

## All India Aakash Test Series for NEET-2024

**TEST - 8 (Code-C)**

Test Date : 02/04/2023

**ANSWERS**

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

# HINTS & SOLUTIONS

## [PHYSICS]

### SECTION - A

1. Answer (2)

**Hint:** Using position vectors of individual masses

$$\text{Sol.: } \vec{r}_{\text{com}} = \frac{m_1 \vec{r}_1 + m_2 \vec{r}_2 + m_3 \vec{r}_3}{m_1 + m_2 + m_3}$$

$$\begin{aligned} & \frac{m(0\hat{i} + 0\hat{j}) + m(a\hat{i} + 0\hat{j}) + 2m\left(\frac{a}{2}\hat{i} + \frac{\sqrt{3}}{2}a\hat{j}\right)}{4m} \\ &= \frac{ma\hat{i} + ma\hat{i} + \sqrt{3}ma\hat{j}}{4m} \end{aligned}$$

$$\vec{r}_{\text{COM}} = \frac{a}{2}\hat{i} + \frac{\sqrt{3}}{4}a\hat{j}$$

2. Answer (2)

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

$$\text{Sol.: } a = 3x^2$$

$$\frac{v dv}{dx} = 3x^2$$

$$\int_0^v v dv = \int_0^x (3x^2) dx \Rightarrow \frac{v^2}{2} = x^3$$

At  $v = 4$

$$\frac{4^2}{2} = x^3 \Rightarrow x = 2 \text{ m}$$

3. Answer (1)

**Hint:** From the graph  $A = 2 \text{ m}$

$$v_{\text{max}} = 6 \text{ m s}^{-1}$$

$$\text{Sol.: We know } \frac{v_{\text{max}}}{x_{\text{max}}} = \frac{A\omega}{A} \Rightarrow \omega = \frac{6}{2}$$

$$\therefore \omega = 3 \text{ rad s}^{-1}$$

$$\text{Thus } T = \frac{2\pi}{\omega} \Rightarrow T = \frac{2\pi}{3} = \frac{2}{3} \left( \frac{22}{7} \right) = \frac{44}{21} \approx 2.1 \text{ s}$$

4. Answer (3)

**Hint:** Plastic region of 'A' is larger than that of 'B'

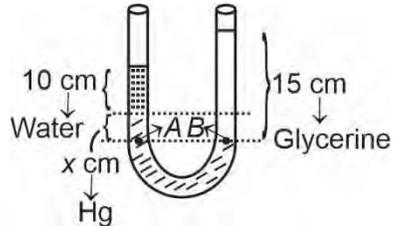
**Sol.:** Higher the plastic region more ductile is the material.

Slope of stress-strain curve gives Young's modulus

5. Answer (2)

**Hint:** Use the expression of pressure due to liquid column

**Sol.:**



In equilibrium,  $P_A = P_B$

$$P_0 + \frac{(10)}{100}(1000)g + \frac{x}{100}(13600)g = P_0 + \left(\frac{15}{100}\right)(1200)g$$

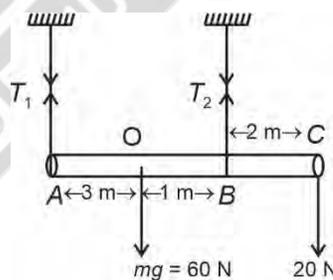
$$100 + 136x = 180$$

$$x = \frac{80}{136} \text{ cm} \approx 0.6 \text{ cm}$$

6. Answer (1)

**Hint:** In equilibrium, net torque about A or B is zero

**Sol.:** We know,  $\sum \tau$  (About A) = 0



$$T_1(0) - 60(3) + T_2(4) - 20(6) = 0$$

$$T_2(4) = 300$$

$$T_2 = 75 \text{ N}$$

Similarly  $\sum \tau$  (About B) = 0

$$-T_1(4) + 1(60) - 2(20) + T_2(0) = 0$$

$$T_1(4) = 20$$

$$T_1 = 5 \text{ N}$$

$$\therefore \frac{T_1}{T_2} = \frac{5 \text{ N}}{75 \text{ N}} = \frac{1}{15}$$

7. Answer (4)

**Hint and Sol.:** The mean distance from Earth to Sun is known as 'Astronomical unit'.

8. Answer (2)

**Hint and Sol.:** Water has maximum density at 4°C. Therefore the most dense water will lie deepest.

9. Answer (2)

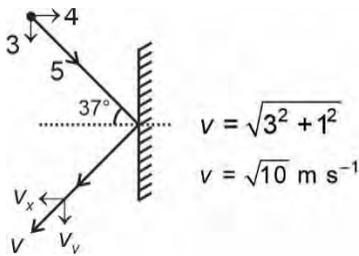
**Hint & Sol.:**  $I = \frac{1}{2} \left( \frac{m}{6} \right) R^2$

$$I = \frac{mR^2}{12}$$

10. Answer (1)

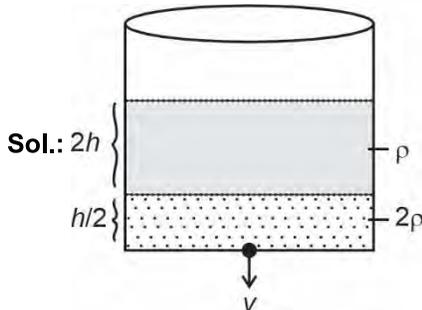
**Hint:** Only component of velocity perpendicular to wall changes while the component that is parallel to the wall remains same

**Sol.:**  $v_x = 0.25 \times 4 = 1 \text{ m s}^{-1}$



11. Answer (4)

**Hint:** Use Bernoulli's equation at top and bottom points



(Total energy)<sub>Top</sub> = (Total energy)<sub>Bottom</sub>

$$P_0 + \frac{1}{2} \rho (0)^2 + 2\rho g \left( \frac{h}{2} \right) + \rho g (2h) = P_0 + \frac{1}{2} (2\rho) v^2 + 0$$

$$\rho gh + 2\rho gh = \frac{1}{2} (2\rho) v^2$$

$$3gh = v^2 \Rightarrow v = \sqrt{3gh}$$

12. Answer (4)

**Hint and Sol.:** Gravitational and electrostatic forces are conservative in nature.

13. Answer (4)

**Hint and Sol.:**  $P_i - P_0 = \frac{2T}{R}$

$$\therefore P_i = P_0 + \frac{2T}{R}$$

14. Answer (4)

**Hint and Sol.:** The observation which is having highest number of decimal places is considered as most precise.

15. Answer (4)

**Hint:** Reflectance (r) + Absorptance (a) + Transmittance (t) = 1

**Sol.:** Absorptance (a) = 1 - 2(0.4)

$$a = 0.2$$

$$\Rightarrow \text{We know, } a = \frac{\text{Radiation absorbed}}{\text{Incident radiation}} = \frac{R}{Q}$$

$$0.2 = \frac{R}{100}$$

$$R = 20 \text{ J}$$

16. Answer (1)

**Hint:** According to principle of homogeneity

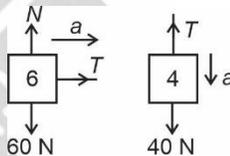
$$\text{Dimension of } [F] = \left[ \frac{\alpha^2}{\beta} \right] = \left[ \frac{E}{\beta} \right]$$

$$\text{Sol.} \left[ \frac{\alpha^2}{\beta} \right] = [F] = [MLT^{-2}]$$

17. Answer (2)

**Hint:**  $\sum \vec{F} = m\vec{a}$

**Sol.:**



From the above FBD:

$$T = 6(a) \text{ and } 40 - T = 4(a)$$

$$\therefore 40 - 6a = 4a$$

$$\Rightarrow a = 4 \text{ m s}^{-2}$$

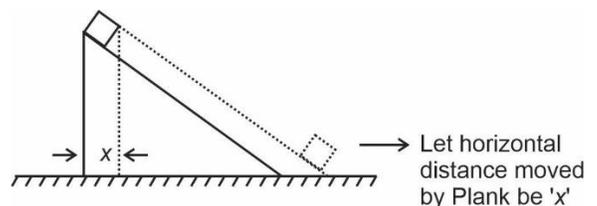
18. Answer (3)

**Hint:** When  $\vec{F}_{\text{ext}} = 0$  then  $\vec{a}_{\text{COM}} = 0$  and if also  $u = 0$  then  $\Delta x_{\text{COM}} = 0$

$$\text{Sol.} \Delta x_{\text{COM}} = \frac{m_A (\Delta x_A) + m_B (\Delta x_B)}{m_A + m_B}$$

$$0 = 16(x) + 4(8 + x) \Rightarrow 32 = -20x$$

$$x = -1.6 \text{ m}$$



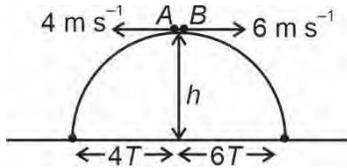
19. Answer (1)

**Hint and Sol.:** Viscosity of a liquid is an inherent property which depends on nature of liquid and physical conditions like temperature and pressure but not on area of contact or velocity gradient.

20. Answer (1)

**Hint:** Time of flight is same for both bodies as their initial vertical velocities are zero.

**Sol.:** Let, time of flight be 'T'



Here  $10T = 20$

$\therefore T = 2$  seconds

$$\text{Now, } T = \sqrt{\frac{2h}{g}}$$

$$2 = \sqrt{\frac{2h}{10}}$$

$\therefore h = 20$  m

21. Answer (3)

**Hint:**  $v = \omega\sqrt{(A^2 - x^2)}$

$$\text{Sol.} \text{ Given } \frac{1}{2}Kx^2 = \frac{3}{4}\left(\frac{1}{2}mv^2\right)$$

$$\therefore \frac{1}{2}mv^2 = \frac{4}{3}\left(\frac{1}{2}Kx^2\right)$$

$$A^2 = \frac{7}{3}x^2$$

$$\therefore x = 10\sqrt{\frac{3}{7}} \text{ cm}$$

22. Answer (4)

**Hint and Sol.:** Since the speed is constant, the given circular motion is uniform

Hence  $a_c = \frac{v^2}{R}$  but  $a_t = 0$

23. Answer (3)

**Hint and Sol.:** For the given aquarium the conditions are isothermal

$$\therefore P_i V_i = P_f V_f \Rightarrow P \propto \frac{1}{V}$$

Pressure on going upwards decreases and thus volume and radius of bubble increase.

But surface tension of liquid remains constant throughout.

24. Answer (4)

**Hint:** Use Stefan- Boltzmann law i.e.

Rate of radiation  $u = \sigma eA(T^4)$

$$u \propto T^4$$

$$\text{Sol.} \frac{u_1}{u_2} = \left(\frac{T_1}{T_2}\right)^4$$

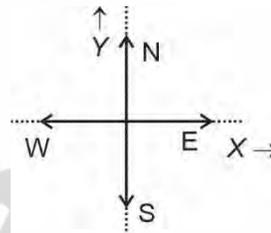
$$\frac{\alpha}{u_2} = \left(\frac{300 \text{ K}}{900 \text{ K}}\right)^4 \Rightarrow u_2 = (3^4)\alpha$$

$$u_2 = 81\alpha$$

25. Answer (4)

**Hint:** Use  $\langle \vec{a} \rangle = \frac{\vec{v}_f - \vec{v}_i}{t}$

$$\text{Sol.} \langle \vec{a} \rangle = \frac{-40\vec{i} - 30\vec{j}}{2}$$



$$|\langle \vec{a} \rangle| = \frac{1}{2}\sqrt{40^2 + 30^2}$$

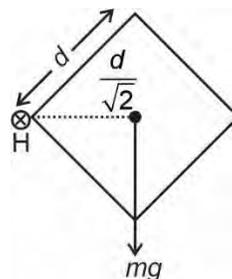
$$|\langle \vec{a} \rangle| = \frac{50}{2} = 25 \text{ m s}^{-2}$$

26. Answer (1)

**Hint:**  $\tau = I\alpha$  (About hinge)

$$\text{Sol.} \frac{mgd}{\sqrt{2}} = \left(\frac{md^2}{6} + \frac{md^2}{2}\right)\alpha$$

$$\frac{mgd}{\sqrt{2}} = \left(\frac{2md^2}{3}\right)\alpha$$



$$\frac{3g}{2\sqrt{2}d} = \alpha$$

27. Answer (4)

**Hint:** Use, Thrust force  $F_t = v_r \left( \frac{dm}{dt} \right)$

**Sol.:** We know,  $v = \sqrt{2g \frac{l}{2}}$

$$v = \sqrt{gl}$$

Now,  $\frac{dm}{dt} = \frac{m}{l} \left( \frac{dx}{dt} \right)$

$$\frac{dm}{dt} = \frac{mv}{l}$$

$$\therefore F_t = v \left( \frac{m}{l} \right) v = \frac{m}{l} v^2$$

$$F_t = \frac{m}{l} (\sqrt{gl})^2 = mg$$

Net force by chain on table  $F = \frac{mg}{2} + mg = \frac{3mg}{2}$

$$\frac{3(6 \times 10)}{2} = 90 \text{ N}$$

28. Answer (3)

**Hint:** Use,  $hR = \text{constant}$

**Sol.:** We know for a capillary tube

$$hR = \frac{2T}{\rho g} = \text{constant}$$

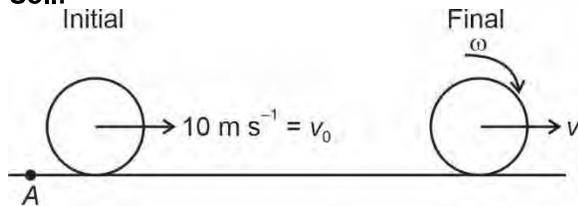
$$\therefore h \propto \frac{1}{R}$$

If  $h$  is halved then  $R$  gets doubled

29. Answer (2)

**Hint:** Angular momentum of sphere about a point on horizontal surface is conserved.

**Sol.:**



$$\therefore \sum \tau (\text{About } A) = 0$$

$$\therefore L_i = L_f (\text{About } A)$$

$$mv_0R = mvR + I\omega$$

$$mv_0R = mvR + \frac{2}{5}mR^2 \left( \frac{v}{R} \right)$$

$$v_0R = \frac{7}{5}vR$$

$$\frac{5}{7}v_0 = v$$

$$\frac{50}{7} \text{ m s}^{-1} = v$$

$$\therefore \omega = \frac{v}{R} = \frac{50}{7 \times \frac{1}{2}} = \frac{100}{7} \text{ rad s}^{-1}$$

30. Answer (1)

**Hint:** Heat lost by water = Heat gained by water at  $80^\circ\text{C}$  at  $20^\circ\text{C}$

**Sol.:** Let  $T$  be the equilibrium temperature

$$m_1c\Delta T_1 = m_2c\Delta T_2$$

$$4(80 - T) = 10(T - 20)$$

$$320 - 4T = 10T - 200$$

$$520 = 14T$$

$$T \approx 37^\circ\text{C}$$

31. Answer (1)

**Hint:** Work done in cyclic process = Area under  $PV$  diagram

[Interchange the axis of graph]

**Sol.:**  $W = \frac{-1}{2} (40 \times 10^3) (60 \times 10^{-6})$  [(-)ve sign due to anti-clockwise]

$$W = -1200 \times 10^{-3} \text{ J}$$

$$W = -1.2 \text{ J}$$

32. Answer (3)

**Hint and Sol.:** In isothermal process  $\Delta T = 0$

$$\therefore \Delta U = 0$$

33. Answer (2)

**Hint:** Comparing the given equation with standard equation of a progressive wave

**Sol.:** A progressive wave is given by

$$y = A \sin \left[ 2\pi \left( \frac{t}{T} - \frac{x}{\lambda} \right) \right]$$

On comparison with given wave equation

$$A = 4 \text{ cm}$$

$$T = 0.02 \text{ s} \therefore f = \frac{1}{T} = \frac{1}{0.02} = 50 \text{ Hz}$$

$$\lambda = 100 \text{ cm}$$

$$\therefore v = f\lambda = 50(100) = 5000 \text{ cm s}^{-1}$$

34. Answer (2)

**Hint:** Use speed,  $v = \sqrt{\frac{T}{\mu}}$

**Sol.:** We know,  $v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{80}{0.05}} = \sqrt{1600}$

$v = 40 \text{ m s}^{-1}$

35. Answer (1)

**Hint:** Question is asking about  $\frac{C_V}{C_P} = \frac{1}{\gamma}$

**Sol.:**  $C_V = \frac{fR}{2}, C_P = \frac{fR}{2} + R$

$$\frac{C_V}{C_P} = \frac{\frac{fR}{2}}{\frac{fR}{2} + R} = \frac{f}{f+2}$$

**SECTION - B**

36. Answer (3)

**Hint:** Below Earth's surface  $g' = g\left(1 - \frac{d}{R}\right)$

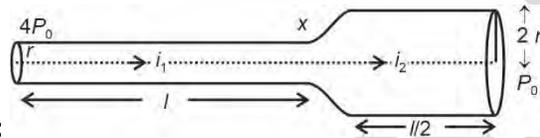
**Sol.:** For weight to reduce to 10%  $g'$  should be reduced to 10%

i.e.  $\frac{10}{100}g = g\left(1 - \frac{d}{R}\right)$

$$\frac{1}{10} = 1 - \frac{d}{R}$$

$$\frac{d}{R} = 1 - \frac{1}{10} = \frac{9}{10} \Rightarrow d = 0.9R$$

37. Answer (2)



**Hint:**

Fluid current in both pipes is same

**Sol.:** According to Poiseuille's equation

$i_1 = i_2$

$$\left(\frac{\Delta P}{R_F}\right)_1 = \left(\frac{\Delta P}{R_F}\right)_2$$

$$\frac{4P_0 - x}{\frac{8\eta l}{\pi r^4}} = \frac{x - P_0}{\frac{8\eta \frac{l}{2}}{\pi(2r)^4}}$$

$$\frac{(4P_0 - x)\pi r^4}{8\eta l} = \frac{32(x - P_0)\pi r^4}{8\eta l}$$

$$4P_0 - x = 32x - 32P_0$$

$$36 P_0 = 33x$$

$$x = \frac{12}{11} P_0$$

38. Answer (2)

**Hint:**  $f' = \left(\frac{v}{v \pm v_s}\right) f$

**Sol.:**  $f_{\text{approach}} = 1000$

$$= \left(\frac{v-0}{v-v_s}\right) f$$

$$= \left(\frac{350}{350-50}\right) f = \frac{350}{300} f = 1000$$

$$\therefore f = \frac{1000 \times 300}{350}$$

Now  $f_{\text{receding}} = \left(\frac{v-0}{v+v_s}\right) f$

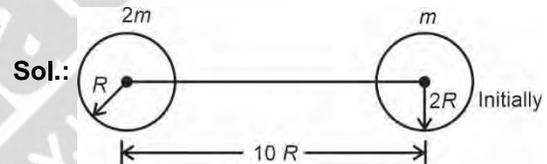
$$= \left(\frac{350}{350+50}\right) \left(\frac{1000 \times 300}{350}\right)$$

$$= \frac{350 \times 1000 \times 300}{400 \times 350}$$

$$= 750 \text{ Hz}$$

39. Answer (3)

**Hint:** Use the concept of law of conservation of mechanical energy.

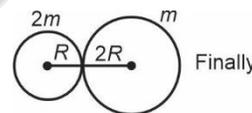


**Sol.:**

According to conservation of momentum

$$2mv_1 + mv_2 = 0$$

$$2v_1 = -v_2$$



According to conservation of energy :

$$\frac{-G(m)(2m)}{10R} + 0 = \frac{-Gm(2m)}{3R} + \frac{1}{2}(2m)v_1^2 + \frac{1}{2}mv_2^2$$

$$\Rightarrow \frac{2Gm^2}{3R} - \frac{2Gm^2}{10R} = \frac{1}{2}m(2v_1^2 + v_2^2)$$

$$= \frac{1}{2}m(2v_1^2 + 4v_1^2)$$

$$\Rightarrow \frac{20Gm^2 - 6Gm^2}{30R} = \frac{1}{2}m(6v_1^2)$$

$$\Rightarrow \frac{14Gm^2}{30R} = 3mv_1^2$$

$$\Rightarrow \sqrt{\frac{14Gm}{90R}} = v_1$$

$$\Rightarrow v_1 = \frac{1}{3} \sqrt{\frac{7Gm}{5R}}$$

40. Answer (1)

**Hint:** Use  $T = 2\pi \sqrt{\frac{l}{mg}}$

**Sol.:**  $T = 2\pi \sqrt{\frac{\left(\frac{mR^2}{3}\right)}{\left(\frac{mgR}{2}\right)}}$

$$T = 2\pi \sqrt{\frac{2R}{3g}}$$

41. Answer (4)

**Hint:** Maximum efficiency  $\eta = 1 - \frac{T_L}{T_H}$

**Sol.:**  $\therefore \eta = 1 - \frac{400 \text{ K}}{600 \text{ K}}$

$$= 1 - \frac{2}{3} = \frac{1}{3} \Rightarrow 33\%$$

Thus, for given heat engine  $\eta \leq 33\%$  i.e. 20%

42. Answer (2)

**Hint and Sol.:** Potential energy is defined only for conservative forces

43. Answer (2)

**Hint and Sol.:**  $\frac{5}{3} = \frac{m(g+a)}{m(g-a)}$

$$a = g/4$$

44. Answer (4)

**Hint and Sol.:** Beat time period = 2 (time between consecutive maximum and minimum amplitude)

$$T = 2 \left( \frac{1}{12} \right) = \frac{1}{6} \text{ s}$$

$$\therefore \text{Beat frequency } \nu = \frac{1}{T} = 6 \text{ Hz}$$

Thus  $f$  can be either  $(250 - 6) \text{ Hz}$   
or  $(250 + 6) \text{ Hz}$

$$\therefore 256 \text{ Hz is correct answer}$$

45. Answer (1)

**Hint & Sol.:** SI unit of viscosity is Pa s

46. Answer (1)

**Hint:** Minimum speed at bottommost point should be  $\sqrt{5gl}$  to loop the path completely.

**Sol.:** According to Work - Energy theorem

$$\left( \frac{1}{2} mv^2 \right)_{\text{Bottom}} = \frac{1}{2} kx^2$$

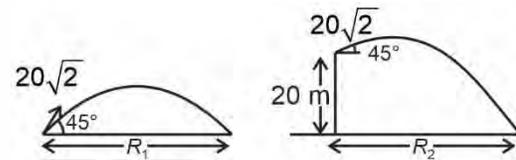
$$\Rightarrow x = \sqrt{5gl \left( \frac{m}{k} \right)}$$

$$\sqrt{\frac{4}{1000}} \times 5 \times 10 \times 5 = x$$

$$x = \frac{2 \times 5}{10} = 1 \text{ m}$$

47. Answer (2)

**Hint:**



Range for ground to ground projectile is maximum at  $45^\circ$

**Sol.:**  $R_1 = \frac{u^2}{g} = \frac{(20\sqrt{2})^2}{10} = 80 \text{ m}$

For Time of flight ( $T$ ) in second case:

$$-20 = 20T - \frac{1}{2}(10 T^2)$$

$$-20 = 20T - 5T^2$$

$$T^2 - 4T - 4 = 0$$

solving it we get

$$T = 2\sqrt{2} + 2 = 4.8 \text{ s}$$

$$R_2 = u_x T = 20(4.8) = 96 \text{ m}$$

$$\therefore R_2 - R_1 = 96 - 80 = 16 \text{ m}$$

48. Answer (3)

**Hint and Sol.:** Assumptions of kinetic theory of gases mention that all collisions even collision of molecules with walls of containers are elastic in nature.

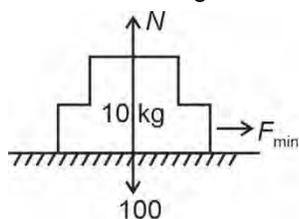
49. Answer (1)

**Hint:** For first harmonic  $\nu = f\lambda$  and  $\frac{\lambda}{2} = L$

**Sol.:**  $\therefore \nu = f(2L) = 294 (2) (0.7)$

$$\nu = 411.6 \approx 412 \text{ Hz}$$

50. Answer (2)

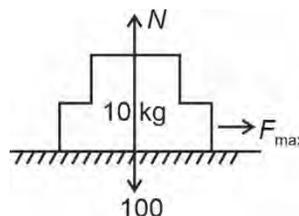
**Hint:** The maximum acceleration of upper block is ' $\mu g$ '**Sol.:** For starting the motion

$$F_{\min} = \text{zero}$$

For blocks to move together  $a_{\max} = \mu g$ 

$$= 0.4(10) = 4 \text{ m s}^{-2}$$

$$\therefore F_{\max} = ma_{\max}$$



$$F_{\max} = 10(4)$$

$$F_{\max} = 40 \text{ N}$$

## [CHEMISTRY]

### SECTION - A

51. Answer (4)

**Hint:** Number of atoms = Number of moles  $\times$  atomicity  $\times N_A$ .

$$\text{Sol.}: 12 \text{ g O}_3 = \frac{12}{48} \times 3 \times N_A = 0.75 N_A$$

$$6 \text{ g H}_2\text{O} = \frac{6}{18} \times 3 \times N_A = N_A$$

$$14 \text{ g CO} = \frac{14}{28} \times 2 \times N_A = N_A$$

$$22 \text{ g CO}_2 = \frac{22}{44} \times 3 \times N_A = 1.5 N_A$$

52. Answer (4)

**Hint:** Aqueous solution of salt of strong base and weak acid will have highest pH.**Sol.:**  $\text{K}_2\text{CO}_3$  is a salt of strong base, KOH and weak acid,  $\text{H}_2\text{CO}_3$ , therefore its aqueous solution will be basic in nature and have pH greater than 7.

53. Answer (2)

$$\text{Hint: } K_p = K_c (\text{RT})^{\Delta n_g}$$

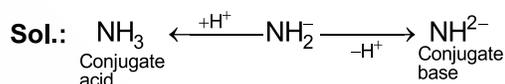
$$\text{Sol.}: \text{For, } \text{Ni(s)} + 4\text{CO(g)} \rightleftharpoons \text{Ni(CO)}_4\text{(g)}$$

$$\Delta n_g = 1 - 4 = -3$$

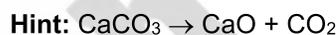
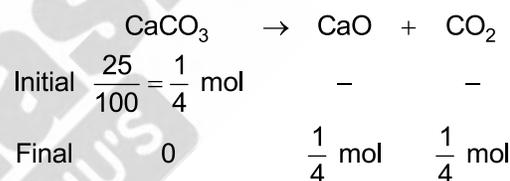
$$K_p = K_c (\text{RT})^{-3} = K_c \frac{1}{(\text{RT})^3}$$

$$\frac{K_c}{K_p} = (\text{RT})^3$$

54. Answer (3)

**Hint:** Conjugate base should have one proton less than respective species.

55. Answer (2)

**Sol.:** Molar mass of  $\text{CaCO}_3 = 100 \text{ g}$ 1 mol  $\text{CaCO}_3$  will produce 22.4 L  $\text{CO}_2$  at STP
$$\frac{1}{4} \text{ mol CaCO}_3 \text{ will produce } 22.4 \times \frac{1}{4} \text{ L CO}_2 \text{ at STP}$$

$$\Rightarrow 5.6 \text{ L CO}_2$$

56. Answer (1)

$$\text{Hint: Number of moles} = \frac{\text{Given mass}}{\text{Molar mass}}$$

$$\text{Sol.}: \frac{n_{\text{SO}_2}}{n_{\text{O}_2}} = \frac{\frac{3x}{64}}{\frac{2x}{32}} = \frac{3}{4}$$

57. Answer (3)

**Hint:** Maximum number of orbitals in any shell =  $n^2$ **Sol.:** For N shell,  $n = 4$ 

$$\text{Number of orbitals in N shell} = (4)^2 = 16$$

58. Answer (1)

**Hint:** Bohr's model is applicable for single electron species.

**Sol.:** Bohr's model could not explain the splitting of spectral line in magnetic field (Zeeman effect) as well as in electric field (Stark effect).

59. Answer (4)

**Hint:**  $\Delta x \cdot m\Delta v_x \geq \frac{h}{4\pi}$

**Sol.:** Since,  $\Delta v_x = 2\Delta x$

$$\Rightarrow \Delta x \cdot m(2\Delta x) = \frac{h}{4\pi}$$

$$\Delta x^2 = \frac{h}{8\pi m}$$

$$\Delta x = \sqrt{\frac{h}{8\pi m}}$$

60. Answer (2)

**Hint:** According to kinetic theory of gases, the total energy of gas molecules before and after collision remains same.

**Sol.:** Collision of gas molecules are perfectly elastic. There may be exchange of energy between colliding molecules, their individual energies may change but sum of their energies remain constant.

61. Answer (3)

**Hint:**  $PV = nRT$

**Sol.:**  $n_{\text{CH}_4} = \frac{48}{16} = 3 \text{ mol}$  [82.1 dm<sup>3</sup> = 82.1 L]

$$P = \frac{nRT}{V} = \frac{3 \times 0.0821 \times 300}{82.1}$$

$$= 0.9 \text{ atm}$$

62. Answer (3)

**Hint:** Solubility decreases with decrease in hydration enthalpy.

**Sol.:** On going down the group in group 2 elements, as the size of cation increases, the hydration enthalpy decreases and resultantly their solubility in water decreases.

63. Answer (1)

**Hint:** Calcium sulphate dihydrate is called gypsum, while calcium sulphate hemihydrate is plaster of Paris.

**Sol.:**

Chemical formula	Names
CaSO <sub>4</sub> ·2H <sub>2</sub> O	Gypsum
CaSO <sub>4</sub> · $\frac{1}{2}$ H <sub>2</sub> O	Plaster of Paris
Ca(OH) <sub>2</sub>	Slaked lime
CaO	Quick lime

64. Answer (4)

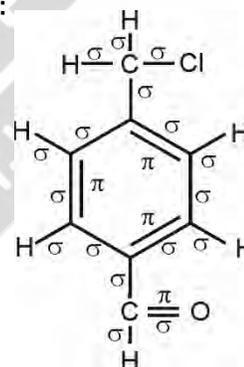
**Hint:** Alkali metals and their salts imparts characteristic colours to an oxidizing flame.

**Sol.:**

Metal	Colour
Li	Crimson red
Na	Yellow
Rb	Red violet
Cs	Blue

65. Answer (1)

**Hint:** In multiple bonded carbon atoms, one bond is always  $\sigma$  bond.

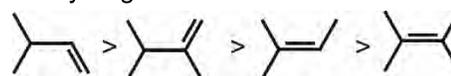
**Sol.:**

66. Answer (4)

**Hint:** Heat of hydrogenation increases with decrease in stability of alkene.

**Sol.:** Lesser the number of hyperconjugative structures, lesser will be the stability of alkene and higher will be its heat of hydrogenation.

Heat of hydrogenation:



67. Answer (2)

**Hint:** Fractional distillation is used to separate different fractions of crude oil in petroleum industry

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

68. Answer (2)

**Hint:** Addition reaction occurs in unsaturated hydrocarbons.

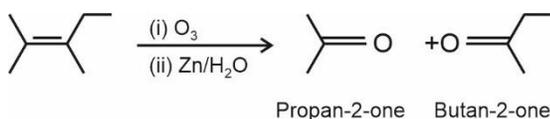
**Sol.:**

(I)	Addition reaction	1 Br <sub>2</sub> molecule is added
(II)	Substitution reaction	Cl replaces H in benzene
(III)	Elimination reaction	1 HBr molecule is eliminated

69. Answer (1)

**Hint:** Ozonolysis involves cleavage of carbon-carbon double bonds and get converted to the respective carbonyl compounds.

**Sol.:**



70. Answer (3)

**Hint:** F has lesser negative electron gain enthalpy than Cl. Because adding an electron to 2p orbital leads to greater repulsion than adding an electron to larger 3p orbital.

**Sol.:**

Element	O	F	Cl	S
$\Delta_{\text{eg}}H$ (kJ mol <sup>-1</sup> )	-141	-328	-349	-200

71. Answer (1)

**Hint:** Atomic number of Unnilbium is 102

**Sol.:**

Nobelium : Unnilbium

Mendelevium : Unnilunium

Lawrencium : Unniltrium

Rutherfordium : Unnilquadium

72. Answer (4)

**Hint:** Bond order =  $\frac{N_b - N_a}{2}$

where  $N_b$  is number of electrons in BMO and  $N_a$  is number of electrons in ABMO

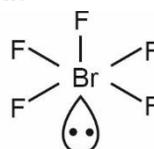
**Sol.:**

Species	Bond order
N <sub>2</sub>	3
N <sub>2</sub> <sup>-</sup>	2.5
O <sub>2</sub>	2
O <sub>2</sub> <sup>2-</sup>	1

73. Answer (2)

**Hint:** Hybridisation can be predicted by the sum of total number of  $\sigma$  bonds and number of lone pair of electrons on central atom.

**Sol.:**



$sp^3d^2$  hybridised

(Square pyramidal)

74. Answer (2)

**Hint:** The number of ejected electrons depends upon intensity of light whereas their kinetic energy depends upon frequency of light used.

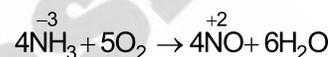
**Sol.:** Photoelectric effect is explained on the basis of particle nature of light.

75. Answer (2)

**Hint:** The oxidation number of N in NH<sub>3</sub> = -3

**Sol.:** Oxidation number of N in NO =  $x + (-2) = 0$

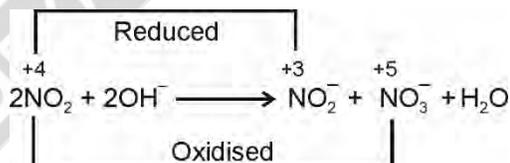
$$\Rightarrow x = +2$$



76. Answer (2)

**Hint:** In disproportionation reaction, an element is simultaneously oxidised and reduced

**Sol.:**



77. Answer (1)

**Hint:** H<sub>2</sub>O<sub>2</sub> is non-planar molecule and auto oxidation of 2-alkylanthraquinols forms H<sub>2</sub>O<sub>2</sub>.

**Sol.:** Strength of H<sub>2</sub>O<sub>2</sub> =  $M \times 11.2$

$$= \frac{30}{34} \times 11.2 \approx 10 \text{ V}$$

78. Answer (4)

**Hint:** Metallic hydrides are non-stoichiometric hydrides

**Sol.:** NaH : Ionic hydride

HF : Covalent hydride

CH<sub>4</sub> : Covalent hydride

VH<sub>0.56</sub> : Metallic hydride

79. Answer (3)

**Hint:** The value of extensive property depends upon quantity or size of matter present in system.

**Sol.:**

- Density, pressure and molar heat capacity are intensive properties as these don't depend on the quantity or size of matter present.

Internal energy depends on amount of substance therefore is an extensive property

80. Answer (4)

**Hint:** Standard enthalpy of formation is zero for elements which are present in their standard or reference state.

**Sol.:** Standard state of carbon is graphite therefore  $\Delta_f H$  of diamond is non-zero.

81. Answer (1)

**Hint:**  $\Delta S = 2.303 nR \log \frac{V_f}{V_i}$  (at constant temperature)

$$\text{Sol.} \quad \Delta S = 2.303 \times 2 \times R \times \log \frac{100}{1}$$

$$= 2.303 \times 2 \times R \times \log 10^2$$

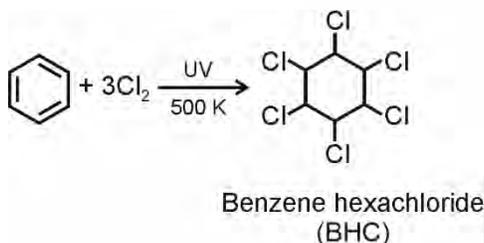
$$= 2.303 \times 2 \times R \times 2$$

$$= 9.202 R$$

82. Answer (2)

**Hint:** Under UV light,  $\text{Cl}_2$  undergoes free radical addition reaction with benzene.

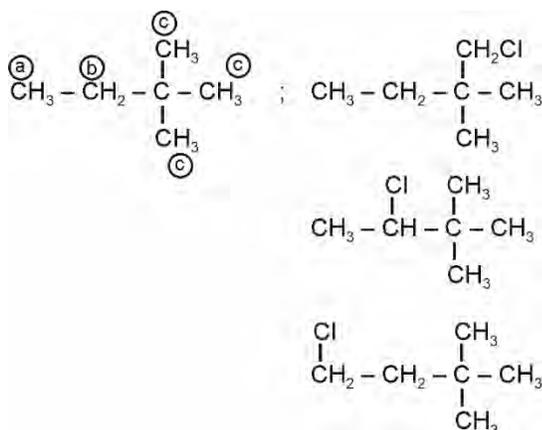
**Sol.:**



83. Answer (3)

**Hint:** More the number of distinct hydrogen atoms, more the number of monochloro derivatives.

**Sol.:**



84. Answer (4)

**Hint:** The main components of photochemical smog are formed by the action of sunlight on unsaturated hydrocarbons and nitrogen oxides.

**Sol.:** Aldrin is a pesticide.

85. Answer (4)

**Hint:** Stability of group 14 dihalides increases down the group.

**Sol.:**  $\text{PbCl}_2$  is thermally and chemically more stable than  $\text{PbCl}_4$

### SECTION - B

86. Answer (4)

$$\text{Hint: } M = \frac{M_1 V_1 + M_2 V_2}{V_1 + V_2}$$

$$\text{Sol.} \quad M_1 = 0.5 \text{ M} \quad M_2 = 1.5$$

$$V_1 = 100 \text{ mL} \quad V_2 = 200 \text{ mL}$$

$$0.5 \times 100 + 1.5 \times 200 = M(100 + 200)$$

$$50 + 300 = M(300)$$

$$\frac{350}{300} = M$$

$$M \approx 1.17 \text{ M}$$

87. Answer (2)

**Hint:** Electronic configuration of Be [ $Z = 4$ ] =  $1s^2 2s^2$ .

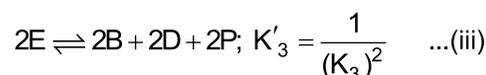
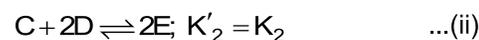
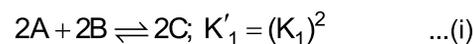
**Sol.:**

Element	Electronic conf.	Set of Quantum Number for last electron
Na [ $Z = 11$ ]	$[\text{Ne}]3s^1$	$n = 3, l = 0, m_l = 0, m_s = \frac{1}{2}$
Be [ $Z = 4$ ]	$1s^2 2s^2$	$n = 2, l = 0, m_l = 0, m_s = -\frac{1}{2}$
N [ $Z = 7$ ]	$1s^2 2s^2 2p^3$	$n = 2, l = 1, m_l = -1, m_s = \frac{1}{2}$
Cl [ $Z = 17$ ]	$[\text{Ne}]3s^2 3p^5$	$n = 3, l = 1, m_l = 0, m_s = -\frac{1}{2}$

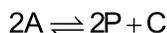
88. Answer (2)

**Hint:** On adding two equilibria, their equilibrium constants get multiplied.

**Sol.:**



Adding (i), (ii) and (iii)



$$K = \frac{K_1^2 K_2}{K_3^2}$$

89. Answer (2)

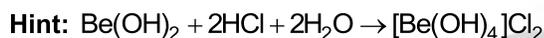
**Hint:** Boyle's law [P and V relationship] at constant T, PV = constant.

$$\text{Sol.: } P \propto \frac{1}{V}$$

$$P = K \frac{1}{V}$$

As temperature increases the slope of P vs  $\frac{1}{V}$  graph increases too.

90. Answer (2)



**Sol.:** Hybridisation of Be in  $[\text{Be}(\text{OH})_4]^{2-}$  is  $sp^3$

91. Answer (4)

**Hint & Sol.:**  $-\text{COOH}$  group shows  $-R$  effect.

92. Answer (1)

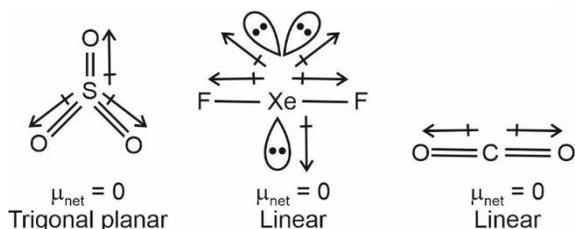
**Hint:** The s and p block elements together are called representative elements.

**Sol.:** K and Sr are s-block elements, In, Sn, and Pb are p-block elements and V, Ti and Fe are d-block elements.

93. Answer (3)

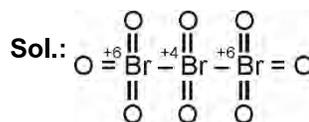
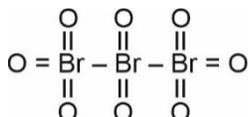
**Hint:** Molecule with net zero dipole moment is non-polar.

**Sol.:**



94. Answer (4)

**Hint:**  $\text{Br}_3\text{O}_8$ :



95. Answer (2)

**Hint:** Permanent hardness is caused due to soluble salts of Mg and Ca in form of chlorides and sulphates in water.

**Sol.:** Ion Exchange method is called permutit process. Hydrated sodium aluminium silicate is permutit and can remove temporary as well as permanent hardness of water.

96. Answer (1)

**Hint:**  $\Delta G = \Delta H - T\Delta S$

$$\text{Sol.: } \Delta G = 2500 - 300 \times 15$$

$$= -2000 \text{ cal}$$

$$\Delta G = -2 \text{ kcal}$$

97. Answer (4)

**Hint:**  $C_p - C_v = R$

**Sol.:** As per first law of thermodynamics

$$\Delta U = w + q$$

$$\Rightarrow C_p = R + C_v$$

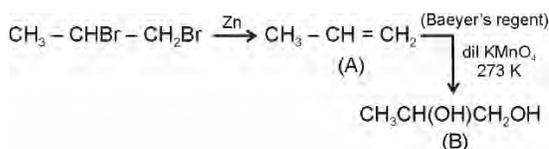
$$\Rightarrow \Delta H = \Delta U + \Delta n_g RT$$

$$\Rightarrow \Delta U = nC_v \Delta T$$

98. Answer (1)

**Hint:** Aqueous solution of  $\text{KMnO}_4$  is Baeyer's reagent.

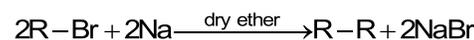
**Sol.:**



99. Answer (4)

**Hint:** Wurtz reaction is useful for preparation of higher alkanes with even number of carbon atoms.

**Sol.:** Wurtz Reaction:



$\text{CH}_4$  cannot be prepared through Wurtz reaction.

100. Answer (3)

**Hint & Sol.:** Maximum prescribed concentration of Cd in drinking water is 0.005 ppm.

**[BOTANY]****SECTION - A**

101. Answer (4)

**Hint:** Nucleoplasm or nuclear matrix is the fluid filled space enclosed inside nuclear envelope.

**Sol.:** Perinuclear space is the space enclosed between two nuclear membranes.

102. Answer (1)

**Hint:** ATP synthesis by photophosphorylation and oxidative phosphorylation occur in chloroplast and mitochondria respectively.

**Sol.:**

- SER is involved in lipid synthesis.
- Golgi complex is involved in modification and packaging of materials.

103. Answer (1)

**Hint:** 'Omnis cellula - e- cellula' means all cells arise from pre-existing cells.

**Sol.:** Rudolf Virchow modified cell theory by adding the statement 'Omnis cellula -e- cellula'.

- Robert Hooke first discovered dead cells.
- Robert Brown first described nucleus.
- George Palade discovered ribosomes.

104. Answer (2)

**Hint:** Fluid filled space surrounded by nuclear membrane is nucleoplasm.

**Sol.:** Cytoplasm is surrounded by plasma membrane.

105. Answer (3)

**Hint:** Complete disintegration of nuclear envelope marks the beginning of second phase of karyokinesis i.e. metaphase.

**Sol.:** DNA synthesis and centriole duplication occurs in S-phase of interphase.

Tubulin proteins are synthesised during G<sub>2</sub> phase of interphase.

106. Answer (4)

**Hint:** Karyokinesis is the process of nuclear division further divided into four substages.

**Sol.:** M-phase is the phase of actual cell division and is the most dramatic phase of cell cycle.

107. Answer (4)

**Hint:** Mitosis is the process by which parent cell divides into two identical daughter cells.

**Sol.:** Mitosis is also termed as equational division because the number of chromosomes in parent cell and daughter cells are same.

108. Answer (1)

**Hint:** Zygotene involves pairing of homologous chromosomes, i.e. synapsis with the help of proteinaceous synaptonemal complex.

**Sol.:** Pachytene involves crossing over i.e. exchange of genetic segments between non sister chromatids of homologous chromosomes. Diplotene involves dissolution of synaptonemal complex.

Diakinesis is final substage of prophase-I which involves terminalisation of chiasmata and represents transition to metaphase-I.

109. Answer (3)

**Hint:** *In-situ* conservation strategy involves conservation of living organisms at their natural places i.e. on site conservation.

**Sol.:** Botanical gardens are *ex-situ* conservation strategy of plants.

110. Answer (2)

**Hint:** Mango belongs to family Anacardiaceae and order Sapindales while brinjal belongs to family Solanaceae and order Polymoniales.

**Sol.:** Mango and brinjal belong to same class Dicotyledonae.

111. Answer (4)

**Hint:** Cell wall was one of the most important criteria used by Linnaeus in two kingdom classification.

**Sol.:** Fungi are multicellular, eukaryotic, heterotrophic, cell wall containing organisms placed under Plantae according to two kingdom classification system.

112. Answer (2)

**Hint:** Chemoautotrophic bacteria do not use light as a source of energy.

**Sol.:** Chemoautotrophic bacteria oxidise certain inorganic substances and use this released chemical energy for further process. They also help in recycling of inorganic substances.

113. Answer (3)

**Hint:** Methanogens are found in marshy areas.

**Sol.:** Methanogens are obligate anaerobes thus found in anaerobic environment.

114. Answer (2)

**Hint:** Chief producers in oceans, i.e., the diatoms are photosynthetic protists.

**Sol.:** Diatoms are unicellular, eukaryotic, photoautotrophic, lack flagella except during reproductive stage.

115. Answer (2)

**Hint:** In numerical taxonomy hundreds of characters can be considered at the same time and each character is given equal weightage.

**Sol.:** Numerical taxonomy uses computers based on all observable characters. Numbers and codes are assigned to all the characters and each character is given equal importance.

116. Answer (2)

**Hint:** Isogamous reproduction involves fusion of two gametes which are similar in size.

**Sol.:** *Spirogyra* produces non motile, non flagellated isogametes.

*Ulothrix* produces motile, flagellated isogametes.

*Volvox* and *Fucus* show oogamous reproduction *i.e.* fusion of two dissimilar gametes-one large, non motile (static) female gamete and a small, motile male gamete.

117. Answer (3)

**Hint:** *Ulothrix* is a green freshwater algae.

**Sol.:** Many species of *Porphyra*, *Laminaria* and *Sargassum* are among the 70 species of marine algae used as food.

118. Answer (1)

**Hint:** Phaeophyceae (brown algae) have 2 unequal lateral flagella and reserve material as mannitol and laminarin.

**Sol.:** Chlorophyceae (green algae) have 2-8, equal, apical flagella and reserve material as starch.

Rhodophyceae (red algae) lack flagella and reserve material is floridean starch which is very similar to amylopectin and glycogen in structure.

119. Answer (3)

**Hint:** A single leaf arising at each node in alternate manner is alternate phyllotaxy, as in China rose, mustard and sunflower plants.

**Sol.:** In opposite phyllotaxy, a pair of leaves arise at each node, and lie opposite to each other as in *Calotropis* and guava plants.

120. Answer (3)

**Hint:** In cymose inflorescence, the main axis terminates in a flower, thus, growth is limited and youngest flower is at the base and oldest at the top *i.e.* basipetal order.

**Sol.:** In racemose inflorescence, the main axis continues to grow, *i.e.* unlimited growth and the flowers are borne laterally in acropetal order *i.e.* youngest at the top and oldest at the base.

121. Answer (2)

**Hint:** Periderm is a collective term used for all three layers *i.e.* phellem, phellogen and phelloderm.

**Sol.:** Phellogen is cork cambium which is a de-differentiated tissue or secondary meristem. Phellem is cork and phelloderm is secondary cortex. They both are re-differentiated tissues or secondary permanent tissues.

122. Answer (2)

**Hint:** Phloem fibres or bast fibres are elongated, unbranched, pointed, dead sclerenchymatous cells which help in mechanical support and strength.

**Sol.:** Companion cells maintain the pressure gradient in sieve tubes.

123. Answer (3)

**Hint:** Movement of molecules against concentration gradient with the help of energy is active transport.

**Sol.:** Movement of single type of molecules across transport proteins during diffusion is uniport.

Movement of two different types of molecules simultaneously across the transport proteins during diffusion is co-transport. If they move in same direction it is symport, and if they move in opposite direction, it is antiport.

124. Answer (1)

**Hint:** Downhill movement of molecules *i.e.* from their high concentration to low concentration does not require energy.

**Sol.:** Active transport is uphill movement of molecules *i.e.* against concentration gradient thus it requires energy (ATP), special proteins and is highly selective.

125. Answer (4)

**Hint:** Mg is constituent of the ring structure of chlorophyll.

**Sol.:** Mg activates enzymes of photosynthesis like RuBisCO and respiration like pyruvate dehydrogenase.

126. Answer (3)

**Hint:** N<sub>2</sub> fixation is conversion of atmospheric N<sub>2</sub> into NH<sub>3</sub>.

**Sol.:** Ammonification is decomposition of dead organic matter into ammonia.

Nitrification is conversion of NH<sub>3</sub> to NO<sub>2</sub><sup>-</sup> then to NO<sub>3</sub><sup>-</sup>

Denitrification is reduction of nitrate present in soil into nitrogen.

127. Answer (1)

**Hint:**  $\alpha$ -ketoglutaric acid acts as raw material for synthesis of amino acids.

**Sol.:** Succinyl CoA acts as raw material for synthesis of chlorophyll. Acetyl CoA acts as raw material for synthesis of carotenoids. Oxaloacetic acid acts as raw material for synthesis of pyrimidines.

128. Answer (1)

**Hint:** Acetyl CoA will directly enter Krebs cycle.

**Sol.:** 1 Acetyl CoA will undergo 1 Krebs cycle and yield 3 NADH<sub>2</sub>, 1 FADH<sub>2</sub> and 1 GTP.

Each NADH<sub>2</sub> yields 3 ATP through ETS

$\therefore 3 \text{ NADH}_2 \rightarrow 3 \times 3 = 9 \text{ ATP}$

Each FADH<sub>2</sub> yields 2 ATP by ETS

$\therefore 1 \text{ FADH}_2 \rightarrow 1 \times 2 = 2 \text{ ATP}$

GTP is equivalent to ATP

Total = 9 + 2 + 1 = 12 ATP

129. Answer (3)

**Hint:** Fats and proteins having respiratory quotient less than 1, for fats it is 0.7 and for proteins it is 0.9.

**Sol.:** For carbohydrates RQ = 1

For organic acids RQ > 1

130. Answer (3)

**Hint:** Tomato is a C<sub>3</sub> plant and maize is a C<sub>4</sub> plant.

**Sol.:** Calvin cycle requires 3 ATP and 2 NADPH<sub>2</sub> per CO<sub>2</sub> fixation.

C<sub>4</sub> pathway requires 5 ATP and 2 NADPH<sub>2</sub> per CO<sub>2</sub> fixation.

Thus, there is a difference of 2 ATP per CO<sub>2</sub> fixed.

Since, a sucrose molecule has 12 C

$\therefore 12 \times 2 = 24 \text{ ATP}$  are additionally required in C<sub>4</sub> plants.

131. Answer (2)

**Hint:** RuBisCO is the most abundant protein (enzyme) of the living world.

**Sol.:** PEPcase or phosphoenol pyruvate carboxylase is carbon fixation enzyme in C<sub>4</sub> pathway.

132. Answer (2)

**Hint:** C<sub>4</sub> plants follow Hatch and Slack pathway to avoid photorespiratory losses.

**Sol.:** C<sub>4</sub> plants lack RuBisCO enzyme in mesophyll cells. Primary CO<sub>2</sub> fixation in mesophyll cells takes place with the help of PEPcase and Calvin cycle occurs in bundle sheath cells.

133. Answer (4)

**Hint:** Auxin is commonly termed as growth hormone.

**Sol.:** ABA is commonly known as stress hormone as it helps plants in overcoming environmental stresses.

134. Answer (1)

**Hint:** ABA induces stomatal closure thus, minimises transpirational loss of water and is used as antitranspirant.

**Sol.:** Ethylene is one of the most widely used PGR in agriculture. Ethylene is used as ripening hormone.

135. Answer (1)

**Hint:** Auxins are indole compounds like

IAA  $\rightarrow$  Indole-3-acetic acid

IBA  $\rightarrow$  Indole-3-butyric acid.

**Sol.:** Cytokinins are purine derivatives, gibberellins are terpene derivatives and ABA is carotenoid derivative.

## SECTION - B

136. Answer (2)

**Hint:** Nerve cells are some of the longest cells. The shape of the cell may vary with the function they perform.

**Sol.:** Nerve cells are branched and long. Columnar epithelial cells are long and narrow.

137. Answer (1)

**Hint:** Number of mitotic divisions required to produce 'n' number of cells = n - 1

**Sol.:** Number of mitotic divisions required to produce 64 cells  $\Rightarrow 64 - 1 \Rightarrow 63$

138. Answer (3)

**Hint:** Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheets, along with their description for future use.

**Sol.:** Label on herbarium sheets provide information about date and place of collection, its english, local, and scientific name, name of family and name of collector.

139. Answer (3)

**Hint:** Polymoniales is the order including families having similar characters.

**Sol.:** On the basis similar floral characters Solanaceae and Convolvulaceae families are placed in same order Polymoniales.

140. Answer (2)

**Hint:** Smut is caused by fungus *Ustilago*.

**Sol.:** *Ustilago* belongs to Basidiomycetes and causes smut disease.

141. Answer (4)

**Hint:** Viroids are infectious RNA particles without capsid and are smaller than viruses.

**Sol.:** Prions are infectious protein particles, similar in size to viruses. They lack genetic material. Viroids cause diseases in plants.

142. Answer (1)

**Hint:** Mosses are evolutionary more advanced than liverworts.

**Sol.:** Mosses along with lichens are the first organisms to colonise rocks. Mosses have an elaborate mechanism of spore dispersal.

143. Answer (3)

**Hint:** Roots in some plants change their shape and structure and become modified to perform other functions.

**Sol.:** Main functions of the root system are absorption, conduction, anchorage, storage and synthesis of PGRs.

In some plants, roots modify to perform functions other than absorption, conduction etc. like mechanical support, respiration etc.

144. Answer (3)

**Hint:** Sucker helps in spreading to new niches and when older parts die new plants are formed.

**Sol.:** Underground stems of potato (tuber), ginger (rhizome) and zaminkand (corm) are modified to store food in them. They also act as organs of perennation.

145. Answer (1)

**Hint:** Roots have radial vascular bundles.

**Sol.:** In monocot stems, vascular bundles are conjoint, collateral, closed and are scattered in ground tissue. In dicot stem, vascular bundles are open and are arranged in a ring.

146. Answer (1)

**Hint:** Early or spring wood is lighter in colour and lower in density.

**Sol.:** In the spring season, cambium is very active and produces a large number of xylary elements having vessels with wider cavities.

147. Answer (4)

**Sol.:** Water is a limiting factor for plant growth and development in both agricultural and natural environment.

148. Answer (3)

**Hint:** In absence of essential elements, a plant cannot complete its life cycle.

**Sol.:** C, N, Mg are essential macronutrients but Na is a beneficial element.

149. Answer (3)

**Hint:** Hydroponics is technique of growing plants in a soilless nutrient solution.

**Sol.:** It is useful in areas having thin, infertile and dry soils.

150. Answer (3)

**Hint:** Aldolase catalyses conversion of Fructose - 1, 6 - Bisphosphate into 3-phosphoglyceraldehyde and dihydroxyacetone-phosphate.

**Sol.:** Hexokinase catalyses conversion of glucose into glucose-6-phosphate

Enolase catalyses conversion of 2-phosphoglyceric acid into phospho-enol-pyruvate.

## [ZOOLOGY]

### SECTION - A

151. Answer (3)

**Hint:** Cyclostomes are without jaws.

**Sol.:** Gnathostomes are jaw-bearing animals. Organisms of super class Pisces and Tetrapoda belong to division Gnathostomata.

*Pterophyllum* – Class Osteichthyes

*Pteropus* – Class Mammalia

*Testudo* – Class Reptilia

*Myxine* belongs to class Cyclostomata and division Agnatha (jawless animals).

152. Answer (1)

**Hint:** It stimulates melanocytes.

**Sol.:** Pars intermedia is the part of adenohipophysis.

It secretes only one hormone, *i.e.*, Melanocyte Stimulating Hormone (MSH).

PRL is Prolactin which is produced by anterior pituitary.

Pineal gland secretes melatonin.

Neurohypophysis stores and releases two hormones – oxytocin and Anti-Diuretic Hormone (ADH).

153. Answer (4)

**Hint:** Peptic cells secrete the proenzyme pepsinogen.

**Sol.:**

Oxyntic cells	–	Secrete HCl
Chief cells	–	Peptic cells
Goblet cells	–	Mucus

154. Answer (2)

**Hint:** Thoracic volume affects pulmonary volume.

**Sol.:** The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by the dome-shaped diaphragm. The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the pulmonary volume.

155. Answer (3)

**Hint:** Rh incompatibility occurs between Rh –ve blood of a pregnant mother and Rh +ve blood of the foetus.

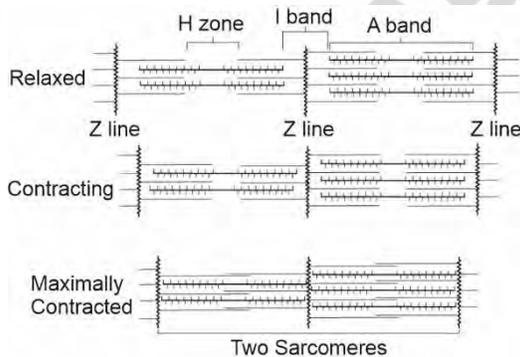
**Sol.:** Since 'Q' is an Rh +ve individual she won't face any Rh incompatibility issues whether her foetus is Rh +ve or Rh –ve.

'Y' on the other hand, is Rh –ve so if her foetus is Rh –ve then there is no Rh incompatibility. But, if her foetus is Rh +ve, then it is a case of Rh incompatibility and the subsequent pregnancies may be problematic.

156. Answer (4)

**Hint:** Shortening of sarcomere

**Sol.:**



157. Answer (3)

**Hint:** Carpals + Pectoral girdle bones in humans

**Sol.:** The respiratory system of cockroach comprises a network of trachea, that open through 10 pairs of small holes called spiracles present on the lateral side of the body.

158. Answer (2)

**Hint:** Exclude toxins

**Sol.:**

Pigment	–	Anthocyanin
Drug	–	Curcumin
Toxins		Ricin, Abrin

159. Answer (1)

**Hint:** Nerve fibres of CNS

**Sol.:** There are two types of axons, namely, myelinated and unmyelinated.

- Unmyelinated nerve fibres are enclosed by a Schwann cell that does not form a myelin sheath around the axon in PNS.
- Myelinated nerve fibres are enclosed by a myelin sheath formed by oligodendrocytes in CNS and Schwann cells in PNS.
- Schwann cells enclose both myelinated and unmyelinated nerve fibres only in PNS.

160. Answer (3)

**Hint:** If glomerular blood flow increases, glomerular blood pressure increases

**Sol.:** When glomerular blood flow increases, glomerular blood pressure increases and so does the glomerular filtration rate. An increase in blood flow to the atria of the heart causes the release of Atrial Natriuretic Factor (ANF). ANF causes vasodilation which decreases the blood pressure.

161. Answer (3)

**Hint:** An obese person has this tissue in excess compared to a thin person.

**Sol.:** Areolar tissue and adipose tissue are two types of loose connective tissue.

Adipose tissue is located mainly beneath the skin. The cells of this tissue are specialised to store fats, hence called fat cells.

They provide insulation and shock absorption to the body.

Tendons and ligaments are dense regular connective tissue.

162. Answer (3)

**Hint:** Single opening which helps in ingestion as well as egestion.

**Sol.:**

Bioluminescence	Ctenophora	<i>Pleurobrachia</i>
Radula	Mollusca	<i>Sepia</i>
Hypostome	Coelenterata	<i>Meandrina</i>
Spongocoel	Porifera	<i>Sycon</i>

163. Answer (1)

**Hint:** Conversion of glucose to glycogen is glycogenesis.

**Sol.:** The gland mentioned is pancreas.

Endocrine part of pancreas have two main types of cells called  $\alpha$ -cells and  $\beta$ -cells. The  $\alpha$ -cells secrete a hormone called glucagon, while the  $\beta$ -cells secrete insulin.

Glucagon is hyperglycemic hormone as it stimulates glycogenolysis.

Insulin is hypoglycemic hormone as it stimulates glycogenesis.

Such hormones which have opposite effects are said to be antagonistic.

164. Answer (2)

**Hint:** Also excreted by birds

**Sol.:** The primary nitrogenous waste of cockroach is uric acid.

Ammonia – Bony fishes

Urea – Mammals

165. Answer (4)

**Hint:** Caused due to decreased level of estrogen

**Sol.:** Gout is the inflammation of joints due to accumulation of uric acid crystals.

Rheumatoid arthritis is the inflammation of joints due to autoimmune response of the body.

Myasthenia gravis is an autoimmune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscles.

166. Answer (2)

**Hint:** Pia mater is in contact with the brain tissue.

**Sol.:** The brain is covered by cranial meninges. The outermost layer is the dura mater. The middle layer is the arachnoid which is very thin and the innermost layer is the pia mater which is in contact with brain tissue.

167. Answer (2)

**Hint:** Tight junctions stop substances from leaking across a tissue.

**Sol.:** Nearly all animal tissues have specialised junctions which provide both structural and functional links between its individual cells.

Three types of cell junctions are found in the epithelium and other tissues-

(i)	Tight junctions	–	Prevent substances from leaking across a tissue
(ii)	Adhering junctions	–	Cement neighbouring cells together
(iii)	Gap junctions	–	Facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells

168. Answer (1)

**Hint:** All are uricotelic.

**Sol.:** On the basis of the chief nitrogenous wastes excreted, there are three groups of animals-

(i)	Ammonotelic	–	Bony fishes, aquatic amphibians, aquatic insects
(ii)	Ureotelic	–	Mammals, terrestrial amphibians, marine fishes
(iii)	Uricotelic	–	Reptiles, birds, land snails, insects

169. Answer (2)

**Hint:** Grasshoppers shows same type of development

**Sol.:** Paurometabolous development is seen in cockroaches (*P. americana*). The nymph look very much like adults.

The nymph grows by moulting about 13 times to reach the adult form. The next to last nymphal stage has wing pads but only adult cockroaches have wings.

170. Answer (1)

**Hint:** Systolic pressure is 120 mm Hg.

**Sol.:** The instrument used to check the blood pressure is sphygmomanometer.

Normal systolic blood pressure = 120 mm Hg

Normal diastolic blood pressure = 80 mm Hg

$$\therefore \text{Normal blood pressure} = \frac{120}{80} \text{ mm Hg}$$

171. Answer (4)

**Hint:**  $pO_2$  in deoxygenated blood is 40 mm Hg.

**Sol.:**

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O <sub>2</sub>	159	104	40	95	40
CO <sub>2</sub>	0.3	40	45	40	45

172. Answer (4)

**Hint:** Enzyme present in saliva**Sol.:** Rennin is found in the gastric juice and is proteolytic.

Chymotrypsin is the activated form of chymotrypsinogen and is proteolytic.

Pepsin is found in gastric juice of infants and digests protein.

Amylase is found in saliva as well as pancreatic juice and digests starch (polysaccharide).

173. Answer (2)

**Hint:** Animals having circular mouth**Sol.:** All living members of class Cyclostomata are ectoparasites on fishes. Their body is devoid of scales and paired fins.

Cranium and vertebral column are cartilaginous.

174. Answer (1)

**Hint:** Select an amphibian**Sol.:**

Frogs	–	Lungs
Fishes	–	Gills
Flatworms	–	Entire body surface
Earthworms	–	Moist cuticle

175. Answer (1)

**Hint:** Iodinated amine**Sol.:**

Peptide, polypeptide, protein hormones – Insulin, glucagon, pituitary hormones, hypothalamic hormones, erythropoietin *etc.*

Steroids – Cortisol, testosterone, estradiol and progesterone

Iodothyronines – T<sub>3</sub>, T<sub>4</sub>

Amino acid derivative – Epinephrine

176. Answer (4)

**Hint:** It is cardiac muscle tissue.**Sol.:** Cardiac muscle tissue is unique to the heart.

It has communication junctions (intercalated discs) at some fusion points which allow the cells to contract as a unit.

They show striations like skeletal muscle tissue and are involuntary like smooth muscle tissue.

177. Answer (2)

**Hint:** A protein + an aldehyde of vitamin A**Sol.:** Opsin and retinal make up the photosensitive compound in human eyes called rhodopsin.

178. Answer (2)

**Hint:** Exclude cheek bones**Sol.:** Paired bones given above are zygomatic and ulna.

Unpaired bones given above are hyoid, sacrum, sternum, ethmoid and sphenoid.

179. Answer (2)

**Hint:** RuBisCO**Sol.:**

GLUT-4	–	Enables glucose transport into cells
Collagen	–	Most abundant protein in animal world
RuBisCO	–	Most abundant protein in whole of biosphere
Antibody	–	Fights infectious agents

180. Answer (1)

**Hint:** From PCT to the tip of loop of Henle osmolarity increases.**Sol.:** A special arrangement of Henle's loop and vasa recta is called counter current which helps to maintain a concentration gradient in the medullary interstitium.

The osmolarity increases from 300 mOsmol L<sup>-1</sup> in cortex to 1200 mOsmol L<sup>-1</sup> in the inner medulla.

181. Answer (1)

**Hint:** Platelets are produced from megakaryocytes.**Sol.:** Platelets, also known as thrombocytes are cell fragments produced from megakaryocytes.

Platelets release the substances which are involved in the coagulation or clotting of blood.

182. Answer (3)

**Hint:** Loading of O<sub>2</sub> with Hb**Sol.:** If the oxygen dissociation curve moves to the left then the conditions are conducive for the binding of oxygen and haemoglobin. When pO<sub>2</sub> is high, pCO<sub>2</sub> is low, H<sup>+</sup> concentration is lower and

the temperature is lower, then the conditions are favourable for the formation of oxyhaemoglobin.

183. Answer (3)

**Hint:** Collateral glands help in the formation of ootheca.

**Sol.:** Cockroaches are dioecious and show sexual dimorphism.

Only the male cockroaches bear a pair of short, thread-like anal styes which are absent in females.

Collateral glands and spermathecae are female reproductive structures.

184. Answer (2)

**Hint:** Platypus

**Sol.:** Members of class Aves and Mammalia are warm-blooded animals.

Mammary glands are a unique characteristic of mammals.

Platypus is an egg-laying (oviparous) mammal.

185. Answer (4)

**Hint:** Squamous epithelium

**Sol.:** Squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs.

Ciliated epithelium helps in moving particles or mucus in a specific direction over the epithelium.

### SECTION - B

186. Answer (2)

**Hint:** Malpighian tubules

**Sol.:** Malpighian tubules are excretory structures which are present at the junction of midgut and hindgut.

They are 100–150 yellow-coloured thin filamentous blind tubules.

187. Answer (4)

**Hint:** The enzyme runs through catalytic cycle again and again.

**Sol.:**  $E + S \rightleftharpoons ES \longrightarrow EP \longrightarrow E + P$

After the completion of the reaction, the enzyme releases the products of the reaction and the free enzyme is ready to bind to another molecule of the substrate and run through the catalytic cycle once again.

188. Answer (2)

**Hint:** Hepatic cells constitute functional unit of liver.

**Sol.:** Liver is the largest exocrine gland of the human body.

Hepatic lobules are its structural and functional units.

Each hepatic lobule is covered by Glisson's capsule.

189. Answer (1)

**Hint:** Secretes lysozyme

**Sol.:** Paneth cells secrete lysozymes.

Zymogen cells secrete inactive enzymes like pepsinogen.

Argentaffin cells have an endocrine function.

Kupffer cells are phagocytic.

190. Answer (1)

**Hint:** Carotid artery is a systemic artery.

**Sol.:** Pulmonary artery carries deoxygenated blood whereas carotid artery carries oxygenated blood.

The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves.

Electrocardiograph is machine used to obtain ECG.

191. Answer (1)

**Hint:** Functional kidney from donors is required.

**Sol.:** Kidney transplantation is the ultimate method in the correction of acute renal failure.

192. Answer (3)

**Hint:** Multiple of 7

**Sol.:**

Tarsals	–	7 in each hindlimb
Metatarsals	–	5 in each hindlimb
Carpals	–	8 in each forelimb
True ribs	–	14
Phalanges	–	14 in each hindlimb
Metacarpals	–	5 in each forelimb

193. Answer (2)

**Hint:** Present in the cyton only

**Sol.:** Axon is the long process of the neuron. It does not have Nissl's granules.

194. Answer (2)

**Hint:** Direct neural regulation

**Sol.:** Neurohypophysis (Pars nervosa) also known as posterior pituitary stores and releases oxytocin and vasopressin.

Hormones from hypothalamus reach anterior pituitary through portal circulation.

195. Answer (1)

**Hint:** Transmission of impulses to brain is the last step.

**Sol.:**

- Ear drum vibrates in response to sound waves.
- Ear ossicles (malleus, incus, stapes) transmit the vibrations to the oval window.
- The vibrations produce waves in the cochlear lymph which induce a ripple in the basilar membrane.
- Movement of the basilar membrane bend the hair cells, pressing them against the tectorial membrane.
- Impulses are generated in the associated afferent neurons which are finally transmitted to the auditory cortex of the brain.

196. Answer (2)

**Hint:** Carboxypeptidase also need the same co-factor.

**Sol.:** Non-protein constituents called co-factors are bound to the enzyme to make the enzyme catalytically active.

Peroxidase and catalase need the co-factor haem.

Carboxypeptidase and carbonic anhydrase show their effect in the presence of zinc ions.

197. Answer (1)

**Hint:** Urochordate

**Sol.:** *Ascidia* belongs to subphylum Urochordata.

In *Branchiostoma*, notochord is present in larval tail as well as in adults. *Dentalium* and *Aplysia* are molluscs, without notochord.

198. Answer (1)

**Hint:** The starch-I<sub>2</sub> is blue in colour.

**Sol.:** Presence of starch is confirmed by iodine test as starch can hold I<sub>2</sub> molecules in its helical portion.

199. Answer (4)

**Hint:** Loose motions

**Sol.:** The abnormal frequency of bowel movements and increased liquidity of the faecal discharge is known as diarrhoea. It reduces the absorption of food. In indigestion, food is not properly digested. Vomiting is ejection of stomach contents through the mouth.

200. Answer (4)

**Hint:** Floor of diencephalon

**Sol.:** Hypothalamus is the basal part of diencephalon.

□ □ □

## All India Aakash Test Series for NEET-2024

**TEST - 8 (Code-D)**

Test Date : 02/04/2023

**ANSWERS**

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

# HINTS & SOLUTIONS

## [PHYSICS]

### SECTION - A

1. Answer (1)

**Hint:** Question is asking about  $\frac{C_V}{C_P} = \frac{1}{\gamma}$

$$\text{Sol.: } C_V = \frac{fR}{2}, C_P = \frac{fR}{2} + R$$

$$\frac{C_V}{C_P} = \frac{\frac{fR}{2}}{\frac{fR}{2} + R} = \frac{f}{f+2}$$

2. Answer (2)

**Hint:** Use speed,  $v = \sqrt{\frac{T}{\mu}}$

$$\text{Sol.: } \text{We know, } v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{80}{0.05}} = \sqrt{1600}$$

$$v = 40 \text{ m s}^{-1}$$

3. Answer (2)

**Hint:** Comparing the given equation with standard equation of a progressive wave

**Sol.:** A progressive wave is given by

$$y = A \sin \left[ 2\pi \left( \frac{t}{T} - \frac{x}{\lambda} \right) \right]$$

On comparison with given wave equation

$$A = 4 \text{ cm}$$

$$T = 0.02 \text{ s} \therefore f = \frac{1}{T} = \frac{1}{0.02} = 50 \text{ Hz}$$

$$\lambda = 100 \text{ cm}$$

$$\therefore v = f\lambda = 50(100) = 5000 \text{ cm s}^{-1}$$

4. Answer (3)

**Hint and Sol.:** In isothermal process  $\Delta T = 0$

$$\therefore \Delta U = 0$$

5. Answer (1)

**Hint:** Work done in cyclic process = Area under  $PV$  diagram

[Interchange the axis of graph]

$$\text{Sol.: } W = \frac{-1}{2} (40 \times 10^3) (60 \times 10^{-6}) \text{ [(-)ve sign due}$$

to anti-clockwise]

$$W = -1200 \times 10^{-3} \text{ J}$$

$$W = -1.2 \text{ J}$$

6. Answer (1)

**Hint:** Heat lost by water = Heat gained by water at  $80^\circ\text{C}$  at  $20^\circ\text{C}$

**Sol.:** Let  $T$  be the equilibrium temperature

$$m_1 c \Delta T_1 = m_2 c \Delta T_2$$

$$4(80 - T) = 10(T - 20)$$

$$320 - 4T = 10T - 200$$

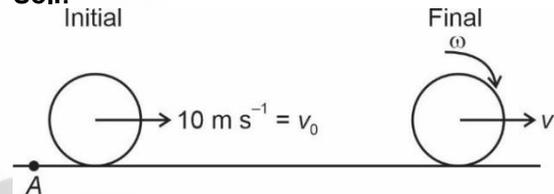
$$520 = 14T$$

$$T \approx 37^\circ\text{C}$$

7. Answer (2)

**Hint:** Angular momentum of sphere about a point on horizontal surface is conserved.

**Sol.:**



$$\therefore \sum \tau (\text{About } A) = 0$$

$$\therefore L_i = L_f (\text{About } A)$$

$$mv_0 R = mvR + I\omega$$

$$mv_0 R = mvR + \frac{2}{5} mR^2 \left( \frac{v}{R} \right)$$

$$v_0 R = \frac{7}{5} vR$$

$$\frac{5}{7} v_0 = v$$

$$\frac{50}{7} \text{ m s}^{-1} = v$$

$$\therefore \omega = \frac{v}{R} = \frac{50}{7 \times \frac{1}{2}} = \frac{100}{7} \text{ rad s}^{-1}$$

8. Answer (3)

**Hint:** Use,  $hR = \text{constant}$

**Sol.:** We know for a capillary tube

$$hR = \frac{2T}{\rho g} = \text{constant}$$

$$\therefore h \propto \frac{1}{R}$$

If  $h$  is halved then  $R$  gets doubled

9. Answer (4)

**Hint:** Use, Thrust force  $F_t = v_r \left( \frac{dm}{dt} \right)$

**Sol.:** We know,  $v = \sqrt{2g \frac{l}{2}}$

$$v = \sqrt{gl}$$

Now,  $\frac{dm}{dt} = \frac{m}{l} \left( \frac{dx}{dt} \right)$

$$\frac{dm}{dt} = \frac{mv}{l}$$

$$\therefore F_t = v \left( \frac{m}{l} \right) v = \frac{m}{l} v^2$$

$$F_t = \frac{m}{l} (\sqrt{gl})^2 = mg$$

Net force by chain on table  $F = \frac{mg}{2} + mg = \frac{3mg}{2}$

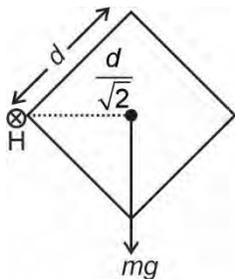
$$\frac{3(6 \times 10)}{2} = 90 \text{ N}$$

10. Answer (1)

**Hint:**  $\tau = l\alpha$  (About hinge)

**Sol.:**  $\frac{mgd}{\sqrt{2}} = \left( \frac{md^2}{6} + \frac{md^2}{2} \right) \alpha$

$$\frac{mgd}{\sqrt{2}} = \left( \frac{2md^2}{3} \right) \alpha$$

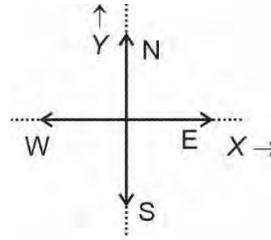


$$\frac{3g}{2\sqrt{2}d} = \alpha$$

11. Answer (4)

**Hint:** Use  $\langle \vec{a} \rangle = \frac{\vec{v}_f - \vec{v}_i}{t}$

**Sol.:**  $\langle \vec{a} \rangle = \frac{-40\vec{i} - 30\vec{j}}{2}$



$$|\langle \vec{a} \rangle| = \frac{1}{2} \sqrt{40^2 + 30^2}$$

$$|\langle \vec{a} \rangle| = \frac{50}{2} = 25 \text{ m s}^{-2}$$

12. Answer (4)

**Hint:** Use Stefan- Boltzmann law *i.e.*

Rate of radiation  $u = \sigma eA(T^4)$

$u \propto T^4$

**Sol.:**  $\frac{u_1}{u_2} = \left( \frac{T_1}{T_2} \right)^4$

$$\frac{\alpha}{u_2} = \left( \frac{300 \text{ K}}{900 \text{ K}} \right)^4 \Rightarrow u_2 = (3^4)\alpha$$

$$u_2 = 81\alpha$$

13. Answer (3)

**Hint and Sol.:** For the given aquarium the conditions are isothermal

$$\therefore P_i V_i = P_f V_f \Rightarrow P \propto \frac{1}{V}$$

Pressure on going upwards decreases and thus volume and radius of bubble increase.

But surface tension of liquid remains constant throughout.

14. Answer (4)

**Hint and Sol.:** Since the speed is constant, the given circular motion is uniform

$$\text{Hence } a_c = \frac{v^2}{R} \text{ but } a_t = 0$$

15. Answer (3)

**Hint:**  $v = \omega \sqrt{(A^2 - x^2)}$

**Sol.:** Given  $\frac{1}{2} Kx^2 = \frac{3}{4} \left( \frac{1}{2} mv^2 \right)$

$$\therefore \frac{1}{2} mv^2 = \frac{4}{3} \left( \frac{1}{2} Kx^2 \right)$$

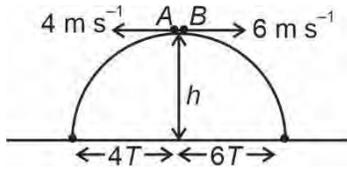
$$A^2 = \frac{7}{3} x^2$$

$$\therefore x = 10 \sqrt{\frac{3}{7}} \text{ cm}$$

16. Answer (1)

**Hint:** Time of flight is same for both bodies as their initial vertical velocities are zero.

**Sol.:** Let, time of flight be 'T'



Here  $10T = 20$

$\therefore T = 2$  seconds

Now,  $T = \sqrt{\frac{2h}{g}}$

$2 = \sqrt{\frac{2h}{10}}$

$\therefore h = 20$  m

17. Answer (1)

**Hint and Sol.:** Viscosity of a liquid is an inherent property which depends on nature of liquid and physical conditions like temperature and pressure but not on area of contact or velocity gradient.

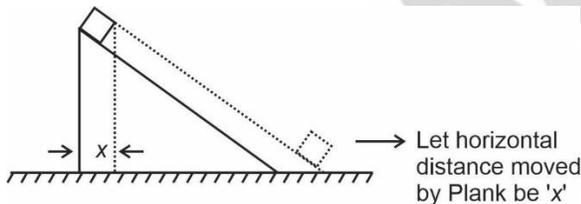
18. Answer (3)

**Hint:** When  $\vec{F}_{ext} = 0$  then  $\vec{a}_{COM} = 0$  and if also  $u = 0$  then  $\Delta x_{COM} = 0$

**Sol.:**  $\Delta x_{COM} = \frac{m_A(\Delta x_A) + m_B(\Delta x_B)}{m_A + m_B}$

$0 = 16(x) + 4(8 + x) \Rightarrow 32 = -20x$

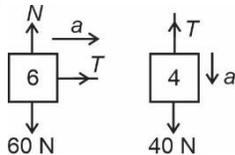
$x = -1.6$  m



19. Answer (2)

**Hint:**  $\sum \vec{F} = m\vec{a}$

**Sol.:**



From the above FBD:

$T = 6(a)$  and  $40 - T = 4(a)$

$\therefore 40 - 6a = 4a$

$\Rightarrow a = 4$  m s<sup>-2</sup>

20. Answer (1)

**Hint:** According to principle of homogeneity

Dimension of  $[F] = \left[ \frac{\alpha^2}{\beta} \right] = \left[ \frac{E}{\beta} \right]$

**Sol.:**  $\left[ \frac{\alpha^2}{\beta} \right] = [F] = [MLT^{-2}]$

21. Answer (4)

**Hint:** Reflectance (r) + Absorptance (a) + Transmittance (t) = 1

**Sol.:** Absorptance (a) = 1 - 2(0.4)

$a = 0.2$

$\Rightarrow$  We know,  $a = \frac{\text{Radiation absorbed}}{\text{Incident radiation}} = \frac{R}{Q}$

$0.2 = \frac{R}{100}$

$R = 20$  J

22. Answer (4)

**Hint and Sol.:** The observation which is having highest number of decimal places is considered as most precise.

23. Answer (4)

**Hint and Sol.:**  $P_i - P_0 = \frac{2T}{R}$

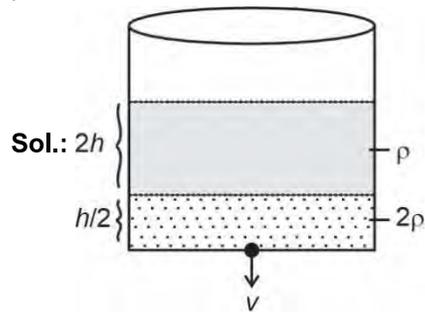
$\therefore P_i = P_0 + \frac{2T}{R}$

24. Answer (4)

**Hint and Sol.:** Gravitational and electrostatic forces are conservative in nature.

25. Answer (4)

**Hint:** Use Bernoulli's equation at top and bottom points



(Total energy)<sub>Top</sub> = (Total energy)<sub>Bottom</sub>

$P_0 + \frac{1}{2}\rho(0)^2 + 2\rho g\left(\frac{h}{2}\right) + \rho g(2h) = P_0 + \frac{1}{2}(2\rho)v^2 + 0$

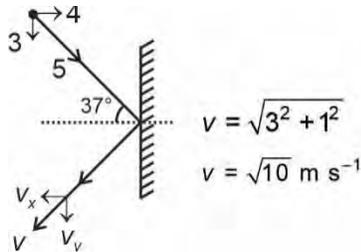
$\rho gh + 2\rho gh = \frac{1}{2}(2\rho)v^2$

$3gh = v^2 \Rightarrow v = \sqrt{3gh}$

26. Answer (1)

**Hint:** Only component of velocity perpendicular to wall changes while the component that is parallel to the wall remains same

**Sol.:**  $v_x = 0.25 \times 4 = 1 \text{ m s}^{-1}$



27. Answer (2)

**Hint & Sol.:**  $I = \frac{1}{2} \left( \frac{m}{6} \right) R^2$

$$I = \frac{mR^2}{12}$$

28. Answer (2)

**Hint and Sol.:** Water has maximum density at 4°C. Therefore the most dense water will lie deepest.

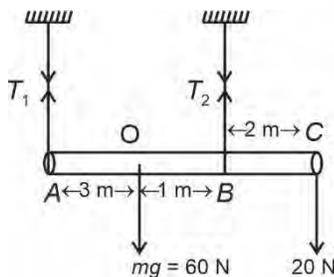
29. Answer (4)

**Hint and Sol.:** The mean distance from Earth to Sun is known as 'Astronomical unit'.

30. Answer (1)

**Hint:** In equilibrium, net torque about A or B is zero

**Sol.:** We know,  $\sum \tau$  (About A) = 0



$$T_1(0) - 60(3) + T_2(4) - 20(6) = 0$$

$$T_2(4) = 300$$

$$T_2 = 75 \text{ N}$$

Similarly  $\sum \tau$  (About B) = 0

$$-T_1(4) + 1(60) - 2(20) + T_2(0) = 0$$

$$T_1(4) = 20$$

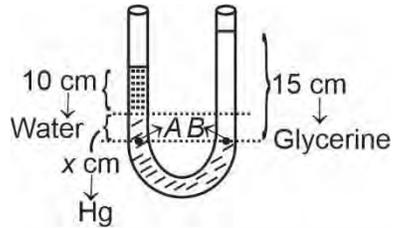
$$T_1 = 5 \text{ N}$$

$$\therefore \frac{T_1}{T_2} = \frac{5 \text{ N}}{75 \text{ N}} = \frac{1}{15}$$

31. Answer (2)

**Hint:** Use the expression of pressure due to liquid column

**Sol.:**



In equilibrium,  $P_A = P_B$

$$P_0 + \frac{(10)}{100}(1000)g + \frac{x}{100}(13600)g = P_0 + \left( \frac{15}{100} \right)(1200)g$$

$$100 + 136x = 180$$

$$x = \frac{80}{136} \text{ cm} \approx 0.6 \text{ cm}$$

32. Answer (3)

**Hint:** Plastic region of 'A' is larger than that of 'B'

**Sol.:** Higher the plastic region more ductile is the material.

Slope of stress-strain curve gives Young's modulus

33. Answer (1)

**Hint:** From the graph  $A = 2 \text{ m}$

$$v_{\max} = 6 \text{ m s}^{-1}$$

$$\text{Sol.} \text{ We know } \frac{v_{\max}}{x_{\max}} = \frac{A\omega}{A} \Rightarrow \omega = \frac{6}{2}$$

$$\therefore \omega = 3 \text{ rad s}^{-1}$$

$$\text{Thus } T = \frac{2\pi}{\omega} \Rightarrow T = \frac{2\pi}{3} = \frac{2}{3} \left( \frac{22}{7} \right) = \frac{44}{21} \approx 2.1 \text{ s}$$

34. Answer (2)

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

$$\text{Sol.} \text{ } a = 3x^2$$

$$\frac{v dv}{dx} = 3x^2$$

$$\int_0^v v dv = \int_0^x (3x^2) dx \Rightarrow \frac{v^2}{2} = x^3$$

At  $v = 4$

$$\frac{4^2}{2} = x^3 \Rightarrow x = 2 \text{ m}$$

35. Answer (2)

**Hint:** Using position vectors of individual masses

$$\text{Sol.: } \vec{r}_{\text{com}} = \frac{m_1\vec{r}_1 + m_2\vec{r}_2 + m_3\vec{r}_3}{m_1 + m_2 + m_3}$$

$$= \frac{m(0\hat{i} + 0\hat{j}) + m(a\hat{i} + 0\hat{j}) + 2m\left(\frac{a}{2}\hat{i} + \frac{\sqrt{3}}{2}a\hat{j}\right)}{4m}$$

$$= \frac{ma\hat{i} + ma\hat{i} + \sqrt{3}ma\hat{j}}{4m}$$

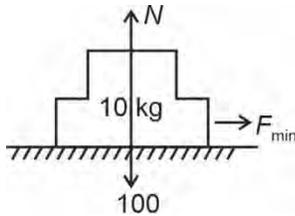
$$\vec{r}_{\text{COM}} = \frac{a}{2}\hat{i} + \frac{\sqrt{3}}{4}a\hat{j}$$

**SECTION - B**

36. Answer (2)

**Hint:** The maximum acceleration of upper block is ' $\mu g$ '

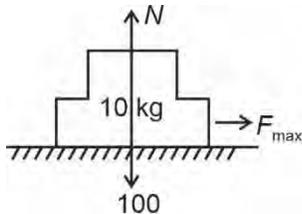
**Sol.:** For starting the motion



$F_{\text{min}} = \text{zero}$

For blocks to move together  $a_{\text{max}} = \mu g$   
 $= 0.4(10) = 4 \text{ m s}^{-2}$

$\therefore F_{\text{max}} = ma_{\text{max}}$



$F_{\text{max}} = 10(4)$

$F_{\text{max}} = 40 \text{ N}$

37. Answer (1)

**Hint:** For first harmonic  $v = f\lambda$  and  $\frac{\lambda}{2} = L$

**Sol.:**  $\therefore v = f(2L) = 294 (2) (0.7)$

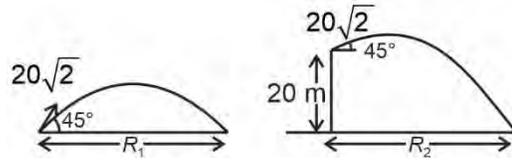
$v = 411.6 \approx 412 \text{ Hz}$

38. Answer (3)

**Hint and Sol.:** Assumptions of kinetic theory of gases mention that all collisions even collision of molecules with walls of containers are elastic in nature.

39. Answer (2)

**Hint:**



Range for ground to ground projectile is maximum at  $45^\circ$

**Sol.:**  $R_1 = \frac{u^2}{g} = \frac{(20\sqrt{2})^2}{10} = 80 \text{ m}$

For Time of flight ( $T$ ) in second case:

$-20 = 20T - \frac{1}{2}(10 T^2)$

$-20 = 20T - 5T^2$

$T^2 - 4T - 4 = 0$

solving it we get

$T = 2\sqrt{2} + 2 = 4.8 \text{ s}$

$R_2 = u_x T = 20(4.8) = 96 \text{ m}$

$\therefore R_2 - R_1 = 96 - 80 = 16 \text{ m}$

40. Answer (1)

**Hint:** Minimum speed at bottommost point should be  $\sqrt{5gl}$  to loop the path completely.

**Sol.:** According to Work - Energy theorem

$\left(\frac{1}{2}mv^2\right)_{\text{Bottom}} = \frac{1}{2}kx^2$

$\Rightarrow x = \sqrt{5gl\left(\frac{m}{k}\right)}$

$\sqrt{\frac{4}{1000}} \times 5 \times 10 \times 5 = x$

$x = \frac{2 \times 5}{10} = 1 \text{ m}$

41. Answer (1)

**Hint & Sol.:** SI unit of viscosity is Pa s

42. Answer (4)

**Hint and Sol.:** Beat time period = 2 (time between consecutive maximum and minimum amplitude)

$T = 2\left(\frac{1}{12}\right) = \frac{1}{6} \text{ s}$

$\therefore$  Beat frequency  $v = \frac{1}{T} = 6 \text{ Hz}$

Thus  $f$  can be either  $(250 - 6) \text{ Hz}$  or  $(250 + 6) \text{ Hz}$

$\therefore 256 \text{ Hz}$  is correct answer

43. Answer (2)

**Hint and Sol.:**  $\frac{5}{3} = \frac{m(g+a)}{m(g-a)}$

$a = g/4$

44. Answer (2)

**Hint and Sol.:** Potential energy is defined only for conservative forces

45. Answer (4)

**Hint:** Maximum efficiency  $\eta = 1 - \frac{T_L}{T_H}$

**Sol.:**  $\therefore \eta = 1 - \frac{400 \text{ K}}{600 \text{ K}}$

$= 1 - \frac{2}{3} = \frac{1}{3} \Rightarrow 33\%$

Thus, for given heat engine  $\eta \leq 33\%$  i.e. 20%

46. Answer (1)

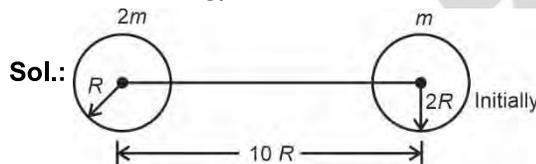
**Hint:** Use  $T = 2\pi\sqrt{\frac{l}{mg}}$

**Sol.:**  $T = 2\pi\sqrt{\frac{\frac{mR^2}{3}}{\frac{mgR}{2}}}$

$T = 2\pi\sqrt{\frac{2R}{3g}}$

47. Answer (3)

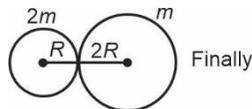
**Hint:** Use the concept of law of conservation of mechanical energy.



According to conservation of momentum

$2mv_1 + mv_2 = 0$

$2v_1 = -v_2$



According to conservation of energy :

$\frac{-G(m)(2m)}{10R} + 0 = \frac{-Gm(2m)}{3R} + \frac{1}{2}(2m)v_1^2 + \frac{1}{2}mv_2^2$

$\Rightarrow \frac{2Gm^2}{3R} - \frac{2Gm^2}{10R} = \frac{1}{2}m(2v_1^2 + v_2^2)$

$= \frac{1}{2}m(2v_1^2 + 4v_1^2)$

$\Rightarrow \frac{20Gm^2 - 6Gm^2}{30R} = \frac{1}{2}m(6v_1^2)$

$\Rightarrow \frac{14Gm^2}{30R} = 3mv_1^2$

$\Rightarrow \sqrt{\frac{14Gm}{90R}} = v_1$

$\Rightarrow v_1 = \frac{1}{3}\sqrt{\frac{7Gm}{5R}}$

48. Answer (2)

**Hint:**  $f' = \left(\frac{v}{v \pm v_s}\right) f$

**Sol.:**  $f_{\text{approach}} = 1000$

$= \left(\frac{v-0}{v-v_s}\right) f$

$= \left(\frac{350}{350-50}\right) f = \frac{350}{300} f = 1000$

$\therefore f = \frac{1000 \times 300}{350}$

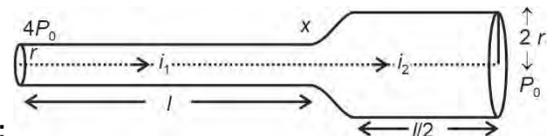
Now  $f_{\text{receding}} = \left(\frac{v-0}{v+v_s}\right) f$

$= \left(\frac{350}{350+50}\right) \left(\frac{1000 \times 300}{350}\right)$

$= \frac{350 \times 1000 \times 300}{400 \times 350}$

$= 750 \text{ Hz}$

49. Answer (2)



**Hint:**

Fluid current in both pipes is same

**Sol.:** According to Poiseuille's equation

$i_1 = i_2$

$\left(\frac{\Delta P}{R_F}\right)_1 = \left(\frac{\Delta P}{R_F}\right)_2$

$$\frac{4P_0 - x}{8\eta l} = \frac{x - P_0}{8\eta \frac{l}{2}}$$

$$\frac{(4P_0 - x)\pi r^4}{8\eta l} = \frac{32(x - P_0)\pi r^4}{8\eta l}$$

$$4P_0 - x = 32x - 32P_0$$

$$36P_0 = 33x$$

$$x = \frac{12}{11}P_0$$

50. Answer (3)

**Hint:** Below Earth's surface  $g' = g\left(1 - \frac{d}{R}\right)$

**Sol.:** For weight to reduce to 10%  $g'$  should be reduced to 10%

$$i.e. \frac{10}{100}g = g\left(1 - \frac{d}{R}\right)$$

$$\frac{1}{10} = 1 - \frac{d}{R}$$

$$\frac{d}{R} = 1 - \frac{1}{10} = \frac{9}{10} \Rightarrow d = 0.9R$$

## [CHEMISTRY]

### SECTION - A

51. Answer (4)

**Hint:** Stability of group 14 dihalides increases down the group.

**Sol.:**  $PbCl_2$  is thermally and chemically more stable than  $PbCl_4$

52. Answer (4)

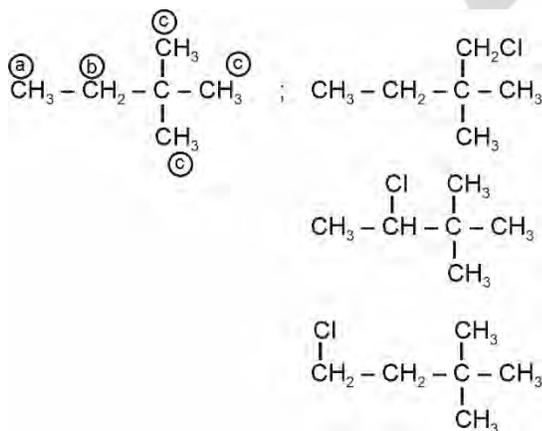
**Hint:** The main components of photochemical smog are formed by the action of sunlight on unsaturated hydrocarbons and nitrogen oxides.

**Sol.:** Aldrin is a pesticide.

53. Answer (3)

**Hint:** More the number of distinct hydrogen atoms, more the number of monochloro derivatives.

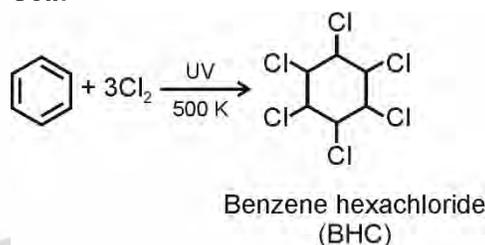
**Sol.:**



54. Answer (2)

**Hint:** Under UV light,  $Cl_2$  undergoes free radical addition reaction with benzene.

**Sol.:**



55. Answer (1)

**Hint:**  $\Delta S = 2.303 nR \log \frac{V_f}{V_i}$  (at constant temperature)

$$\begin{aligned} \text{Sol.} \quad \Delta S &= 2.303 \times 2 \times R \times \log \frac{100}{1} \\ &= 2.303 \times 2 \times R \times \log 10^2 \\ &= 2.303 \times 2 \times R \times 2 \\ &= 9.202 R \end{aligned}$$

56. Answer (4)

**Hint:** Standard enthalpy of formation is zero for elements which are present in their standard or reference state.

**Sol.:** Standard state of carbon is graphite therefore  $\Delta_f H$  of diamond is non-zero.

57. Answer (3)

**Hint:** The value of extensive property depends upon quantity or size of matter present in system.

**Sol.:**

- Density, pressure and molar heat capacity are intensive properties as these don't depend on the quantity or size of matter present.

Internal energy depends on amount of substance therefore is an extensive property

58. Answer (4)

**Hint:** Metallic hydrides are non-stoichiometric hydrides**Sol.:** NaH : Ionic hydride

HF : Covalent hydride

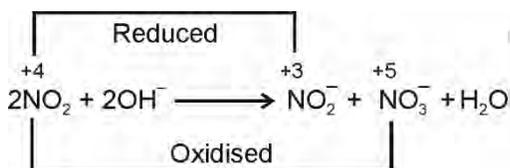
CH<sub>4</sub> : Covalent hydrideVH<sub>0.56</sub> : Metallic hydride

59. Answer (1)

**Hint:** H<sub>2</sub>O<sub>2</sub> is non-planar molecule and auto oxidation of 2-alkylantraquinols forms H<sub>2</sub>O<sub>2</sub>.**Sol.:** Strength of H<sub>2</sub>O<sub>2</sub> = M × 11.2

$$= \frac{30}{34} \times 11.2 \approx 10 \text{ V}$$

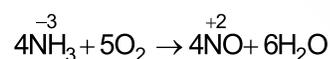
60. Answer (2)

**Hint:** In disproportionation reaction, an element is simultaneously oxidised and reduced**Sol.:**

61. Answer (2)

**Hint:** The oxidation number of N in NH<sub>3</sub> = -3**Sol.:** Oxidation number of N in NO = x + (-2) = 0

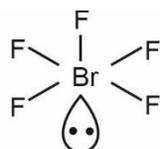
$$\Rightarrow x = +2$$



62. Answer (2)

**Hint:** The number of ejected electrons depends upon intensity of light whereas their kinetic energy depends upon frequency of light used.**Sol.:** Photoelectric effect is explained on the basis of particle nature of light.

63. Answer (2)

**Hint:** Hybridisation can be predicted by the sum of total number of  $\sigma$  bonds and number of lone pair of electrons on central atom.**Sol.:** $sp^3d^2$  hybridised

(Square pyramidal)

64. Answer (4)

$$\text{Hint: Bond order} = \frac{N_b - N_a}{2}$$

where  $N_b$  is number of electrons in BMO and  $N_a$  is number of electrons in ABMO**Sol.:**

Species	Bond order
N <sub>2</sub>	3
N <sub>2</sub> <sup>-</sup>	2.5
O <sub>2</sub>	2
O <sub>2</sub> <sup>2-</sup>	1

65. Answer (1)

**Hint:** Atomic number of Unnilbium is 102**Sol.:**

Nobelium : Unnilbium

Mendelevium : Unnilunium

Lawrencium : Unniltrium

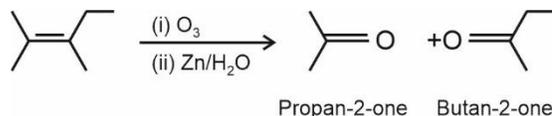
Rutherfordium : Unnilquadium

66. Answer (3)

**Hint:** F has lesser negative electron gain enthalpy than Cl. Because adding an electron to 2p orbital leads to greater repulsion than adding an electron to larger 3p orbital.**Sol.:**

Element	O	F	Cl	S
$\Delta_{\text{eg}}H$ (kJ mol <sup>-1</sup> )	-141	-328	-349	-200

67. Answer (1)

**Hint:** Ozonolysis involves cleavage of carbon-carbon double bonds and get converted to the respective carbonyl compounds.**Sol.:**

68. Answer (2)

**Hint:** Addition reaction occurs in unsaturated hydrocarbons.**Sol.:**

(I)	Addition reaction	1 Br <sub>2</sub> molecule is added
(II)	Substitution reaction	Cl replaces H in benzene
(III)	Elimination reaction	1 HBr molecule is eliminated

69. Answer (2)

**Hint:** Fractional distillation is used to separate different fractions of crude oil in petroleum industry

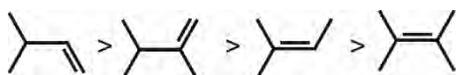
**Sol.:** Distillation under reduced pressure is used to purify liquids having high boiling points and those, which decompose at or below their boiling points.

70. Answer (4)

**Hint:** Heat of hydrogenation increases with decrease in stability of alkene.

**Sol.:** Lesser the number of hyperconjugative structures, lesser will be the stability of alkene and higher will be its heat of hydrogenation.

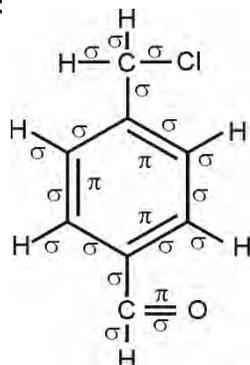
Heat of hydrogenation:



71. Answer (1)

**Hint:** In multiple bonded carbon atoms, one bond is always  $\sigma$  bond.

**Sol.:**



72. Answer (4)

**Hint:** Alkali metals and their salts imparts characteristic colours to an oxidizing flame.

**Sol.:**

Metal	Colour
Li	Crimson red
Na	Yellow
Rb	Red violet
Cs	Blue

73. Answer (1)

**Hint:** Calcium sulphate dihydrate is called gypsum, while calcium sulphate hemihydrate is plaster of Paris.

**Sol.:**

Chemical formula	Names
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	Gypsum
$\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$	Plaster of Paris
$\text{Ca}(\text{OH})_2$	Slaked lime
$\text{CaO}$	Quick lime

74. Answer (3)

**Hint:** Solubility decreases with decrease in hydration enthalpy.

**Sol.:** On going down the group in group 2 elements, as the size of cation increases, the hydration enthalpy decreases and resultantly their solubility in water decreases.

75. Answer (3)

**Hint:**  $PV = nRT$

$$\text{Sol. } n_{\text{CH}_4} = \frac{48}{16} = 3 \text{ mol} \quad [82.1 \text{ dm}^3 = 82.1 \text{ L}]$$

$$P = \frac{nRT}{V} = \frac{3 \times 0.0821 \times 300}{82.1}$$

$$= 0.9 \text{ atm}$$

76. Answer (2)

**Hint:** According to kinetic theory of gases, the total energy of gas molecules before and after collision remains same.

**Sol.:** Collision of gas molecules are perfectly elastic. There may be exchange of energy between colliding molecules, their individual energies may change but sum of their energies remain constant.

77. Answer (4)

$$\text{Hint: } \Delta x \cdot m \Delta v_x \geq \frac{h}{4\pi}$$

**Sol.:** Since,  $\Delta v_x = 2\Delta x$

$$\Rightarrow \Delta x \cdot m(2\Delta x) = \frac{h}{4\pi}$$

$$\Delta x^2 = \frac{h}{8\pi m}$$

$$\Delta x = \sqrt{\frac{h}{8\pi m}}$$

78. Answer (1)

**Hint:** Bohr's model is applicable for single electron species.

**Sol.:** Bohr's model could not explain the splitting of spectral line in magnetic field (Zeeman effect) as well as in electric field (Stark effect).

79. Answer (3)

**Hint:** Maximum number of orbitals in any shell =  $n^2$

**Sol.:** For N shell,  $n = 4$

Number of orbitals in N shell =  $(4)^2 = 16$

80. Answer (1)

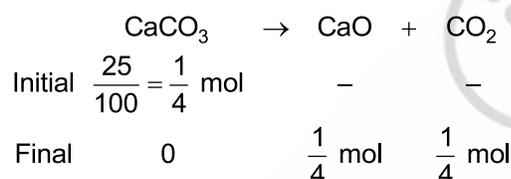
**Hint:** Number of moles =  $\frac{\text{Given mass}}{\text{Molar mass}}$

$$\text{Sol.: } \frac{n_{\text{SO}_2}}{n_{\text{O}_2}} = \frac{\frac{3x}{64}}{\frac{2x}{32}} = \frac{3}{4}$$

81. Answer (2)

**Hint:**  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

**Sol.:** Molar mass of  $\text{CaCO}_3 = 100 \text{ g}$



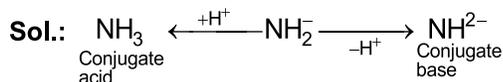
1 mol  $\text{CaCO}_3$  will produce 22.4 L  $\text{CO}_2$  at STP

$\frac{1}{4}$  mol  $\text{CaCO}_3$  will produce  $22.4 \times \frac{1}{4}$  L  $\text{CO}_2$  at STP

$\Rightarrow 5.6 \text{ L CO}_2$

82. Answer (3)

**Hint:** Conjugate base should have one proton less than respective species.



83. Answer (2)

**Hint:**  $K_p = K_c (\text{RT})^{\Delta n_g}$

**Sol.:** For,  $\text{Ni(s)} + 4\text{CO(g)} \rightleftharpoons \text{Ni(CO)}_4(\text{g})$

$$\Delta n_g = 1 - 4 = -3$$

$$K_p = K_c (\text{RT})^{-3} = K_c \frac{1}{(\text{RT})^3}$$

$$\frac{K_c}{K_p} = (\text{RT})^3$$

84. Answer (4)

**Hint:** Aqueous solution of salt of strong base and weak acid will have highest pH.

**Sol.:**  $\text{K}_2\text{CO}_3$  is a salt of strong base, KOH and weak acid,  $\text{H}_2\text{CO}_3$ , therefore its aqueous solution will be basic in nature and have pH greater than 7.

85. Answer (4)

**Hint:** Number of atoms = Number of moles  $\times$  atomicity  $\times N_A$ .

$$\text{Sol.: } 12 \text{ g O}_3 = \frac{12}{48} \times 3 \times N_A = 0.75 N_A$$

$$6 \text{ g H}_2\text{O} = \frac{6}{18} \times 3 \times N_A = N_A$$

$$14 \text{ g CO} = \frac{14}{28} \times 2 \times N_A = N_A$$

$$22 \text{ g CO}_2 = \frac{22}{44} \times 3 \times N_A = 1.5 N_A$$

## SECTION - B

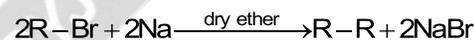
86. Answer (3)

**Hint & Sol.:** Maximum prescribed concentration of Cd in drinking water is 0.005 ppm.

87. Answer (4)

**Hint:** Wurtz reaction is useful for preparation of higher alkanes with even number of carbon atoms.

**Sol.:** Wurtz Reaction:

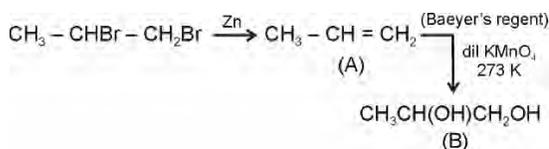


$\text{CH}_4$  cannot be prepared through Wurtz reaction.

88. Answer (1)

**Hint:** Aqueous solution of  $\text{KMnO}_4$  is Baeyer's reagent.

**Sol.:**



89. Answer (4)

**Hint:**  $C_p - C_v = R$

**Sol.:** As per first law of thermodynamics

$$\Delta U = w + q$$

$$\Rightarrow C_p = R + C_v$$

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

$$\Rightarrow \Delta U = nC_v \Delta T$$

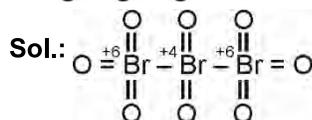
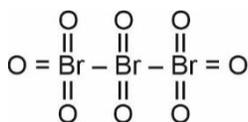
90. Answer (1)

**Hint:**  $\Delta G = \Delta H - T\Delta S$ **Sol.:**  $\Delta G = 2500 - 300 \times 15$   
 $= -2000 \text{ cal}$  $\Delta G = -2 \text{ kcal}$ 

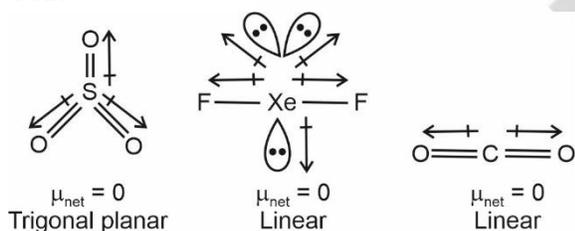
91. Answer (2)

**Hint:** Permanent hardness is caused due to soluble salts of Mg and Ca in form of chlorides and sulphates in water.**Sol.:** Ion Exchange method is called permutit process. Hydrated sodium aluminium silicate is permutit and can remove temporary as well as permanent hardness of water.

92. Answer (4)

**Hint:**  $\text{Br}_3\text{O}_8$ :

93. Answer (3)

**Hint:** Molecule with net zero dipole moment is non-polar.**Sol.:**

94. Answer (1)

**Hint:** The s and p block elements together are called representative elements.**Sol.:** K and Sr are s-block elements, In, Sn, and Pb are p-block elements and V, Ti and Fe are d-block elements.

95. Answer (4)

**Hint & Sol.:**  $-\text{COOH}$  group shows  $-\text{R}$  effect.

96. Answer (2)

**Hint:**  $\text{Be}(\text{OH})_2 + 2\text{HCl} + 2\text{H}_2\text{O} \rightarrow [\text{Be}(\text{OH})_4]\text{Cl}_2$ **Sol.:** Hybridisation of Be in  $[\text{Be}(\text{OH})_4]^{2-}$  is  $sp^3$ 

97. Answer (2)

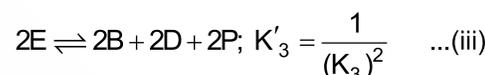
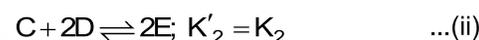
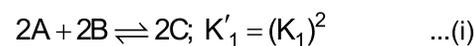
**Hint:** Boyle's law [P and V relationship] at constant T,  $PV = \text{constant}$ .

**Sol.:**  $P \propto \frac{1}{V}$

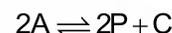
$P = K \frac{1}{V}$

As temperature increases the slope of P vs  $\frac{1}{V}$  graph increases too.

98. Answer (2)

**Hint:** On adding two equilibria, their equilibrium constants get multiplied.**Sol.:**

Adding (i), (ii) and (iii)



$K = \frac{K_1^2 K_2}{K_3^2}$

99. Answer (2)

**Hint:** Electronic configuration of Be [ $Z = 4$ ] =  $1s^2 2s^2$ .**Sol.:**

Element	Electronic conf.	Set of Quantum Number for last electron
Na [ $Z = 11$ ]	$[\text{Ne}]3s^1$	$n = 3, l = 0, m_l = 0, m_s = \frac{1}{2}$
Be [ $Z = 4$ ]	$1s^2 2s^2$	$n = 2, l = 0, m_l = 0, m_s = -\frac{1}{2}$
N [ $Z = 7$ ]	$1s^2 2s^2 2p^3$	$n = 2, l = 1, m_l = -1, m_s = \frac{1}{2}$
Cl [ $Z = 17$ ]	$[\text{Ne}]3s^2 3p^5$	$n = 3, l = 1, m_l = 0, m_s = -\frac{1}{2}$

100. Answer (4)

**Hint:**  $M = \frac{M_1 V_1 + M_2 V_2}{V_1 + V_2}$

**Sol.:**  $M_1 = 0.5 \text{ M}$        $M_2 = 1.5$

$V_1 = 100 \text{ mL}$        $V_2 = 200 \text{ mL}$

$0.5 \times 100 + 1.5 \times 200 = M(100 + 200)$

$50 + 300 = M(300)$

$\frac{350}{300} = M$

$M \approx 1.17 \text{ M}$

**[BOTANY]****SECTION - A**

101. Answer (1)

**Hint:** Auxins are indole compounds like

IAA → Indole-3-acetic acid

IBA → Indole-3-butyric acid.

**Sol.:** Cytokinins are purine derivatives, gibberellins are terpene derivatives and ABA is carotenoid derivative.

102. Answer (1)

**Hint:** ABA induces stomatal closure thus, minimises transpirational loss of water and is used as antitranspirant.**Sol.:** Ethylene is one of the most widely used PGR in agriculture. Ethylene is used as ripening hormone.

103. Answer (4)

**Hint:** Auxin is commonly termed as growth hormone.**Sol.:** ABA is commonly known as stress hormone as it helps plants in overcoming environmental stresses.

104. Answer (2)

**Hint:** C<sub>4</sub> plants follow Hatch and Slack pathway to avoid photorespiratory losses.**Sol.:** C<sub>4</sub> plants lack RuBisCO enzyme in mesophyll cells. Primary CO<sub>2</sub> fixation in mesophyll cells takes place with the help of PEPcase and Calvin cycle occurs in bundle sheath cells.

105. Answer (2)

**Hint:** RuBisCO is the most abundant protein (enzyme) of the living world.**Sol.:** PEPcase or phosphoenol pyruvate carboxylase is carbon fixation enzyme in C<sub>4</sub> pathway.

106. Answer (3)

**Hint:** Tomato is a C<sub>3</sub> plant and maize is a C<sub>4</sub> plant.**Sol.:** Calvin cycle requires 3 ATP and 2 NADPH<sub>2</sub> per CO<sub>2</sub> fixation.C<sub>4</sub> pathway requires 5 ATP and 2 NADPH<sub>2</sub> per CO<sub>2</sub> fixation.Thus, there is a difference of 2 ATP per CO<sub>2</sub> fixed.

Since, a sucrose molecule has 12 C

∴ 12 × 2 = 24 ATP are additionally required in C<sub>4</sub> plants.

107. Answer (3)

**Hint:** Fats and proteins having respiratory quotient less than 1, for fats it is 0.7 and for proteins it is 0.9.**Sol.:** For carbohydrates RQ = 1

For organic acids RQ &gt; 1

108. Answer (1)

**Hint:** Acetyl CoA will directly enter Krebs cycle.**Sol.:** 1 Acetyl CoA will undergo 1 Krebs cycle and yield 3 NADH<sub>2</sub>, 1 FADH<sub>2</sub> and 1 GTP.Each NADH<sub>2</sub> yields 3 ATP through ETS∴ 3 NADH<sub>2</sub> → 3 × 3 = 9 ATPEach FADH<sub>2</sub> yields 2 ATP by ETS∴ 1 FADH<sub>2</sub> → 1 × 2 = 2 ATP

GTP is equivalent to ATP

Total = 9 + 2 + 1 = 12 ATP

109. Answer (1)

**Hint:** α-ketoglutaric acid acts as raw material for synthesis of amino acids.**Sol.:** Succinyl CoA acts as raw material for synthesis of chlorophyll. Acetyl CoA acts as raw material for synthesis of carotenoids. Oxaloacetic acid acts as raw material for synthesis of pyrimidines.

110. Answer (3)

**Hint:** N<sub>2</sub> fixation is conversion of atmospheric N<sub>2</sub> into NH<sub>3</sub>.**Sol.:** Ammonification is decomposition of dead organic matter into ammonia.Nitrification is conversion of NH<sub>3</sub> to NO<sub>2</sub><sup>-</sup> then to NO<sub>3</sub><sup>-</sup>

Denitrification is reduction of nitrate present in soil into nitrogen.

111. Answer (4)

**Hint:** Mg is constituent of the ring structure of chlorophyll.**Sol.:** Mg activates enzymes of photosynthesis like RuBisCO and respiration like pyruvate dehydrogenase.

112. Answer (1)

**Hint:** Downhill movement of molecules *i.e.* from their high concentration to low concentration does not require energy.**Sol.:** Active transport is uphill movement of molecules *i.e.* against concentration gradient thus it requires energy (ATP), special proteins and is highly selective.

113. Answer (3)

**Hint:** Movement of molecules against concentration gradient with the help of energy is active transport.

**Sol.:** Movement of single type of molecules across transport proteins during diffusion is uniport.

Movement of two different types of molecules simultaneously across the transport proteins during diffusion is co-transport. If they move in same direction it is symport, and if they move in opposite direction, it is antiport.

114. Answer (2)

**Hint:** Phloem fibres or bast fibres are elongated, unbranched, pointed, dead sclerenchymatous cells which help in mechanical support and strength.

**Sol.:** Companion cells maintain the pressure gradient in sieve tubes.

115. Answer (2)

**Hint:** Periderm is a collective term used for all three layers *i.e.* phellem, phellogen and phelloderm.

**Sol.:** Phellogen is cork cambium which is a de-differentiated tissue or secondary meristem. Phellem is cork and phelloderm is secondary cortex. They both are re-differentiated tissues or secondary permanent tissues.

116. Answer (3)

**Hint:** In cymose inflorescence, the main axis terminates in a flower, thus, growth is limited and youngest flower is at the base and oldest at the top *i.e.* basipetal order.

**Sol.:** In racemose inflorescence, the main axis continues to grow, *i.e.* unlimited growth and the flowers are borne laterally in acropetal order *i.e.* youngest at the top and oldest at the base.

117. Answer (3)

**Hint:** A single leaf arising at each node in alternate manner is alternate phyllotaxy, as in China rose, mustard and sunflower plants.

**Sol.:** In opposite phyllotaxy, a pair of leaves arise at each node, and lie opposite to each other as in *Calotropis* and guava plants.

118. Answer (1)

**Hint:** Phaeophyceae (brown algae) have 2 unequal lateral flagella and reserve material as mannitol and laminarin.

**Sol.:** Chlorophyceae (green algae) have 2-8, equal, apical flagella and reserve material as starch.

Rhodophyceae (red algae) lack flagella and reserve material is floridean starch which is very similar to amylopectin and glycogen in structure.

119. Answer (3)

**Hint:** *Ulothrix* is a green freshwater algae.

**Sol.:** Many species of *Porphyra*, *Laminaria* and *Sargassum* are among the 70 species of marine algae used as food.

120. Answer (2)

**Hint:** Isogamous reproduction involves fusion of two gametes which are similar in size.

**Sol.:** *Spirogyra* produces non motile, non flagellated isogametes.

*Ulothrix* produces motile, flagellated isogametes.

*Volvox* and *Fucus* show oogamous reproduction *i.e.* fusion of two dissimilar gametes-one large, non motile (static) female gamete and a small, motile male gamete.

121. Answer (2)

**Hint:** In numerical taxonomy hundreds of characters can be considered at the same time and each character is given equal weightage.

**Sol.:** Numerical taxonomy uses computers based on all observable characters. Numbers and codes are assigned to all the characters and each character is given equal importance.

122. Answer (2)

**Hint:** Chief producers in oceans, *i.e.*, the diatoms are photosynthetic protists.

**Sol.:** Diatoms are unicellular, eukaryotic, photoautotrophic, lack flagella except during reproductive stage.

123. Answer (3)

**Hint:** Methanogens are found in marshy areas.

**Sol.:** Methanogens are obligate anaerobes thus found in anaerobic environment.

124. Answer (2)

**Hint:** Chemoautotrophic bacteria do not use light as a source of energy.

**Sol.:** Chemoautotrophic bacteria oxidise certain inorganic substances and use this released chemical energy for further process. They also help in recycling of inorganic substances.

125. Answer (4)

**Hint:** Cell wall was one of the most important criteria used by Linnaeus in two kingdom classification.

**Sol.:** Fungi are multicellular, eukaryotic, heterotrophic, cell wall containing organisms placed under Plantae according to two kingdom classification system.

126. Answer (2)

**Hint:** Mango belongs to family Anacardiaceae and order Sapindales while brinjal belongs to family Solanaceae and order Polymoniales.

**Sol.:** Mango and brinjal belong to same class Dicotyledonae.

127. Answer (3)

**Hint:** *In-situ* conservation strategy involves conservation of living organisms at their natural places *i.e.* on site conservation.

**Sol.:** Botanical gardens are *ex-situ* conservation strategy of plants.

128. Answer (1)

**Hint:** Zygotene involves pairing of homologous chromosomes, *i.e.* synapsis with the help of proteinaceous synaptonemal complex.

**Sol.:** Pachytene involves crossing over *i.e.* exchange of genetic segments between non sister chromatids of homologous chromosomes. Diplotene involves dissolution of synaptonemal complex.

Diakinesis is final substage of prophase-I which involves terminalisation of chiasmata and represents transition to metaphase-I.

129. Answer (4)

**Hint:** Mitosis is the process by which parent cell divides into two identical daughter cells.

**Sol.:** Mitosis is also termed as equational division because the number of chromosomes in parent cell and daughter cells are same.

130. Answer (4)

**Hint:** Karyokinesis is the process of nuclear division further divided into four substages.

**Sol.:** M-phase is the phase of actual cell division and is the most dramatic phase of cell cycle.

131. Answer (3)

**Hint:** Complete disintegration of nuclear envelope marks the beginning of second phase of karyokinesis *i.e.* metaphase.

**Sol.:** DNA synthesis and centriole duplication occurs in S-phase of interphase.

Tubulin proteins are synthesised during G<sub>2</sub> phase of interphase.

132. Answer (2)

**Hint:** Fluid filled space surrounded by nuclear membrane is nucleoplasm.

**Sol.:** Cytoplasm is surrounded by plasma membrane.

133. Answer (1)

**Hint:** '*Omnis cellula - e- cellula*' means all cells arise from pre-existing cells.

**Sol.:** Rudolf Virchow modified cell theory by adding the statement '*Omnis cellula -e- cellula*'.

- Robert Hooke first discovered dead cells.
- Robert Brown first described nucleus.
- George Palade discovered ribosomes.

134. Answer (1)

**Hint:** ATP synthesis by photophosphorylation and oxidative phosphorylation occur in chloroplast and mitochondria respectively.

**Sol.:**

- SER is involved in lipid synthesis.
- Golgi complex is involved in modification and packaging of materials.

135. Answer (4)

**Hint:** Nucleoplasm or nuclear matrix is the fluid filled space enclosed inside nuclear envelope.

**Sol.:** Perinuclear space is the space enclosed between two nuclear membranes.

#### SECTION - B

136. Answer (3)

**Hint:** Aldolase catalyses conversion of Fructose - 1, 6 - Bisphosphate into 3-phosphoglyceraldehyde and dihydroxyacetone-phosphate.

**Sol.:** Hexokinase catalyses conversion of glucose into glucose-6-phosphate

Enolase catalyses conversion of 2-phosphoglyceric acid into phospho-enol-pyruvate.

137. Answer (3)

**Hint:** Hydroponics is technique of growing plants in a soilless nutrient solution.

**Sol.:** It is useful in areas having thin, infertile and dry soils.

138. Answer (3)

**Hint:** In absence of essential elements, a plant cannot complete its life cycle.

**Sol.:** C, N, Mg are essential macronutrients but Na is a beneficial element.

139. Answer (4)

**Sol.:** Water is a limiting factor for plant growth and development in both agricultural and natural environment.

140. Answer (1)

**Hint:** Early or spring wood is lighter in colour and lower in density.

**Sol.:** In the spring season, cambium is very active and produces a large number of xylary elements having vessels with wider cavities.

141. Answer (1)

**Hint:** Roots have radial vascular bundles.

**Sol.:** In monocot stems, vascular bundles are conjoint, collateral, closed and are scattered in ground tissue. In dicot stem, vascular bundles are open and are arranged in a ring.

142. Answer (3)

**Hint:** Sucker helps in spreading to new niches and when older parts die new plants are formed.

**Sol.:** Underground stems of potato (tuber), ginger (rhizome) and zaminkand (corm) are modified to store food in them. They also act as organs of perennation.

143. Answer (3)

**Hint:** Roots in some plants change their shape and structure and become modified to perform other functions.

**Sol.:** Main functions of the root system are absorption, conduction, anchorage, storage and synthesis of PGRs.

In some plants, roots modify to perform functions other than absorption, conduction etc. like mechanical support, respiration etc.

144. Answer (1)

**Hint:** Mosses are evolutionary more advanced than liverworts.

**Sol.:** Mosses along with lichens are the first organisms to colonise rocks. Mosses have an elaborate mechanism of spore dispersal.

145. Answer (4)

**Hint:** Viroids are infectious RNA particles without capsid and are smaller than viruses.

**Sol.:** Prions are infectious protein particles, similar in size to viruses. They lack genetic material. Viroids cause diseases in plants.

146. Answer (2)

**Hint:** Smut is caused by fungus *Ustilago*.

**Sol.:** *Ustilago* belongs to Basidiomycetes and causes smut disease.

147. Answer (3)

**Hint:** Polymoniales is the order including families having similar characters.

**Sol.:** On the basis similar floral characters Solanaceae and Convolvulaceae families are placed in same order Polymoniales.

148. Answer (3)

**Hint:** Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheets, along with their description for future use.

**Sol.:** Label on herbarium sheets provide information about date and place of collection, its english, local, and scientific name, name of family and name of collector.

149. Answer (1)

**Hint:** Number of mitotic divisions required to produce 'n' number of cells =  $n - 1$

**Sol.:** Number of mitotic divisions required to produce 64 cells  $\Rightarrow 64 - 1 \Rightarrow 63$

150. Answer (2)

**Hint:** Nerve cells are some of the longest cells. The shape of the cell may vary with the function they perform.

**Sol.:** Nerve cells are branched and long. Columnar epithelial cells are long and narrow.

## [ZOOLOGY]

### SECTION - A

151. Answer (4)

**Hint:** Squamous epithelium

**Sol.:** Squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs.

Ciliated epithelium helps in moving particles or mucus in a specific direction over the epithelium.

152. Answer (2)

**Hint:** Platypos

**Sol.:** Members of class Aves and Mammalia are warm-blooded animals.

Mammary glands are a unique characteristic of mammals.

Platypos is an egg-laying (oviparous) mammal.

153. Answer (3)

**Hint:** Collateral glands help in the formation of ootheca.

**Sol.:** Cockroaches are dioecious and show sexual dimorphism.

Only the male cockroaches bear a pair of short, thread-like anal styes which are absent in females.

Collateral glands and spermathecae are female reproductive structures.

154. Answer (3)

**Hint:** Loading of  $O_2$  with Hb

**Sol.:** If the oxygen dissociation curve moves to the left then the conditions are conducive for the binding of oxygen and haemoglobin. When  $pO_2$  is high,  $pCO_2$  is low,  $H^+$  concentration is lower and the temperature is lower, then the conditions are favourable for the formation of oxyhaemoglobin.

155. Answer (1)

**Hint:** Platelets are produced from megakaryocytes.

**Sol.:** Platelets, also known as thrombocytes are cell fragments produced from megakaryocytes.

Platelets release the substances which are involved in the coagulation or clotting of blood.

156. Answer (1)

**Hint:** From PCT to the tip of loop of Henle osmolarity increases.

**Sol.:** A special arrangement of Henle's loop and vasa recta is called counter current which helps to maintain a concentration gradient in the medullary interstitium.

The osmolarity increases from 300 mOsmol L<sup>-1</sup> in cortex to 1200 mOsmol L<sup>-1</sup> in the inner medulla.

157. Answer (2)

**Hint:** RuBisCO

**Sol.:**

GLUT-4	–	Enables glucose transport into cells
Collagen	–	Most abundant protein in animal world
RuBisCO	–	Most abundant protein in whole of biosphere
Antibody	–	Fights infectious agents

158. Answer (2)

**Hint:** Exclude cheek bones

**Sol.:** Paired bones given above are zygomatic and ulna.

Unpaired bones given above are hyoid, sacrum, sternum, ethmoid and sphenoid.

159. Answer (2)

**Hint:** A protein + an aldehyde of vitamin A

**Sol.:** Opsin and retinal make up the photosensitive compound in human eyes called rhodopsin.

160. Answer (4)

**Hint:** It is cardiac muscle tissue.

**Sol.:** Cardiac muscle tissue is unique to the heart. It has communication junctions (intercalated discs) at some fusion points which allow the cells to contract as a unit.

They show striations like skeletal muscle tissue and are involuntary like smooth muscle tissue.

161. Answer (1)

**Hint:** Iodinated amine

**Sol.:**

Peptide, polypeptide, protein hormones – Insulin, glucagon, pituitary hormones, hypothalamic hormones, erythropoietin *etc.*

Steroids – Cortisol, testosterone, estradiol and progesterone

Iodothyronines – T<sub>3</sub>, T<sub>4</sub>

Amino acid derivative – Epinephrine

162. Answer (1)

**Hint:** Select an amphibian

**Sol.:**

Frogs	–	Lungs
Fishes	–	Gills
Flatworms	–	Entire body surface
Earthworms	–	Moist cuticle

163. Answer (2)

**Hint:** Animals having circular mouth

**Sol.:** All living members of class Cyclostomata are ectoparasites on fishes. Their body is devoid of scales and paired fins.

Cranium and vertebral column are cartilaginous.

164. Answer (4)

**Hint:** Enzyme present in saliva

**Sol.:** Rennin is found in the gastric juice and is proteolytic.

Chymotrypsin is the activated form of chymotrypsinogen and is proteolytic.

Pepsin is found in gastric juice of infants and digests protein.

Amylase is found in saliva as well as pancreatic juice and digests starch (polysaccharide).

165. Answer (4)

**Hint:** pO<sub>2</sub> in deoxygenated blood is 40 mm Hg.

**Sol.:**

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O <sub>2</sub>	159	104	40	95	40
CO <sub>2</sub>	0.3	40	45	40	45

166. Answer (1)

**Hint:** Systolic pressure is 120 mm Hg.**Sol.:** The instrument used to check the blood pressure is sphygmomanometer.

Normal systolic blood pressure = 120 mm Hg

Normal diastolic blood pressure = 80 mm Hg

$$\therefore \text{Normal blood pressure} = \frac{120}{80} \text{ mm Hg}$$

167. Answer (2)

**Hint:** Grasshoppers shows same type of development**Sol.:** Paurometabolous development is seen in cockroaches (*P. americana*). The nymph look very much like adults.

The nymph grows by moulting about 13 times to reach the adult form. The next to last nymphal stage has wing pads but only adult cockroaches have wings.

168. Answer (1)

**Hint:** All are uricotelic.**Sol.:** On the basis of the chief nitrogenous wastes excreted, there are three groups of animals-

(i)	Ammonotelic	–	Bony fishes, aquatic amphibians, aquatic insects
(ii)	Ureotelic	–	Mammals, terrestrial amphibians, marine fishes
(iii)	Uricotelic	–	Reptiles, birds, land snails, insects

169. Answer (2)

**Hint:** Tight junctions stop substances from leaking across a tissue.**Sol.:** Nearly all animal tissues have specialised junctions which provide both structural and functional links between its individual cells.

Three types of cell junctions are found in the epithelium and other tissues-

(i)	Tight junctions	–	Prevent substances from leaking across a tissue
(ii)	Adhering junctions	–	Cement neighbouring cells together

(iii)	Gap junctions	–	Facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells
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170. Answer (2)

**Hint:** Pia mater is in contact with the brain tissue.**Sol.:** The brain is covered by cranial meninges. The outermost layer is the dura mater. The middle layer is the arachnoid which is very thin and the innermost layer is the pia mater which is in contact with brain tissue.

171. Answer (4)

**Hint:** Caused due to decreased level of estrogen**Sol.:** Gout is the inflammation of joints due to accumulation of uric acid crystals.

Rheumatoid arthritis is the inflammation of joints due to autoimmune response of the body.

Myasthenia gravis is an autoimmune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscles.

172. Answer (2)

**Hint:** Also excreted by birds**Sol.:** The primary nitrogenous waste of cockroach is uric acid.

Ammonia – Bony fishes

Urea – Mammals

173. Answer (1)

**Hint:** Conversion of glucose to glycogen is glycogenesis.**Sol.:** The gland mentioned is pancreas.Endocrine part of pancreas have two main types of cells called  $\alpha$ -cells and  $\beta$ -cells. The  $\alpha$ -cells secrete a hormone called glucagon, while the  $\beta$ -cells secrete insulin.

Glucagon is hyperglycemic hormone as it stimulates glycogenolysis.

Insulin is hypoglycemic hormone as it stimulates glycogenesis.

Such hormones which have opposite effects are said to be antagonistic.

174. Answer (3)

**Hint:** Single opening which helps in ingestion as well as egestion.

**Sol.:**

Bioluminescence	Ctenophora	<i>Pleurobrachia</i>
Radula	Mollusca	<i>Sepia</i>
Hypostome	Coelenterata	<i>Meandrina</i>
Spongocoel	Porifera	<i>Sycon</i>

175. Answer (3)

**Hint:** An obese person has this tissue in excess compared to a thin person.

**Sol.:** Areolar tissue and adipose tissue are two types of loose connective tissue.

Adipose tissue is located mainly beneath the skin. The cells of this tissue are specialised to store fats, hence called fat cells.

They provide insulation and shock absorption to the body.

Tendons and ligaments are dense regular connective tissue.

176. Answer (3)

**Hint:** If glomerular blood flow increases, glomerular blood pressure increases

**Sol.:** When glomerular blood flow increases, glomerular blood pressure increases and so does the glomerular filtration rate. An increase in blood flow to the atria of the heart causes the release of Atrial Natriuretic Factor (ANF). ANF causes vasodilation which decreases the blood pressure.

177. Answer (1)

**Hint:** Nerve fibres of CNS

**Sol.:** There are two types of axons, namely, myelinated and unmyelinated.

- Unmyelinated nerve fibres are enclosed by a Schwann cell that does not form a myelin sheath around the axon in PNS.
- Myelinated nerve fibres are enclosed by a myelin sheath formed by oligodendrocytes in CNS and Schwann cells in PNS.
- Schwann cells enclose both myelinated and unmyelinated nerve fibres only in PNS.

178. Answer (2)

**Hint:** Exclude toxins

**Sol.:**

Pigment	–	Anthocyanin
Drug	–	Curcumin
Toxins		Ricin, Abrin

179. Answer (3)

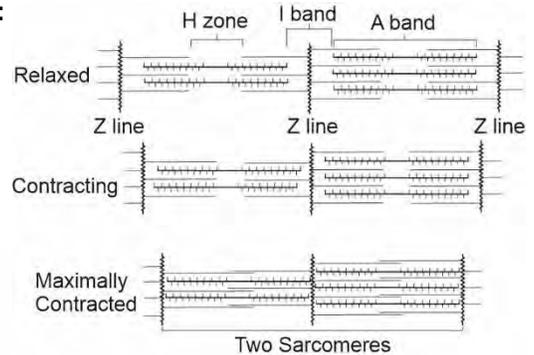
**Hint:** Carpals + Pectoral girdle bones in humans

**Sol.:** The respiratory system of cockroach comprises a network of trachea, that open through 10 pairs of small holes called spiracles present on the lateral side of the body.

180. Answer (4)

**Hint:** Shortening of sarcomere

**Sol.:**



181. Answer (3)

**Hint:** Rh incompatibility occurs between Rh –ve blood of a pregnant mother and Rh +ve blood of the foetus.

**Sol.:** Since 'Q' is an Rh +ve individual she won't face any Rh incompatibility issues whether her foetus is Rh +ve or Rh –ve.

'Y' on the other hand, is Rh –ve so if her foetus is Rh –ve then there is no Rh incompatibility. But, if her foetus is Rh +ve, then it is a case of Rh incompatibility and the subsequent pregnancies may be problematic.

182. Answer (2)

**Hint:** Thoracic volume affects pulmonary volume.

**Sol.:** The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by the dome-shaped diaphragm. The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the pulmonary volume.

183. Answer (4)

**Hint:** Peptic cells secrete the proenzyme pepsinogen.

**Sol.:**

Oxyntic cells	–	Secrete HCl
Chief cells	–	Peptic cells
Goblet cells	–	Mucus

184. Answer (1)

**Hint:** It stimulates melanocytes.**Sol.:** Pars intermedia is the part of adenohypophysis.

It secretes only one hormone, i.e., Melanocyte Stimulating Hormone (MSH).

PRL is Prolactin which is produced by anterior pituitary.

Pineal gland secretes melatonin.

Neurohypophysis stores and releases two hormones – oxytocin and Anti-Diuretic Hormone (ADH).

185. Answer (3)

**Hint:** Cyclostomes are without jaws.**Sol.:** Gnathostomes are jaw-bearing animals. Organisms of super class Pisces and Tetrapoda belong to division Gnathostomata.*Pterophyllum* – Class Osteichthyes*Pteropus* – Class Mammalia*Testudo* – Class Reptilia*Myxine* belongs to class Cyclostomata and division Agnatha (jawless animals).**SECTION - B**

186. Answer (4)

**Hint:** Floor of diencephalon**Sol.:** Hypothalamus is the basal part of diencephalon.

187. Answer (4)

**Hint:** Loose motions**Sol.:** The abnormal frequency of bowel movements and increased liquidity of the faecal discharge is known as diarrhoea. It reduces the absorption of food. In indigestion, food is not properly digested. Vomiting is ejection of stomach contents through the mouth.

188. Answer (1)

**Hint:** The starch-I<sub>2</sub> is blue in colour.**Sol.:** Presence of starch is confirmed by iodine test as starch can hold I<sub>2</sub> molecules in its helical portion.

189. Answer (1)

**Hint:** Urochordate**Sol.:** *Ascidia* belongs to subphylum Urochordata.In *Branchiostoma*, notochord is present in larval tail as well as in adults. *Dentalium* and *Aplysia* are molluscs, without notochord.

190. Answer (2)

**Hint:** Carboxypeptidase also need the same co-factor.**Sol.:** Non-protein constituents called co-factors are bound to the enzyme to make the enzyme catalytically active.

Peroxidase and catalase need the co-factor haem.

Carboxypeptidase and carbonic anhydrase show their effect in the presence of zinc ions.

191. Answer (1)

**Hint:** Transmission of impulses to brain is the last step.**Sol.:**

- Ear drum vibrates in response to sound waves.
- Ear ossicles (malleus, incus, stapes) transmit the vibrations to the oval window.
- The vibrations produce waves in the cochlear lymph which induce a ripple in the basilar membrane.
- Movement of the basilar membrane bend the hair cells, pressing them against the tectorial membrane.
- Impulses are generated in the associated afferent neurons which are finally transmitted to the auditory cortex of the brain.

192. Answer (2)

**Hint:** Direct neural regulation**Sol.:** Neurohypophysis (Pars nervosa) also known as posterior pituitary stores and releases oxytocin and vasopressin.

Hormones from hypothalamus reach anterior pituitary through portal circulation.

193. Answer (2)

**Hint:** Present in the cyton only**Sol.:** Axon is the long process of the neuron. It does not have Nissl's granules.

194. Answer (3)

**Hint:** Multiple of 7**Sol.:**

Tarsals	–	7 in each hindlimb
Metatarsals	–	5 in each hindlimb
Carpals	–	8 in each forelimb
True ribs	–	14
Phalanges	–	14 in each hindlimb
Metacarpals	–	5 in each forelimb

195. Answer (1)

**Hint:** Functional kidney from donors is required.

**Sol.:** Kidney transplantation is the ultimate method in the correction of acute renal failure.

196. Answer (1)

**Hint:** Carotid artery is a systemic artery.

**Sol.:** Pulmonary artery carries deoxygenated blood whereas carotid artery carries oxygenated blood.

The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves.

Electrocardiograph is machine used to obtain ECG.

197. Answer (1)

**Hint:** Secretes lysozyme

**Sol.:** Paneth cells secrete lysozymes.

Zymogen cells secrete inactive enzymes like pepsinogen.

Argentaffin cells have an endocrine function.

Kupffer cells are phagocytic.

198. Answer (2)

**Hint:** Hepatic cells constitute functional unit of liver.

**Sol.:** Liver is the largest exocrine gland of the human body.

Hepatic lobules are its structural and functional units.

Each hepatic lobule is covered by Glisson's capsule.

199. Answer (4)

**Hint:** The enzyme runs through catalytic cycle again and again.

**Sol.:**  $E + S \rightleftharpoons ES \longrightarrow EP \longrightarrow E + P$

After the completion of the reaction, the enzyme releases the products of the reaction and the free enzyme is ready to bind to another molecule of the substrate and run through the catalytic cycle once again.

200. Answer (2)

**Hint:** Malpighian tubules

**Sol.:** Malpighian tubules are excretory structures which are present at the junction of midgut and hindgut.

They are 100–150 yellow-coloured thin filamentous blind tubules.

