All India Aakash Test Series for NEET-2025

TEST - 7 (Code-C)

Click Here for Code-D Sol.

Test Date : 24/03/2024

ANSWERS

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


Aakash
Medical|IIT-JEE|Foundations

14. Answer (2)

Hint: $(f_s)_{max} = (\mu_s)\, N$

Sol.: $(f_s)_{max} = (0.5)\,(20) = 10$ N

Thus 20 N will make the block slide

Now, $a = \dfrac{F-f}{m} = \dfrac{20-(0.5)(20)}{2}$

$a = 5$ m/s^2

15. Answer (2)

Hint & Sol.: $\left|\vec{A}+\vec{B}\right| = \left|\vec{A}-\vec{B}\right|$

$A^2 + B^2 + 2AB\cos\theta = A^2 + B^2 - 2AB\cos\theta$

$4AB\cos\theta = 0$

$\therefore \cos\theta = 0$

$\therefore \theta = 90°$

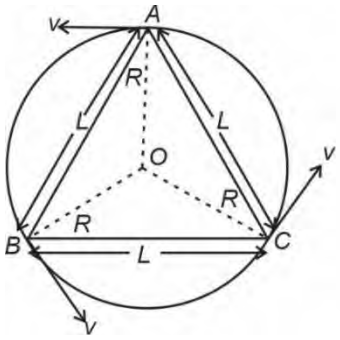
16. Answer (1)

Hint: $\vec{L} = \vec{r} \times \vec{p}$

Sol.: The perpendicular distance of line of motion of linear momentum remains constant hence the angular momentum remains constant.

17. Answer (3)

Hint:



$\dfrac{L}{\sqrt{3}} = R$

$\therefore L = R\sqrt{3}$

Sol.: We know,

Centripetal force = Gravitational force

$\dfrac{Mv^2}{R} = 2\dfrac{GM^2}{L^2}(\cos 30°)$

$\dfrac{Mv^2}{R} = \dfrac{2GM^2}{\left(R\sqrt{3}\right)^2}\left(\dfrac{\sqrt{3}}{2}\right)$

$v^2 = \dfrac{GM}{\left(R\sqrt{3}\right)}$

$\therefore v = \sqrt{\dfrac{GM}{R\sqrt{3}}}$

18. Answer (2)

Hint: Impulse, $\vec{J} = m\left(\vec{v_f} - \vec{v_i}\right)$

Sol.: Here,

$\vec{J} = m\left[(-v\cos 30°\hat{i} + v\sin 30°\hat{j}) - (v\cos 30°\hat{i} + v\sin 30°\hat{j})\right]$

$\therefore \left|\vec{J}\right| = 2mv\cos 30°$

$= 2(1)(100)\left(\dfrac{\sqrt{3}}{2}\right)$

$\therefore \left|\vec{J}\right| = 100\sqrt{3}$ N s

19. Answer (2)

Hint: $v_P = \dfrac{dy}{dt}$, $\therefore v_P = 2\pi f\, y_0 \cos 2\pi\left[ft - \dfrac{x}{\lambda}\right]$

Sol.: Maximum particle velocity

$\therefore v_{max} = 2\pi f\, y_0$

Now, according to question

$v_{max} = 4v$

$2\pi f\, y_0 = 4(f\lambda)$

Hence, $\lambda = \dfrac{\pi y_0}{2}$

20. Answer (4)

Hint: Use principle of superposition of waves

Sol.: Resultant amplitude

$A = \sqrt{a^2 + a^2 + 2a^2\cos 90°}$

$\therefore A = a\sqrt{2}$

21. Answer (1)

Hint & Sol.:

$\because \sum F_{ext} = 0$

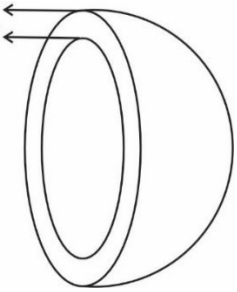
$\therefore a_{com} = 0$

As, initial $u_{com} = 0$

$\therefore$ final $v_{com} = 0$

22. Answer (2)

Hint:



Sol.: Force due to surface tension on one half $= 4\pi RT$

23. Answer (4)

Hint: Thermal current $\frac{Q}{t} = \frac{kA\Delta T}{x}$

Sol.: $\frac{\left(\frac{Q}{t}\right)_1}{\left(\frac{Q}{t}\right)_2} = \frac{\left(\frac{A}{x}\right)_1}{\left(\frac{A}{x}\right)_2} = \frac{A_1x_2}{A_2x_1}$

$= \frac{1}{4}\times\frac{1}{2} = \frac{1}{8}$

24. Answer (2)

Hint: For a process having equation of state as

PV^x = Constant

Work done $W = \frac{nR\Delta T}{1-x}$

Sol.: Here,

$\frac{P}{\sqrt{V}}$ = Constant

$\Rightarrow PV^{-\frac{1}{2}}$ = Constant

Now,

$W = \frac{nR\Delta T}{1-x} = R\left[\frac{30}{1-\left(-\frac{1}{2}\right)}\right]$

$W = 20R$

25. Answer (2)

Hint: $\frac{\Delta t}{t} = \frac{1}{2}\alpha\Delta\theta$

Sol.: $\frac{5}{t} = \frac{1}{2}\alpha(\theta - 15)$.... (i)

$\frac{10}{t} = \frac{1}{2}\alpha(30-\theta)$ .... (ii)

Dividing (i) and (ii) we get

$\frac{1}{2} = \frac{\theta-15}{30-\theta} \Rightarrow \theta = 20°C$

26. Answer (2)

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

Sol.: After removing 800 g

$3 = 2\pi\sqrt{\frac{900}{K}}$ ... (i)

Now, after removing 500 g

$T = 2\pi\sqrt{\frac{1200}{K}}$ ... (ii)

Dividing (i) and (ii)

We get, $T = 2\sqrt{3}$ seconds

27. Answer (4)

Hint: $E = \frac{1}{2}KA^2$

Sol.: K.E $= \frac{1}{2}K\left[A^2 - \frac{3A^2}{4}\right]$

K.E $= \frac{1}{2}K\left[\frac{A^2}{4}\right]$

$\therefore$ K.E $= \frac{E}{4}$

28. Answer (4)

Hint: Centripetal force is always perpendicular to velocity while tangential force is along or opposite to the velocity.

Sol.: Since, a_t is changing with time therefore a_c will also keep changing with time.

Also, $P = \vec{F}\cdot\vec{v}$.

For centripetal force $P = (F)(v)\cos 90° = 0$

29. Answer (4)

Hint: Area of $F-t$ graph = Impulse or change in momentum

Sol.: $m(v_f - v_i)$ = Area of $F-t$ curve

$m(u-0) = \frac{\pi(f_0T)}{2}$

$\therefore u = \frac{\pi(f_0T)}{2m}$

30. Answer (1)

Hint: According to principle of calorimetry, in an isolated system.

Heat lost = Heat gained

Sol.: $(100)(C_A)[100-90] = (50)(C_B)(90-75)$

$2C_A = 1.5C_B \Rightarrow C_A = \frac{3}{4}C_B$

Now, $(100)C_A(100-\theta) = (50)(C_B)(\theta - 50)$

$2\times\frac{3}{4}(100-\theta) = (\theta - 50)$

$\therefore \theta = 80°C$

31. Answer (1)

Hint : Standard equation of a Harmonic wave is

$y = A\sin(\omega t - kx) \rightarrow$ for (+)ve x-axis

$y = A\sin(\omega t + kx) \rightarrow$ for (–)ve x-axis

Sol.: In $y = 10^{-3}\sin(50t + 2x)$

$v = \frac{\omega}{k} = \frac{50}{2} = 25$ m/s

32. Answer (4)

Hint: Addition of two perpendicular SHM has amplitude $A = \sqrt{A_1^2 + A_2^2}$

Sol.: $y = 5(\sin(3\pi t) + \sqrt{3}\cos 3\pi t)$

can be written as

$y = 10\sin\left(3\pi t + \frac{\pi}{3}\right)$

$\therefore$ Amplitude $A = 10$ cm

and $T = \frac{2\pi}{\omega} = \frac{2\pi}{3\pi} = \frac{2}{3}$ second

33. Answer (3)

Hint: At lowest point

$T - mg = \frac{mv^2}{R}$

Sol.: $T - mg = \frac{mv^2}{R}$

$T = mg + \frac{mv^2}{R}$

$= \frac{1}{2}\times 10 + \frac{1}{2}\times\frac{8^2}{1}$

= 5 + 32 = 37 N

34. Answer (3)

Hint: Process CA is an isobaric process

Sol.: $W = P\Delta V = 5 \times 4 = 20$ J

35. Answer (1)

Hint & Sol.: Since the particle is moving with constant speed hence there would be only centripetal acceleration which will only change in direction and magnitude will remain fixed.

SECTION - B

36. Answer (1)

Hint: For a closed vessel

$Q = nC_v\Delta T$

Sol.: $Q = n\left(\frac{fR}{2}\right)(\Delta T)$

$Q = \left(\frac{14}{28}\right)\left(\frac{5R}{2}\right)(4T - T)$ $[T \propto v^2]$

$Q = \frac{1}{2}\times\frac{5}{2}\times\frac{25}{3}\times 900$

$Q = 9375$ J

37. Answer (2)

Hint & Sol.: $\vec{A}\times\vec{B} = AB\sin\theta\hat{n}$

For parallel vectors $\theta = 0°$

$\therefore \quad \vec{A}\times\vec{B} = 0$

38. Answer (3)

Hint & Sol.: Since, $dU = 0 \Rightarrow T$ = constant, as internal energy is a function of temperature for an ideal gas.

39. Answer (2)

Hint: Work done = Δ K.E [Work Energy Theorem]

Sol.: $v = \frac{dx}{dt}$, $\therefore [v = 6t]$

Now, $W = \frac{1}{2}m(v_f^2 - v_i^2)$

$= \frac{1}{2}(2)[36t^2 - 0]$

$= 36(5)^2 = 900$ J

40. Answer (1)

Hint: Work – Energy theorem

Sol.: Work done by gravity = Change in (K.E)

$mg\frac{l}{2}\sin 30° = \frac{1}{2}I\omega^2$

$\frac{mgl}{4} = \frac{1}{2}\frac{ml^2}{3}\omega^2$

$\omega = \sqrt{\frac{3g}{2l}}$

$\omega = \sqrt{30}$ rad s^{-1}

41. Answer (4)

Hint: If position vector varies with time as $\vec{r} = (a\cos\omega t)\hat{i} + (a\sin\omega t)\hat{j}$ then particle is in circular motion.

Sol.: In circular motion, velocity of a particle is always perpendicular to its position vector.

42. Answer (1)

Hint: Heat flow rate, $\frac{dQ}{dt} = \frac{kA\Delta T}{l}$

Sol.: Energy flux $\phi = \frac{1}{A}\left(\frac{dQ}{dt}\right) = \frac{k\Delta T}{l}$

$\therefore \phi = \frac{(0.1)(1273-373)}{1}$

$\therefore \phi = 90\ W/m^2$

43. Answer (2)

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

Sol.: Here, $\lambda = \frac{v}{f} = \frac{1}{f}\sqrt{\frac{T}{\mu}}$

$\lambda = \frac{1}{80}\sqrt{\frac{8}{0.005}} = \frac{1}{80}\sqrt{\frac{8000}{5}}$

$\lambda = \frac{40}{80}\ m = 0.5\ m$

Thus, separation between successive nodes $= \frac{\lambda}{2}$

$= 25\ cm$

44. Answer (3)

Hint: Velocity of oscillating particle on wave is given by $v_p = -v$(slope)

Sol.: At '*B*' slope is negative

$\therefore$ Particle velocity will be along $+Y$ axis

While velocity of particle need not to be necessarily along the velocity of wave.

45. Answer (2)

Hint: Use equations of uniformly accelerated motion

Sol.: Here, $h = \frac{1}{2}gt^2$ $[\because u = 0]$

And $40 = \frac{1}{2}gt^2 - \frac{1}{2}g(t-2)^2$

$40 = \frac{1}{2}g[t^2 - t^2 + 4t - 4]$

$40 = 5(4t-4)$

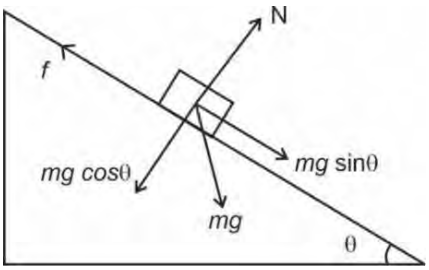
$40 = 20t - 20$

$\therefore t = 3\ s$

Now, $h = \frac{1}{2}(10)(3)^2 = 45\ m$

46. Answer (2)

Hint:



In absence of friction

$a = g\sin\theta$

In presence of friction

$a' = g\sin\theta - \mu g\cos\theta$

Sol.: According to question

$t' = 2t$

$\sqrt{\frac{2s}{a'}} = 2\sqrt{\frac{2s}{a}}$

$\therefore \sqrt{\frac{2s}{\frac{g}{\sqrt{2}} - \frac{\mu g}{\sqrt{2}}}} = 2\sqrt{\frac{2s}{\frac{g}{\sqrt{2}}}}$

$\therefore \mu = \frac{3}{4} = 0.75$

47. Answer (2)

Hint: At highest point velocity is equal to horizontal component of initial velocity.

Sol.: $(K.E)_i = \frac{1}{2}mu^2 = K$

$(KE)_f = \frac{(KE)i}{2}$

$\frac{1}{2}mv^2 = \frac{1}{2}\left[\frac{1}{2}mu^2\right]$

$v = \frac{u}{\sqrt{2}} = u\cos 45°$

$\therefore$ at highest point.

48. Answer (3)

Hint: Potential Energy $U = \frac{1}{2}kx^2$

Kinetic Energy $K = \frac{1}{2}k(A^2 - x^2)$

Sol.: Here, $U = K$

$\therefore \frac{1}{2}kx^2 = \frac{1}{2}kA^2 - \frac{1}{2}kx^2$

$2kx^2 = kA^2$

$\therefore x = \pm\frac{A}{\sqrt{2}}$

49. Answer (1)

Hint: $PV = nRT$

Sol.: $n = \frac{7}{28}$

$\therefore PV = \frac{1}{4}RT$

50. Answer (2)

Hint: $Y = \frac{Fl}{Ax}$

$\therefore F = \left(\frac{YA}{l}\right)x = kx$

Sol.: Let 'L' be natural length of string

Now,

$8 = k(x - L)$ ……(i)

$10 = k(y - L)$ ……(ii)

$18 = k(z - L)$ ……(iii)

Solving above equations, we get

$z = 5y - 4x$

[CHEMISTRY]

SECTION - A

51. Answer (2)

Hint: Number of atoms

= number of moles × atomicity × N_A

Sol.: Number of atoms in 4.4 g CO_2

$= \frac{4.4}{44} \times N_A \times 3 = 0.3\ N_A$

Number of atoms in 3.4 g NH_3

$= \frac{3.4}{17} \times N_A \times 4 = 0.8\ N_A$

Number of atoms in 1.6 g CH_4

$= \frac{1.6}{16} \times N_A \times 5 = 0.5\ N_A$

Number of atoms in 3.2 g SO_2

$= \frac{3.2}{64} \times N_A \times 3 = 0.15\ N_A$

52. Answer (2)

Hint: In a neutral atom number of protons and electrons are equal.

Sol.: Number of protons = number of electrons = Z = 6

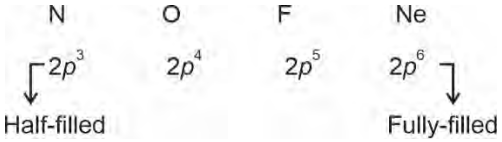
Number of neutrons = A – Z = 13 – 6 = 7

So, ratio will be 7 : 6 : 6

53. Answer (3)

Hint: High ionisation energy is required to remove electron from half-filled and fully filled configuration.

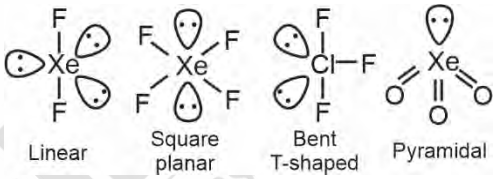
Sol.: order of IE_1 : Ne > F > N > O



54. Answer (4)

Hint: For trigonal bipyramidal geometry lone pair occupy equatorial position.

Sol.:



55. Answer (3)

Hint: Reactant that gets completely consumed in reaction is limiting reagent and it decides the yield of product.

Sol.: $\underset{2\text{ g}}{2H_2} + \underset{8\text{ g}}{O_2} \rightarrow 2H_2O$

1 mol 0.25 mol

Here O_2 is the limiting reagent

1 mol O_2 gives $\rightarrow$ 2 mol H_2O

0.25 mol O_2 will give $\rightarrow$ 0.5 mol H_2O

= 9 g H_2O

56. Answer (2)

Hint: According to the first law of thermodynamics. $\Delta U = q + W$

Sol.: Work done = –150 kJ as it is done by the gas

$\Rightarrow \Delta U = q + W$

$\Rightarrow \Delta U = 100 - 150 = -50$ kJ

57. Answer (2)

Hint: Cationic hydrolysis gives H^+ ions in the solution while anionic hydrolysis gives OH^- ions.

Sol.: *e.g.* $NH_4^+ + H_2O \rightleftharpoons NH_4OH + H^+$

$FeCl_3$	NH_4Cl	Na_2CO_3	NaCl
WBSA	WBSA	SBWA	SBSA
(Acidic)	(Acidic)	(Basic)	(Neutral)

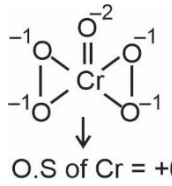
58. Answer (4)

Hint & Sol.: Endothermic reactions are favoured at high temperature and exothermic reactions are favoured at low temperature.

59. Answer (1)

Hint: CrO_5 has two peroxy linkage

Sol.:



O.S of Cr = +6

$MnO_4^- \rightarrow x + 4(-2) = -1 \Rightarrow x = +7$

$ClO_4^- \rightarrow x + 4(-2) = -1 \Rightarrow x = +7$

$H_3PO_4 \rightarrow 3(1) + x + 4(-2) = 0 \Rightarrow x = +5$

60. Answer (1)

Hint: Formal charge is calculated by considering the bond to be covalent

Sol.: Formal charge helps to select the lowest energy structure.

61. Answer (1)

Hint : Non-metals have high E°_{red} values.

Sol.: $Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$

$E^\circ = 1.36$ V

It has most positive $E^\ominus$ among all other options.

62. Answer (4)

Hint: CO forms a stable complex with haemoglobin.

Sol.: Zeolites are widely used as a catalyst in petrochemical industries for cracking of hydrocarbons and isomerisation.

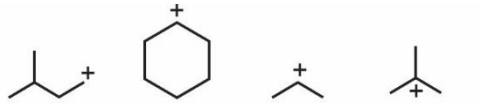
The highly poisonous nature of CO arises due to its ability to form a complex with haemoglobin which is about 300 times more stable than the oxygen-haemoglobin complex.

Being heavy and non-supporter of combustion CO_2 is used as fire extinguisher.

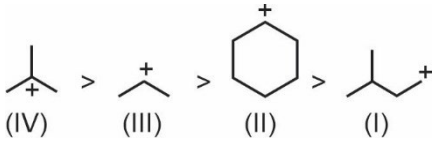
63. Answer (3)

Hint: More is the hyperconjugation, more will be the stability of carbocation

Sol.:



Order of stability:

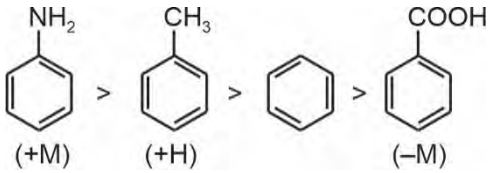


64. Answer (3)

Hint: Rate of electrophilic aromatic substitution is directly proportional to nucleophilicity of benzene ring.

Sol.: The group which increases the electron density in benzene ring i.e. electron donating group, increases the nucleophilicity of benzene ring and hence increases rate of reaction towards electrophilic substitution.

Order:



65. Answer (1)

Hint : At equilibrium $\Delta G = 0$

Sol.: $T = \frac{\Delta H}{\Delta S} = \frac{9000 \text{ J mol}^{-1}}{90 \text{ J mol}^{-1}\text{K}^{-1}} = 100 \text{ K}$

66. Answer (2)

Hint: $CaCO_3$ decomposes on heating into CaO and CO_2.

Sol.: $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

1 mol that is 100 $CaCO_3$ gives $\rightarrow$ 22.4 L CO_2

Volume of $CO_2 = \frac{50}{100} \times \frac{25}{100} \times 22.4 = 2.8$ L

67. Answer (1)

Hint: Angular nodes are equal to the value of 'l'

Sol.: Angular nodes = l = 1 for *p* orbitals

Radial nodes = n – l – 1 = 4 – 1 – 1 = 2

68. Answer (4)

Hint: $K_C = [Al^{3+}][Cl^-]^3$

Sol.: $K_C = [Al^{3+}][Cl^-]^3$

$K_C' = [8\ Al^{3+}]\left[\frac{Cl^-}{2}\right]^3$

$= K_C$

So, Cl^- becomes $\frac{1}{2}$ times.

69. Answer (1)

Hint: Boron is a 2nd period member

Sol.: Boron is unable to form BF_6^{3-} ion due to unavailability of *d*-orbitals, it cannot expand its octet.

Boron cannot exceed maximum covalence of 4.

70. Answer (3)

Hint: Bond order = ½ [(No. of e^- in B.M.O's) – (Number of e^- in A.B.M.O's)]

Sol.: $H_2^+ : (\sigma 1s)^1$; B.O = ½ × 1 = 0.5

$H_2 : (\sigma 1s)^2$; B.O = ½ (2) = 1

Since H_2 has higher bond order it will be more stable.

71. Answer (3)

Hint: Boric acid accepts OH^- from water

Sol.: Boric acid is weakly monobasic and has ability to gain e^- from OH^-.

Boric acid also forms H-bond.

72. Answer (3)

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

Sol.: $\Delta H - \Delta U = \Delta n_g RT$

$2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$

$\Delta n_g = -3$

$$\Delta H - \Delta U = \frac{-3 \times 8.314}{1000} \times 298 = -7.43 \text{ kJ}$$

73. Answer (3)

Hint: pH + pOH = pK_w and $[H^+] = c\alpha$

Sol.:

	HCN $\rightleftharpoons$	H^+ +	CN^-
t = 0	c	–	–
$t = t_{eq}$	$c(1-\alpha)$	$c\alpha$	$c\alpha$

$$K_a = \frac{(c\alpha)^2}{c(1-\alpha)}$$ neglecting α w.r.t. 1

$K_a = c\alpha^2$

$[H^+] = c\alpha$

Given, pOH = 10

pH = 14 – 10 = 4

$[H^+] = 10^{-4}$

$c\alpha = 10^{-4}$

$$\alpha = \frac{10^{-4}}{c}$$

$$\alpha = \frac{10^{-4}}{10^{-2}} = 10^{-2}$$

$K_a = (10^{-2}) \times (10^{-2})^2$

$K_a = 10^{-6}$

74. Answer (2)

Hint: If the reaction is reversed its equilibrium constant gets inversed.

Sol.: $N_2 + 3H_2 \rightleftharpoons 2NH_3$; K

$2NH_3 \rightleftharpoons N_2 + 3H_2$; $K' = \frac{1}{K}$

$NH_3 \rightleftharpoons \frac{1}{2}N_2 + \frac{3}{2}H_2$; $K'' = \left(\frac{1}{K}\right)^{1/2}$

75. Answer (1)

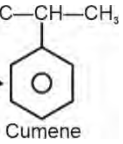
Hint: Reducing agent is capable of reducing other substances by donating electrons.

Sol.: $H_2SO_4 \rightarrow 2(1) + x + 4(-2) = 0 \Rightarrow x = +6$

As sulphur is in +6 oxidation state which is maximum, further loss of electrons is not possible. So, it can't act as a reducing agent.

76. Answer (3)

Hint : Rearrangement of carbocation takes place.

Sol.: $HC \equiv CH \xrightarrow[\text{Fe tube}\\ \text{873 K}]{\text{Red hot}}$  $\xrightarrow[\text{Anhy. } AlCl_3]{CH_3CH_2CH_2Cl}$  Cumene

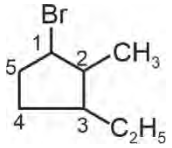
77. Answer (3)

Hint & Sol.: Given electronic configuration is of Ga(31).

The atomic number of the element just above it is 31 – 18 = 13

78. Answer (2)

Hint: Numbering should be done in alphabetical order.

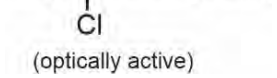
Sol.: 

1-Bromo-3-ethyl-2-methylcyclopentane

79. Answer (2)

Hint: n-Butane has two distinct hydrogen atoms

Sol.: n-Butane $\xrightarrow{Cl_2/h\nu}$ $CH_3–CH_2–CH_2–CH_2–Cl$

and 

(optically active)

Hence, total three isomers are possible

80. Answer (4)

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

91. Answer (3)

Hint: For a particular l, m can have values –l to +l

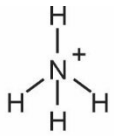
Sol.: For l = 2, m = –2, –1, 0, 1, 2

So, m = –3 not possible for l = 2

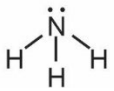
92. Answer (3)

Hint: Number of hybrid orbital

= number of σ bond + number of lone pair

Sol.: $NH_4^+ \rightarrow$  $\rightarrow sp^3$

$NO_2^+ \rightarrow O = \overset{+}{N} = O \rightarrow sp$

$NH_3 \rightarrow$  $\rightarrow sp^3$

93. Answer (4)

Hint: Representative elements are *s* and *p*-block elements except inert gas

Sol.: Z = 9 → F

Z = 31 → Ga

Z = 53 → I

Z = 83 → Bi

All these elements belong to p-block

94. Answer (3)

Hint: Formation of $SO_2(g)$ can be written as

$$S(s) + O_2(g) \longrightarrow SO_2(g)$$

Sol.:

$$S(s) + \frac{3}{2}O_2(g) \rightarrow SO_3(g);\ \Delta H_1 = -x \text{ kcal} \quad ...(1)$$

$$SO_2(g) + \frac{1}{2}O_2(g) \rightarrow SO_3(g);\ \Delta H_2 = -2y \text{ kcal} \quad ...(2)$$

Reversing (2) and adding with (2), we get

$$S(s) + O_2(g) \rightarrow SO_2(g);\ \Delta H_3 = 2y - x \text{ kcal}$$

95. Answer (2)

Hint: $m = \dfrac{x_{solute} \times 1000}{x_{solvent} \times M_{solvent}}$

Sol.: $m = \dfrac{0.05 \times 1000}{0.95 \times 18} = 2.92$ m

96. Answer (3)

Hint: Heterocyclic compounds are organic compounds with a ring structure that contains atleast one other element such as N, O, S etc. with C in the ring.

Sol.: 

Cyclic, planar, $6\pi e^-$ conjugation so it is aromatic and as it contain an O atom in the ring it is also a heterocyclic compound.

97. Answer (1)

Hint: More is the concentration of common ion lesser will be the solubility of salt.

Sol.: $AgCl(s) \rightleftharpoons \underset{s}{Ag^+}(aq) + \underset{s}{Cl^-}(aq)$

Due to more concentration of common ion order of solubility will be → $S_0 > S_2 > S_1 > S_3$

98. Answer (1)

Hint: Empirical formula expresses the simplest whole number ratio of atoms of various elements present in 1 molecule of compound.

Sol.:	S	O
Mass	50 g	50 g
Moles	50/32	50/16
Simplest ratio	1.56/1.56	3.125/1.56
Simplest ratio	1	2

So, EF → SO_2

99. Answer (2)

Hint: The reference state of carbon, oxygen and hydrogen are $C_{(graphite)}$, $O_2(g)$ and $H_2(g)$ respectively.

Sol.: 1 mole of a substance should be formed from elements which should be present in their most stable state of aggregation.

100. Answer (2)

Hint: Isopropyl alcohol is propan-2-ol and n-propyl alcohol is propanol

Sol.: $\overset{3}{H_3C} - \overset{2}{CH_2} - \overset{1}{CH_2} - OH$ (Propanol) $\qquad$ $H_3C - \overset{OH}{\overset{2}{CH}} - \overset{1}{CH_3}$ (Propan-2-ol)

Position isomers

As position of functional group is different.

[BOTANY]

SECTION - A

101. Answer (2)

Hint: Breakdown of proton gradient leads to release of energy.

Sol.: Regarding chemiosmotic hypothesis, translocation of protons from stroma to the thylakoid lumen and splitting of water molecules in the thylakoid lumen cause decrease in pH in the lumen and this creates proton gradient across the thylakoid membrane. The breakdown of this proton gradient results in the synthesis of ATP.

102. Answer (3)

Hint: T.W. Engelmann experimented on *Cladophora* and bacteria.

Sol.: The organisms used in the experiment conducted by T.W. Engelmann were *Cladophora*, which is photosynthetic eukaryotes and aerobic bacteria which are heterotrophic.

103. Answer (1)

Hint: Most of the plants have both living and dead cells.

Sol.: In plants each living cell is located quite close to the surface of the plant. This is one of the reasons why there is absence of respiratory organ in plants.

104. Answer (2)

Hint: During development a complex body organisation is formed.

Sol.: Development is the sum of two processes that are growth and differentiation.

105. Answer (4)

Hint: Rudolf Virchow first explained that cells divided and new cells are formed from pre-existing cells, *i.e.*, *Omnis cellula-e cellula*.

Sol.: Theodore Schwann, by studies on plant tissues, concluded that presence of cell wall is unique character of plant cell.

Matthias Schleiden observed that all plants are composed of different kinds of cells.

Anton von Leeuwenhoek first observed a live cell.

106. Answer (3)

Hint: M phase of the cell cycle takes less than 5% of the total duration.

Sol.: The interphase lasts more than 95% of the duration of cell cycle.

107. Answer (3)

Hint: The three domains are bacteria, Archaea and Eukarya.

Sol.: In six kingdom classification, two kingdoms Archaebacteria and Eubacteria are associated with prokaryotes whereas the rest four are associated with eukaryotes.

108. Answer (2)

Hint: Buds are usually found on stem.

Sol.: Tuber of potato, rhizome of ginger and phylloclade of *Opuntia* are modified stems. They all have buds on their nodes.

109. Answer (1)

Hint: Apical meristems are found at the apices of stem, root or branches.

Sol.: The apical meristems produce the primary plant tissues of plant body and are responsible for the primary growth of the plants. They contribute to the elongation of the plant along their axis. Lateral meristem increases the girth of the stem and roots.

110. Answer (4)

Hint: Members of Phaeophyceae are also called brown algae.

Sol.: Stored food in the brown algae is in the form of mannitol or laminarin. These algae form biflagellate zoospores that are pear-shaped and have two unequal laterally attached flagella.

111. Answer (3)

Hint: Protozoans live as predators or parasites.

Sol.: All protozoans are heterotrophs. Some of them are found in moist soil. Parasitic forms such as *Trypanosoma* have flagella. Some protozoans, like *Plasmodium* have an infectious spore-like stage.

112. Answer (2)

Hint: Organism which are either sterile or infertile, do not reproduce.

Sol.: Reproduction can be regarded as characteristic of living organisms but it is not their exclusive defining characteristic because few organisms such as mule and worker-bees do not reproduce at all.

113. Answer (1)

Hint: The cell membrane is mainly composed of lipids and proteins.

Sol.: In human beings, the membrane of the erythrocyte has approximately 52 percent protein and 40 percent lipids.

114. Answer (3)

Hint: At high light intensities, the C_4 plants show saturation at about 360 $\mu l\ L^{-1}$.

Sol.: At high light intensities, C_3 plants show saturation only beyond 450 $\mu l\ L^{-1}$. Thus, current availability of CO_2 levels is limiting to the C_3 plants.

115. Answer (3)

Hint: For complete oxidation of the fatty acid molecule that has 51 carbon and 6 oxygen atoms, there is the requirement of $\frac{145}{2}$ O_2 molecules.

Sol.: RQ of the given fatty acid molecule

$= \frac{102\ CO_2}{145\ O_2}$

$= 0.7$.

116. Answer (1)

Hint: Vernalisation refers to promotion of flowering by a period of low temperature.

Sol.: The stimulus for vernalisation is perceived by the mature stem apex, or by the embryo of the seed, but not by the leaves.

117. Answer (2)

Hint: Nuclear envelope is made up of two parallel membranes with a space between 10 to 50 nm.

Sol.: The space between two parallel membranes of the nucleus is called perinuclear space.

118. Answer (4)

Hint: Telophase II is the last stage of meiosis II.

Sol.: Meiosis ends with telophase II in which the two groups of chromosomes get enclosed by separate nuclear envelope.

119. Answer (2)

Hint: A flora gives the actual account of habitat and distribution of various plants of a given area.

Sol.: Keys are generally analytical in nature. Museums have collections of preserved plant and animal specimens for study and reference. Botanical gardens are *ex-situ* conservation strategies.

120. Answer (1)

Hint: Viruses can have dsDNA, dsRNA, ssDNA or ssRNA as genetic material.

Sol.: A virus is a nucleoprotein and the genetic material is infectious.

In general, viruses that infect plants have single stranded RNA.

121. Answer (4)

Hint: Plants belonging to the family Gramineae are monocotyledons. Flowers are usually bisexual.

Sol.: Gynoecium in the members of Gramineae is monocarpellary or tricarpellary. Floral formula is as follows:

$\%\ ♂\ P_{2\ (lodicules)}\ A_{3\ or\ 6}\ \underline{G}_1$

122. Answer (1)

Hint: Annual rings are formed of spring wood and autumn wood.

Sol.: One annual ring has one circle of spring wood that is formed during spring season and one circle of autumn wood that is formed during autumn. If there is no seasonal change, there would be uniform secondary growth and thus the annual rings will not be distinct.

123. Answer (3)

Hint: Few members of Phaeophyceae show diplontic life cycle.

Sol.: *Fucus* exhibits diplontic life cycle. *Ectocarpus* and *Polysiphonia* exhibit haplo-diplontic life cycle. *Spirogyra* shows haplontic life cycle.

124. Answer (4)

Hint: In oogamous reproduction, motile or non-motile male gamete fuses with a large non-motile female gamete.

Sol.: Oogamous reproduction is found in the members of Chlorophyceae, Phaeophyceae and Rhodophyceae.

125. Answer (1)

Hint: Maximum absorption of light occurs in wavelength range of light 400 to 500 nm.

Sol.: Chlorophyll *b* shows maximum absorption in the range of 400 to 500 nm of wavelength of light.

126. Answer (2)

Hint: When the two redox equivalents are removed, NAD^+ is converted to NADH + H^+.

Sol.: During glycolysis when glyceraldehyde – 3 – phosphate is converted into 1, 3 – bisphosphoglycerate, two redox equivalents in the form of two hydrogen atoms are removed.

127. Answer (2)

Hint: Parthenocarpic fruits are seedless fruits.

Sol.: Auxins such as IAA and IBA in diluted form are used to produce parthenocarpic fruits.

128. Answer (1)

Hint: The organelles that function in a coordinated manner constitute endomembrane system.

Sol.: Endomembrane system of the cell includes endoplasmic reticulum, Golgi complex, lysosomes and vacuoles. This system does not include mitochondria, chloroplast and peroxisome.

129. Answer (3)

Hint: During the second phase of karyokinesis of M phase, mitotic spindle formation is completed.

Sol.: The microtubules of the spindle fibres attach to the kinetochore during metaphase.

130. Answer (2)

Hint: Taxonomy does not include evolutionary study of organisms.

Sol.: Characterisation, identification, classification and nomenclature are the processes that are basics to taxonomy.

131. Answer (4)

Hint: Autotrophic eubacteria such as cyanobacteria have rigid cell wall but lack of flagella.

Sol.: Heterocysts in cyanobacteria fix N_2 only.

Anabaena is a photosynthetic autotrophic cyanobacterium.

132. Answer (3)

Hint: In hypogynous condition, ovary occupies the highest position in the flower. Examples are mustard, China rose, brinjal and *Petunia*.

Sol.: In perigynous flowers, ovary is said to be half inferior *e.g.*, plum, rose etc.

Other parts of flower arise above the ovary in epigynous flowers. Examples are guava, cucumber, bittergourd, ray floret of sunflower.

133. Answer (1)

Hint: One of the living elements of phloem is absent in most of the monocotyledons.

Sol.: Phloem parenchyma is absent in most of the monocotyledons. The cell of phloem parenchyma have dense cytoplasm and prominent nucleus.

134. Answer (3)

Hint: The spores formed in mosses are haploid.

Sol.: In mosses, the spores on liberation germinate into a creeping, green, branched and frequently filamentous stage called protonema.

135. Answer (3)

Hint: During cell cycle, DNA replication occurs in the synthesis phase.

Sol.: 'S' phase or synthesis phase is a phase in which synthesis or replication of DNA takes place.

SECTION - B

136. Answer (3)

Hint: In C_4 pathway of photosynthesis, the primary CO_2 acceptor is a three carbon compound.

Sol.: Two extra ATP molecules are consumed to fix one molecule of CO_2 in C_4 pathway of photosynthesis as compared to C_3. This process occurs in mesophyll cells. Thus, per CO_2 5 ATP molecules are consumed in C_4. So, we can say that C_4 plants use 30 ATP molecules to fix 6 carbons in the form of glucose.

137. Answer (2)

Hint: The direct synthesis of ATP from metabolites is called substrate level phosphorylation.

Sol.: From one molecule of glucose, 4 ATP are formed during glycolysis and 2 ATP are formed during Krebs cycle.

138. Answer (1)

Hint: In geometrical growth, three phases can be observed. The initial phase is lag phase then the exponential phase and at the final stage there is stationary phase.

Sol.: In geometrical growth of organisms, stationary phase occurs due to the shortage of space, food and accumulation of toxins.

139. Answer (2)

Hint: In the acrocentric chromosome, the centromere is present very close to one end of the chromosome.

Sol.: In both the chromosomes A and B, the centromere is present slightly away from the centre. Therefore, both of them are sub-metacentric chromosomes.

140. Answer (4)

Hint: During zygotene, the homologous chromosomes come to lie side by side in pairs and this pairing is called synapsis.

Sol.: In diplotene stage, the synaptonemal complex formed during zygotene dissolves.

The recombination of genetic material that occurs during pachytene is mediated by the enzyme recombinase.

141. Answer (3)

Hint: Plants belong to family Solanaceae are dicots.

Sol.: Dicotyledonae, Angiospermae and Solanaceae are the class, division and family of genus *Solanum*.

Poales is an order of class Monocotyledonae.

142. Answer (4)

Hint: Protozoans lack cell wall and they do not form zoospores.

Sol.: Protozoans are the members of Protista. Therefore, all protozoans are unicellular, whereas except a few fungi, all are multicellular. Both protozoans and fungi are heterotrophs.

143. Answer (1)

Hint: In China rose, stamens are united in a single bundle and ovary has axile placentation.

Sol.: In China rose, alternate phyllotaxy is present, *i.e.*, single leaf is present at each node in an alternate fashion.

144. Answer (2)

Hint: In dicot leaves, mesophyll is differentiated.

Sol.: In dicot plants, leaves are dorsiventral. In these leaves mesophyll is differentiated into palisade and spongy parenchyma.

145. Answer (2)

Hint: Cones or strobili are the structures that produce spores.

Sol.: In some pteridophytes like *Selaginella* and *Equisetum* and in gymnosperms, the compact structures of sporophylls that are strobili or cones are formed.

146. Answer (4)

Hint: Bulliform cells help in the rolling of leaves inwards to minimise water loss.

Sol.: Bulliform cells are present on the adaxial surface of leaves of grasses.

147. Answer (3)

Hint: Granum is absent in leucoplasts. Unicellular organisms can be prokaryotes or eukaryotes.

Sol.: Eukaryotic flagella have microtubules but prokaryotic flagella do not.

148. Answer (1)

Hint: Meiosis reduces the chromosome number to half in the gametes and thus due to fertilization the diploid number is restored.

Sol.: Mitosis produces new cells for healing the wounds and for regeneration. Meiosis provides a chance for the formation of new combinations of chromosomes. This brings out variations.

149. Answer (3)

Hint: Photorespiration involves chloroplast, peroxisome and mitochondria.

Sol.: Photorespiration is a wasteful process. It does not produce ATP or NADPH.

150. Answer (4)

Hint: Cytochrome *c* transfers electrons between complex III and IV.

Sol.: Cytochrome *c* is a small protein attached to the outer surface of the inner membrane of mitochondria.

[ZOOLOGY]

SECTION - A

151. Answer (3)

Hint: Limbs without webs in between digits

Sol.: In frogs, the forelimbs and hind limbs help in swimming, walking, leaping and burrowing. Forelimbs have four digits while hind limbs have five digits in both male and female frogs. Frogs exhibit sexual dimorphism. Male frogs can be distinguished by the presence of sound producing vocal sacs and also a copulatory pad on the first digit of the fore limbs which are absent in female frogs.

152. Answer (3)

Hint: Hollow woollen ball like structure

Sol.: Primary structure of proteins gives us the sequence of amino acids and their positional information.

Secondary structure of proteins is in the folded form. Eg.: α-helix and β-pleated sheet.

Tertiary structure of protein is the one where the long protein chain is folded upon itself like a hollow woollen ball.

Quaternary structure is formed when a protein has more than one subunits (individual polypeptide chains of a quaternary protein are called subunits) or polypeptide chains and each polypeptide has a primary, secondary or tertiary structure of its own.

153. Answer (4)

Hint: Second largest animal phylum

Sol.: Phylum Mollusca is the second largest phylum of animal kingdom.

Body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump. The anterior head region has sensory tentacles. The mouth contains a file-like rasping organ for feeding, called radula.

154. Answer (2)

Hint: Renin angiotensin aldosterone system

Sol.: Aldosterone is a mineralocorticoid secreted by the cortex region of adrenal gland. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule.

An increase in blood flow to the atria of the heart can cause the release of Atrial Natriuretic Factor. ANF causes vasodilation (dilation of blood vessels).

155. Answer (2)

Hint: Erythrocytes, leucocytes and platelets are collectively called formed elements.

Sol.: Platelets are also called thrombocytes. They are cell fragments produced from megakaryocytes. They release a variety of substances most of which are involved in the coagulation or clotting of blood.

156. Answer (3)

Hint: Adrenaline is an amino acid derivative hormone.

Sol.: Glucagon, insulin, thymosin, parathyroid hormone, erythropoietin, gastrin, secretin, *etc*., are peptide hormones.

Cortisol, testosterone, estradiol and progesterone are steroid hormones.

157. Answer (1)

Hint: True ribs are vertebrosternal ribs.

Sol.: True ribs (vertebrosternal ribs) – 1^{st} to 7^{th} pairs.

False ribs (vertebrochondral ribs) – 8^{th}, 9^{th} and 10^{th} pairs

Floating ribs (vertebral ribs) – 11^{th} and 12^{th} pairs

158. Answer (2)

Hint: Vital capacity + Residual volume

Sol.: Total Lung Capacity (TLC) is the total volume of the air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

Functional residual capacity includes ERV and RV.

159. Answer (3)

Hint: Presence of glucose in urine is glycosuria

Sol.: Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure.

Presence of ketone bodies in urine is known as ketonuria.

Presence of proteins in urine is known as proteinuria.

160. Answer (3)

Hint: First heart sound is the lub sound

Sol.: The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves.

These sounds are of clinical diagnostic significance.

161. Answer (1)

Hint: Structures present in kidney and transport sperms

Sol.: Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally, it communicates with the urinogenital duct that comes out of the kidneys and opens into the cloaca.

162. Answer (4)

Hint: Stunted growth

Sol.: Over-secretion of GH stimulates abnormal growth of the body leading to gigantism.

Low secretion of GH results in stunted growth further resulting in pituitary dwarfism.

Excess secretion of growth hormone in adults especially in middle age can result in severe disfigurement called acromegaly.

Hypothyroidism during pregnancy causes defective development and maturation of the growing baby leading to stunted growth called cretinism.

163. Answer (3)

Hint: Gap junction connects cytoplasm of adjacent cells.

Sol.: Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep the neighbouring cells together. Neuromuscular junctions are present between a neuron and muscle.

164. Answer (4)

Hint: Osteichthyes

Sol.: *Hippocampus* is sea horse and it is a bony fish.

Common name of *Balaenoptera* is blue whale.

165. Answer (1)

Hint: Heart beats 70-75 times in a minute.

Sol.: Sino-atrial node and atrio-ventricular node are nodal tissues of the heart.

The nodal musculature has the ability to generate action potentials without any external stimuli, *i.e.*, it is autoexcitable.

SAN can generate maximum number of action potentials and is responsible for initiating and maintaining the rhythmic contractile activity of the heart. So, it is considered as pacemaker of the heart.

166. Answer (1)

Hint: Cortical pertains to the cortex region

Sol.: Differences between cortical nephrons and juxtamedullary nephrons are as follows:

	Cortical nephrons	**Juxtamedullary nephrons**
1.	Present in majority	Not in majority
2.	Very short Henle's loop	Very long Henle's loop
3.	Extend very little into the medulla	Run deep into the medulla
4.	Vasa recta absent or highly reduced	Vasa recta prominent

167. Answer (1)

Hint: Ion which is more in intracellular fluid

Sol.: The ionic gradients across the resting membrane are maintained by the active transport of ions by the sodium-potassium pump.

When a stimulus is applied at a site, then that site becomes freely permeable to Na^+ leading to reversal of polarity at that site.

168. Answer (2)

Hint: Cockroach shows bilateral symmetry.

Sol.: When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry.

Coelenterates, ctenophores and adult echinoderms have this kind of symmetry.

169. Answer (4)

Hint: First child is Rh +ve

Sol.: A special case of Rh incompatibility has been observed between Rh –ve blood of a pregnant mother with Rh +ve blood of the foetus.

Rh antigens of the foetus do not get exposed to the Rh -ve blood of the mother in the first pregnancy as the two bloods are well separated by the placenta.

However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to small amounts of the Rh +ve blood from the foetus. In such cases, the mother starts preparing antibodies against Rh antigen in her blood.

170. Answer (2)

Hint: Neurons show excitability.

Sol.: Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

Neurons, the unit of neural system are excitable cells.

Neuroglia make up more than one half the volume of neural tissue in our body.

171. Answer (3)

Hint: Co-factors play a crucial role.

Sol.: Co-factors are non-protein constituents bound to the enzyme to make the enzyme catalytically active.

Catalytic activity is lost when the co-factor is removed from the enzyme.

172. Answer (4)

Hint: Disease of the arteries

Sol.: Angina pectoris is acute chest pain. Hypertension is also known as high blood pressure.

Myocardial infarction is also called heart attack.

173. Answer (2)

Hint: Most abundant tissue of the body

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

Fibroblasts are the cells that secrete fibres and also modified polysaccharides.

These polysaccharides accumulate between cells and fibres and act as matrix (ground substance).

Conductivity is shown by neurons and muscle fibres.

Muscle fibres also show contractility.

174. Answer (4)

Hint: Think about basement membrane

Sol.: At the tissue site where pCO_2 is high due to catabolism, CO_2 diffuses into RBCs and forms HCO_3^- and H^+ in presence of enzyme carbonic anhydrase. Diffusion membrane is formed by two cellular layers and an acellular basement membrane in between them.

175. Answer (2)

Hint: They are nodes

Sol.: The cell body of a neuron contains cytoplasm with typical cell organelles and certain granular bodies called Nissl's granules.

The gaps between two adjacent myelin sheaths are called nodes of Ranvier.

The axon terminals of a neuron end in bulb-like structures called synaptic knobs.

176. Answer (1)

Hint: First and second cervical vertebra

Sol.: Pivot joint is present between atlas and axis.

Gliding joint is present between the carpals. Saddle joint is present between carpal and metacarpal of thumb.

Knee joint is a hinge joint.

177. Answer (4)

Hint: Product of anaerobic respiration in animals

Sol.: Organs like lungs, liver and skin also help in the elimination of excretory wastes.

Sebaceous glands are present in the skin and they eliminate substances like sterols, hydrocarbons and waxes through sebum.

Sweat produced by the sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid *etc*.

178. Answer (4)

Hint: Less than 4

Sol.: The skull is composed of cranial bones, facial bones, hyoid bone and ear ossicles.

Cranial bones

Paired – Parietal, temporal

Unpaired – Frontal, occipital, sphenoid, ethmoid

Facial bones

Paired : Zygomatic, lacrimal, maxilla, nasal, inferior nasal conchae, palatine

Unpaired : Mandible, vomer

Ear ossicles are paired bones and they include malleus, incus and stapes.

A single U-shaped bone called hyoid is present at the base of buccal cavity.

179. Answer (1)

Hint: Members of class Osteichthyes have air bladder.

Sol.: Super class Pisces is further classified into class Chondrichthyes and class Osteichthyes.

Members of class Chondrichthyes do not have air bladder and hence have to swim constantly.

Members of class Osteichthyes on the other hand have air bladder, which regulates buoyancy.

180. Answer (3)

Hint: Protochordates are invertebrates.

Sol.: Phylum Chordata is divided into three sub-phyla : Urochordata or Tunicata, Cephalochordata and Vertebrata.

Sub-phyla Urochordata and Cephalochordata are often referred to as protochordates.

181. Answer (2)

Hint: It is a reptile.

Sol.: Generally reptiles have a three chambered heart and show incomplete double circulation.

Crocodilus is an exception. It has 4-chambered heart and show double circulation.

182. Answer (4)

Hint: Bones of hand

Sol.: Micturition is urination.

Piloerection is raising of hair (goosebumps).

Tetany is a skeletal disorder caused due to low calcium in body fluid.

Tetanus is caused due to the bacterium *Clostridium tetani*.

Metacarpals are commonly called palm bones.

Coagulation is clotting of blood.

Breathing is pulmonary ventilation.

183. Answer (2)

Hint: Zona glomerulosa is the outermost layer

Sol.: Adrenal cortex can be divided into three layers:

- Zona glomerulosa (outer layer)
- Zona fasciculata (middle layer)
- Zona reticularis (inner layer)

184. Answer (3)

Hint: Function of cerebrum

Sol.: Hypothalamus is the part of the forebrain.

The hypothalamus contains a number of centres, which control body temperature, urge for eating and drinking. It also contains several groups of neurosecretory cells, which secrete hormones called hypothalamic hormones.

185. Answer (1)

Hint: Part of HMM

Sol.: Each myosin (thick) filament is a polymerised protein.

The globular head and short arm of each meromyosin is known as heavy meromyosin. (HMM).

The globular head is an active ATPase enzyme and has binding sites for ATP and active sites for actin.

SECTION - B

186. Answer (2)

Hint: Low H^+ concentration means high pH.

Sol.: Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2, partial pressure of CO_2, hydrogen ion concentration and temperature.

Factors which are favourable for the formation of oxyhaemoglobin are

i. High pO_2
ii. Low pCO_2
iii. Low H^+ concentration
iv. Low temperature
v. High pH

187. Answer (3)

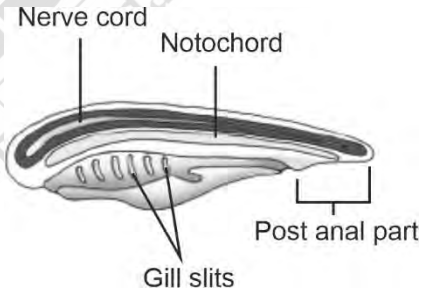
Hint: Atrio-ventricular septum is formed by connective tissue.

Sol.: A thin, muscular wall called the inter-atrial septum separates the right and left atria, whereas the left and the right ventricles are separated by atrio-ventricular septum which is formed by thick fibrous connective tissue.

188. Answer (2)

Hint: 'A' is present in chordates'

Sol.:



189. Answer (1)

Hint: Leydig cells are present in the testes.

Sol.: The Leydig cells or interstitial cells which are present in the intertubular spaces produce a group of hormones called androgens mainly testosterone.

Small amounts of androgenic steroids are also secreted by the adrenal cortex which play a role in the growth of axial hair, pubic hair and facial hair during puberty.

190. Answer (1)

Hint: Gout is a type of arthritis.

Sol.: Myasthenia gravis is an auto-immune disorder affecting neuromuscular junction. Muscular dystrophy is a progressive degeneration of skeletal muscle mostly due to genetic disorder. Gout is inflammation of joints due to accumulation of uric acid crystals.

191. Answer (1)

Hint: Tuft of capillaries is its part

Sol.: Each nephron has two parts – the glomerulus and the renal tubule.

Glomerulus is a tuft of capillaries formed by the afferent arteriole.

The renal tubule consists of Bowman's capsule, PCT, loop of Henle and DCT.

192. Answer (4)

Hint: Occupational respiratory disorder

Sol.: In industries like grinding or stone-breaking, so much dust is produced that the defence mechanism of the body cannot fully cope with the situation.

Long exposure can give rise to inflammation leading to fibrosis and thus causing serious lung disorders, like, silicosis, asbestosis, *etc*.

193. Answer (3)

Hint: Formation of glycogen

Sol.: Cortisol is responsible for lipolysis, proteolysis and gluconeogenesis but not for glycogenesis.

194. Answer (3)

Hint: Polypeptide

Sol.: GLUT-4 is a protein that enables glucose transport into cells.

195. Answer (1)

Hint: Steroid hormone

Sol.: Steroid hormones and iodothyronines are lipophilic, hence, can cross the cell membrane and interact with intracellular receptors. They do not need to generate second messengers.

Glucagon, FSH and GnRH have membrane bound receptors. They do not enter the target cell but generate second messengers.

196. Answer (1)

Hint: 1st class of enzymes

Sol.: Enzymes are divided into six classes each with 4-13 subclasses and named accordingly by a four-digit number.

Oxidoreductases/Dehydrogenases : Enzymes which catalyse oxidoreduction between two substrates S and S′.

Transferases: Enzymes catalysing a transfer of a group, G (other than hydrogen) between a pair of substrate S and S′ *e.g.*,

$$S - G + S' \longrightarrow S + S' - G$$

Hydrolases: Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C–C, C–halide or P–N bonds.

Lyases: Enzymes that catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

$$\begin{array}{cc} X & Y \\ | & | \\ C & - C \end{array} \longrightarrow X - Y + C = C$$

197. Answer (3)

Hint: Malpighian tubules

Sol.: A ring of 6-8 blind tubules called hepatic or gastric caeca is present at the junction of foregut and midgut, which secrete digestive juice.

At the junction of midgut and hindgut is present 100-150 yellow coloured thin filamentous structures called Malpighian tubules.

198. Answer (4)

Hint: Open circulation

Sol.: Cockroaches have an open type of circulatory system as the blood vessels are poorly developed.

Visceral organs located in the haemocoel are bathed in blood (haemolymph).

Heart of cockroach consists of an elongated muscular tube lying along the mid dorsal line of thorax and abdomen.

Blood from sinuses enters the heart through ostia and is pumped anteriorly to sinuses again.

199. Answer (2)

Hint: Low dopamine levels cause Parkinson's disease

Sol.: Alzheimer's is caused due to low levels of acetylcholine, a neurotransmitter which is essential for processing memory and learning.

200. Answer (3)

Hint: Anticoagulant secreted by leech

Sol.: Heparin is an anticoagulant.

Heparin is secreted by basophils and mast cells.

During haemodialysis, blood drained from a convenient artery is pumped into a dialysing unit after adding an anticoagulant like heparin.

Hirudin is an anticoagulant secreted by blood sucking leech (*Hirudinaria*).

❑ ❑ ❑

All India Aakash Test Series for NEET-2025

TEST - 7 (Code-D)

Click Here for Code-C Sol.

Test Date : 24/03/2024

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

SECTION - A

1. Answer (4)

Hint: Beat frequency = $f_1 - f_2$

Sol.: Here, $8 = 512 - f \Rightarrow f = 504$ Hz

or, $8 = f - 512 \Rightarrow f = 520$ Hz

2. Answer (3)

Hint & Sol.: Electric charge is a derived quantity.

3. Answer (3)

Hint & Sol.: Viscous drag $F = -6\pi\eta rv$

4. Answer (4)

Hint: Use $W = nRT \ln\left[\frac{V_f}{V_i}\right]$

Sol.: $W = (0.1)(2)300\left[\ln\left[\frac{2V}{V}\right]\right]$

$W = 60\ln(2) \approx 42$ cal

5. Answer (1)

Hint: Acceleration due to gravity

$g' = g_p - R_e\omega^2\cos^2\lambda$

Sol.: $g' = g_p - R_e\omega^2\left(\frac{1}{2}\right)^2$

$g' = g_p - \frac{R_e\omega^2}{4}$

6. Answer (4)

Hint & Sol.: The average translational kinetic energy of monatomic gas molecule at temperature T is $\frac{3}{2}K_BT$.

7. Answer (1)

Hint: Exponential powers are dimensionless

Sol.: $[A] = [a]$

$\therefore\ [a] = [M^0LT^0]$

$[ct]$ = dimensionless

$\therefore\ [c] = [T^{-1}]$

$\therefore\ [ac] = [LT^{-1}] \rightarrow$ Speed

8. Answer (3)

Hint: Particle reaches the maximum height at, $t = 5$ second.

Sol.: Distance travelled in 5th second = Distance travelled in 6th second

Distance travelled in last second of Ascent = Distance travelled in 1st second of descent

$\therefore\ t = \frac{u}{g}$

$5 = \frac{u}{9.8} \Rightarrow u = 49$ m/s

9. Answer (4)

Hint: Instantaneous acceleration $a = v\frac{dv}{dx}$

Sol.: Thus, when $v = 0$

$a = 0$

10. Answer (1)

Hint & Sol.: When the system is moving at constant velocity then $\vec{a} = 0$ and thus $\vec{F}_{net} = 0$

11. Answer (2)

Hint: $\frac{\Delta t}{t} = \frac{1}{2}\alpha\Delta\theta$

Sol.: $\frac{5}{t} = \frac{1}{2}\alpha(\theta - 15)$ .... (i)

$\frac{10}{t} = \frac{1}{2}\alpha(30 - \theta)$ .... (ii)

Dividing (i) and (ii), we get

$\frac{1}{2} = \frac{\theta - 15}{30 - \theta} \Rightarrow \theta = 20°C$

12. Answer (2)

Hint: For a process having equation of state as PV^x = Constant

Work done $W = \frac{nR\Delta T}{1 - x}$

Sol.: Here,

$\frac{P}{\sqrt{V}}$ = Constant

$\Rightarrow PV^{-\frac{1}{2}}$ = Constant

Now,

$W = \frac{nR\Delta T}{1 - x} = R\left[\frac{30}{1 - \left(-\frac{1}{2}\right)}\right]$

$W = 20R$

13. Answer (4)

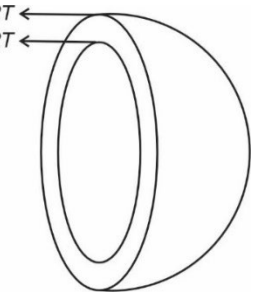
Hint: Thermal current $\frac{Q}{t} = \frac{kA\Delta T}{x}$

Sol.: $\frac{\left(\frac{Q}{t}\right)_1}{\left(\frac{Q}{t}\right)_2} = \frac{\left(\frac{A}{x}\right)_1}{\left(\frac{A}{x}\right)_2} = \frac{A_1x_2}{A_2x_1}$

$= \frac{1}{4}\times\frac{1}{2} = \frac{1}{8}$

14. Answer (2)

Hint:



Sol.: Force due to surface tension on one half $= 4\pi RT$

15. Answer (1)

Hint & Sol.:

$\because \quad \sum F_{ext} = 0$

$\therefore a_{com} = 0$

As, initial $u_{com} = 0$

$\therefore$ final $v_{com} = 0$

16. Answer (4)

Hint: Use principle of superposition of waves

Sol.: Resultant amplitude

$A = \sqrt{a^2 + a^2 + 2a^2\cos 90^\circ}$

$\therefore A = a\sqrt{2}$

17. Answer (2)

Hint: $v_P = \frac{dy}{dt}$, $\therefore v_P = 2\pi f\, y_0 \cos 2\pi\left[ft - \frac{x}{\lambda}\right]$

Sol.: Maximum particle velocity

$\therefore v_{max} = 2\pi f\, y_0$

Now, according to question

$v_{max} = 4v$

$2\pi f\, y_0 = 4(f\lambda)$

Hence, $\lambda = \frac{\pi y_0}{2}$

18. Answer (2)

Hint: Impulse, $\vec{J} = m\left(\vec{v_f} - \vec{v_i}\right)$

Sol.: Here,

$\vec{J} = m\left[(-v\cos 30^\circ\hat{i} + v\sin 30^\circ\hat{j}) - (v\cos 30^\circ\hat{i} + v\sin 30^\circ\hat{j})\right]$

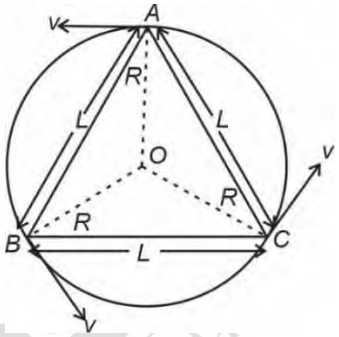
$\therefore \left|\vec{J}\right| = 2mv\cos 30^\circ$

$= 2(1)(100)\left(\frac{\sqrt{3}}{2}\right)$

$\therefore \left|\vec{J}\right| = 100\sqrt{3}$ N s

19. Answer (3)

Hint:



$\frac{L}{\sqrt{3}} = R$

$\therefore L = R\sqrt{3}$

Sol.: We know,

Centripetal force = Gravitational force

$\frac{Mv^2}{R} = 2\frac{GM^2}{L^2}(\cos 30^\circ)$

$\frac{Mv^2}{R} = \frac{2GM^2}{\left(R\sqrt{3}\right)^2}\left(\frac{\sqrt{3}}{2}\right)$

$v^2 = \frac{GM}{\left(R\sqrt{3}\right)}$

$\therefore v = \sqrt{\frac{GM}{R\sqrt{3}}}$

20. Answer (1)

Hint: $\vec{L} = \vec{r} \times \vec{p}$

Sol.: The perpendicular distance of line of motion of linear momentum remains constant hence the angular momentum remains constant.

21. Answer (2)

Hint & Sol.: $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$

$A^2 + B^2 + 2AB\cos\theta = A^2 + B^2 - 2AB\cos\theta$

$4AB\cos\theta = 0$

$\therefore \cos\theta = 0$

$\therefore \theta = 90°$

22. Answer (2)

Hint: $(f_s)_{max} = (\mu_s)\, N$

Sol.: $(f_s)_{max} = (0.5)\,(20) = 10$ N

Thus 20 N will make the block slide

Now, $a = \dfrac{F-f}{m} = \dfrac{20-(0.5)(20)}{2}$

$a = 5$ m/s^2

23. Answer (1)

Hint & Sol.: In case of pure rolling

$v_{TOP} = 2v_{COM}$

$\therefore \quad \dfrac{V_{TOP}}{V_{COM}} = \dfrac{2}{1}$

24. Answer (1)

Hint: $\Delta\phi = \dfrac{2\pi}{\lambda}(\Delta x)$

Sol.: $K = \dfrac{2\pi}{\lambda} = \dfrac{\pi}{15}$

$\therefore \quad \lambda = 30$ cm

Now, $\Delta\phi = \dfrac{2\pi}{30}(16-13)$

$\Delta\phi = \dfrac{2\pi}{10} = \dfrac{\pi}{5}$

25. Answer (3)

Hint: Area under $a - t$ graph gives change in velocity

Sol.: We know,

$v_f - v_i = \dfrac{1}{2}(4)(4)$

$v_f = 8 + 5 \qquad [\because v_i = 5$ m/s$]$

$v_f = 13$ m/s

26. Answer (1)

Hint & Sol.: Since the particle is moving with constant speed hence there would be only centripetal acceleration which will only change in direction and magnitude will remain fixed.

27. Answer (3)

Hint: Process CA is an isobaric process

Sol.: $W = P\Delta V = 5 \times 4 = 20$ J

28. Answer (3)

Hint: At lowest point

$T - mg = \dfrac{mv^2}{R}$

Sol.: $T - mg = \dfrac{mv^2}{R}$

$T = mg + \dfrac{mv^2}{R}$

$= \dfrac{1}{2}\times 10 + \dfrac{1}{2}\times\dfrac{8^2}{1}$

$= 5 + 32 = 37$ N

29. Answer (4)

Hint: Addition of two perpendicular SHM has amplitude $A = \sqrt{A_1^2 + A_2^2}$

Sol.: $y = 5(\sin(3\pi t) + \sqrt{3}\cos 3\pi t)$

can be written as

$y = 10\sin\left(3\pi t + \dfrac{\pi}{3}\right)$

$\therefore$ Amplitude $A = 10$ cm

and $T = \dfrac{2\pi}{\omega} = \dfrac{2\pi}{3\pi} = \dfrac{2}{3}$ second

30. Answer (1)

Hint : Standard equation of a Harmonic wave is

$y = A\sin(\omega t - kx) \rightarrow$ for (+)ve x-axis

$y = A\sin(\omega t + kx) \rightarrow$ for (–)ve x-axis

Sol.: In $y = 10^{-3}\sin(50t + 2x)$

$v = \dfrac{\omega}{k} = \dfrac{50}{2} = 25$ m/s

31. Answer (1)

Hint: According to principle of calorimetry, in an isolated system.

Heat lost = Heat gained

Sol.: $(100)\,(C_A)\,[100-90] = (50)\,(C_B)\,(90-75)$

$2\,C_A = 1.5\,C_B \Rightarrow C_A = \dfrac{3}{4}C_B$

Now, $(100)\,C_A\,(100-\theta) = (50)\,(C_B)\,(\theta - 50)$

$2\times\dfrac{3}{4}(100-\theta) = (\theta - 50)$

$\therefore \quad \theta = 80°C$

32. Answer (4)

Hint: Area of F– t graph = Impulse or change in momentum

Sol.: $m(v_f - v_i)$ = Area of $F - t$ curve

$$m(u-0) = \frac{\pi(f_0 T)}{2}$$

$$\therefore u = \frac{\pi(f_0 T)}{2m}$$

33. Answer (4)

Hint: Centripetal force is always perpendicular to velocity while tangential force is along or opposite to the velocity.

Sol.: Since, a_t is changing with time therefore a_c will also keep changing with time.

Also, $P = \vec{F} \cdot \vec{v}$.

For centripetal force $P = (F)(v)\cos 90° = 0$

34. Answer (4)

Hint: $E = \frac{1}{2}KA^2$

Sol.: K.E $= \frac{1}{2}K\left[A^2 - \frac{3A^2}{4}\right]$

K.E $= \frac{1}{2}K\left[\frac{A^2}{4}\right]$

$\therefore$ K.E $= \frac{E}{4}$

35. Answer (2)

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

Sol.: After removing 800 g

$$3 = 2\pi\sqrt{\frac{900}{K}} \quad \ldots (i)$$

Now, after removing 500 g

$$T = 2\pi\sqrt{\frac{1200}{K}} \quad \ldots (ii)$$

Dividing (i) and (ii)

We get, $T = 2\sqrt{3}$ seconds

SECTION - B

36. Answer (2)

Hint: $Y = \frac{Fl}{Ax}$

$\therefore F = \left(\frac{YA}{l}\right)x = kx$

Sol.: Let 'L' be natural length of string

Now,

$8 = k(x - L)$ ……(i)

$10 = k(y - L)$ ……(ii)

$18 = k(z - L)$ ……(iii)

Solving above equations, we get

$z = 5y - 4x$

37. Answer (1)

Hint: $PV = nRT$

Sol.: $n = \frac{7}{28}$

$\therefore PV = \frac{1}{4}RT$

38. Answer (3)

Hint: Potential Energy $U = \frac{1}{2}kx^2$

Kinetic Energy $K = \frac{1}{2}k(A^2 - x^2)$

Sol.: Here, $U = K$

$\therefore \quad \frac{1}{2}kx^2 = \frac{1}{2}kA^2 - \frac{1}{2}kx^2$

$2kx^2 = kA^2$

$\therefore \quad x = \pm\frac{A}{\sqrt{2}}$

39. Answer (2)

Hint: At highest point velocity is equal to horizontal component of initial velocity.

Sol.: $(K.E)_i = \frac{1}{2}mu^2 = K$

$(KE)_f = \frac{(KE)i}{2}$

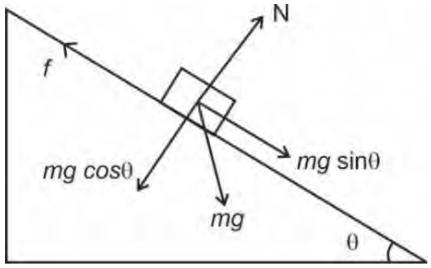
$\frac{1}{2}mv^2 = \frac{1}{2}\left[\frac{1}{2}mu^2\right]$

$v = \frac{u}{\sqrt{2}} = u\cos 45°$

$\therefore$ at highest point.

40. Answer (2)

Hint:



In absence of friction

$a = g\sin\theta$

In presence of friction

$a' = g\sin\theta - \mu g\cos\theta$

Sol.: According to question

$t' = 2t$

$$\sqrt{\frac{2s}{a'}} = 2\sqrt{\frac{2s}{a}}$$

$$\therefore \sqrt{\frac{2s}{\frac{g}{\sqrt{2}} - \frac{\mu g}{\sqrt{2}}}} = 2\sqrt{\frac{2s}{\frac{g}{\sqrt{2}}}}$$

$$\therefore \mu = \frac{3}{4} = 0.75$$

41. Answer (2)

Hint: Use equations of uniformly accelerated motion

Sol.: Here, $h = \frac{1}{2}gt^2$ $[\because u = 0]$

And $40 = \frac{1}{2}gt^2 - \frac{1}{2}g(t-2)^2$

$40 = \frac{1}{2}g[t^2 - t^2 + 4t - 4]$

$40 = 5(4t - 4)$

$40 = 20t - 20$

$\therefore t = 3$ s

Now, $h = \frac{1}{2}(10)(3)^2 = 45$ m

42. Answer (3)

Hint: Velocity of oscillating particle on wave is given by $v_p = -v$(slope)

Sol.: At '*B*' slope is negative

$\therefore$ Particle velocity will be along $+Y$ axis

While velocity of particle need not to be necessarily along the velocity of wave.

43. Answer (2)

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

Sol.: Here, $\lambda = \frac{v}{f} = \frac{1}{f}\sqrt{\frac{T}{\mu}}$

$$\lambda = \frac{1}{80}\sqrt{\frac{8}{0.005}} = \frac{1}{80}\sqrt{\frac{8000}{5}}$$

$$\lambda = \frac{40}{80}\text{ m} = 0.5\text{ m}$$

Thus, separation between successive nodes $= \frac{\lambda}{2}$

$= 25$ cm

44. Answer (1)

Hint: Heat flow rate, $\frac{dQ}{dt} = \frac{kA\Delta T}{l}$

Sol.: Energy flux $\phi = \frac{1}{A}\left(\frac{dQ}{dt}\right) = \frac{k\Delta T}{l}$

$$\therefore \phi = \frac{(0.1)(1273 - 373)}{1}$$

$\therefore \phi = 90$ W/m^2

45. Answer (4)

Hint: If position vector varies with time as $\vec{r} = (a\cos\omega t)\hat{i} + (a\sin\omega t)\hat{j}$ then particle is in circular motion.

Sol.: In circular motion, velocity of a particle is always perpendicular to its position vector.

46. Answer (1)

Hint: Work – Energy theorem

Sol.: Work done by gravity = Change in (K.E)

$$mg\frac{l}{2}\sin 30^\circ = \frac{1}{2}I\omega^2$$

$$\frac{mgl}{4} = \frac{1}{2}\frac{ml^2}{3}\omega^2$$

$$\omega = \sqrt{\frac{3g}{2l}}$$

$\omega = \sqrt{30}$ rad s^{-1}

47. Answer (2)

Hint: Work done = Δ K.E [Work Energy Theorem]

Sol.: $v = \frac{dx}{dt}$, $\therefore [v = 6t]$

Now, $W = \frac{1}{2} m (v_f^2 - v_i^2)$

$= \frac{1}{2} (2) [36t^2 - 0]$

$= 36 (5)^2 = 900$ J

48. Answer (3)

Hint & Sol.: Since, $dU = 0 \Rightarrow T$ = constant, as internal energy is a function of temperature for an ideal gas.

49. Answer (2)

Hint & Sol.: $\vec{A} \times \vec{B} = AB \sin\theta \hat{n}$

For parallel vectors $\theta = 0°$

$\therefore \quad \vec{A} \times \vec{B} = 0$

50. Answer (1)

Hint: For a closed vessel

$Q = nC_v \Delta T$

Sol.: $Q = n\left(\frac{fR}{2}\right)(\Delta T)$

$Q = \left(\frac{14}{28}\right)\left(\frac{5R}{2}\right)(4T - T) \qquad [T \propto v^2]$

$Q = \frac{1}{2} \times \frac{5}{2} \times \frac{25}{3} \times 900$

$Q = 9375$ J

[CHEMISTRY]

SECTION - A

51. Answer (2)

Hint: Number of atoms

= number of moles × atomicity × N_A

Sol.: Number of atoms in 4.4 g CO_2

$= \frac{4.4}{44} \times N_A \times 3 = 0.3\ N_A$

Number of atoms in 3.4 g NH_3

$= \frac{3.4}{17} \times N_A \times 4 = 0.8\ N_A$

Number of atoms in 1.6 g CH_4

$= \frac{1.6}{16} \times N_A \times 5 = 0.5\ N_A$

Number of atoms in 3.2 g SO_2

$= \frac{3.2}{64} \times N_A \times 3 = 0.15\ N_A$

52. Answer (2)

Hint: In a neutral atom number of protons and electrons are equal.

Sol.: Number of protons = number of electrons = Z = 6

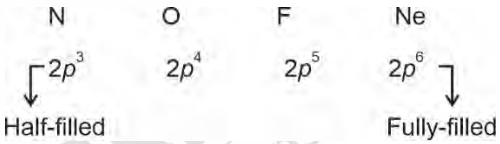
Number of neutrons = A – Z = 13 – 6 = 7

So, ratio will be 7 : 6 : 6

53. Answer (3)

Hint: High ionisation energy is required to remove electron from half-filled and fully filled configuration.

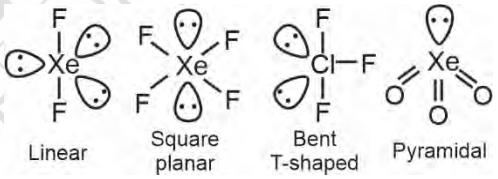
Sol.: order of IE_1 : Ne > F > N > O



54. Answer (4)

Hint: For trigonal bipyramidal geometry lone pair occupy equatorial position.

Sol.:



55. Answer (3)

Hint: Reactant that gets completely consumed in reaction is limiting reagent and it decides the yield of product.

Sol.: $\underset{2\text{ g}}{2H_2} + \underset{8\text{ g}}{O_2} \rightarrow 2H_2O$

1 mol 0.25 mol

Here O_2 is the limiting reagent

1 mol O_2 gives $\rightarrow$ 2 mol H_2O

0.25 mol O_2 will give $\rightarrow$ 0.5 mol H_2O

= 9 g H_2O

56. Answer (2)

Hint: According to the first law of thermodynamics. $\Delta U = q + W$

Sol.: Work done = –150 kJ as it is done by the gas

$\Rightarrow \quad \Delta U = q + W$

$\Rightarrow \quad \Delta U = 100 - 150 = -50$ kJ

57. Answer (2)

Hint: Cationic hydrolysis gives H^+ ions in the solution while anionic hydrolysis gives OH^- ions.

Sol.: *e.g.* $NH_4^+ + H_2O \rightleftharpoons NH_4OH + H^+$

$FeCl_3$	NH_4Cl	Na_2CO_3	NaCl
WBSA	WBSA	SBWA	SBSA
(Acidic)	(Acidic)	(Basic)	(Neutral)

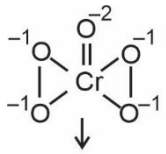
58. Answer (4)

Hint & Sol.: Endothermic reactions are favoured at high temperature and exothermic reactions are favoured at low temperature.

59. Answer (1)

Hint: CrO_5 has two peroxy linkage

Sol.:



O.S of Cr = +6

$MnO_4^- \rightarrow x + 4(-2) = -1 \Rightarrow x = +7$

$ClO_4^- \rightarrow x + 4(-2) = -1 \Rightarrow x = +7$

$H_3PO_4 \rightarrow 3(1) + x + 4(-2) = 0 \Rightarrow x = +5$

60. Answer (1)

Hint: Formal charge is calculated by considering the bond to be covalent

Sol.: Formal charge helps to select the lowest energy structure.

61. Answer (1)

Hint: Reducing agent is capable of reducing other substances by donating electrons.

Sol.: $H_2SO_4 \rightarrow 2(1) + x + 4(-2) = 0 \Rightarrow x = +6$

As sulphur is in +6 oxidation state which is maximum, further loss of electrons is not possible. So, it can't act as a reducing agent.

62. Answer (2)

Hint: If the reaction is reversed its equilibrium constant gets inversed.

Sol.: $N_2 + 3H_2 \rightleftharpoons 2NH_3$; K

$2NH_3 \rightleftharpoons N_2 + 3H_2$; $K' = \frac{1}{K}$

$NH_3 \rightleftharpoons \frac{1}{2}N_2 + \frac{3}{2}H_2$; $K'' = \left(\frac{1}{K}\right)^{1/2}$

63. Answer (3)

Hint: $pH + pOH = pK_w$ and $[H^+] = c\alpha$

Sol.:

	HCN	$\rightleftharpoons$	H^+	+	CN^-
t = 0	c		–		–
$t = t_{eq}$	$c(1-\alpha)$		$c\alpha$		$c\alpha$

$K_a = \frac{(c\alpha)^2}{c(1-\alpha)}$ neglecting α w.r.t. 1

$K_a = c\alpha^2$

$[H^+] = c\alpha$

Given, pOH = 10

pH = 14 – 10 = 4

$[H^+] = 10^{-4}$

$c\alpha = 10^{-4}$

$\alpha = \frac{10^{-4}}{c}$

$\alpha = \frac{10^{-4}}{10^{-2}} = 10^{-2}$

$K_a = (10^{-2}) \times (10^{-2})^2$

$K_a = 10^{-6}$

64. Answer (3)

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

Sol.: $\Delta H - \Delta U = \Delta n_g RT$

$2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$

$\Delta n_g = -3$

$\Delta H - \Delta U = \frac{-3 \times 8.314}{1000} \times 298 = -7.43$ kJ

65. Answer (3)

Hint: Boric acid accepts OH^- from water

Sol.: Boric acid is weakly monobasic and has ability to gain e^- from OH^-.

Boric acid also forms H-bond.

66. Answer (3)

Hint: Bond order = ½ [(No. of e^- in B.M.O's) – (Number of e^- in A.B.M.O's)]

Sol.: $H_2^+ : (\sigma 1s)^1$; B.O = ½ × 1 = 0.5

$H_2 : (\sigma 1s)^2$; B.O = ½ (2) = 1

Since H_2 has higher bond order it will be more stable.

67. Answer (1)

Hint: Boron is a 2nd period member

Sol.: Boron is unable to form BF_6^{3-} ion due to unavailability of *d*-orbitals, it cannot expand its octet.

Boron cannot exceed maximum covalence of 4.

68. Answer (4)

Hint: $K_C = [Al^{3+}] [Cl^-]^3$

Sol.: $K_C = [Al^{3+}] [Cl^-]^3$

$K_C' = [8\ Al^{3+}] \left[\frac{Cl^-}{2}\right]^3$

$= K_C$

So, Cl^- becomes $\frac{1}{2}$ times.

69. Answer (1)

Hint: Angular nodes are equal to the value of 'l'

Sol.: Angular nodes = l = 1 for *p* orbitals

Radial nodes = n – l – 1 = 4 – 1 – 1 = 2

70. Answer (2)

Hint: $CaCO_3$ decomposes on heating into CaO and CO_2.

Sol.: $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

1 mol that is 100 $CaCO_3$ gives $\rightarrow$ 22.4 L CO_2

Volume of $CO_2 = \frac{50}{100} \times \frac{25}{100} \times 22.4 = 2.8$ L

71. Answer (1)

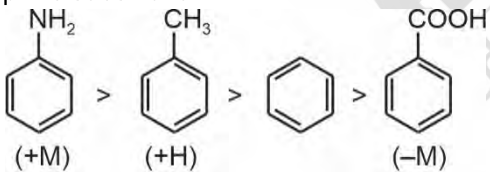
Hint : At equilibrium $\Delta G = 0$

Sol.: $T = \frac{\Delta H}{\Delta S} = \frac{9000\ J\ mol^{-1}}{90\ J\ mol^{-1}K^{-1}} = 100\ K$

72. Answer (3)

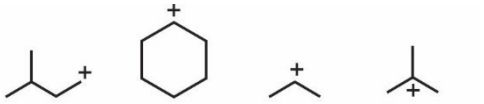
Hint: Rate of electrophilic aromatic substitution is directly proportional to nucleophilicity of benzene ring.

Sol.: The group which increases the electron density in benzene ring i.e. electron donating group, increases the nucleophilicity of benzene ring and hence increases rate of reaction towards electrophilic substitution.

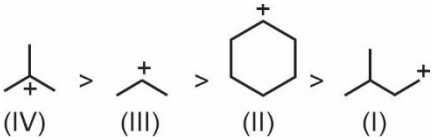
Order: 

73. Answer (3)

Hint: More is the hyperconjugation, more will be the stability of carbocation

Sol.: 

Order of stability:



74. Answer (4)

Hint: CO forms a stable complex with haemoglobin.

Sol.: Zeolites are widely used as a catalyst in petrochemical industries for cracking of hydrocarbons and isomerisation.

The highly poisonous nature of CO arises due to its ability to form a complex with haemoglobin which is about 300 times more stable than the oxygen-haemoglobin complex.

Being heavy and non-supporter of combustion CO_2 is used as fire extinguisher.

75. Answer (1)

Hint : Non-metals have high E°_{red} values.

Sol.: $Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$

$E^\circ = 1.36$ V

It has most positive $E^\ominus$ among all other options.

76. Answer (1)

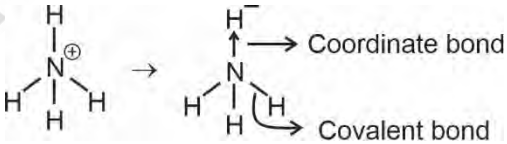
Hint: $\%\ S = \frac{32 \times m_1 \times 100}{233 \times m}$

Sol.: $\%\ S = \frac{32 \times 0.466 \times 100}{233 \times 0.2} = 32\%$

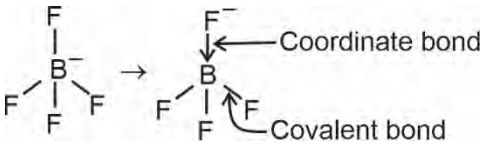
77. Answer (2)

Hint: Coordinate bond is formed by unequal sharing of electrons.

Sol.: $NH_4Cl \rightarrow NH_4^+ Cl^-$ (Ionic bond)



$NaBF_4 \rightarrow Na^+ BF_4^-$ (Ionic bond)



78. Answer (3)

Hint: For isoelectronic species, size $\propto \frac{1}{Z_{eff}}$

Sol.: Correct order of size:

$Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$

So, maximum difference is between N^{3-} and Mg^{2+}.

79. Answer (2)

Hint: T.E. = $-13.6\frac{Z^2}{n^2}$ eV

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

$\Rightarrow$ T.E. = –13.6 eV

80. Answer (4)

Hint: Loss in weight will be equal to the mass of oxygen formed.

Sol.: $KClO_3(s) \xrightarrow{\Delta} KCl(s) + \frac{3}{2}O_2(g)$

Loss in weight = $\frac{3}{2} \times 32 = 48$ g

81. Answer (4)

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

82. Answer (2)

Hint: n-Butane has two distinct hydrogen atoms

Sol.: n-Butane $\xrightarrow{Cl_2/h\nu}$ $CH_3–CH_2–CH_2–CH_2–Cl$

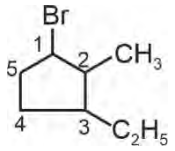
and $CH_3-\overset{*}{\underset{\underset{Cl}{|}}{CH}}-CH_2-CH_3$ (optically active)

Hence, total three isomers are possible

83. Answer (2)

Hint: Numbering should be done in alphabetical order.

Sol.:



1-Bromo-3-ethyl-2-methylcyclopentane

84. Answer (3)

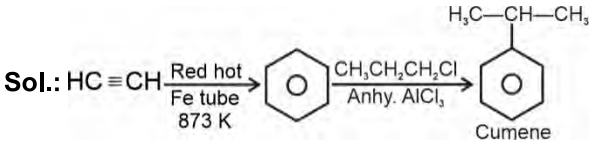
Hint & Sol.: Given electronic configuration is of Ga(31).

The atomic number of the element just above it is 31 – 18 = 13

85. Answer (3)

Hint : Rearrangement of carbocation takes place.

Sol.:

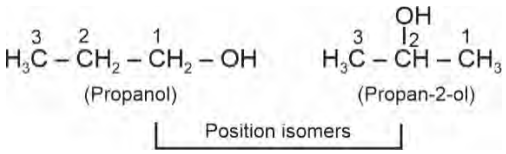


SECTION - B

86. Answer (2)

Hint: Isopropyl alcohol is propan-2-ol and n-propyl alcohol is propanol

Sol.:



As position of functional group is different.

87. Answer (2)

Hint: The reference state of carbon, oxygen and hydrogen are $C_{(graphite)}$, $O_2(g)$ and $H_2(g)$ respectively.

Sol.: 1 mole of a substance should be formed from elements which should be present in their most stable state of aggregation.

88. Answer (1)

Hint: Empirical formula expresses the simplest whole number ratio of atoms of various elements present in 1 molecule of compound.

Sol.:

	S	O
Mass	50 g	50 g
Moles	50/32	50/16
Simplest ratio	1.56/1.56	3.125/1.56
Simplest ratio	1	2

So, EF $\rightarrow$ SO_2

89. Answer (1)

Hint: More is the concentration of common ion lesser will be the solubility of salt.

Sol.: $AgCl(s) \rightleftharpoons \underset{s}{Ag^+}(aq) + \underset{s}{Cl^-}(aq)$

Due to more concentration of common ion order of solubility will be $\rightarrow$ $S_0 > S_2 > S_1 > S_3$

90. Answer (3)

Hint: Heterocyclic compounds are organic compounds with a ring structure that contains atleast one other element such as N, O, S etc. with C in the ring.

Sol.:

Cyclic, planar, $6\pi e^-$ conjugation so it is aromatic and as it contain an O atom in the ring it is also a heterocyclic compound.

91. Answer (2)

Hint: $m = \dfrac{x_{solute} \times 1000}{x_{solvent} \times M_{solvent}}$

Sol.: $m = \dfrac{0.05 \times 1000}{0.95 \times 18} = 2.92\ m$

92. Answer (3)

Hint: Formation of $SO_2(g)$ can be written as

$S(s) + O_2(g) \longrightarrow SO_2(g)$

Sol.:

$S(s) + \dfrac{3}{2}O_2(g) \rightarrow SO_3(g);\ \Delta H_1 = -x\ kcal$ ...(1)

$SO_2(g) + \dfrac{1}{2}O_2(g) \rightarrow SO_3(g);\ \Delta H_2 = -2y\ kcal$ ...(2)

Reversing (2) and adding with (2), we get

$S(s) + O_2(g) \rightarrow SO_2(g);\ \Delta H_3 = 2y - x\ kcal$

93. Answer (4)

Hint: Representative elements are *s* and *p*-block elements except inert gas

Sol.: Z = 9 → F

Z = 31 → Ga

Z = 53 → I

Z = 83 → Bi

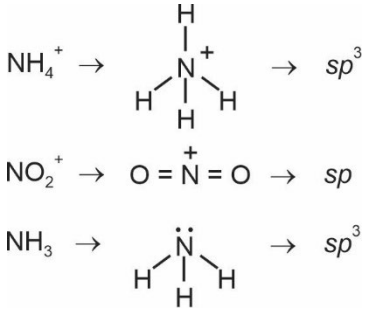
All these elements belong to p-block

94. Answer (3)

Hint: Number of hybrid orbital

= number of σ bond + number of lone pair

Sol.:



95. Answer (3)

Hint: For a particular l, m can have values –l to +l

Sol.: For l = 2, m = –2, –1, 0, 1, 2

So, m = –3 not possible for l = 2

96. Answer (4)

Hint: $\dfrac{\text{Molar heat capacity at constant pressure}(C_p)}{\text{Molar heat capacity at constant volume}(C_v)} = \gamma$

Sol.:

Gas	γ
He	1.67
H_2	1.4
SO_3	1.33

97. Answer (3)

Hint: Calculate the increase and decrease in oxidation number and make them equal.

Sol.: $Cr_2O_7^{2-}(aq) + 3SO_3^{2-}(aq) + 8H^+(aq) \longrightarrow$

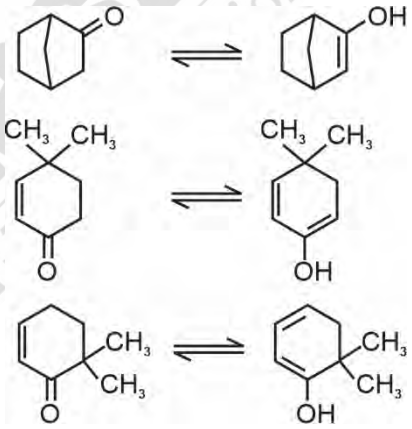
$2Cr^{3+}(aq) + 3SO_4^{2-}(aq) + 4H_2O(l)$

So, a = 1, b = 3; c = 8

∴ a : b : c = 1 : 3 : 8

98. Answer (4)

Hint & Sol.: Due to the presence of active H-atom in a compound with polyvalent group like –CO, $–NO_2$; the substance exists in interconvertible form.



99. Answer (3)

Hint: Oxidising agent reduces itself and oxidises others.

Sol.: Due to inert pair effect Pb^{2+} is more stable than Pb^{4+}.

As Pb^{2+} is more stable, Pb^{4+} will reduce itself to attain +2 oxidation state and hence act as an oxidising agent.

100. Answer (2)

Hint & Sol.: Kharash effect is not observe with HCl and HF due to strong H –X bond, while in case of HI, formation of I_2 takes place from I°, free radical.

[BOTANY]

SECTION - A

101. Answer (2)

Hint: Breakdown of proton gradient leads to release of energy.

Sol.: Regarding chemiosmotic hypothesis, translocation of protons from stroma to the thylakoid lumen and splitting of water molecules in the thylakoid lumen cause decrease in pH in the lumen and this creates proton gradient across the thylakoid membrane. The breakdown of this proton gradient results in the synthesis of ATP.

102. Answer (3)

Hint: T.W. Engelmann experimented on *Cladophora* and bacteria.

Sol.: The organisms used in the experiment conducted by T.W. Engelmann were *Cladophora*, which is photosynthetic eukaryotes and aerobic bacteria which are heterotrophic.

103. Answer (1)

Hint: Most of the plants have both living and dead cells.

Sol.: In plants each living cell is located quite close to the surface of the plant. This is one of the reasons why there is absence of respiratory organ in plants.

104. Answer (2)

Hint: During development a complex body organisation is formed.

Sol.: Development is the sum of two processes that are growth and differentiation.

105. Answer (4)

Hint: Rudolf Virchow first explained that cells divided and new cells are formed from pre-existing cells, *i.e.*, *Omnis cellula-e cellula*.

Sol.: Theodore Schwann, by studies on plant tissues, concluded that presence of cell wall is unique character of plant cell.

Matthias Schleiden observed that all plants are composed of different kinds of cells.

Anton von Leeuwenhoek first observed a live cell.

106. Answer (3)

Hint: M phase of the cell cycle takes less than 5% of the total duration.

Sol.: The interphase lasts more than 95% of the duration of cell cycle.

107. Answer (3)

Hint: The three domains are bacteria, Archaea and Eukarya.

Sol.: In six kingdom classification, two kingdoms Archaebacteria and Eubacteria are associated with prokaryotes whereas the rest four are associated with eukaryotes.

108. Answer (2)

Hint: Buds are usually found on stem.

Sol.: Tuber of potato, rhizome of ginger and phylloclade of *Opuntia* are modified stems. They all have buds on their nodes.

109. Answer (1)

Hint: Apical meristems are found at the apices of stem, root or branches.

Sol.: The apical meristems produce the primary plant tissues of plant body and are responsible for the primary growth of the plants. They contribute to the elongation of the plant along their axis. Lateral meristem increases the girth of the stem and roots.

110. Answer (4)

Hint: Members of Phaeophyceae are also called brown algae.

Sol.: Stored food in the brown algae is in the form of mannitol or laminarin. These algae form biflagellate zoospores that are pear-shaped and have two unequal laterally attached flagella.

111. Answer (1)

Hint: Maximum absorption of light occurs in wavelength range of light 400 to 500 nm.

Sol.: Chlorophyll *b* shows maximum absorption in the range of 400 to 500 nm of wavelength of light.

112. Answer (4)

Hint: In oogamous reproduction, motile or non-motile male gamete fuses with a large non-motile female gamete.

Sol.: Oogamous reproduction is found in the members of Chlorophyceae, Phaeophyceae and Rhodophyceae.

113. Answer (3)

Hint: Few members of Phaeophyceae show diplontic life cycle.

Sol.: *Fucus* exhibits diplontic life cycle. *Ectocarpus* and *Polysiphonia* exhibit haplo-diplontic life cycle. *Spirogyra* shows haplontic life cycle.

114. Answer (1)

Hint: Annual rings are formed of spring wood and autumn wood.

Sol.: One annual ring has one circle of spring wood that is formed during spring season and one circle of autumn wood that is formed during autumn. If there is no seasonal change, there would be uniform secondary growth and thus the annual rings will not be distinct.

115. Answer (4)

Hint: Plants belonging to the family Gramineae are monocotyledons. Flowers are usually bisexual.

Sol.: Gynoecium in the members of Gramineae is monocarpellary or tricarpellary. Floral formula is as follows:

$\%\ ♂\ P_{2\ (lodicules)}\ A_{3\ or\ 6}\ \underline{G}_1$

116. Answer (1)

Hint: Viruses can have dsDNA, dsRNA, ssDNA or ssRNA as genetic material.

Sol.: A virus is a nucleoprotein and the genetic material is infectious.

In general, viruses that infect plants have single stranded RNA.

117. Answer (2)

Hint: A flora gives the actual account of habitat and distribution of various plants of a given area.

Sol.: Keys are generally analytical in nature. Museums have collections of preserved plant and animal specimens for study and reference. Botanical gardens are *ex-situ* conservation strategies.

118. Answer (4)

Hint: Telophase II is the last stage of meiosis II.

Sol.: Meiosis ends with telophase II in which the two groups of chromosomes get enclosed by separate nuclear envelope.

119. Answer (2)

Hint: Nuclear envelope is made up of two parallel membranes with a space between 10 to 50 nm.

Sol.: The space between two parallel membranes of the nucleus is called perinuclear space.

120. Answer (1)

Hint: Vernalisation refers to promotion of flowering by a period of low temperature.

Sol.: The stimulus for vernalisation is perceived by the mature stem apex, or by the embryo of the seed, but not by the leaves.

121. Answer (3)

Hint: For complete oxidation of the fatty acid molecule that has 51 carbon and 6 oxygen atoms, there is the requirement of $\frac{145}{2}$ O_2 molecules.

Sol.: RQ of the given fatty acid molecule

$= \frac{102\ CO_2}{145\ O_2}$

$= 0.7$.

122. Answer (3)

Hint: At high light intensities, the C_4 plants show saturation at about 360 $\mu l\ L^{-1}$.

Sol.: At high light intensities, C_3 plants show saturation only beyond 450 $\mu l\ L^{-1}$. Thus, current availability of CO_2 levels is limiting to the C_3 plants.

123. Answer (1)

Hint: The cell membrane is mainly composed of lipids and proteins.

Sol.: In human beings, the membrane of the erythrocyte has approximately 52 percent protein and 40 percent lipids.

124. Answer (2)

Hint: Organism which are either sterile or infertile, do not reproduce.

Sol.: Reproduction can be regarded as characteristic of living organisms but it is not their exclusive defining characteristic because few organisms such as mule and worker-bees do not reproduce at all.

125. Answer (3)

Hint: Protozoans live as predators or parasites.

Sol.: All protozoans are heterotrophs. Some of them are found in moist soil. Parasitic forms such as *Trypanosoma* have flagella. Some protozoans, like *Plasmodium* have an infectious spore-like stage.

126. Answer (3)

Hint: During cell cycle, DNA replication occurs in the synthesis phase.

Sol.: 'S' phase or synthesis phase is a phase in which synthesis or replication of DNA takes place.

127. Answer (3)

Hint: The spores formed in mosses are haploid.

Sol.: In mosses, the spores on liberation germinate into a creeping, green, branched and frequently filamentous stage called protonema.

128. Answer (1)

Hint: One of the living elements of phloem is absent in most of the monocotyledons.

Sol.: Phloem parenchyma is absent in most of the monocotyledons. The cell of phloem parenchyma have dense cytoplasm and prominent nucleus.

129. Answer (3)

Hint: In hypogynous condition, ovary occupies the highest position in the flower. Examples are mustard, China rose, brinjal and *Petunia*.

Sol.: In perigynous flowers, ovary is said to be half inferior *e.g.*, plum, rose etc.

Other parts of flower arise above the ovary in epigynous flowers. Examples are guava, cucumber, bittergourd, ray floret of sunflower.

130. Answer (4)

Hint: Autotrophic eubacteria such as cyanobacteria have rigid cell wall but lack of flagella.

Sol.: Heterocysts in cyanobacteria fix N_2 only.

Anabaena is a photosynthetic autotrophic cyanobacterium.

131. Answer (2)

Hint: Taxonomy does not include evolutionary study of organisms.

Sol.: Characterisation, identification, classification and nomenclature are the processes that are basics to taxonomy.

132. Answer (3)

Hint: During the second phase of karyokinesis of M phase, mitotic spindle formation is completed.

Sol.: The microtubules of the spindle fibres attach to the kinetochore during metaphase.

133. Answer (1)

Hint: The organelles that function in a coordinated manner constitute endomembrane system.

Sol.: Endomembrane system of the cell includes endoplasmic reticulum, Golgi complex, lysosomes and vacuoles. This system does not include mitochondria, chloroplast and peroxisome.

134. Answer (2)

Hint: Parthenocarpic fruits are seedless fruits.

Sol.: Auxins such as IAA and IBA in diluted form are used to produce parthenocarpic fruits.

135. Answer (2)

Hint: When the two redox equivalents are removed, NAD^+ is converted to $NADH + H^+$.

Sol.: During glycolysis when glyceraldehyde – 3 – phosphate is converted into 1, 3 – bisphosphoglycerate, two redox equivalents in the form of two hydrogen atoms are removed.

SECTION - B

136. Answer (4)

Hint: Cytochrome *c* transfers electrons between complex III and IV.

Sol.: Cytochrome *c* is a small protein attached to the outer surface of the inner membrane of mitochondria.

137. Answer (3)

Hint: Photorespiration involves chloroplast, peroxisome and mitochondria.

Sol.: Photorespiration is a wasteful process. It does not produce ATP or NADPH.

138. Answer (1)

Hint: Meiosis reduces the chromosome number to half in the gametes and thus due to fertilization the diploid number is restored.

Sol.: Mitosis produces new cells for healing the wounds and for regeneration. Meiosis provides a chance for the formation of new combinations of chromosomes. This brings out variations.

139. Answer (3)

Hint: Granum is absent in leucoplasts. Unicellular organisms can be prokaryotes or eukaryotes.

Sol.: Eukaryotic flagella have microtubules but prokaryotic flagella do not.

140. Answer (4)

Hint: Bulliform cells help in the rolling of leaves inwards to minimise water loss.

Sol.: Bulliform cells are present on the adaxial surface of leaves of grasses.

141. Answer (2)

Hint: Cones or strobili are the structures that produce spores.

Sol.: In some pteridophytes like *Selaginella* and *Equisetum* and in gymnosperms, the compact structures of sporophylls that are strobili or cones are formed.

142. Answer (2)

Hint: In dicot leaves, mesophyll is differentiated.

Sol.: In dicot plants, leaves are dorsiventral. In these leaves mesophyll is differentiated into palisade and spongy parenchyma.

143. Answer (1)

Hint: In China rose, stamens are united in a single bundle and ovary has axile placentation.

Sol.: In China rose, alternate phyllotaxy is present, *i.e.*, single leaf is present at each node in an alternate fashion.

144. Answer (4)

Hint: Protozoans lack cell wall and they do not form zoospores.

Sol.: Protozoans are the members of Protista. Therefore, all protozoans are unicellular, whereas except a few fungi, all are multicellular. Both protozoans and fungi are heterotrophs.

145. Answer (3)

Hint: Plants belong to family Solanaceae are dicots.

Sol.: Dicotyledonae, Angiospermae and Solanaceae are the class, division and family of genus *Solanum*.

Poales is an order of class Monocotyledonae.

146. Answer (4)

Hint: During zygotene, the homologous chromosomes come to lie side by side in pairs and this pairing is called synapsis.

Sol.: In diplotene stage, the synaptonemal complex formed during zygotene dissolves.

The recombination of genetic material that occurs during pachytene is mediated by the enzyme recombinase.

147. Answer (2)

Hint: In the acrocentric chromosome, the centromere is present very close to one end of the chromosome.

Sol.: In both the chromosomes A and B, the centromere is present slightly away from the centre. Therefore, both of them are sub-metacentric chromosomes.

148. Answer (1)

Hint: In geometrical growth, three phases can be observed. The initial phase is lag phase then the exponential phase and at the final stage there is stationary phase.

Sol.: In geometrical growth of organisms, stationary phase occurs due to the shortage of space, food and accumulation of toxins.

149. Answer (2)

Hint: The direct synthesis of ATP from metabolites is called substrate level phosphorylation.

Sol.: From one molecule of glucose, 4 ATP are formed during glycolysis and 2 ATP are formed during Krebs cycle.

150. Answer (3)

Hint: In C_4 pathway of photosynthesis, the primary CO_2 acceptor is a three carbon compound.

Sol.: Two extra ATP molecules are consumed to fix one molecule of CO_2 in C_4 pathway of photosynthesis as compared to C_3. This process occurs in mesophyll cells. Thus, per CO_2 5 ATP molecules are consumed in C_4. So, we can say that C_4 plants use 30 ATP molecules to fix 6 carbons in the form of glucose.

[ZOOLOGY]

SECTION - A

151. Answer (3)

Hint: Limbs without webs in between digits

Sol.: In frogs, the forelimbs and hind limbs help in swimming, walking, leaping and burrowing. Forelimbs have four digits while hind limbs have five digits in both male and female frogs. Frogs exhibit sexual dimorphism. Male frogs can be distinguished by the presence of sound producing vocal sacs and also a copulatory pad on the first digit of the forelimbs which are absent in female frogs.

152. Answer (3)

Hint: Hollow woollen ball like structure

Sol.: Primary structure of proteins gives us the sequence of amino acids and their positional information.

Secondary structure of proteins is in the folded form. Eg.: α-helix and β-pleated sheet.

Tertiary structure of protein is the one where the long protein chain is folded upon itself like a hollow woollen ball.

Quaternary structure is formed when a protein has more than one subunits (individual polypeptide chains of a quaternary protein are called subunits) or polypeptide chains and each polypeptide has a primary, secondary or tertiary structure of its own.

153. Answer (4)

Hint: Second largest animal phylum

Sol.: Phylum Mollusca is the second largest phylum of animal kingdom.

Body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump. The anterior head region has sensory tentacles. The mouth contains a file-like rasping organ for feeding, called radula.

154. Answer (2)

Hint: Renin angiotensin aldosterone system

Sol.: Aldosterone is a mineralocorticoid secreted by the cortex region of adrenal gland. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule.

An increase in blood flow to the atria of the heart can cause the release of Atrial Natriuretic Factor. ANF causes vasodilation (dilation of blood vessels).

155. Answer (2)

Hint: Erythrocytes, leucocytes and platelets are collectively called formed elements.

Sol.: Platelets are also called thrombocytes. They are cell fragments produced from megakaryocytes. They release a variety of substances most of which are involved in the coagulation or clotting of blood.

156. Answer (3)

Hint: Adrenaline is an amino acid derivative hormone.

Sol.: Glucagon, insulin, thymosin, parathyroid hormone, erythropoietin, gastrin, secretin, *etc*., are peptide hormones.

Cortisol, testosterone, estradiol and progesterone are steroid hormones.

157. Answer (1)

Hint: True ribs are vertebrosternal ribs.

Sol.: True ribs (vertebrosternal ribs) – 1^{st} to 7^{th} pairs.

False ribs (vertebrochondral ribs) – 8^{th}, 9^{th} and 10^{th} pairs

Floating ribs (vertebral ribs) – 11^{th} and 12^{th} pairs

158. Answer (2)

Hint: Vital capacity + Residual volume

Sol.: Total Lung Capacity (TLC) is the total volume of the air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

Functional residual capacity includes ERV and RV.

159. Answer (3)

Hint: Presence of glucose in urine is glycosuria

Sol.: Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure.

Presence of ketone bodies in urine is known as ketonuria.

Presence of proteins in urine is known as proteinuria.

160. Answer (3)

Hint: First heart sound is the lub sound

Sol.: The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves.

These sounds are of clinical diagnostic significance.

161. Answer (2)

Hint: They are nodes

Sol.: The cell body of a neuron contains cytoplasm with typical cell organelles and certain granular bodies called Nissl's granules.

The gaps between two adjacent myelin sheaths are called nodes of Ranvier.

The axon terminals of a neuron end in bulb-like structures called synaptic knobs.

162. Answer (4)

Hint: Think about basement membrane

Sol.: At the tissue site where pCO_2 is high due to catabolism, CO_2 diffuses into RBCs and forms HCO_3^- and H^+ in presence of enzyme carbonic anhydrase. Diffusion membrane is formed by two cellular layers and an acellular basement membrane in between them.

163. Answer (2)

Hint: Most abundant tissue of the body

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

Fibroblasts are the cells that secrete fibres and also modified polysaccharides.

These polysaccharides accumulate between cells and fibres and act as matrix (ground substance).

Conductivity is shown by neurons and muscle fibres.

Muscle fibres also show contractility.

164. Answer (4)

Hint: Disease of the arteries

Sol.: Angina pectoris is acute chest pain. Hypertension is also known as high blood pressure.

Myocardial infarction is also called heart attack.

165. Answer (3)

Hint: Co-factors play a crucial role.

Sol.: Co-factors are non-protein constituents bound to the enzyme to make the enzyme catalytically active.

Catalytic activity is lost when the co-factor is removed from the enzyme.

166. Answer (2)

Hint: Neurons show excitability.

Sol.: Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

Neurons, the unit of neural system are excitable cells.

Neuroglia make up more than one half the volume of neural tissue in our body.

167. Answer (4)

Hint: First child is Rh +ve

Sol.: A special case of Rh incompatibility has been observed between Rh –ve blood of a pregnant mother with Rh +ve blood of the foetus.

Rh antigens of the foetus do not get exposed to the Rh –ve blood of the mother in the first pregnancy as the two bloods are well separated by the placenta.

However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to small amounts of the Rh +ve blood from the foetus. In such cases, the mother starts preparing antibodies against Rh antigen in her blood.

168. Answer (2)

Hint: Cockroach shows bilateral symmetry.

Sol.: When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry.

Coelenterates, ctenophores and adult echinoderms have this kind of symmetry.

169. Answer (1)

Hint: Ion which is more in intracellular fluid

Sol.: The ionic gradients across the resting membrane are maintained by the active transport of ions by the sodium-potassium pump.

When a stimulus is applied at a site, then that site becomes freely permeable to Na^+ leading to reversal of polarity at that site.

170. Answer (1)

Hint: Cortical pertains to the cortex region

Sol.: Differences between cortical nephrons and juxtamedullary nephrons are as follows:

	Cortical nephrons	**Juxtamedullary nephrons**
1.	Present in majority	Not in majority
2.	Very short Henle's loop	Very long Henle's loop
3.	Extend very little into the medulla	Run deep into the medulla
4.	Vasa recta absent or highly reduced	Vasa recta prominent

171. Answer (1)

Hint: Heart beats 70-75 times in a minute.

Sol.: Sino-atrial node and atrio-ventricular node are nodal tissues of the heart.

The nodal musculature has the ability to generate action potentials without any external stimuli, *i.e.*, it is autoexcitable.

SAN can generate maximum number of action potentials and is responsible for initiating and maintaining the rhythmic contractile activity of the heart. So, it is considered as pacemaker of the heart.

172. Answer (4)

Hint: Osteichthyes

Sol.: *Hippocampus* is sea horse and it is a bony fish.

Common name of *Balaenoptera* is blue whale.

173. Answer (3)

Hint: Gap junction connects cytoplasm of adjacent cells.

Sol.: Tight junctions help to stop substances from leaking across a tissue. Adhering junctions perform cementing to keep the neighbouring cells together. Neuromuscular junctions are present between a neuron and muscle.

174. Answer (4)

Hint: Stunted growth

Sol.: Over-secretion of GH stimulates abnormal growth of the body leading to gigantism.

Low secretion of GH results in stunted growth further resulting in pituitary dwarfism.

Excess secretion of growth hormone in adults especially in middle age can result in severe disfigurement called acromegaly.

Hypothyroidism during pregnancy causes defective development and maturation of the growing baby leading to stunted growth called cretinism.

175. Answer (1)

Hint: Structures present in kidney and transport sperms

Sol.: Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally, it communicates with the urinogenital duct that comes out of the kidneys and opens into the cloaca.

176. Answer (1)

Hint: Part of HMM

Sol.: Each myosin (thick) filament is a polymerised protein.

The globular head and short arm of each meromyosin is known as heavy meromyosin. (HMM).

The globular head is an active ATPase enzyme and has binding sites for ATP and active sites for actin.

177. Answer (3)

Hint: Function of cerebrum

Sol.: Hypothalamus is the part of the forebrain.

The hypothalamus contains a number of centres, which control body temperature, urge for eating and drinking. It also contains several groups of neurosecretory cells, which secrete hormones called hypothalamic hormones.

178. Answer (2)

Hint: Zona glomerulosa is the outermost layer

Sol.: Adrenal cortex can be divided into three layers:

- Zona glomerulosa (outer layer)
- Zona fasciculata (middle layer)
- Zona reticularis (inner layer)

179. Answer (4)

Hint: Bones of hand

Sol.: Micturition is urination.

Piloerection is raising of hair (goosebumps).

Tetany is a skeletal disorder caused due to low calcium in body fluid.

Tetanus is caused due to the bacterium *Clostridium tetani*.

Metacarpals are commonly called palm bones.

Coagulation is clotting of blood.

Breathing is pulmonary ventilation.

180. Answer (2)

Hint: It is a reptile.

Sol.: Generally reptiles have a three chambered heart and show incomplete double circulation.

Crocodilus is an exception. It has 4-chambered heart and show double circulation.

181. Answer (3)

Hint: Protochordates are invertebrates.

Sol.: Phylum Chordata is divided into three sub-phyla : Urochordata or Tunicata, Cephalochordata and Vertebrata.

Sub-phyla Urochordata and Cephalochordata are often referred to as protochordates.

182. Answer (1)

Hint: Members of class Osteichthyes have air bladder.

Sol.: Super class Pisces is further classified into class Chondrichthyes and class Osteichthyes.

Members of class Chondrichthyes do not have air bladder and hence have to swim constantly.

Members of class Osteichthyes on the other hand have air bladder, which regulates buoyancy.

183. Answer (4)

Hint: Less than 4

Sol.: The skull is composed of cranial bones, facial bones, hyoid bone and ear ossicles.

Cranial bones

Paired – Parietal, temporal

Unpaired – Frontal, occipital, sphenoid, ethmoid

Facial bones

Paired : Zygomatic, lacrimal, maxilla, nasal, inferior nasal conchae, palatine

Unpaired : Mandible, vomer

Ear ossicles are paired bones and they include malleus, incus and stapes.

A single U-shaped bone called hyoid is present at the base of buccal cavity.

184. Answer (4)

Hint: Product of anaerobic respiration in animals

Sol.: Organs like lungs, liver and skin also help in the elimination of excretory wastes.

Sebaceous glands are present in the skin and they eliminate substances like sterols, hydrocarbons and waxes through sebum.

Sweat produced by the sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid *etc*.

185. Answer (1)

Hint: First and second cervical vertebra

Sol.: Pivot joint is present between atlas and axis.

Gliding joint is present between the carpals. Saddle joint is present between carpal and metacarpal of thumb.

Knee joint is a hinge joint.

SECTION - B

186. Answer (3)

Hint: Anticoagulant secreted by leech

Sol.: Heparin is an anticoagulant.

Heparin is secreted by basophils and mast cells.

During haemodialysis, blood drained from a convenient artery is pumped into a dialysing unit after adding an anticoagulant like heparin.

Hirudin is an anticoagulant secreted by blood sucking leech (*Hirudinaria*).

187. Answer (2)

Hint: Low dopamine levels cause Parkinson's disease

Sol.: Alzheimer's is caused due to low levels of acetylcholine, a neurotransmitter which is essential for processing memory and learning.

188. Answer (4)

Hint: Open circulation

Sol.: Cockroaches have an open type of circulatory system as the blood vessels are poorly developed.

Visceral organs located in the haemocoel are bathed in blood (haemolymph).

Heart of cockroach consists of an elongated muscular tube lying along the mid dorsal line of thorax and abdomen.

Blood from sinuses enters the heart through ostia and is pumped anteriorly to sinuses again.

189. Answer (3)

Hint: Malpighian tubules

Sol.: A ring of 6-8 blind tubules called hepatic or gastric caeca is present at the junction of foregut and midgut, which secrete digestive juice.

At the junction of midgut and hindgut is present 100-150 yellow coloured thin filamentous structures called Malpighian tubules.

190. Answer (1)

Hint: 1st class of enzymes

Sol.: Enzymes are divided into six classes each with 4-13 subclasses and named accordingly by a four-digit number.

Oxidoreductases/Dehydrogenases : Enzymes which catalyse oxidoreduction between two substrates S and S′.

Transferases: Enzymes catalysing a transfer of a group, G (other than hydrogen) between a pair of substrate S and S′ *e.g.*,

$S - G + S' \longrightarrow S + S' - G$

Hydrolases: Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C–C, C–halide or P–N bonds.

Lyases: Enzymes that catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

$$\begin{array}{cc} X & Y \\ | & | \\ C & - C \end{array} \longrightarrow X - Y + C = C$$

191. Answer (1)

Hint: Steroid hormone

Sol.: Steroid hormones and iodothyronines are lipophilic, hence, can cross the cell membrane and interact with intracellular receptors. They do not need to generate second messengers.

Glucagon, FSH and GnRH have membrane bound receptors. They do not enter the target cell but generate second messengers.

192. Answer (3)

Hint: Polypeptide

Sol.: GLUT-4 is a protein that enables glucose transport into cells.

193. Answer (3)

Hint: Formation of glycogen

Sol.: Cortisol is responsible for lipolysis, proteolysis and gluconeogenesis but not for glycogenesis.

194. Answer (4)

Hint: Occupational respiratory disorder

Sol.: In industries like grinding or stone-breaking, so much dust is produced that the defence mechanism of the body cannot fully cope with the situation.

Long exposure can give rise to inflammation leading to fibrosis and thus causing serious lung disorders, like, silicosis, asbestosis, *etc*.

195. Answer (1)

Hint: Tuft of capillaries is its part

Sol.: Each nephron has two parts – the glomerulus and the renal tubule.

Glomerulus is a tuft of capillaries formed by the afferent arteriole.

The renal tubule consists of Bowman's capsule, PCT, loop of Henle and DCT.

196. Answer (1)

Hint: Gout is a type of arthritis.

Sol.: Myasthenia gravis is an auto-immune disorder affecting neuromuscular junction. Muscular dystrophy is a progressive degeneration of skeletal muscle mostly due to genetic disorder. Gout is inflammation of joints due to accumulation of uric acid crystals.

197. Answer (1)

Hint: Leydig cells are present in the testes.

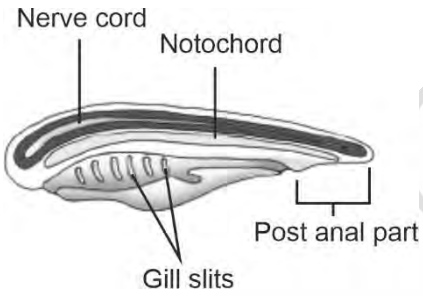
Sol.: The Leydig cells or interstitial cells which are present in the intertubular spaces produce a group of hormones called androgens mainly testosterone.

Small amounts of androgenic steroids are also secreted by the adrenal cortex which play a role in the growth of axial hair, pubic hair and facial hair during puberty.

198. Answer (2)

Hint: 'A' is present in chordates'

Sol.:



199. Answer (3)

Hint: Atrio-ventricular septum is formed by connective tissue.

Sol.: A thin, muscular wall called the inter-atrial septum separates the right and left atria, whereas the left and the right ventricles are separated by atrio-ventricular septum which is formed by thick fibrous connective tissue.

200. Answer (2)

Hint: Low H^+ concentration means high pH.

Sol.: Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2, partial pressure of CO_2, hydrogen ion concentration and temperature.

Factors which are favourable for the formation of oxyhaemoglobin are

i. High pO_2

ii. Low pCO_2

iii. Low H^+ concentration

iv. Low temperature

v. High pH

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