PACE-IIT & MEDICAL

ANSWER KEY FOR MAJOR TEST- 06 (FOR 2023 ASPIRANTS) 23rd Oct 2022

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

Solutions

1. (2)

$$g = 4\pi^2 \cdot \frac{l}{T^2}$$

$$\Rightarrow \quad \frac{\Delta g}{g} \times 100 = \frac{\Delta l}{l} \times 100 + 2\frac{\Delta T}{T} \times 100$$

$$= \frac{\Delta l}{l} \times 100 + 2 \cdot \frac{\Delta t}{t} \times 100$$

$$= \frac{0.1}{20.0} \times 100 + 2 \times \frac{1}{90} \times 100$$

$$= \frac{100}{200} + \frac{200}{90} = \frac{1}{2} + \frac{20}{9} \equiv 3\%$$

2. (2)

Let the initial velocity of ball be u.

Time of rise $t_1 = \frac{u}{g+a}$ and height reached $h = \frac{u^2}{2(g+a)}$

Time of fall t_2 is given by

$$\frac{1}{2}(g-a)t_2^2 = \frac{u^2}{2(g+a)}$$

$$\Rightarrow \quad t_2 = \frac{u}{\sqrt{(g+a)(g-a)}} = \frac{u}{(g+a)}\sqrt{\frac{g+a}{g-a}}$$

$$\therefore \quad t_2 > t_1 \text{ because } \frac{1}{g+a} < \frac{1}{g-a}$$

3. (4)

$$\vec{v}_B = \vec{v}_{BA} + \vec{v}_A$$

$$= (5\hat{i} + 12\hat{j}) + (3\hat{i} - 4\hat{j})$$

$$\vec{v}_B = 8\hat{i} + 8\hat{j}$$

4. (4)

Solution: Charge (q) = 0.2 C; Distance (d) = 2m; Angle θ = 60° and work done (W) = 4J.

Work done in moving the charge (W)

$= F.d\cos\theta = qEd\cos\theta$

$\text{or}, E = \frac{W}{qd\cos\theta} = \frac{4}{0.2\times2\times\cos60^\circ} = \frac{4}{0.4\times0.5}$

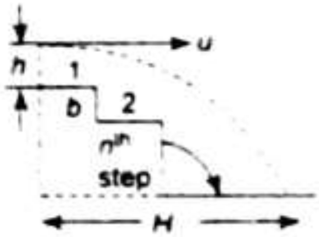
= 20 N/C.

5. (3)

If the ball hits the nth step, then horizontal distance traversed = *nh*.

Here, velocity along horizontal direction = *u*

Velocity along vertical direction = 0



$\therefore \quad nb = ut \qquad (i)$

$nh = 0 + \frac{1}{2}gt^2 \qquad (ii)$

From (i), $t = \frac{nb}{u}$, $\therefore = nh = \frac{1}{2}g\times\left(\frac{nb}{u}\right)^2$

$n = \frac{2hu^2}{gb^2}$

6. (4)

Here $T_1\cos(90-\theta)+T_2\cos\theta-100$

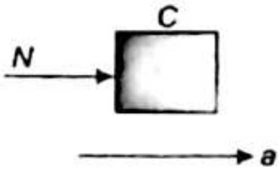
And $T_1\cos\theta-T_2\cos(90-\theta)$

Solving. $T_1 = 80N$

7. (2)

Horizontal acceleration of the system is

$$a = \frac{F}{2m + m + 2m} = \frac{F}{5m}$$



Let N be the normal reaction between B and C. Free body diagram of C gives

$$N = 2ma = \frac{2}{5}F$$

Now B will not slide downward if $\mu N \geq m_B g$

or $\mu\left(\frac{2}{5}F\right) \geq mg$ or $F \geq \frac{5}{2\mu}mg$

8. (4)

$$\text{Av. Power} = \frac{\frac{1}{2}mv^2}{t} = \frac{\frac{1}{2} \times 1000 \times (15)^2}{5} = 22500 \text{ W}$$

9. (4)

Initial K.E. of the body $= \frac{1}{2}mv^2 = \frac{1}{2} \times 25 \times 4 = 50$ J

Work done against resistive force

= Area between F-x graph

$= \frac{1}{2} \times 4 \times 20 = 40$ J

Final K.E. = Initial K.E. – Work done against resistive force

= 50 – 40 = 10 J

10. (3)

Impulse $= \Delta \mathbf{p} = m(\mathbf{v}_f - \mathbf{v}_i)$

$$= m\left[\left(-\frac{3}{4}v_0 \cos 53°\hat{\mathbf{i}} + \frac{3}{4}v_0 \sin 53°\hat{\mathbf{j}}\right) - (v_0 \cos 37°\hat{\mathbf{i}} + v_0 \sin 37°\hat{\mathbf{j}})\right]$$

$$= -\frac{5}{4}mv_0\hat{\mathbf{i}}$$

11. (2)

In elastic collision between equal masses velocities are interchanged. Therefore change in momentum in any one particle is mu.

Now, $|\Delta \mathbf{p}| = |\text{Impulse}|$

$= \text{area under } F\text{-}t \text{ graph}$

$\therefore \quad mu = \frac{1}{2} \times t_0 \times F_0$

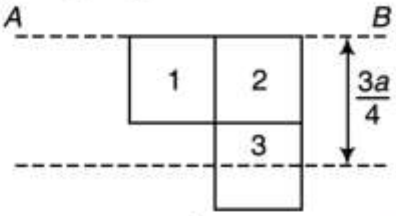
$\therefore \quad F_0 = \frac{2mu}{t_0}$ **Ans.**

12. (3)

In case of pure rolling on ground, net work done by friction = 0

13. (2)

$I_{AB} = I_1 + I_2 + I_3$



$$= \frac{(m/4)(a/2)^2}{3} + \frac{(m/4)(a/2)^2}{3} + \left[\frac{(m/4)(a/2)^2}{12} + (m/4)\left(\frac{3a}{4}\right)^2\right]$$

$$= \frac{3}{16} ma^2$$

14. (2)

$\omega = 10 + 5t$

$$\alpha = \frac{d\omega}{dt} = 5$$

At $t = 0, \omega = 10 \text{ rad/s}$

and $\alpha = 5 \text{ rad/s}^2 \Rightarrow r = OA = 1 \text{ m}$

$\mathbf{v} = (r\omega)\,\hat{\mathbf{j}} = (10\hat{\mathbf{j}}) \text{ m/s}$

$\mathbf{a} = (r\alpha)\,\hat{\mathbf{j}} - (r\omega^2)\,\hat{\mathbf{i}}$

$= (-100\,\hat{\mathbf{i}} + 5\hat{\mathbf{j}}) \text{ m/s}^2$

15. (2)

$T \propto r^{3/2}$

$$\frac{T_2}{T_1} = \left(\frac{r_2}{r_1}\right)^{3/2} = \left(\frac{3R + R}{R}\right)^{3/2} = 8$$

$\therefore \quad T_2 = 8T_1$

16. (2)

$$g = \frac{GM}{R^2} = \frac{G\left(\frac{4}{3}\pi R^3 \rho\right)}{R^2}$$

or $\quad g \propto \rho R$

or $\quad g_1 = g_2$

$\therefore \quad \rho_1 R_1 = \rho_2 R_2$

or $\quad R_2 = \frac{\rho_1}{\rho_2} \cdot R_1 = \left(\frac{1}{2}\right) R = \frac{R}{2}$

17. (1)

In equation $x = A \cos \omega t$, putting $x = \frac{A}{2}$ we get

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

$\therefore \quad \left(\frac{2\pi}{T}\right) t = \frac{\pi}{3}$

or $\quad t = \frac{T}{6}$

18. (2)

$$T \propto \frac{1}{\sqrt{g}} \propto \frac{1}{\sqrt{M/R^2}}$$

or $\quad T \propto \frac{R}{\sqrt{M}}$

R and M both are doubled. So, T will become $\sqrt{2}$ times.

$\therefore \quad T^{-1} = \sqrt{2}\, T = 2\sqrt{2}$ s $\qquad$ (as $T = 2$ s)

19. (4)

$$\left[\frac{\eta}{\rho}\right] = \left[\frac{ML^{-1} T^{-1}}{ML^{-3}}\right] = [M^0 L^2 T^{-1}]$$

20. (1)

21. (1)

Solution: For electron De-Broglie wavelength,

$$\lambda_e = \frac{h}{\sqrt{2mE}}$$

For photon E = pc

$\Rightarrow$ De-Broglie wavelength, $\lambda_{Ph} = \frac{hc}{E}$

$$\therefore \frac{\lambda_e}{\lambda_{Ph}} = \frac{h}{\sqrt{2mE}} \times \frac{E}{hc} = \left(\frac{E}{2m}\right)^{\frac{1}{2}} \frac{1}{c}$$

22. (4)

Solution: As Y = A sin (ωt – kx + φ)

$\omega = 2\pi f = \frac{2\pi}{\pi} = 2 [\because f = \frac{1}{\pi}]$

$k = \frac{2\pi}{\lambda} = \frac{2\pi}{2} = 1 [\because \lambda = 2\pi]$

$\therefore Y = 1 \sin(2t - x + \varphi) [\because A = 1\ m]$

23. (3)

Solution: $n \to 2 - 1$

$E = 10.2$ eV

$kE = E - \varphi$

$Q = 10.20 - 3.57$

$h\upsilon_0 = 6.63$ eV

$\upsilon_0 = \frac{6.63 \times 1.6 \times 10^{-19}}{6.67 \times 10^{-34}} = 1.6 \times 10^{15}$ Hz

24. (1)

Solution: The wave equation is y = Asin (ωt)cos (kx);

$c = \omega/k = 100/0.01 = 10^4$ m/s.

25. (2)

Solution: Let λ_0 be cut off wavelength.

Work function $= \frac{hc}{\lambda_0} = 4.125 \times 1.6 \times 10^{-19}$

$$\lambda_0 = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{4.125 \times 1.6 \times 10^{-19}} = 3000A$$

26. (4)

Solution: Third overtone has a frequency 7 n, which means $L = \frac{7\lambda}{4}$ = three full loops + one half loop, which would make four nodes and four antinodes.

27. (3)

Solution: Kinetic energy of alpha nucleus is equall to electrostatic potential energy of the system of the alpha particle and the heavy nucleus. That is,

$\frac{1}{2}mv^2 = \frac{1}{4\pi\varepsilon_0}\frac{q_\alpha Ze}{r_0}$

where r_0 is the distance of closest approach

$r_0 = \frac{2}{4\pi\varepsilon_0}\frac{q_\alpha Ze}{mv^2}$

$= r_0 \propto Ze \propto q_\alpha \propto \frac{1}{m} \propto \frac{1}{v^2}$

28. (1)

Solution: A balanced wheatstone bridge simply requires

$\frac{P}{Q} = \frac{R}{s} \Rightarrow \frac{2}{2} = \frac{2}{s}$

Therefore, S should be 2Ω.

A resistance of 6Ω is connected in parallel.

In parallel combination,

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{2} = \frac{1}{6} + \frac{1}{S}$

$= S = 3\Omega$

29. (4)

Solution: According to the principle of calorimetry.

Heat lost = Heat gained

$mL_v + ms_w\Delta\theta = m_w s_w$ ••

$\Rightarrow m \times 540 + m \times 1 \times (100 - 80)$

$= 20 \times 1 \times (80 - 10)$

$\Rightarrow m = 2.5$ g

Therefore total mass of water at 80°C

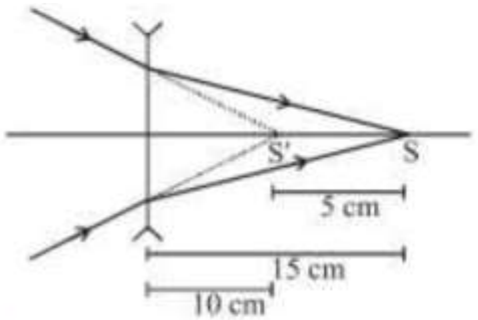
= (20 + 2.5) g = 22.5 g

30. (2)

Solution: Potential at the centre of the sphere

= potential on the surface = 80 V.

31. (2)



Solution:

By lens formula,

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

u = 10 cm

v = 15 cm

f = ?

Putting the values, we get

$$\frac{1}{15}-\frac{1}{10}=\frac{1}{f}$$

$$\frac{10-15}{150}=\frac{1}{f}\; f=-\frac{150}{3}=-30 \text{ cm}$$

32. (3)

Solution: $C = 10\ \mu F\, d = 8$ cm

$C' = ?\, d' = 4$ cm

$C=\frac{A\epsilon_0}{d}\Rightarrow C\alpha\frac{1}{d}$

If d is halved then C will be doubled.

Hence, $C' = 2C = 2\times 10\ \mu F = 20\ \mu F$

33. (3)

Solution: $T_1 = 273 + 27 = 300K$

$T_2 = 273 + 927 = 1200K$

For adiabatic process,

$P^{1-\gamma}\,T^{\gamma}=$ constant

$\Rightarrow P_1^{1-\gamma}T_1^{\gamma}= P_2^{1-\gamma}\,T_2^{\gamma}$

$=\left(\frac{P_2}{P_1}\right)^{1-\gamma}=\left(\frac{T_1}{T_2}\right)^{\gamma}$

$\Rightarrow\left(\frac{P_1}{T_2}\right)^{1-\gamma}=\left(\frac{T_2}{T_1}\right)^{\gamma}$

$$\left(\frac{P_1}{P_2}\right)^{1-1.4}=\left(\frac{1200}{300}\right)^{1.4}$$

$$\left(\frac{P_1}{P_2}\right)^{-0.4}=(4)^{1.4}$$

$$\left(\frac{P_2}{P_1}\right)^{0.4}=4^{1.4}$$

$$P_2=P_1 4^{\left(\frac{1.4}{0.4}\right)}=P_1 4^{\left(\frac{7}{2}\right)}$$

$= P_1\,(2^7) = 2\times 128 = 256$ atm

34. (4)

Solution: Effective resistance of B and C

$$\frac{R_B.R_C}{R_B+R_C}=\frac{1.5R\times 3R}{1.5R+3R}=\frac{4.5R^2}{4.5R}=R$$

i.e., equal to resistance of voltmeter A.

In parallel potential difference is same so, $V_B = V_C$ and in series current is same

So, $V_A = V_B = V_C$

35. (1)

Solution: Magnitude m = +ve ⇒ virtual image

m = –ve ⇒ real image

magnitude of magnification,

$|m| > 1$ ⇒ magnified image

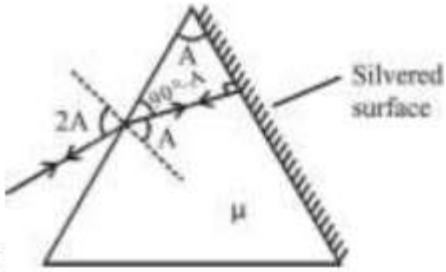
$|m| < 1$ ⇒ diminished image

36. (2)

Solution: Power dissipated = P

$$= \frac{V^2}{R} = \frac{(18)^2}{6} = 54W$$

37. (2)



Solution:

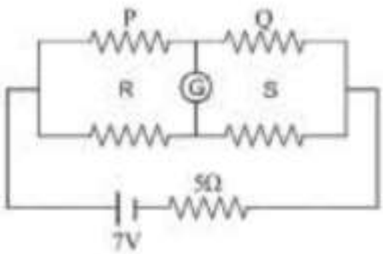
According to Snell's law $\mu = \frac{\sin i}{\sin r}$

⇒ (1) sin 2A = (μ) sin A ⇒ μ = 2 cos A

38. (1)

Solution: Given : V = 7 V

r = 5Ω



$R_{eq} = \frac{40\times120}{40+120}\,\Omega$

$I = \frac{V}{R} = \frac{7}{5+\frac{40\times120}{40+120}}$

$= \frac{7}{5+30} = \frac{1}{5} = 0.2$ A.

39. (2)

Solution: According to Einsten's photoelectric effect, the K.E. of the radiated electrons

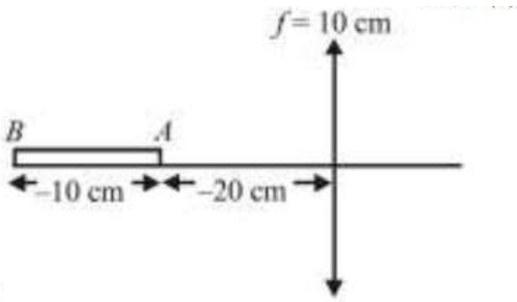
$K.E_{max} = E - W$

$\frac{1}{2}mv_1^2 = (1 - 0.5)$ eV = 0.5 eV

$\frac{1}{2}mv_2^2 = (2.5 - 0.5)$ eV = 2 eV

$$\frac{v_1}{v_2} = \sqrt{\frac{0.5}{2}} = \frac{1}{\sqrt{4}} = 1:2$$

40. (4)



Solution:

The focal length of the mirror

$-\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$

For *A* end of the rod the image distance

When $u_1 = -20$ cm

$\Rightarrow \frac{-1}{10}=\frac{1}{v_1}-\frac{1}{20}$

$\frac{1}{v_1}=\frac{-1}{10}+\frac{1}{20}=\frac{-2+1}{20}$

$v_1 = -20$ cm

For when $u_2 = -30$ cm

$\frac{1}{f}=\frac{1}{v_2}-\frac{1}{30}$

$\frac{1}{v_2}=\frac{-1}{10}+\frac{1}{30}=\frac{-30+10}{300}=\frac{-20}{300}$

$v_2 = -15$ cm

$L = v_2 - v_1 = -15-(-20)$

$L = 5$ cm

41. (3)

Solution: Resistance is directly proportional to length

$\frac{1}{R_{AB}}=\frac{1}{3}+\frac{1}{4+5}=\frac{(4+5)+3}{(3)(4+5)}$

$R_{AB}=\frac{3\times(4+5)}{3+(4+5)}=\frac{27}{12}$

Similarly,

$R_{BC}=\frac{4\times(3+5)}{4+(3+5)}=\frac{32}{12}$

$R_{AC}=\frac{5\times(3+4)}{5+(3+4)}=\frac{35}{12}$

$\therefore R_{AB} : R_{BC} : R_{AC} = 27 : 32 : 35$

42. (4)

Solution: $\eta = 1-\frac{T_1}{T_2}$

$T_1 = -23°C = 250$ K, $T_2 = 100°C = 373$K

$\eta = 1-\frac{250}{373}=\frac{373-250}{373}$

43. (3)

Solution: There is no external force so centre of mass of the system will not shift

44. (1)

Solution: Amplitude (A) = 0.01 m, Frequency = 60 Hz

Maximum acceleration

$= A\omega^2 = 0.01 \times (2\pi n)^2$

$= 0.01 \times 4\pi^2 \times 60 \times 60 = 144\pi^2$ m/sec^2

45. (2)

Solution: (i) When key between the terminals 1 and 2 is plugged in,

P.D. across $R = IR = k\,l_1$

$\Rightarrow R = k\,l_1$ as $I = 1A$

(ii)When key between terminals 1 and 3 is plugged in,

P.D. across $(X + R) = I(X + R) = k\,l_2$

$\Rightarrow X + R = k\,l_2$

$\therefore X = k\,(l_2 - l_1)$

$\therefore R = kl_1$ and $X = k\,(l_2 - l_1)$

46. (1)

Solution: Mass gets detached at the upper extreme position when pan returns to its mean position.

At that point, $R = mg - m\omega^2 a = 0$

i.e. $g = \omega^2 a$

$\Rightarrow a = g/\omega^2 = mg/k$

$= a = \frac{2 \times 10}{200}\left[\text{As} = \omega^2 = \frac{k}{m}\right]$

$= a = \frac{1}{10m} = 10cm$

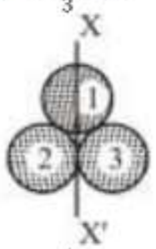
47. (3)

Solution: Moment of inertia of shell 1 along diameter

$I_{diameter} = \frac{2}{3}MR^2$

Moment of inertia of shell 2 = m. i of shell 3

$= I_{tangential} = \frac{2}{3}MR^2 + MR^2 = \frac{5}{3}MR^2$



So,I of the system along x x^1

$= I_{diameter} + (I_{tangential}) \times 2$

or,$I_{total} = \frac{2}{3}R^2 + \left(\frac{5}{3}MR^2\right) \times 2$

$= \frac{12}{3}MR^2 = 4MR^2$

48. (1)

Solution: mg = 72 N (body weight on the surface)

$$g = \frac{GM}{R^2}$$

At a height $H = \frac{R}{2}$,

$$g' = \frac{GM}{\left(R + \frac{R}{2}\right)^2} = \frac{4GM}{9R^2}$$

Body weight at height$H = \frac{R}{2}$,

$$mg' = m \times \frac{4}{9}\frac{GM}{R^2}$$

$$= m \times \frac{4}{9} \times g = \frac{4}{9} mg$$

$$= \frac{4}{9} \times 72 = 32N$$

49. (2)

Solution: $\overline{\nu} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$, where $n_1 = 2$, $n_2 = 4$

$$\overline{\nu} = R\left(\frac{1}{4} - \frac{1}{16}\right)$$

$$\frac{1}{\lambda} = R\left(\frac{12}{4 \times 16}\right) \Rightarrow \lambda = \frac{16}{3R}$$

50. (1)

Solution: According to photoelectric effect, speed of electron (kinetic energy) emitted depends upon frequency of incident light while number of photoelectrons emitted depends upon intensity of incident light. Hence, as the intensity of light increases, the photocurrent increases. In a photo-cell, the photocurrent has no relation with the applied voltage.

Stopping potential is the (negative) potential at which the current is just reduced to zero. It is independent of intensity of light but depends on the frequency of light similar to K.E.

51. (4)

52. (1)

$$\text{Rate} = k[A]^x[B]^y$$

$$1.2 \times 10^{-3} = k[0.05]^x \times [0.01]^y \quad \text{...(i)}$$

$$1.2 \times 10^{-3} = k[0.05]^x \times [0.10]^y \quad \text{...(ii)}$$

Dividing Eq. (i) by Eq. (ii), we get

$$1 = (0.1)^y \Rightarrow y = 0$$

Now, $2.4 \times 10^{-3} = k[0.10]^x[0.05]^y$ ...(iii)

Dividing Eq. (iii) by Eq. (ii) and substituting $y = 0$, we get

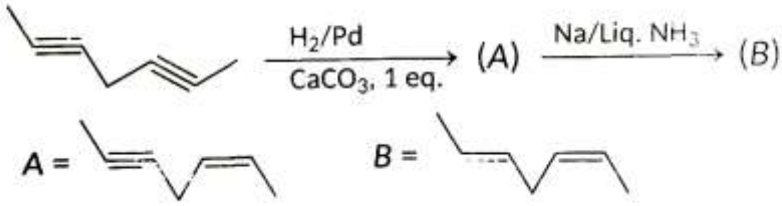
$$2 = (2)^x \Rightarrow x = 1$$

53. (3)

54. (4)

Au / Pt does not react with HNO_3.

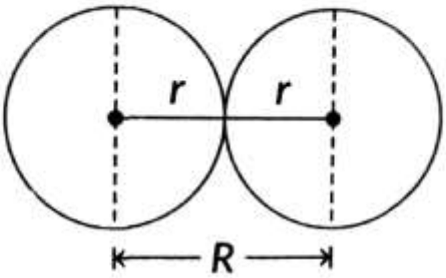
55. (3)



$H_2/Pd, CaCO_3$ leads to *syn*-addition whereas $Na/liq. NH_3$ leads to *anti*-addition.

56. (4)

When two molecules collide, then at the point of collision, their centres are separated by 2r.
(where, r = radius of the molecule)



Thus, effective volume occupied by two molecules

$$= \frac{4}{3}\pi R^3 = \frac{4}{3}\pi(2r)^3 = 8\left(\frac{4}{3}\pi r^3\right)$$

Effective volume occupied by one molecule

$$= \frac{8}{2}\left(\frac{4}{3}\pi r^3\right) = 4\left(\frac{4}{3}\pi r^3\right)$$

$\because$ Volume of one molecule, if no collision occurs

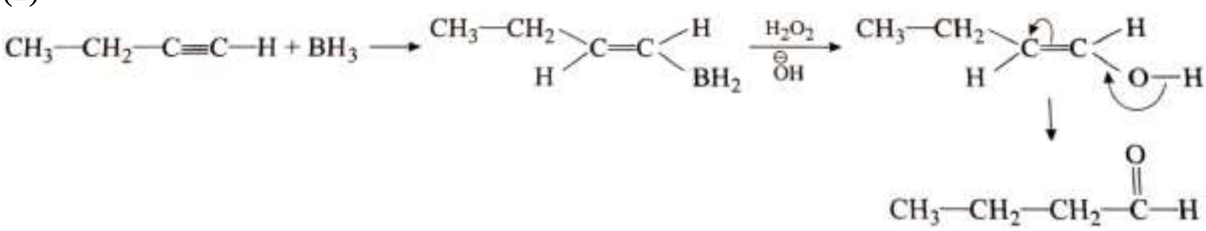
$$= \frac{4}{3}\pi r^3 = V$$

Effective volume of one molecule = 4V

And effective volume of molecules in one mole of the gas = $4N_0V = b$

$\because N_0$ = Avogadro's number

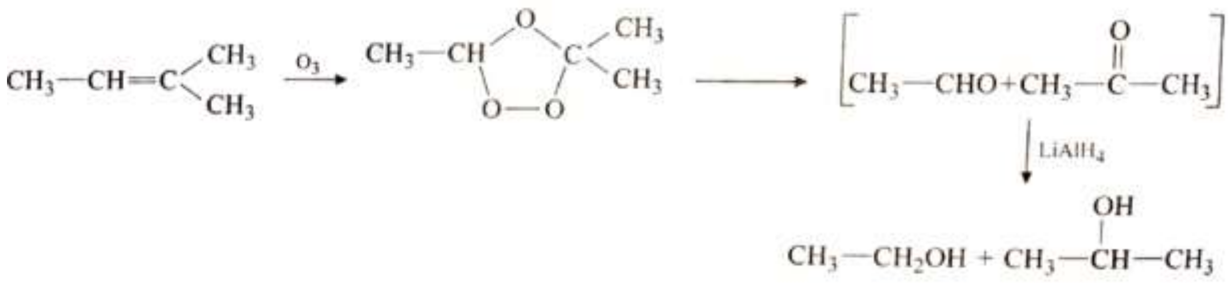
57. (1)



58. (3)

It is cyclic silicone.

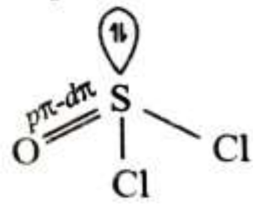
59. (4)



60.

(4)

Hybridisation of $S = sp^3$



61. (3)

From the reaction,

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

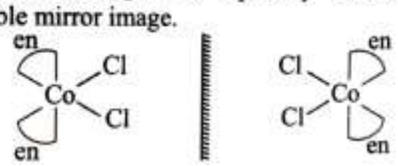
2F charge is required for 63.5g

For 6.35g Cu = 0.2 F charge is required.

So, number of electrons required $= \frac{N_A}{5}$ electrons.

62. (3)

- Complex $[Co(NH_3)_4Cl_2]Cl$ have two G.I. which are optically inactive due to presence of plane of symmetry.
- Complex $[Co(NH_3)_3Cl_3]$ also have two optically inactive geometrical isomers due to presence of plane of symmetry.
- Complex *cis* $[Co(en)_2Cl_2]Cl$ is optically active due to formation of non-superimposable mirror image.



63. (2)

64. (1)

$[Cr(H_2O)_6]\ Cl_3$ have three Cl^- ions.

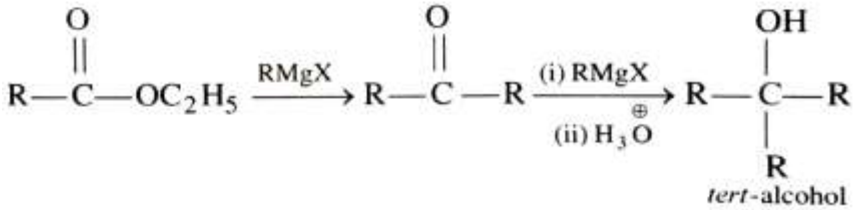
65. (3)

$$\Delta S = nC_V \ln\frac{T_2}{T_1} + nR \ln\frac{V_2}{V_1}$$

$$= 2 \times 12.5 \times 2.303 \log\frac{320}{300} + \left(2 \times 8.314 \times 2.303 \log\frac{4}{2}\right)$$

$$= 1.6 + 11.5 = 13.1\,J\,K^{-1}\ mol^{-1}$$

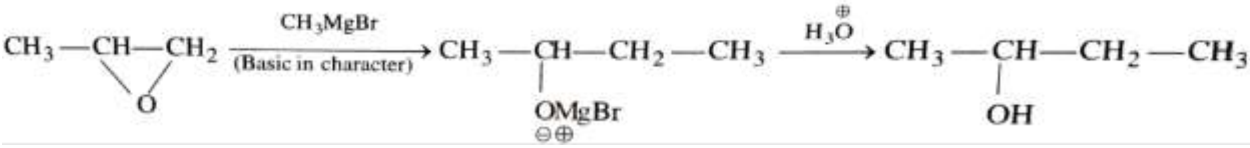
66. (3)



67. (4)

Two–CO groups with central atoms are present in same plane (total five atoms).

68. (2)



69. (3)

$$Ca_3N_2 + 6H_2O \longrightarrow 3Ca(OH)_2 + 2NH_3 \uparrow$$
$$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + H{-}C \equiv C{-}H(g)$$
$$Ca_3P_2 + 6H_2O \longrightarrow 3Ca(OH)_2 + 2PH_3 \uparrow$$
$$CaO + H_2O \longrightarrow Ca(OH)_2$$

70. (2)

On adding CO, equilibrium (II) will shift in backward direction. Hence, concentration of Cl_2 will decrease. Now decrease in concentration of Cl_2, will shift equilibrium (l) in the forward direction, i.e., more PCl_5 will dissociate. Hence, concentration of PCl_5 will decrease.

71. (2)

72. (1)

The stability of the oxide of alkali metals depends upon the comparability of size of cation and anion. Therefore the main oxide of alkali metals formed on excess of air are as follows :

Li	Li_2O
Na	Na_2O_2
K	KO_2
Rb	RbO_2
Cs	CsO_2

73. (3)

$[OH^-]$ required for $Mg(OH)_2$ precipitation

$$= \sqrt{\frac{7.1\times10^{-12}}{0.1}} = 8.4\times10^{-6}$$

$[HO^-]$ required for $Ca(OH)_2$ precipitation

At pH = 10, $[OH^-]=10^{-4}$ which is greater then that required for $Mg(OH)_2$ precipitation but less than that required for $Ca(OH)_2$ precipitation.

$$= \sqrt{\frac{6.5\times10^{-6}}{0.1}} = 8\times10^{-3}$$

$$= 8\times10^{-3}\,M$$

74. (3)
Properties of NO: It is paramagnetic colourless gas in which bond order of N–O bond is 2.5 and produce brown coloured gas with O_2,
$2NO + O_2 \rightarrow 2NO_2$

75. (2)
The expressions are
$$\Lambda^{\circ}_{m\,(Ba(OH)_2)} = \lambda^{\circ}_{Ba^{2+}} + 2\lambda^{\circ}_{OH^-} \quad ...(i)$$
$$\Lambda^{\circ}_{m\,(BaCl_2)} = \lambda^{\circ}_{Ba^{2+}} + 2\lambda^{\circ}_{Cl^-} \quad ...(ii)$$
$$\Lambda^{\circ}_{m\,(NH_4Cl)} = \lambda^{\circ}_{NH_4^+} + \lambda^{\circ}_{Cl^-} \quad ...(iii)$$
Dividing Eqs. (i) and (ii) by 2 and subtracting them, and adding this difference to Eq. (iii), we get
$$\Lambda^{\circ}_{m(NH_4OH)} = \Lambda^{\circ}_{NH_4^+} + \Lambda^{\circ}_{OH^-}$$
$$= \frac{1}{2}\Lambda^{\circ}_{m\,[Ba(OH)_2]} - \frac{1}{2}\Lambda^{\circ}_{m(BaCl_2)} + \Lambda^{\circ}_{m(NH_4Cl)}$$
$$= \frac{1}{2} \times 457 - \frac{1}{2} \times 240.6 + 2129.8 = 2238\ S\ cm^2\ mol^{-1}$$

76. (2)
$Ca_2B_6O_{11}\,5H_2O$ is called colemanite and it is used to prepare H_3BO_3 and borax.

77. (2)
(2) Statement (2) is, correct, whereas all other statements are incorrect.
The energy of AOs depend on the $(n + l)$ value
n + l value of $(n - 1)\ d = n + 1$;
n + l value of $ns = n$
(n + l) value of $(n + 1)\ d = n + 3$;
n + l value of $nf = (n + 3)$
But due to lower value of principle quantum number energy of nf < (n + 1) d.
$\Rightarrow$ energy of (n + 2) s < nf.

78. (1)
SO_2 is not required in Solvay process.

79. (2)
Applying Graham's laws,
$$\frac{r(O_2)}{r(X)} = \frac{t(X)}{t(O_2)} = \frac{44}{37.5} = \sqrt{\frac{M(X)}{32}}$$
$\Rightarrow \quad M(X) = 44(CO_2)$

80. (1)

81. (3)

$$H-H(g)+\frac{1}{2}(O=O)(g)\rightarrow H-O-H(l)$$

$$\Delta_f H^\circ(H_2O)$$

$$=[(\text{Bond energy})_{H-H}+\frac{1}{2}(\text{Bond energy})_{O=O}]$$

$$-[\Delta H^o_{vap}(H_2O)+2(\text{Bond energy})_{O-H}]$$

$$=x_1+\frac{x_2}{2}-[x_4+2x_3]$$

$$=\left[x_1+\frac{x_2}{2}-2x_3-x_4\right]$$

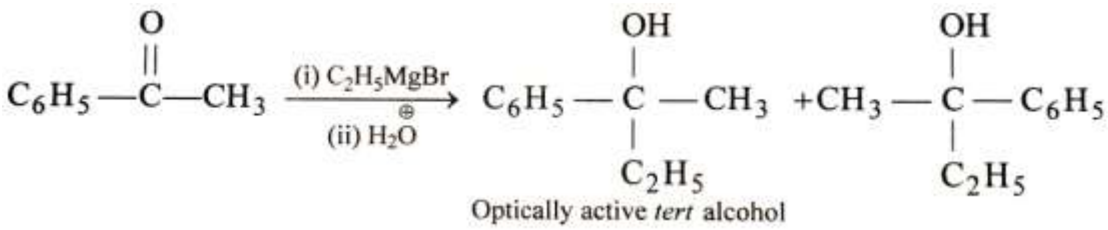
82. (1)

Alkene having following structure gives *anti* Markovnikov addition $H_2C=CH-Z$ where Z is strong–*I* group.

83. (4)

H_3O^+ is the acid. It's conjugate base is H_2O not OH^-.

84. (4)



85. (1)

$$aA \rightarrow bB$$

$$\Rightarrow \frac{\left(\frac{-dA}{dt}\right)}{a}=\frac{\left(\frac{dB}{dt}\right)}{b}$$

$$\Rightarrow \frac{-dA}{dt}=\frac{a}{b}\times\frac{dB}{dt}$$

$$\Rightarrow \log\left(\frac{-dA}{dt}\right)=\log\left(\frac{a}{b}\right)+\log\left(\frac{dB}{dt}\right)$$

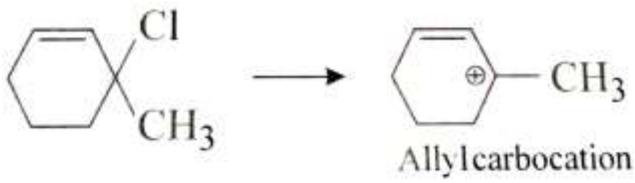
$$\text{Given}, \log\left(\frac{-dA}{dt}\right)=\log\left(\frac{dB}{dt}\right)+0.6020$$

$$\Rightarrow \log\left(\frac{a}{b}\right)=0.6020=2\times0.3010$$

$$=2\times\log 2=\log 4$$

$$\Rightarrow a:b=4$$

86. (4)



87. (3)

The balanced form of cell reactions is

$$3I_2 + 5Cr_2O_7^{2-}(aq) + 34H^+ \rightarrow 6IO_3^-(aq) + 10Cr^{3+}(aq) + 17H_2O$$

$$\Rightarrow E_{cell} = E^o_{cell} - \frac{0.06}{n} \times \log\left\{\frac{[IO_3^-(aq)]^6[Cr^{3+}(aq)^{10}]}{[CrO_7^{2-}(aq)]^5[H^+]^{34}}\right\}$$

The total number of electrons involve in the reaction is 30. Substituting for n and concentrations of reactions and products, we have

$$E_{cell} = 0.135 - \frac{0.06}{30} \times \log\left\{\frac{[10^{-4}]^6[10^{-3}]^{10}}{[10^{-2}]^5[10^{-1}]^{34}}\right\}$$

$$= 0.135 - \frac{0.06}{30}\log\left(10^{-10}\right)$$

$$= 0.155V$$

88. (3)

Leaving power of –O–SO_2–CF_3 is maximum.

89. (3)

90. (1)

Reaction intermediate is benzyl carbocation. Presence of CH_3O–group at *para* position stabilised the RI.

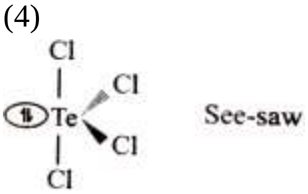
91. (2)

$$\Delta H = \Delta U + \Delta nR(T_2 - T_1)$$

$$= 30.0 + 1 \times 0.0821 \times \left(245 - 95\right)$$

$$= 42.315 L - atm$$

92. (4)



93. (1)

94. (4)

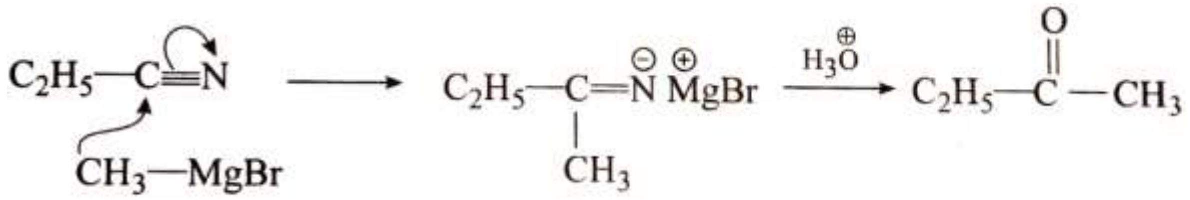
By Henderson's equation,

$$pOH = pK_b + \log \frac{HX}{[X^-]} = 4 + \log 2$$

$$\therefore pH = 14 - pOH = 10 - \log 2$$

95. (4)
$[Ni(CN)_4]^{4-}$ dsp^2-hybridisation of Ni with square planar geometry.

96. (2)



97. (3)
When mixture of CO and H_2 is treated with H_2O at high temperature to oxidise CO is called shift reaction.

98. (1)

$$100\text{mL of } 0.50\text{M KCl} = \frac{100 \times 0.50}{1000} \text{mol KCl}$$

$$= 0.05 \text{ mol KCl}$$

$$100\text{mL of } 0.40\text{ M KCl} = \frac{100 \times 0.4}{1000} = 0.04 \text{mol KCl}$$

$$\text{KCl required} = 0.05 - 0.04$$

$$= 0.01\text{mol} = 0.745\text{g}$$

99. (2)
$CaCO_3$ = Insoluble in water
Solubility of bicarbonates of IA increases down the group.

100. (3)

For first-order reaction, half-life period is given by

$$t_{1/2} = \frac{0.693}{k} \text{ or } k = \frac{0.693}{t_{1/2}}$$

Given that, at $T_1 = 27°C = 300K$; $t_{1/2} = 20$ min

Therefore, $k_1 = \frac{0.693}{20} = 0.0346 \text{min}^{-1}$

At $T_2 = 77°C = 350K$; $t_{1/2} = 5$ min

Therefore, $k_2 = \frac{0.693}{5} = 0.1386 \text{min}^{-1}$

The activation energy is related to rate constants at two different temperatures by the equation,

$$E_a = 2.303R \times \frac{T_1T_2}{T_2 - T_1} \times \log\frac{k_2}{k_1}$$

Substituting values in the equation, we get

$$\Rightarrow \quad E_a = 2.303 \times 8.314 \times \frac{300 \times 350}{350 - 300} \times \log\frac{0.1386}{0.0346}$$

$$= 24.233 \text{ kJ mol}^{-1}$$

101. (4)
The Living world, (XI), Page nos. 4,6 and 11

102. (3)
Environmental issues (XII), Page no. 282, Figure 16.8

103. (3)
Biodiversity and conservation (XII), Page no. 267

104. (4)
Ecosystem (XII), Page no. 243

105. (3)
Sexual reproduction in flowering plants (XII), Page no. 29

106. (4)
Environmental issues (XII), Page nos. 270 and 274

107. (2)
Biodiversity and conservation (XII), Page no. 263

108. (3)
Organisms and populations (XII), Page no. 223

109. (4)
Ecosystem (XII), Page no. 243

110. (2)
Molecular basis of inheritance (XII), Page no. 97

111. (3)
Strategies for enhancement in food production (Plant breeding) (XII), Page no. 174 and 175

112. (3)
Organisms and populations (XII), Page no. 218

113. (3)
Biodiversity and conservation (XII), Page no 262

114. (2)
Ecosystem (XII), Page no. 244

115. (3)
Principles of inheritance and variation (XII), Page no. 70, Figure 5.1

116. (1)
Environmental issues (XII), Page nos. 184, 278, 280, 281 and 284

117. (2)
Organisms and populations (XII), Page no. 225

118. (2)
Biodiversity and conservation (XII), Page no. 261

119. (4)
Ecosystem (XII), Page no. 250

120. (2)
Sexual reproduction in flowering plants (XII), Page nos. 23, 27, 31, 35, 36 and 38.

121. (4)
Microbes in human welfare (XII), Page no. 181

122. (3)
Environmental issues (XII), Page nos. 276 and 277

123. (3)
Oragnisms and populations (XII), Page no. 223

124. (2)
Biodiversity and conservation (XII), Page no. 261

125. (3)
Molecular basis of inheritance (XII), Page nos. 104 and 105

126. (2)
Environmental issues (XII), Page nos. 270, 272, 274 and 284

127. (2)
Organisms and population (XII), Page nos. 229 and 230

128. (2)
Ecosystem (XII), Page no 242 and 253

129. (1)
Organisms and population (XII), page no 225 and 226

130. (3)
Principles of inheritance and variation (XII), page no. 91 and 92

131. (2)
Environmental issues (XII), Page nos. 274, 276 and 282

132. (2)
Organisms and populations (XII), page nos. 224 and 225

133. (3)
Biodiversity and conservation (XII), page no. 264

134. (1)
Ecosystem (XII), Page no. 248 and 249

135. (2)
Reproduction in organisms (XII), Page no. 13, Table 1.1

136. (3)
Organisms and Populations, (XII), Page nos. 235, 236 and 237

137. (3)
Biodiversity and conservation (XII), Page no. 260

138. (4)
Environmental issues (XII), Page no. 281

139. (3)
Ecosystem (XII), Page nos. 245 and 246

140. (2)
Biodiversity and conservation (XII), Page no. 265

141. (2)
Environmental issues (XII), Page nos. 271, 272 and 278

142. (4)
Ecosystem (XII), Page nos. 250, 251

143. (3)
Organisms and population (XII), Page nos. 233, 234, 236 and 238

144. (3)
Biodiversity and conservation (XII), Page nos. 261, 263 and 265

145. (2)
Environmental issues (XII), Page nos. 183, 184, 185, 274, 275 and 276

146. (3)
Ecosystem (XII), Page nos. 250 and 251

147. (4)
Biodiversity and conservation (XII), Page nos. 266 and 267

148. (1)
Environmental issues (XII), Page no. 281

149. (3)
Ecosystem (XII), Page nos. 245, 246 and 249

150. (2)
Organisms and populations (XII), Page nos. 233, 234, 235, 236, 239 and 238

151. (2)
An antibiotic resistance gene in a vector is a selectable marker that helps to select and transformants from non-transformants.

152. (3)
XII NCERT pg 168

153. (4)
XII NCERT pg 195,Each REN cuts DNA at specific sites called recognition sites identified as Palindrome sequences expressed as 6 base pairs

154. (4)
Nitrogenous wastes are formed in liver, kidney is responsible for their elimination. Kidneys regulate blood pressure via RAAS mechanism.

155. (3)
XII NCERT pg 195, In 1963, 2 enzymes were discovered in bacteria that makes its defence mechanism to protect bacteria from attack of bacteriophage.

156. (2)
XII NCERT pg 211, 2nd para

157. (1)
XI NCERT pg 260. The columnar cells of intestinal mucosa has microvilli .Stomach foldings are called rugae. MALT of ileum is called Peyer's patches.

158. (1)
Genetic engineering has made possible that eukaryotic genes can be expressed in prokaryotic organism .Though the basic cellular machinery is different, protein synthesis is same as codons coding for amino acids is universally the same.

159. (3)
XII NCERT pg 169, last para

160. (1)
XI NCERT pg 47, 1st para, When the animal shows digestive cavity with only one opening to function as mouth or anus, the digestive system is incomplete and animal is at blind sac body plan.

161. (4)
XII NCERT pg 211

162. (3)
XI NCERT pg 275,1st para

163. (2)
XII NCERT pg 200, last para, Entry of foreign DNA in bacteria is called Transformation.

164. (2)
XII NCERT pg 168, last para. MOET technique

165. (3)
XII NCERT pg 211. Polypeptide chain A has 21 amino acids and polypeptide chain B has 30 amino acids. Polypeptide chains A and B are interconnected by two S – S linkage.

166. (2)
XI NCERT pg 306

167. (4)
XII NCERT pg 199, figure. Pvu II is at rop gene site.

168. (4)
XII NCERT pg 209, 2nd para

169. (4)
XII NCERT pg 198,2nd para

170. (3)
XII NCERT pg 199, 1st para

171. (3)

172. (1)
XII NCERT pg 168

173. (3)
XII NCERT pg 200. Lac z gene of pUC19 plasmid codes for enzyme β - galactosidase that makes bacterial colonies blue on agar plate containing chromogenic material.

174. (1)
XII NCERT pg 209

175. (1)
XII NCERT pg 212. Southern blotting for DNA detection, Nouthern blotting for RNA detection, Western blotting for Protein detection

176. (4)
XII NCERT pg 203. Taq polymerase is a thermophilic enzyme isolated from bacterium *Thermus aquaticus*.

177. (2)
XII NCERT pg 203,4th para

178. (3)
XII NCERT pg 208. Bt crops expressing cry genes make them resistant to particular insects.

179. (2)
XII NCERT pg 167,168

180. (2)
NCERT pg 212, 1st para

181. (1)
XII NCERT pg 203, 1st para

182. (1)
XII NCERT pg 165, last line

183. (3)
XII NCERT pg 204, 1st para.

184. (3)
XII NCERT pg 208,last para

185. (2)
The nodes of Ranvier are gaps between myelin sheath of axon and hence are part of only Myelinated nerve fibre

186. (1)
XII NCERT pg 213

187. (4)
XII NCERT pg 211. A and b chains of insulin are linked together via 2 inter-disulphide bonds

188. (2)
Yeast being a eukaryotic cell can excise introns from the RNA transcript

189. (3)
Only Humans are bipedal .Even birds show 4-chambered heart. All reptiles and birds also show internal fertilization and not just mammals.

190. (4)
XII NCERT pg 195,2nd para

191. (3)
XII NCERT pg 195, last para

192. (3)
Epithelial tissue shows max capacity of self renewal and repair. Epithelial tissue lacks its own blood supply to reduce blood loss during injury. Simple Epithelial tissue is found on inner and compound in outer body surface.

193. (2)
XII NCERT pg 210, 2nd para

194. (2)
Both eukaryotic and prokaryotic cells can be used as host cells. Antibiotic resistant genes are used as a selectable marker. Gene amplification is done both using PCR (invitro) and invivo.

195. (1)
Mutations are random and hence non-directional. Darwinian variations are small and directional. Saltation refers to single step large mutation.

196. (2)
XII NCERT pg 61, 1st line

197. (2)
XII NCERT pg 209,2nd para

198. (3)
XII NCERT pg 199,2nd para

199. (1)
Restriction endonuclease shall cut DNA to isolate gene of interest. DNA ligase shall join gene of interest to cloning vector. DNA polymerase shall make multiple copies of rDNA.

200. (3)
XII NCERT pg 168,3rd para