargaff's rule:-

[Guanine] = [Cytosine]

[Adenine] = [Thymine]

Therefore, G and C would be 35% each and A and T would be 15% each.

Now, cytosine and thymine would be 35 + 15 = 50.

196. Answer (2)

**Hint:** Also possess communication junctions.

**Sol.:** Cell junctions fuse the plasma membranes of cardiac muscle cells and make them stick together. Communication junctions (intercalated discs) at some fusion points allow the cells to contract as a unit.

The wall of internal organs such as the blood vessels, stomach and intestine contain smooth muscles.

Each muscle is made of many long, cylindrical fibres arranged in parallel arrays. These fibres are composed of numerous fine fibrils, called myofibrils.

197. Answer (2)

**Hint:** Adult human Hb has two $\alpha$ and two $\beta$ chains.

**Sol.:** Some proteins are an assembly of more than one polypeptide or subunits. The manner in which these individual folded polypeptides are arranged with respect to each other is the architecture of a protein otherwise called the quaternary structure of a protein.

Adult human haemoglobin consists of 4 subunits. Two of these are identical to each other.

198. Answer (1)

**Hint:** Conformation

**Sol.:** An enzyme like any protein has the secondary and tertiary structure. Tertiary structure is absolutely necessary for the many biological activities of protein. Backbone of the protein chain folds upon itself, the chain criss crosses itself and hence, many crevices or pockets are made. One such pocket is the 'active site'.

An active site of an enzyme is a crevice or pocket into which the substrate fits. Thus, enzymes through their active sites, catalyse reactions at a high rate.

199. Answer (3)

**Hint:** Presence of ribose sugar

**Sol.:** For nucleic acids, the building block is a nucleotide.

A nucleotide has three chemically distinct components. One is a heterocyclic compound, the second is a monosaccharide and the third, phosphoric acid or phosphate.

Nucleoside is nucleotide excluding phosphate group.

200. Answer (2)

**Hint:** $V_{max}$ will be achieved when all active sites of an enzyme are occupied.

**Sol.:** All the active sites of an enzyme when gets occupied by the substrate, do not bind to other substrate molecules present in the reaction mixture.

Velocity of a reaction reaches maximum when all the active sites of an enzymes are occupied by the substrate.

❑ ❑ ❑

# All India Aakash Test Series for NEET - 2025

## TEST - 5 (Code-B)

Click here for Code-A Sol.

**Test Date : 05/01/2025**

## ANSWERS

| | | | | |
|---|---|---|---|---|
| 1. (3) | 41. (3) | 81. (2) | 121. (2) | 161. (2) |
| 2. (2) | 42. (4) | 82. (4) | 122. (4) | 162. (4) |
| 3. (2) | 43. (4) | 83. (3) | 123. (4) | 163. (4) |
| 4. (3) | 44. (4) | 84. (4) | 124. (1) | 164. (1) |
| 5. (3) | 45. (4) | 85. (3) | 125. (3) | 165. (2) |
| 6. (2) | 46. (1) | 86. (1) | 126. (1) | 166. (1) |
| 7. (1) | 47. (4) | 87. (4) | 127. (3) | 167. (1) |
| 8. (4) | 48. (3) | 88. (3) | 128. (3) | 168. (3) |
| 9. (3) | 49. (3) | 89. (3) | 129. (1) | 169. (3) |
| 10. (2) | 50. (2) | 90. (1) | 130. (1) | 170. (3) |
| 11. (3) | 51. (3) | 91. (4) | 131. (3) | 171. (3) |
| 12. (3) | 52. (3) | 92. (3) | 132. (1) | 172. (2) |
| 13. (4) | 53. (4) | 93. (1) | 133. (4) | 173. (3) |
| 14. (3) | 54. (3) | 94. (1) | 134. (4) | 174. (4) |
| 15. (3) | 55. (2) | 95. (3) | 135. (4) | 175. (4) |
| 16. (3) | 56. (1) | 96. (3) | 136. (2) | 176. (4) |
| 17. (3) | 57. (3) | 97. (3) | 137. (3) | 177. (2) |
| 18. (4) | 58. (2) | 98. (2) | 138. (4) | 178. (3) |
| 19. (1) | 59. (1) | 99. (1) | 139. (2) | 179. (4) |
| 20. (2) | 60. (1) | 100. (1) | 140. (2) | 180. (4) |
| 21. (2) | 61. (4) | 101. (1) | 141. (4) | 181. (3) |
| 22. (3) | 62. (1) | 102. (3) | 142. (1) | 182. (3) |
| 23. (4) | 63. (2) | 103. (4) | 143. (3) | 183. (3) |
| 24. (3) | 64. (3) | 104. (4) | 144. (4) | 184. (3) |
| 25. (3) | 65. (2) | 105. (1) | 145. (1) | 185. (2) |
| 26. (1) | 66. (1) | 106. (1) | 146. (1) | 186. (2) |
| 27. (1) | 67. (4) | 107. (3) | 147. (3) | 187. (3) |
| 28. (2) | 68. (4) | 108. (2) | 148. (4) | 188. (1) |
| 29. (3) | 69. (1) | 109. (4) | 149. (2) | 189. (2) |
| 30. (1) | 70. (1) | 110. (2) | 150. (4) | 190. (2) |
| 31. (3) | 71. (4) | 111. (4) | 151. (3) | 191. (3) |
| 32. (2) | 72. (1) | 112. (3) | 152. (4) | 192. (2) |
| 33. (3) | 73. (1) | 113. (3) | 153. (4) | 193. (3) |
| 34. (2) | 74. (3) | 114. (3) | 154. (4) | 194. (2) |
| 35. (1) | 75. (3) | 115. (3) | 155. (3) | 195. (3) |
| 36. (3) | 76. (3) | 116. (3) | 156. (3) | 196. (2) |
| 37. (3) | 77. (4) | 117. (4) | 157. (3) | 197. (4) |
| 38. (1) | 78. (3) | 118. (2) | 158. (3) | 198. (3) |
| 39. (3) | 79. (1) | 119. (4) | 159. (2) | 199. (4) |
| 40. (3) | 80. (2) | 120. (2) | 160. (2) | 200. (4) |

# HINTS & SOLUTIONS

## [PHYSICS]

### SECTION-A

1. Answer (3)

**Hint:** $v = u + at$

**Sol.:** $\Rightarrow t \propto u$

$\frac{t}{t'} = \frac{u}{2u}$

$t' = 2t$

2. Answer (2)

**Hint & Sol:** $v = u + at$

$v = 2 \times 2 = 4$ m/s

3. Answer (2)

**Hint:** Time taken to reach ground $t = \sqrt{\frac{2h}{g}}$

**Sol.:** A heavy and a light body when released from the same height, reach the ground simultaneously and with same velocity.

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

4. Answer (3)

**Hint:** Slope of $v$-$t$ curve = $\frac{\text{Change in velocity}}{\text{time}}$

**Sol.:** $\tan\theta = \frac{\text{Change in velocity}}{\text{time}} = \text{acceleration}$

5. Answer (3)

**Hint:** $\vec{v}_{r/w} = \vec{v}_r - \vec{v}_w$

**Sol.:** $\vec{v}_r = -6\hat{j}$

$\vec{v}_w = 8\hat{i}$

$\vec{v}_{r/w} = -6\hat{j} - 8\hat{j}$

$|\vec{v}_{r/w}| = \sqrt{36+64} = \sqrt{100} = 10$ m/s

6. Answer (2)

**Hint :** Centripetal acceleration $a_c = \omega^2 r$

**Sol.:** $a_c = \omega^2 r \Rightarrow a_c \propto \omega^2 r$ and $\omega = 2\pi f$

$\Rightarrow a_c \propto f^2$

If frequency is made thrice, acceleration becomes 9 times

7. Answer (1)

**Hint:** At origin x-coordinate = 0

**Sol.:** $x = \sin t - \sqrt{3}\cos t$

$\sin t = \sqrt{3}\cos t$

$\tan t = \sqrt{3}$

$t = \frac{\pi}{3}$ s

8. Answer (4)

**Hint:** Time of flight $(T) = \frac{2u_y}{g}$

**Sol.:** $T = \frac{2\times 8}{10} = 1.6$ s

9. Answer (3)

**Hint:** $\vec{P} + \vec{Q} = \hat{i}$

**Sol.:** $\vec{P} + \vec{Q} = \hat{i}$

$\vec{Q} = \hat{i} - (\hat{i} + 2\hat{j} - 3\hat{k})$

$= \hat{i} - \hat{i} - 2\hat{j} + 3\hat{k}$

$\vec{Q} = -2\hat{j} + 3\hat{k}$

$|\vec{Q}| = \sqrt{4+9} = \sqrt{13}$ units

10. Answer (2)

**Hint:** $D$ = Sum of horizontal distances covered by ball thrown by Prateek and Rohan.

**Sol.:** $x_1 + x_2 = D$

$u\cos\theta \times t + u' \times t = D$

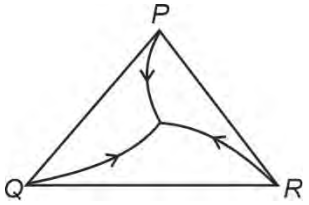
$20\sqrt{2} \times \frac{1}{\sqrt{2}} \times 5 + 20 \times 5 = D$

$100 + 100 = D$

$D = 200$ m

11. Answer (3)

**Hint & Sol:** Since they are always pointing towards the next, they will meet at centroid of triangle by symmetry.



12. Answer (3)

**Hint:** $v_{avg} = \dfrac{\text{Total displacement}}{\text{Total time taken}}$

**Sol.:** Displacement = $AB = R\sqrt{2} = 2\sqrt{2}$

$\Rightarrow V_{avg} = \dfrac{2\sqrt{2}}{2} = \sqrt{2}$ m/s

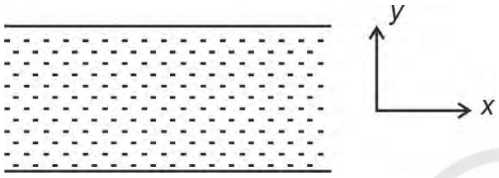
13. Answer (4)

**Hint:** $\vec{V}_{m/b} = \vec{V}_{m/w} - \vec{V}_{b/w}$

**Sol.:** $\vec{V}_{m/w} = 3\hat{j}$

$\vec{V}_{b/w} = -4\hat{i}$

$\vec{V}_{m/b} = 3\hat{j} - (-4\hat{i}) = 3\hat{j} + 4\hat{i}$




$|\vec{V}_{m/b}| = \sqrt{9+16}$ = 5 km/h

Direction $\theta = \tan^{-1}\left(\dfrac{3}{4}\right)$

$\theta$ = 37°, with the river flow.

14. Answer (3)

**Hint:** $y = x\tan\theta\left[1 - \dfrac{x}{R}\right]$

**Sol.:** $y = x\sqrt{3}\left[1 - \dfrac{x}{\sqrt{3}\,7}\right]$

Comparing with

$y = x\tan\theta\left[1 - \dfrac{x}{R}\right]$

$\therefore\ R = \dfrac{\sqrt{3}}{7}$

15. Answer (3)

**Hint & Sol.:** At maximum height angle between velocity and acceleration is 90°.

16. Answer (3)

**Hint:** $a = v\dfrac{dv}{dx}$

**Sol.:** As $a = v\dfrac{dv}{dx}$

$a = 15(5) = 75$ m/s$^2$

17. Answer (3)

**Hint & Sol:**

$\dfrac{\text{joule ohm}}{\text{sec volt}} = \dfrac{\text{joule}}{\text{sec ampere}} = \dfrac{\text{joule}}{\text{coulomb}} = \text{volt}$

18. Answer (4)

**Hint:** $\tan\alpha = \dfrac{Q\sin\theta}{P + Q\cos\theta}$ and

$R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$

**Sol.:** $\tan 90^\circ = \dfrac{Q\sin\theta}{P + Q\cos\theta}$ or $P + Q\cos\theta = 0$

$\Rightarrow \cos\theta = \dfrac{-P}{Q}$

$R = \dfrac{Q}{2} = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$

$\dfrac{Q^2}{4} = P^2 + Q^2 + 2PQ \times \dfrac{-P}{Q}$

On solving

$\dfrac{P}{Q} = \dfrac{\sqrt{3}}{2}$

$\cos\theta = \dfrac{-\sqrt{3}}{2} = \cos 150^\circ$

$\theta$ = 150°

19. Answer (1)

**Hint:** Area under *v-t* curve gives change in position.

**Sol.:** Area above time axis is positive and area below time axis is negative, then displacement = (4 – 4) = 0

While for distance take all areas as positive, distance covered = (4 + 4) = 8 m

20. Answer (2)

**Hint:** Average velocity = $\dfrac{\text{Total displacement}}{\text{Total time}}$

Average speed = $\dfrac{\text{Total distance}}{\text{Total time}}$

**Sol.:** As after each lap initial and final position is same.

So displacement is zero

$\therefore$ Average velocity = 0

Now, total distance in one lap = $2\pi r$

$= 2 \times \pi \times 20$

$= 40\ \pi$

Average speed = $\frac{\text{Total distance}}{\text{Total time}}$

$= \frac{40 \times 3.14}{6.28} = 20$ m/s

21. Answer (2)

**Hint:** $v = \frac{dr}{dt}$ and $a = \frac{dv}{dt}$

**Sol.:** $r \propto t^{\frac{5}{2}}$

$r = k\, t^{\frac{5}{2}}$

$\frac{dr}{dt} = k \times \frac{5}{2} t^{\frac{3}{2}}$

$v \propto t^{\frac{3}{2}}$ ...(i)

$v = k' t^{\frac{3}{2}}$

$\frac{dv}{dt} = k' \times \frac{3}{2} t^{\frac{1}{2}} \Rightarrow a \propto t^{\frac{1}{2}}$ ...(ii)

From (i) & (ii), we get $v \propto a^3$

22. Answer (3)

**Hint:** Velocity is a vector quantity

**Sol.:** As velocity is a vector quantity so it can be positive, negative or zero

$\vec{v}_{avg} = \frac{\text{Displacement}}{\text{Total time}} = \frac{\Delta \vec{r}}{\Delta t}$

$\therefore$ Direction is along net displacement

23. Answer (4)

**Hint:** If initial and final position is same then displacement is zero.

**Sol.:** In 1 min 5 s

Number of revolution = 5

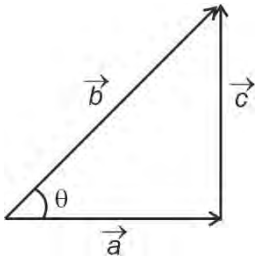
Displacement = Zero

24. Answer (3)

**Hint:** $\vec{a} - \vec{b} + \vec{c} = \vec{0}$

$\Rightarrow \vec{a} + \vec{c} = \vec{b}$

**Sol.:**




$\vec{a} + \vec{c} = \vec{b}$

$\cos\theta = \frac{\sqrt{3}c}{2c}$

$\theta = 30°$

25. Answer (3)

**Hint :** Use concept of dimensional analysis

**Sol.:** Dimensions of a physical quantity are the powers to which base quantities are raised to express that quantity. For example [F] = [MLT$^{-2}$]

According to principle of homogeneity

If $x + y = z$

Then $[x] = [y] = [z]$

26. Answer (1)

**Hint :** L.C = MSD – VSD

**Sol:** $N$ VSD = $(N - 1)$ MSD

L.C = MSD – VSD

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

$\text{L.C} = \frac{\text{MSD}}{N} = \frac{1}{100N}$

27. Answer (1)

**Hint & Sol:** Dimensional analysis does not give any information about dimensionless constants.

28. Answer (2)

**Hint & Sol:** Distance is the actual path length between two points of a body and displacement is the vector from initial position to final position. So both assertion and reason are true but reason is not the correct explanation of assertion.

29. Answer (3)

**Hint:** Density = $\frac{\text{Mass}}{\text{Volume}}$

**Sol.:** $d = \frac{m}{\pi r^2 l}$

$\frac{\Delta d}{d} = \frac{\Delta m}{m} + \frac{2\Delta r}{r} + \frac{\Delta l}{l}$

$\Rightarrow \frac{\Delta d}{d} = \frac{0.003}{0.3} 2 \times \frac{0.005}{5} + \frac{0.06}{6}$

$= 0.01 + 0.02 + 0.01 = 0.04$

% error in density = $0.04 \times 100 = 4\%$

30. Answer (1)

**Hint:** Angular speed, $\omega = \frac{2\pi}{T}$

**Sol.:** $T = \pi$ s

$\omega = \frac{2\pi}{\pi}$ = 2 rad/s

31. Answer (3)

**Hint:** Rise in temperature $\theta = \theta_2 - \theta_1$

**Sol.:** $\theta_1 = (20.6 \pm 0.2)°C$

$\theta_2 = (80 \pm 0.3)°C$

$\theta = \theta_2 - \theta_1$

$= 80 - 20.6 = 59.4°C$

$\Delta\theta = \pm (\Delta\theta_1 + \Delta\theta_2)$

$= \pm(0.2 + 0.3) = \pm 0.5°C$

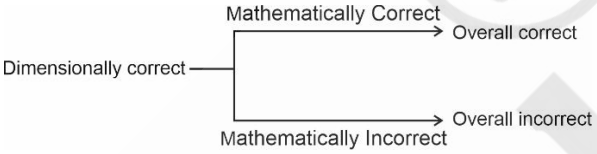
$\therefore$ Rise in temperature = (59.4 ± 0.5)°C

32. Answer (2)

**Hint & Sol.:** When number is expressed in exponential form, the exponential term does not affect the number of significant figures, so given value has 3 significant figures.

33. Answer (3)

**Hint & Sol.:**




Dimensionally incorrect $\Rightarrow$ Overall incorrect

34. Answer (2)

**Hint:** Use relation $n_1u_1 = n_2u_2$

**Sol.:** Energy = $[ML^2T^{-2}]$

$a = 1, b = 2, c = -2$

$$n_2 = n_1\left(\frac{M_1}{M_2}\right)^a\left(\frac{L_1}{L_2}\right)^b\left(\frac{T_1}{T_2}\right)^c$$

$$= 1\left(\frac{\text{kg}}{100\text{ g}}\right)^1\left(\frac{\text{m}}{10\text{ cm}}\right)^2\left(\frac{\text{s}}{5\text{ s}}\right)^{-2}$$

$$= \left(\frac{1000\text{ g}}{100\text{ g}}\right)\left(\frac{100\text{ cm}}{10\text{ cm}}\right)^2\left(\frac{1}{5}\right)^{-2}$$

$= 10 \times 100 \times (5)^2 = 25000$

35. Answer (1)

**Hint:** $\theta$ (in rad) $= \frac{\text{Arc}}{\text{Radius}}$

**Sol.:** If $l = r$

*i.e.* arc length = Radius of circle, then $\theta$ = 1 radian

## SECTION-B

36. Answer (3)

**Hint & Sol:** The area under acceleration-time curve gives the change in velocity.

37. Answer (3)

**Hint:** $R = u_x \times T$

**Sol.:** $R = \frac{2u_xu_y}{g} = \frac{2u^2\sin\theta\cos\theta}{g} = \frac{u^2\sin 2\theta}{g}$

38. Answer (1)

**Hint & Sol.:** $\vec{v}_{Q/P} = \vec{v}_Q - \vec{v}_P$

$\vec{v}_{Q/P} = 50\hat{i} - 10\hat{i}$

$\vec{v}_{Q/P} = 40\hat{i}$

39. Answer (3)

**Hint & Sol:** According to Galileo ratio

Distance travelled in successive time is in ratio

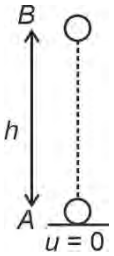
1 : 3 : 5 : ...


40. Answer (3)

**Hint:** $S = ut + \frac{1}{2}at^2$

**Sol.:** $h = ut + \frac{1}{2}at^2$

$h = \frac{1}{2} \times 2 \times 100 = 100$ m




41. Answer (3)

**Hint:** $S = ut + \frac{1}{2}at^2$

$S_n^{\text{th}} = u + \frac{a}{2}(2n - 1)$

**Sol.:** $S_7 = 10\times7+\frac{1}{2}\times2\times49 = 70 + 49 = 119$ m

$S_{7^{th}} = 10+\frac{2}{2}(2\times7-1) = 10 + 13 = 23$

Ratio = $\frac{119}{23}$

42. Answer (4)

**Hint: & Sol:** Velocity is vector so even if magnitude of velocity does not change but direction changes.

Increment or decrement in speed depends on direction of $\vec{v}$ and $\vec{a}$

43. Answer (4)

**Hint:** $R=\frac{u^2\sin2\theta}{g}$, $H_{max}=\frac{u^2\sin^2\theta}{2g}$

**Sol.:** $\frac{u^2\times2\times\sin\theta\times\cos\theta}{g}=\frac{u^2\times\sin\theta\times\sin\theta}{2g}$

$\tan\theta = 4$

$\theta = \tan^{-1}(4)$

44. Answer (4)

**Hint:** $|\vec{P}|=\sqrt{x^2+y^2}$

**Sol.:** $P=\sqrt{1^2+1^2}=\sqrt{2}$ units

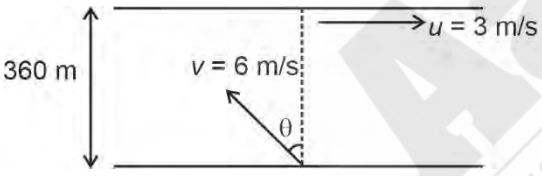
45. Answer (4)

**Hint & Sol:** All the statements are correct.

46. Answer (1)

**Hint:** For $t_{min}$, boat should be steered perpendicularly to the flow of river

**Sol.:**




To cross the river in minimum time, $\theta = 0°$

$t_{min}=\frac{d}{v}=\frac{360}{6}=60$ s

Drift = 3 × 60 = 180 m

47. Answer (4)

**Hint:** Trigonometric functions are dimensionless

**Sol.:** $[Y]=\frac{[F]}{[A]}=\left[\frac{(\tau\cos\theta)\,t^x}{l^3}\right]=\left[\frac{Frt^x}{l^3}\right]$

$\Rightarrow\left[\frac{F}{l^2}\right]=\left[\frac{F}{l^2}t^x\right]$

$t^x = 1$

$x = 0$

48. Answer (3)

**Hint:** For parabolic curve $a \propto x^2 \Rightarrow a = kx^2$

**Sol.:** $\frac{da}{dx}=2kx \quad \left[\text{given } \frac{da}{dx}=1 \text{ at } x=1\right]$

$1 = 2k \times 1 \Rightarrow k=\frac{1}{2}$ so $a=\frac{1}{2}x^2$

At $x = 3 \Rightarrow a=\frac{9}{2}=4.5$ m/s$^2$

49. Answer (3)

**Hint & Sol:** $\vec{v}=2\hat{i}$

$\vec{a}=2\hat{i}+3\hat{j}-5\hat{k}$

Component of $\vec{a}$ along $\vec{v}$ is 2 m/s$^2$

50. Answer (2)

**Hint & Sol:** Momentum $\rightarrow$ [MLT$^{-1}$]

Work $\rightarrow$ [ML$^2$T$^{-2}$]

Angle $\rightarrow$ Dimensionless

Pressure $\rightarrow$ [ML$^{-1}$T$^{-2}$]

# [CHEMISTRY]

## SECTION-A

51. Answer (3)

**Hint & Sol.:** $d_{z^2}$ and $d_{x^2-y^2}$ have electron density along axes.

52. Answer (3)

**Hint:** n, l and m together denotes an orbital

**Sol.:** An orbital can have maximum of 2 electrons

53. Answer (4)

**Hint:** Bohr's theory is applicable to single electronic system.

**Sol.:** $Be^{2+}$ has 2 electrons so Bohr's theory is not applicable to it.

54. Answer (3)

**Hint:** Number of protons = Atomic number

Number of nucleons = Mass number

**Sol.:** Number of proton = 90

Number of electron = 90

Number of neutrons = 232 – 90 = 142

55. Answer (2)

**Hint:** Energy of photon = h$\nu$

**Sol.:** Power of bulb = 100 $Js^{-1}$

Energy of one photon = $E = \frac{hc}{\lambda}$

$= \frac{6.626\times10^{-34}\times3\times10^{8}}{6.626\times10^{-12}} = \frac{10^{-34}\times3\times10^{8}}{10^{-9}}$

$= 3 \times 10^{-17}$ J

Number of photons emitted = $\frac{100}{3\times10^{-17}}$

$= 33.33 \times 10^{17}$

$= 3.33 \times 10^{18} s^{-1}$

56. Answer (1)

**Hint:** Kinetic energy of electrons increases with the increase of frequency of light.

**Sol.:** The number of electrons ejected is proportional to the intensity of light.

57. Answer (3)

**Hint:** Bohr's theory could not explain ability of atoms to form molecules by chemical bonds

**Sol.:** Bohr's theory was unable to explain the splitting of spectral lines in the presence of magnetic field or an electric field.

58. Answer (2)

**Hint & Sol:** Lyman series for hydrogen atom falls in UV region.

59. Answer (1)

**Hint:** $n\lambda = 2\pi r$

**Sol.:** $r_3 = a_0 n^3 = 52.9 \times 3^2$

$\lambda = \frac{2\pi r}{n} = \frac{2\pi\times52.9\times3^2}{3}$

$\lambda = 317.4\pi$

60. Answer (1)

**Hint:** $\frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

**Sol.:** For shortest wavelength in Lyman series $n_1 = 1$, $n_2 = \infty$

$\frac{1}{\lambda} = R_H$

$\lambda = \frac{1}{R_H}$

61. Answer (4)

**Hint & Sol.:** $r_n = \frac{a_0 n^2}{Z} = \frac{0.53\times(2)^2}{1} = 2.12$ Å

62. Answer (1)

**Hint:** Mole of molecules

$= \frac{\text{Given mass of molecule}}{\text{Molar Mass}}$

**Sol.:** 4g $H_2$ = 2 moles

32 g $SO_2 = \frac{32}{64} = 0.5$ mole

22 g $CO_2 = \frac{22}{44} = 0.5$ mole

24 g $O_3 = \frac{24}{48} = 0.5$ mole

63. Answer (2)

**Hint:** 1 molecule of $O_3$ has 3 O atoms.

**Sol.:** Total number of O atoms in 0.1 mol of $O_3$

$= 0.1 \times 3 \times 6.02 \times 10^{23} = 1.806 \times 10^{23}$

64. Answer (3)

**Hint:** Molarity is defined as number of moles (n) of solute dissolved in one litre of solution.

**Sol.:** Molarity $= \frac{n\times1000}{V\,(mL)}$

$= \frac{\frac{6.02\times10^{21}}{6.02\times10^{23}}\times1000}{100} = 10^{-2}\times10 = 10^{-1}M$

$= 0.1$ M

65. Answer (2)

**Hint:** Weighted average atomic mass

$= \frac{1}{100}\sum p_i M_i$

**Sol.:** Weighted average atomic mass

$= \frac{1}{100}\sum p_i M_i$ ($p_i$ = Percentage, $M_i$ = Atomic mass)

$= \frac{1}{100}(100\times90 + 99\times8 + 102\times2) = 99.96$ amu

66. Answer (1)

**Hint:** Zeros preceding to first non-zero digit are not significant.

**Sol.:** 0.0034 has 2 significant figures.

67. Answer (4)

**Hint:** Molecular formula is integral multiple of empirical formula

**Sol.:**

| | % | Mole | Mole ratio |
|---|---|---|---|
| C | 80 | $\frac{80}{12} = 6.67$ | $\frac{6.67}{6.67} = 1$ |
| H | 20 | $\frac{20}{1} = 20$ | $\frac{20}{6.67} = 3$ |

Empirical formula of the compound = $CH_3$

Molecular formula could be = $(CH_3)_n$ (n = 1, 2, 3…)

$(CH_3)_{\times 2} = C_2H_6$

68. Answer (4)

**Hint & Sol.:**

| | IUPAC name | | IUPAC official name |
|---|---|---|---|
| a. | Unnilunium | → | Mendelevium |
| b. | Unnilbium | → | Nobelium |
| c. | Unniltrium | → | Lawrencium |
| d. | Unnilquadium | → | Rutherfordium |

69. Answer (1)

**Hint:** Mole of $HNO_3$ in the given solution = $900 \times 4 \times 10^{-3}$

**Sol.:** Mass of $HNO_3$ in the given solution = $900 \times 4 \times 10^{-3} \times 63$ g = 226.8 g

Mass of concentrated $HNO_3$ solution required =

$= \frac{100}{70} \times 226.8 = 324$ g

70. Answer (1)

**Hint:** A chemical reactions follows conservation of mass.

**Sol.:** Reaction involved in Haber's process:

$N_2 + 3H_2 \longrightarrow 2NH_3$

Moles of hydrogen molecules required = $\frac{3}{2} \times 30 = 45$

71. Answer (4)

**Hint:** Boron does not have d-orbital.

**Sol.:** For alkali metals, as the shell size for valence electron increases the ionisation energy decreases.

72. Answer (1)

**Hint:** $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

**Sol.:** Mole of $C_2H_6$ (ethane) = $\frac{180}{30} = 6$

Mole of $O_2$ required = $\frac{7}{2} \times 6 = 21$

Volume of $O_2$ required at STP

= 21 × 22.4 = 470.4 L

73. Answer (1)

**Hint:** Electron gain enthalpy generally becomes less negative on moving down the group.

**Sol.:** Due to smaller size of 2p orbitals, the upcoming electron experiences repulsion with valence electrons and hence O has least negative electron gain enthalpy among group 16 elements.

74. Answer (3)

**Hint:** Ionization enthalpy generally increases across the period.

**Sol.:** $1s^2 2s^2 2p^3$ represents electronic configuration of N and it has stable half-filled configuration of *p*-orbital so it has maximum ionization enthalpy.

75. Answer (3)

**Hint:** Cerium (Ce) is *f*-block element

**Sol.:**

- *s* and *p* block elements are called representative elements. Bismuth (Bi) and rubidium (Rb) are *p* and *s* block elements respectively.
- Ge and Sb are semi-metals or metalloids.
- Ti is *d* block element.

76. Answer (3)

**Hint:** Metals have low electronegativity while non-metals have high electronegativity.

**Sol.:** Electronegativity is directly related to that non-metallic properties of elements. Thus, the increase in electronegativities across a period is accompanied by an increase in non metallic properties.

Electronegativity is a non-measurable quantity. Pauling assigned arbitrarily value of 4.0 to fluorine.

77. Answer (4)

**Hint:** Orbital dipole due to lone pair has to be considered in both $NH_3$ and $NF_3$.

**Sol.:** In case of $NH_3$ the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N–H bonds, whereas in $NF_3$ the orbital dipole is in the direction opposite to the resultant dipole moment of three N–F bonds.

78. Answer (3)

**Hint:** Higher charge increases the energy and decreases stability of the species.

**Sol.:** Formal charge helps in the selection of lowest energy structure from a number of possible Lewis structures. Generally the lowest energy structure is the one with the smallest formal charges on atoms.

79. Answer (1)

**Hint:** n $\rightarrow$ Principal quantum number

l $\rightarrow$ Azimuthal quantum number

**Sol.:**

n = 3, l = 1 $\rightarrow$ 3*p*

n = 2, l = 0 $\rightarrow$ 2*s*

n = 3, l = 0 $\rightarrow$ 3*s*

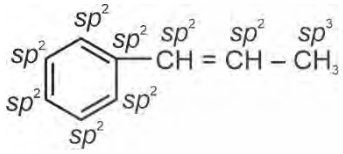
n = 2, l = 1 $\rightarrow$ 2*p*

80. Answer (2)

**Hint & Sol.:** Double bond in $C_2$ consists of both $\pi$ bonds because of presence of four electrons in two $\pi$ molecular orbitals. ($\pi$ $2p_x$ and $\pi 2p_y$)

81. Answer (2)

**Hint:** C with one double bond is $sp^2$ hybridised.

**Sol.:** 


Total number of $sp^2$ hybridised carbon atoms is 8.

82. Answer (4)

**Hint:** The species which has unpaired electron are paramagnetic in nature.

**Sol.:**

| **Species** | **Magnetic nature** |
|---|---|
| $H_2$ | Diamagnetic |
| $O_2^+$ | Paramagnetic |
| $N_2$ | Diamagnetic |
| $O_2$ | Paramagnetic |
| $F_2$ | Diamagnetic |
| $H_2^+$ | Paramagnetic |
| $O_2^-$ | Paramagnetic |

83. Answer (3)

**Hint:** Bond angle and shape of molecule depends upon repulsive interaction of electron pairs.

**Sol.:**

| **Molecule** | **Bond angle** |
|---|---|
| $BF_3$ | 120° |
| $CH_4$ | 109.5° |
| $NH_3$ | 107° |
| $H_2O$ | 104.5° |

84. Answer (4)

**Hint:** Molecules with bond order zero do not exist.

Bond order = $\frac{1}{2}(N_b - N_a)$

**Sol.:**

Bond order of $H_2 = \frac{1}{2}(2-0) = 1$

Bond order of $C_2 = \frac{1}{2}(8-4) = 2$

Bond order of $N_2 = \frac{1}{2}(10-4) = 3$

Bond order of $Be_2 = \frac{1}{2}(2-2) = 0$

So $Be_2$ does not exist

85. Answer (3)

**Hint:** In case of polyatomic molecules the dipole moment not only depend upon individual dipole moments of bonds but also on the spatial arrangement of various bonds in the molecule.

**Sol.:** For $BeF_2$, $BF_3$, $CO_2$ and $CH_4$ the dipole moment, $\mu_{net}$ = 0 because of symmetrical structure.

## SECTION-B

86. Answer (1)

**Hint:** E is inversely proportional to $\lambda$

**Sol.:** $\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$

$\frac{25}{100} = \frac{\lambda_2}{\lambda_1}$

$\lambda_1 = 4\lambda_2$

87. Answer (4)

**Hint:** $\lambda = \frac{h}{mv}$

**Sol.:** $\lambda = \frac{h}{mv} = \frac{6.6\times10^{-34}}{0.66\times10^{3}} = 1\times10^{-36}\text{m}$

88. Answer (3)

**Hint:** For a given value of n,

l = 0, 1, 2… (n – 1)

**Sol.:** for n = 5

l can have value = 0, 1, 2, 3, 4

Hence for n = 5, l $\neq$ 5

89. Answer (3)

**Hint:** For multi electronic species, higher is the value of (n + l) higher is the energy of orbital.

**Sol.:**

$5p \rightarrow n + l = 6$

$5s \rightarrow n + l = 5$

$4p \rightarrow n + l = 5$

$3d \rightarrow n + l = 5$

If (n + l) value is same, higher is value of n higher is energy

So correct order

$5p > 5s > 4p > 3d$

90. Answer (1)

**Hint:** As the bond order increases the stability of species increases.

**Sol.:**

| Species | Bond Order |
|---|---|
| $O_2$ | 2 |
| $O_2^+$ | 2.5 |
| $O_2^-$ | 1.5 |
| $O_2^{2-}$ | 1 |

91. Answer (4)

**Hint :** 100 L of air contains 20 L of $O_2$

**Sol. :** Volume of $O_2$ in 56 L air

$= \frac{20}{100} \times 56 = 11.2\ L$

Number of $O_2$ molecule

$= \frac{11.2}{22.4} \times 6.02 \times 10^{23} = 3.01 \times 10^{23}$

92. Answer (3)

**Hint :** Molality = $\frac{\text{Mole of solute}}{\text{Mass of solvent in kg}}$

**& Sol.:** Let volume of solution = 1 litre

Moles of NaOH = 1

Mass of NaOH solution = 1000 × 1.20 = 1200 g

Mass of $H_2O$ = 1200 – 40 = 1160 g

Molality = $\frac{\text{Mole of NaOH}}{\text{Mass of solvent in kg}}$

$= \frac{1}{1.16} = 0.86\ m$

93. Answer (1)

**Sol.:** Molarity is number of moles of solute present in 1 litre of solution. As the volume of solution changes with temperature, the molarity is temperature dependent.

94. Answer (1)

**Hint:** Molar mass × mole = Given mass

**Sol.:** Let, atomic mass of element X be 'a' u and atomic mass of element Y be 'b' u

$0.2 (a + 2b) = 20$

$a + 2b = 100$ …(i)

$0.1 (3a + 2b) = 18$

$3a + 2b = 180$ …(ii)

Solving (i) & (ii) will give

a = 40 u and b = 30 u

95. Answer (3)

**Hint:** Amphoteric oxides behaves as acidic compound with bases and as basic compound with acid.

**Sol.:** $Na_2O$ = Basic

$Cl_2O_7$ = Acidic

$N_2O$ = Neutral

$Al_2O_3$ = Amphoteric

96. Answer (3)

**Hint:** 1 mole of C-12 has $6.022 \times 10^{23}$ atoms.

**Sol.:** Mass of one C-12 atom = $\frac{12}{6.022 \times 10^{23}}$

$= 1.99 \times 10^{-23}$ g

97. Answer (3)

**Hint:** The greater the charge on the cation, the greater the covalent character of the ionic bond.

**Sol.:** The polarising power of cation increases with increase in charge, hence covalent character of ionic bond increases.

So increasing order of covalent character is

$NaCl < MgCl_2 < AlCl_3$

98. Answer (2)

**Hint:** Hybridisation of Ni in $[Ni(CN)_4]^{2-}$ is $dsp^2$ and its shape is square planar.

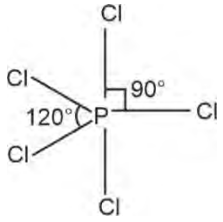
**Sol.:**

| Molecules/ions | Hybridisation type | Shape |
|---|---|---|
| $[Ni(CN)_4]^{2-}$ | $dsp^2$ | Square planar |
| $PF_5$ | $sp^3d$ | Trigonal bipyramidal |
| $BrF_5$ | $sp^3d^2$ | Square pyramidal |
| $SF_6$ | $sp^3d^2$ | Octahedral |

99. Answer (1)

**Hint:** Hybridisation of P in $PCl_5$ is $sp^3d$.

**Sol.:**




Hybridisation : $sp^3d$ ; shape : Trigonal bipyramidal

In $PCl_5$ the axial bonds are longer and weaker than equatorial bonds.

100. Answer (1)

**Hint:** Intermolecular hydrogen bond is formed between two different molecules of the same or different compounds.

**Sol.:** Intramolecular hydrogen bond is formed when hydrogen atom is in between two highly electronegative atoms present within the same molecule. o-nitrophenol forms intramolecular H-bond, while ethanol forms intermolecular hydrogen bond.

# [BOTANY]

## SECTION - A

101. Answer (1)

**Hint:** Anton von Leeuwenhoek observed few living cells capable of moving *e.g.* Protozoa, bacteria, etc.

**Sol.:** Robert Hooke studied and discovered the cell from a thin slice of cork.

Robert Brown discovered the nucleus of a cell. Rudolf Virchow first explained that cells divided and new cells are formed from pre-existing cells (*Omnis cellula-e cellula*).

102. Answer (3)

**Hint:** R.B.C. are round and biconcave in shape.

**Sol.:** White blood cells – amoeboid.

Mesophyll cells – round and oval.

Nerve cells – branched and long.

103. Answer (4)

**Hint:** Anything less than a complete structure of a cell does not ensure independent living.

**Sol.:** Matthias Schleiden, a German botanist studied a large number of plants and observed that all plants are composed of different kinds of cells which form the tissue of the plants.

104. Answer (4)

**Hint:** Some of the organelles function in a co-ordinated manner and constitute an endomembrane system.

**Sol.:** The organelles included in the endomembrane system are Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles.

105. Answer (1)

**Hint:** International Code of Zoological Nomenclature set rules for scientific naming of animals.

**Sol.:** International Code of Botanical Nomenclature set rules for scientific naming of plants.

106. Answer (1)

**Hint:** Liquid endosperm in coconut represents multinucleate condition

**Sol.:** Liquid endosperm in coconut is an example of syncytium.

107. Answer (3)

**Hint:** In the taxonomic hierarchy species serve as the basic and lowest category.

**Sol.:** Arrangement of taxonomic categories in descending order in animal is

Kingdom, Phylum, Class, Order, Family, Genus, Species.

108. Answer (2)

**Hint:** It is the phase where actual cell division occurs.

**Sol.:** M-phase is the most dramatic period of the cell cycle which involves a major reorganisation of virtually all components of the cell.

109. Answer (4)

**Hint:** This phase is also known as quiescent stage.

**Sol.:** In $G_0$ phase the cells do not appear to exhibit division.

110. Answer (2)

**Hint:** This organelle is not bound by a membrane.

**Sol.:** Centriole lacks DNA but can perform its duplication during S-phase.

111. Answer (4)

**Hint:** $G_1$ phase is post mitotic phase. This phase is the interval between mitosis and initiation of DNA replication.

**Sol.:** Tubulin protein is synthesised in $G_2$ phase.

112. Answer (3)

**Hint :** In this stage, splitting of centromere takes place.

**Sol.:** Anaphase is the best stage to study shape of chromosomes.

113. Answer (3)

**Hint:** Mesosomes are formed by the invagination of plasma membrane into the cell.

**Sol.:** Chromatophores are the membranous extensions into the cytoplasm which contain pigments.

114. Answer (3)

**Hint:** Plasmid is a extra-chromosomal double stranded circular DNA.

**Sol.:** Plasmid DNA is used to monitor bacterial transformation with foreign DNA and it also confers certain unique phenotypic characters to bacteria.

115. Answer (3)

**Hint:** Fimbriae are known to help in attaching the bacteria to rocks in streams.

**Sol.:** Flagella help bacteria in motility and it is made up of flagellin protein. Cell wall prevent the bacterium from bursting or collapsing.

116. Answer (3)

**Hint:** Adjacent cells in a plant tissue are held together by a thin, sticky, amorphous layer of cementing material called middle lamella.

**Sol.:** Middle lamella is chiefly made up of calcium and magnesium pectate.

117. Answer (4)

**Hint:** Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies.

**Sol.:** Inclusion bodies are not bound by any membrane systems and lie free in the cytoplasm.

*e.g.*- Phosphate granules

Cyanophycean granules

Glycogen granules.

118. Answer (2)

**Hint:** The correct sequence of different stages of prophase I is as follows:

Leptotene → Zygotene → Pachytene → Diplotene → Diakinesis.

**Sol:**

(1) Condensation and coiling of chromatin fibres begins during leptotene.

(2) Synapsis of homologous chromosomes occur during zygotene.

(3) Exchange of genetic material between non-sister chromatids of homologous chromosomes occurs during pachytene.

(4) Chiasmata can be observed during diplotene.

(5) Disintegration of nuclear envelope can be observed during diakinesis.

119. Answer (4)

**Hint:** Cell wall is non-living, rigid structure and its composition varies in different groups.

**Sol.:** Algal cell wall is made up of cellulose, galactans, mannans and minerals like calcium carbonate.

Fungal cell wall is composed of chitin.

120. Answer (2)

**Hint:** Plastids are present in plant cells and absent in animal cells.

**Sol.:** Almost all plant cells lack centrosome and centrioles.

121. Answer (2)

**Hint:** Dictyotene stage can be seen in some female vertebrates.

**Sol.:** In oocytes of some vertebrates, diplotene lasts for month or years. It is called dictyotene stage.

122. Answer (4)

**Hint:** This figure is representing the cell in metaphase I.

**Sol.:** In metaphase I, the microtubules of the spindle fibres from opposite poles attach to the centromere of the chromosome facing towards it.

123. Answer (4)

**Hint:** Mitosis maintains the size of the cell.

**Sol.:** Meiosis provides a chance for the formation of new combinations of chromosomes. This brings out variations.

124. Answer (1)

**Hint:** Systematics include characterisation, identification, nomenclature, classification and phylogeny of organisms.

**Sol.:** Systematics is more wider field of science as it involves identification, nomenclature and classification. It also takes into account evolutionary relationships between various organisms.

125. Answer (3)

**Hint:** Telophase is the last stage of karyokinesis.

**Sol.:** If APC is defective in a human cell, separation of sister chromatids, decondensation of chromosomes and reassembly of nuclear membrane will get affected. Histone proteins are synthesised during S-phase.

126. Answer (1)

**Hint:** Recombinase enzyme is required in pachytene stage.

**Sol.:** The site where crossing over occurs forms a recombination nodule. The recombination is an enzyme-mediated process, an enzyme called recombinase is involved during this process.

127. Answer (3)

**Hint:** Interkinesis is a gap which exists between meiosis I and meiosis II.

**Sol.:** During interkinesis, there is no replication of DNA occur.

128. Answer (3)

**Hint:** 4 microspores are produced from 1 microspore mother cell after one meiosis.

**Sol.:** Number of meiotic divisions required to make x number of seeds

$= x + \frac{x}{4} = 100 + \frac{100}{4} = 125$

129. Answer (1)

**Hint:** In this phase of karyokinesis, chromosomes appear like a ball of wool. It is also called spireme stage.

**Sol.:** Prophase is the first stage of karyokinesis of mitosis.

130. Answer (1)

**Hint:** Each centrosome radiates out microtubules called asters.

**Sol.:** The two asters together with spindle fibres forms mitotic apparatus.

131. Answer (3)

**Hint:** Metacentric chromosomes appear V shaped.

**Sol.:** During anaphase, acrocentric chromosomes appear J shaped.

132. Answer (1)

**Hint:** Leucoplasts are colourless plastids which generally occur near the nucleus in non-green cells.

**Sol.:** Aleuroplast store proteins while elaioplasts store fats and oils.

133. Answer (4)

**Hint:** Mitochondria is a double membrane bound organelles.

**Sol.:** Ribosomes are non-membrane bound organelles found in all cells.

134. Answer (4)

**Hint:** SER is associated with muscle contraction by release and uptake of $Ca^{+2}$ ions.

**Sol.:** Golgi-apparatus is the important site of formation of glycoproteins and glycolipids.

135. Answer (4)

**Hint:** The fluid nature of the membrane is important for the functions like cell growth, secretion, endocytosis, etc.

**Sol.:** Quasi-fluid nature of lipids, enables lateral movement of protein within the overall bilayer and this ability to move within the membrane is measured as fluidity.

## SECTION - B

136. Answer (2)

**Hint:** Wheat belongs to Poaceae family.

**Sol.:** Polymoniales is an order of dicot plants such as brinjal.

137. Answer (3)

**Hint:** DNA replication takes place in 'S' phase.

**Sol.:** Egg of an organism has 10 pg DNA.

In $G_1$ phase the amount of DNA would be 20 pg

After the completion of 'S' phase it will be 40 pg DNA.

$\therefore$ The amount of DNA in $G_2$ phase = 40 pg.

138. Answer (4)

**Hint:** The outer membrane forms the continuous limiting boundary of the mitochondria.

**Sol.:** Each mitochondria is a double membrane-bound structure with the outer membrane and the inner membrane dividing its lumen distinctly into two aqueous compartments.

139. Answer (2)

**Hint:** This organelle is membrane bound.

**Sol.:** In *Amoeba*, contractile vacuole is important for osmoregulation and excretion.

140. Answer (2)

**Hint:** The phenomenon of bringing the chromosome on the equator of spindle is called congression. It occurs in metaphase.

**Sol.:** Anaphase – Formation of interzonal fibres.

Metaphase – Congression of chromosomes.

Telophase – Reassembly of nuclear membrane.

141. Answer (4)

**Hint:** This diagram shows the internal structure of cilia/flagella.

**Sol.:** Label A represents central microtubules. This structure's core is called axoneme which is surrounded by plasma membrane (Label C). This structure has 9 radial spokes and interdoublet linkers.

142. Answer (1)

**Hint:** In animal cells, cytokinesis is achieved by the formation of a furrow.

**Sol.:** Phragmoplast is formed by the Golgi complex and grows centrifugally to form cell plate.

143. Answer (3)

**Hint:** All the chromosomes align themselves at the equator in metaphase stage.

**Sol:** Nucleolus, ER, Golgi bodies and other organelles reappear in telophase. Centrosome begins to move towards opposite poles of the cell during prophase.

144. Answer (4)

**Hint :** Human's cell cycle machinery is more complex than yeast.

**Sol.:** Period of cell cycle varies from organism to organism and also from cell to cell. Yeast cell divides once in 90 minutes and a typical human cell divides in every 24 hours.

145. Answer (1)

**Hint:** Centriole gives a cartwheel appearance.

**Sol.:** (i) Mitochondria – Possess oxysomes

(ii) Lysosomes – Also known as Suicidal bag

(iii) Microfilaments – Involve in cytoplasmic streaming

146. Answer (1)

**Hint:** Ribosomes was discovered by George Palade.

**Sol.:** An improved model of the structure of the cell membrane was proposed by Singer and Nicolson widely accepted as Fluid Mosaic model.

147. Answer (3)

**Hint:** Nucleolus is a spherical structure found in the nucleoplasm.

**Sol.:** Nucleolus is not bounded by any membrane.

148. Answer (4)

**Hint:** The *Cis* and *Trans* faces of the Golgi complex are entirely different, but interconnected.

**Sol.:** *Trans* face of Golgi complex gives rise to the secretory vesicles.

149. Answer (2)

**Hint :** It is the second stage of karyokinesis.

**Sol.:** The complete disintegration of nuclear envelope marks the beginning of metaphase.

150. Answer (4)

**Hint:** Many membrane bound minute vesicles called microbodies contain various enzymes.

**Sol.:** Microbodies are present in both plant and animal cells. They lack DNA.

# [ZOOLOGY]

## SECTION - A

151. Answer (3)

**Hint:** Homopolymer of glucose

**Sol.:** Cellulose is a polymeric polysaccharide consisting of only one type of monosaccharide units *i.e.,* glucose. Cellulose is a homopolymer. Cellulose does not contain complex helices and hence, cannot hold $I_2$.

Starch forms helical secondary structures and it can hold $I_2$ molecules in the helical portion. The starch $-I_2$ complex is blue in colour.

152. Answer (4)

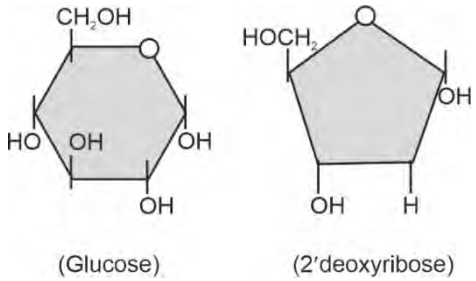
**Hint:** Collagen fibres are arranged in a regular pattern in dense regular connective tissue.

**Sol.:** Fibres and fibroblasts are compactly packed in the dense connective tissues. Orientation of fibres show a regular or irregular pattern and form dense regular and dense irregular connective tissues respectively.

153. Answer (4)

**Hint:** OH group at 2′ position is absent in deoxyribose sugar.

**Sol.:**




(Glucose) (2′deoxyribose)

The sugar found in polynucleotides is either ribose (a monosaccharide pentose) or 2′ deoxyribose. A nucleic acid containing deoxyribose is called deoxyribonucleic acid (DNA) while that which contains ribose is called ribonucleic acid (RNA).

154. Answer (4)

**Hint:** Possess basal nuclei.

**Sol.:** Squamous epithelium forms diffusion boundary. Ciliated epithelium allows movement of particles or mucus in a specific direction over the epithelium. Cuboidal and columnar epithelium help in secretion and absorption of certain substances.

Compound epithelium is made of more than one layer of cells and thus has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses.

155. Answer (3)

**Hint:** Concanavalin-A

**Sol.:** Curcumin and vinblastin are drugs whereas concanavalin-A belongs to the category of lectins.

Carotenoids and anthocyanins are pigments, morphine and codeine are alkaloids.

156. Answer (3)

**Hint:** Composed of a single layer of cube-like cells.

**Sol.:** Cuboidal epithelium has cells in which nucleus is present at central position. The columnar epithelium is composed of a single layer of tall and slender cells. Their nuclei are located at the base. Free surface may have microvilli.

Compound epithelium is made of more than one layer of cells and thus has a limited role in secretion and absorption.

157. Answer (3)

**Hint:** More than half

**Sol.:** Neuroglial cells which make up more than one half the volume of neural tissue in human body are the cells which protect and support neurons.

Neuroglial cells are specialised cells found in the brain and spinal cord. They are non-excitable cells of neural tissue.

158. Answer (3)

**Hint:** Epithelium which bears cilia is present in the inner surface of hollow organs.

**Sol.:** Goblet cells of alimentary canal are included in unicellular glandular epithelium.

Tubular parts of nephrons in the kidney have cuboidal epithelium. Compound epithelium is present in the inner lining of ducts of salivary glands. Ciliated epithelium is present in the inner surface of bronchioles

159. Answer (2)

**Hint:** Class III of enzymes

**Sol.:** Following are the classes of enzymes:-

(I) Oxidoreductases/dehydrogenases

(II) Transferases

(III) Hydrolases

(IV) Lyases

(V) Isomerases

(VI) Ligases

Hydrolases are the enzymes that catalyse hydrolysis of ester, ether, peptide, glycosidic, C – C, C-halide or P-N bonds. Ester bond is present between ribose sugar and phosphate in a nucleotide.

160. Answer (2)

**Hint:** The cells that secrete collagen or elastin are absent in blood.

**Sol.:** In all connective tissues, except blood, the cells secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the tissues.

161. Answer (2)

**Hint:** Bone marrow produces blood cells.

**Sol.:** Blood is a fluid connective tissue containing plasma, RBCs, WBCs and platelets. The bone marrow in some bones is the site of production of blood cells. If bone marrow gets damaged, production of blood cells would get hampered.

162. Answer (4)

**Hint:** Intercalated discs are communication/gap junctions.

**Sol.:** Intercalated discs (gap/communication junctions) facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells. These allow the cells to contract as a unit.

Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep neighbouring cells together.

Block of fibrous cartilage is present between adjacent vertebrae as intervertebral disc.

163. Answer (4)

**Hint:** Some nucleic acids behave like enzymes.

**Sol.:** Almost all enzymes are proteins. There are some nucleic acids that behave like enzymes. These are called ribozymes.

164. Answer (1)

**Hint:** Exclude aliphatic amino acids.

**Sol.:** Based on the number of amino and carboxyl groups, there are acidic (*e.g.* glutamic acid), basic (lysine) and neutral (valine) amino acids. Similarly, there are aromatic amino acids (tyrosine, phenylalanine and tryptophan).

165. Answer (2)

**Hint:** These cells have least regeneration capacity.

**Sol.:** Neural tissue exerts the greatest control over the body's responsiveness to changing conditions. Neurons, the unit of neural system, are excitable cells.

Muscle cells are the part of muscular tissue.

Neuroglial cells are not excitable cells. Mast cells are present in areolar connective tissue.

166. Answer (1)

**Hint:** On the basis of number of layers, two types of this tissues are found.

**Sol.:** Epithelial tissue has a free surface, which faces either a body fluid or the outside environment and thus, provides a covering or a lining for some part of the body.

Connective tissues have special function of linking and supporting other tissues/organs of the body.

Muscles play an active role in all the movements of the body. Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

167. Answer (1)

**Hint:** An unicellular organism

**Sol.:** In the complex body of multicellular animals, the basic functions are carried out by different groups of cells in a well-organised manner.

Division of labour is present in multicellular organisms in which tissue, organ system level organisation is present, eg., *Hydra, Periplaneta, Homo sapiens.* It is absent in unicellular organisms like *Paramoecium*.

168. Answer (3)

**Hint:** Most abundant protein in an animal world

**Sol.:**

| **Protein** | **Function** |
|---|---|
| Collagen | Intercellular ground substance |
| Trypsin | Enzyme |
| Receptor | Sensory reception |

169. Answer (3)

**Hint:** Columnar cells

**Sol.:** If the columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium. Ciliated epithelium is present in the lining of fallopian tube in human females and bronchioles.

170. Answer (3)

**Hint:** Primary metabolites have identifiable functions.

**Sol.:** Organic compounds including amino acids, sugars *etc.*, are called primary metabolites. Primary metabolites have identifiable functions and play known roles in normal physiological processes.

At present, roles and functions of secondary metabolites are unknown.

The acid insoluble fraction has only four types of organic compounds *i.e.,* proteins, nucleic acids, polysaccharides and lipids. These classes of compounds with the exception of lipids, have molecular weights in the range of 10,000 Da and above.

171. Answer (3)

**Hint:** Fat storage tissue

**Sol.:** The given figure represents a fat cell, abundantly present in adipose tissue which is a type of loose connective tissue. It is located mainly beneath the skin. The cells of this tissue are specialised to store fats. The excess of nutrients which are not used immediately are converted into fats and are stored in this tissue.

Orientation of fibres show a regular or irregular pattern in dense regular and irregular connective tissue respectively.

172. Answer (2)

**Hint:** Nerve impulse initiates from dendrites of a neuron.

**Sol.:** In a neuron, upon stimulation, the nerve impulses travel in the following direction:

Dendrites $\rightarrow$ Cell body $\rightarrow$ Axon

173. Answer (3)

**Hint:** Main tissue that provides structural frame to the body.

**Sol.:** Bones have a hard and non-pliable ground substance rich in calcium salts and collagen fibres which give bone its strength. The intercellular material of cartilage is solid and pliable and resists compression.

Both bone and cartilage are specialised connective tissues.

174. Answer (4)

**Hint:** Polymeric substances (exception : lipids) are present in acid-insoluble fraction.

**Sol.:** The acid insoluble fraction has only four types of organic compounds *i.e.,* proteins (*e.g.*, Haemoglobin, Insulin, Collagen), nucleic acids (*e.g.,* DNA, RNA), polysaccharides (*e.g.*, Glycogen, Inulin) and lipids.

Tryptophan is an amino acid; glucose is a monosaccharide and adenine is a nitrogenous base and will be found in the acid- soluble fraction.

175. Answer (4)

**Hint:** Present in the walls of stomach and intestine

**Sol.:** Non-striated muscles are also called involuntary muscles as their functioning cannot be directly controlled. Skeletal and cardiac muscles are striated muscles. Smooth muscle fibres taper at both ends (fusiform) and do not show striations. These are uninucleated and unbranched.

176. Answer (4)

**Hint:** Cell junctions are absent in skeletal muscles.

**Sol.:** Connective tissues are the most abundant and widely distributed tissues in the body of complex animals.

In a typical skeletal muscle such as the biceps, striated/striped muscle fibres are bundled together in a parallel fashion. Cell junctions hold the smooth muscle fibres together and they are bundled together in a connective tissue sheath.

In heart, cardiac muscle fibres are present which are uninucleated.

177. Answer (2)

**Hint:** Proteins constitute 10-15% of the total cellular mass.

**Sol.:**

| **Component** | **% of the total cellular mass** |
|---|---|
| Water | 70-90 |
| Proteins | 10-15 |
| Carbohydrates | 3 |
| Lipids | 2 |
| Nucleic acids | 5-7 |
| Ions | 1 |

Collagen – Protein, Glycogen – Carbohydrate, Palmitic acid-Lipid, DNA-Nucleic acid, Calcium-Ion.

178. Answer (3)

**Hint:** Monomer of inulin is also known as fruit sugar.

**Sol.:** Inulin is a polymer of fructose.

Insulin is a hormone and is proteinaceous in nature and made up of amino acid residues.

Cellulose is a homopolymer of glucose. Ribose is a pentose sugar and is present in RNA.

179. Answer (4)

**Hint:** Haematopoiesis

**Sol.:** The intercellular material of cartilage is solid and pliable and resists compression. Cartilage is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.

The bone marrow in some bones is the site of production of blood cells.

180. Answer (4)

**Hint:** Endocrine gland.

**Sol.:** On the basis of mode of pouring of their secretions, glands are divided into two categories namely exocrine and endocrine glands. Exocrine glands secrete mucus, saliva, earwax, oil, milk, digestive enzymes (*e.g.* trypsin) and other cell products. These products are released from ducts or tubes.

In contrast, endocrine glands do not have ducts. Their products, called hormones (*e.g.* insulin), are secreted directly into the fluid bathing the gland.

181. Answer (3)

**Hint:** Temperature gets reduced by 10°C.

**Sol.:** A general rule of thumb is that rate doubles or decreases by half for every 10°C change in temperature in either direction.

In the mentioned case, temperature decreases by 10°C, for which the rate of reaction decreases by half means from 2X to X.

182. Answer (3)

**Hint:** Dehydration reaction includes removal of a $H_2O$ molecule.

**Sol.:** Molecular formula of glucose – $C_6H_{12}O_6$

2 molecules of glucose form 'X' after dehydration reaction which involves removal of a $H_2O$ molecule.

So, $C_{12}H_{24}O_{12} - H_2O = C_{12}H_{22}O_{11}$

Therefore, molecular formula for 'X' is $C_{12}H_{22}O_{11}$.

183. Answer (3)

**Hint:** Derived from monocytes

**Sol.:** Areolar connective tissue serves as a support framework for epithelium. It contains fibroblasts, macrophages and mast cells.

Macrophages are phagocytic cells.

Fibroblast cells produce fibres.

Mast cells secrete histamine and serotonin in case of allergic reactions.

184. Answer (3)

**Hint:** Salivary gland is an exocrine gland.

**Sol.:** Some of the columnar or cuboidal cells get specialised for secretion and are called glandular epithelium. They are mainly of two types : unicellular, consisting of isolated glandular cells (goblet cells of the alimentary canal) and multicellular, consisting of cluster of cells (salivary glands). Salivary glands are exocrine glands. Endocrine glands are also known as ductless glands.

185. Answer (2)

**Hint:** An enzyme present in plants.

**Sol.:** Chitin is present in the exoskeleton of arthropods. Collagen is the most abundant protein in the animal world while Ribulose bisphosphate Carboxylase-Oxygenase (RuBisCO) is the most abundant protein in whole of the biosphere.

**SECTION - B**

186. Answer (2)

**Hint:** $V_{max}$ will be achieved when all active sites of an enzyme are occupied.

**Sol.:** All the active sites of an enzyme when gets occupied by the substrate, do not bind to other substrate molecules present in the reaction mixture.

Velocity of a reaction reaches maximum when all the active sites of an enzymes are occupied by the substrate.

187. Answer (3)

**Hint:** Presence of ribose sugar

**Sol.:** For nucleic acids, the building block is a nucleotide.

A nucleotide has three chemically distinct components. One is a heterocyclic compound, the second is a monosaccharide and the third, phosphoric acid or phosphate.

Nucleoside is nucleotide excluding phosphate group.

188. Answer (1)

**Hint:** Conformation

**Sol.:** An enzyme like any protein has the secondary and tertiary structure. Tertiary structure is absolutely necessary for the many biological activities of protein. Backbone of the protein chain folds upon itself, the chain criss crosses itself and hence, many crevices or pockets are made. One such pocket is the 'active site'.

An active site of an enzyme is a crevice or pocket into which the substrate fits. Thus, enzymes through their active sites, catalyse reactions at a high rate.

189. Answer (2)

**Hint:** Adult human Hb has two $\alpha$ and two $\beta$ chains.

**Sol.:** Some proteins are an assembly of more than one polypeptide or subunits. The manner in which these individual folded polypeptides are arranged with respect to each other is the architecture of a protein otherwise called the quaternary structure of a protein.

Adult human haemoglobin consists of 4 subunits. Two of these are identical to each other.

190. Answer (2)

**Hint:** Also possess communication junctions.

**Sol.:** Cell junctions fuse the plasma membranes of cardiac muscle cells and make them stick together. Communication junctions (intercalated discs) at some fusion points allow the cells to contract as a unit.

The wall of internal organs such as the blood vessels, stomach and intestine contain smooth muscles.

Each muscle is made of many long, cylindrical fibres arranged in parallel arrays. These fibres are composed of numerous fine fibrils, called myofibrils.

191. Answer (3)

**Hint:** Cytosine and thymine are substituted pyrimidines present in DNA.

**Sol.:** Substituted purines : Adenine and guanine

Substituted pyrimidines : Cytosine and thymine

Given, guanine = 35%

According to Chargaff's rule:-

[Guanine] = [Cytosine]

[Adenine] = [Thymine]

Therefore, G and C would be 35% each and A and T would be 15% each.

Now, cytosine and thymine would be 35 + 15 = 50.

192. Answer (2)

**Hint:** Possess hydrogen bond

**Sol.:** Exoskeleton of arthropods is made up of chitin (monomer is N-acetyl glucosamine). Water is the most abundant chemical in living organisms.

Each amino acid has its own unique pH at which it exists in zwitterionic form.

Sulphur is present in the structure of cysteine.

193. Answer (3)

**Hint:** Zwitterionic form of an amino acid.

**Sol.:** A particular property of an amino acid is the ionizable nature of $-NH_2$ and $-COOH$ groups. Hence, in solutions of different pH, the structure of an amino acid changes.

194. Answer (2)

**Hint:** Equal to the number of OH groups in a molecule of glycerol.

**Sol.:** Heterocyclic ring means presence of any other atom apart from carbon in that ring.

From the mentioned compounds, ribose, adenylic acid and uracil possess heterocyclic ring.

Serine is an amino acid and does not possess cyclic ring.

Glycerol is trihydroxy propane.

Cholesterol has homocyclic ring.

195. Answer (3)

**Hint:** An energy requiring reaction.

**Sol.:** If product is at a lower level than substrate in terms of potential energy, the reaction would be an exothermic reaction.

One need not supply energy (by heating) in order to form the product.

196. Answer (2)

**Hint:** Exclude the ion required for blood clotting.

**Sol.:** A number of enzymes require metal ions for their activity which form coordination bonds with side chains at the active site and at the same time form one or more coordination bonds with the substrate, *e.g.*, zinc is a cofactor for the proteolytic enzyme, 'carboxypeptidase'.

197. Answer (4)

**Hint:** Prosthetic group.

**Sol.:** In 'peroxidase' and 'catalase', which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.

Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme.

198. Answer (3)

**Hint:** Without C=C bond

**Sol.:** Arachidonic acid is an unsaturated fatty acid and has 20-C atoms including the carboxyl carbon. Glycerol is trihydroxy propane. Lecithin is a phospholipid found in the cell membranes of living organisms. Palmitic acid possesses 16 carbons including carboxyl carbon.

199. Answer (4)

**Hint:** Bone cells are enclosed in fluid-filled cavities.

**Sol.:** In the dense regular connective tissue, the collagen fibres are present in rows between many parallel bundles of fibres.

Tendons which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of this tissue.

Dense irregular connective tissue is present in skin. Osteocytes are present in the spaces called lacunae.

200. Answer (4)

**Hint:** Bond that joins two cysteine residues together.

**Sol.:** Glycosidic bonds are present in sugars, phosphodiester and hydrogen bonds are found in nucleic acids. Only peptide bonds are present in primary structure of protein.

Hydrogen bonds stabilize the tertiary structure of protein. In a nucleic acid, the bond formed between the phosphate and hydroxyl group of sugar is an ester bond.

❑ ❑ ❑