28/04/2025

Code-C Phase-2

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***011-47623456

MM : 720 Final Test Series(P2)-2024-25_Test-10C **Time : 180 Min.**

PHYSICS

1. (2)
2. (3)
3. (4)
4. (1)
5. (1)
6. (3)
7. (3)
8. (3)
9. (2)
10. (3)
11. (3)
12. (4)
13. (4)
14. (2)
15. (4)
16. (3)
17. (1)
18. (4)
19. (1)
20. (3)
21. (1)
22. (3)
23. (3)
24. (2)
25. (2)
26. (1)
27. (1)
28. (1)
29. (3)
30. (2)
31. (2)
32. (4)
33. (2)
34. (1)
35. (2)
36. (4)
37. (4)
38. (3)
39. (2)
40. (2)
41. (3)
42. (1)
43. (3)
44. (3)
45. (2)

CHEMISTRY

46. (4)
69. (4)

47. (1)
48. (2)
49. (2)
50. (2)
51. (1)
52. (3)
53. (3)
54. (1)
55. (3)
56. (3)
57. (3)
58. (2)
59. (1)
60. (3)
61. (4)
62. (2)
63. (3)
64. (2)
65. (4)
66. (4)
67. (4)
68. (3)
70. (2)
71. (1)
72. (3)
73. (4)
74. (1)
75. (4)
76. (3)
77. (2)
78. (3)
79. (3)
80. (1)
81. (1)
82. (4)
83. (3)
84. (1)
85. (1)
86. (2)
87. (4)
88. (3)
89. (2)
90. (2)

BIOLOGY

91. (3)
92. (2)
93. (2)
94. (4)
95. (2)
96. (3)
97. (2)
98. (3)
99. (3)
100. (2)
101. (4)
136. (4)
137. (4)
138. (3)
139. (2)
140. (3)
141. (3)
142. (3)
143. (2)
144. (2)
145. (1)
146. (4)

102. (3)
103. (3)
104. (1)
105. (3)
106. (4)
107. (2)
108. (4)
109. (3)
110. (2)
111. (1)
112. (4)
113. (4)
114. (4)
115. (1)
116. (1)
117. (3)
118. (1)
119. (2)
120. (4)
121. (4)
122. (3)
123. (2)
124. (4)
125. (1)
126. (3)
127. (3)
128. (2)
129. (1)
130. (2)
131. (2)
132. (1)
133. (3)
134. (1)
135. (3)
147. (2)
148. (2)
149. (3)
150. (2)
151. (1)
152. (2)
153. (4)
154. (2)
155. (1)
156. (1)
157. (2)
158. (2)
159. (2)
160. (2)
161. (3)
162. (2)
163. (1)
164. (2)
165. (3)
166. (3)
167. (3)
168. (3)
169. (4)
170. (1)
171. (3)
172. (3)
173. (4)
174. (1)
175. (2)
176. (1)
177. (4)
178. (1)
179. (4)
180. (1)

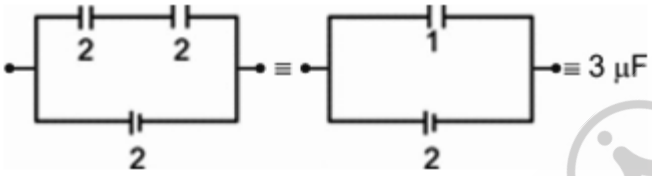
Hints and Solutions

PHYSICS

(1) **Answer :** (2)
Solution:
For no deflection
$q\left(\vec{E}+\vec{v}\times\vec{B}\right)=0$
$v=\frac{E}{B}$

(2) **Answer :** (3)
Solution:
$Q = ne$
$n=\frac{Q}{e}=\frac{10^{-10}}{1.6\times10^{-19}}$
$n = 6.25 \times 10^8$ electrons

(3) **Answer :** (4)
Solution:



(4) **Answer :** (1)
Solution:
The Lyman spectral lines for a hydrogen atom lie in the ultraviolet region of the electromagnetic spectrum.

(5) **Answer :** (1)
Solution:
$e=-\frac{d\phi}{dt}$
For $0 < t < T$, e = negative constant
For $T < t < 2T$, e = zero
For $2T < t < 3T$, e = positive constant

(6) **Answer :** (3)
Solution:
F = (W + X) . (W + Y)
F = W + (X . Y)

(7) **Answer :** (3)
Solution:
$C_{eq} = \frac{C_1C_2}{C_1+C_2}+C_3$
= 6 + 6 = 12 μF
$Q = C_{eq}V$
= 12 × 6 = 72 μC

(8) **Answer :** (3)
Solution:
Difference in frequency = 120 Hz
So in closed organ pipe, difference in consecutive frequencies = $2f_0 \Rightarrow 2f_0 = 120 \Rightarrow$ fundamental frequency f_0 = 60 Hz

(9) **Answer :** (2)
Solution:
$\lambda=\frac{h}{\sqrt{2mK}}$

$\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{K_2}{K_1}} = \sqrt{\frac{16K}{K}} = 4$

$\lambda_2 = \lambda_1/4$

$\frac{\Delta\lambda}{\lambda} \times 100 = \frac{\lambda_1 - \lambda_1/4}{\lambda_1} \times 100 = 75\%$

(10) Answer : (3)
Solution:
Potential of smaller drop $V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$

$\frac{4}{3}\pi R^3 = 64 \times \frac{4}{3}\pi r^3$

$R = 4r$

Potential of bigger drop = $V' = \frac{1}{4\pi\varepsilon_0}\frac{64q}{4r} = 16V$

(11) Answer : (3)
Solution:

$f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{10^{-4} \times 10^{-6}}} = \frac{10^5}{2\pi}$ Hz

(12) Answer : (4)
Solution:
Displacement current exists within the gap of a capacitor when the electric field between its plates is changing, which typically happens when the charge on the capacitor is changing.

(13) Answer : (4)
Solution:
When width of magnetic field is more than radius, then deviation is 180°.

(14) Answer : (2)
Solution:

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

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

$\frac{1}{f} = \frac{v^2-u^2}{vu(v-u)}$

$\frac{1}{f} = \frac{\frac{v}{u}-\frac{u}{v}}{v-u} = \frac{m_1-m_2}{x}$

$f = \frac{x}{m_1-m_2}$

(15) Answer : (4)
Hint:
Kinetic theory of gases.
Solution:

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

$v_{\text{avg}} = \sqrt{\frac{8RT}{\pi M}}$

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

$v_{\text{rms}} : v_{\text{mp}} : v_{\text{avg}} = \sqrt{3} : \sqrt{2} : \sqrt{\frac{8}{\pi}}$

(16) Answer : (3)
Hint:
$W = \frac{nR\Delta T}{1-\gamma}$
Solution:

$\gamma = \frac{4}{3}$

$n = 2$

$T_0V^{\gamma-1} = T_1(8V)^{\gamma-1}$

$T_0V^{\frac{4}{3}-1} = T_1(8V)^{\left(\frac{4}{3}-1\right)}$

$T_1 = \frac{T_0}{2} = \frac{300}{2} = 150\,\text{K}$

ΔT = (150 – 300) = –150 K

$W = \frac{nR\Delta T}{1-\gamma} = \frac{2\times 2\times(-150)}{1-\frac{4}{3}}$

= 1800 cal

(17) Answer : (1)

Solution:

$W = 2P_0 \times 2V_0 = 4P_0V_0$

In process *AB*, heat supplied = $nC_v\Delta T = n \times \frac{3}{2}R \times 2T_0$

= 3 nRT_0

In process *BC*, heat supplied = $nC_p\Delta T = n \times \frac{5}{2}R6T_0$

= 15 nRT_0

Total heat supplied = $18nRT_0 = 18P_0V_0$

$\eta = \frac{W}{Q_{\text{sup plied}}} \times 100 = \frac{4P_0V_0}{18P_0V_0} \times 100 = 22.2\%$

(18) Answer : (4)

Solution:

$\frac{1}{2}K\left(\frac{1}{100}\right)^2 = 50$ ...(i)

$\frac{1}{2}K\left(\frac{2}{100}\right)^2 = E$ ...(ii)

(ii) ÷ (i) gives

$4 = \frac{E}{50} \Rightarrow E = 200$ J

(19) Answer : (1)

Hint:

$\Delta L = \frac{FL}{AY} \Rightarrow A = \frac{FL}{Y\Delta L}$

Solution:

$\frac{A_B}{A_S} = \frac{Y_S}{Y_B} \Rightarrow \left(\frac{R_B}{R_S}\right)^2 = \frac{2}{1} \Rightarrow \frac{R_B}{R_S} = \sqrt{2}$

(20) Answer : (3)

Solution:

Bernoulli's theorem holds good for only ideal liquid.

(21) Answer : (1)

Hint:

$\frac{\Delta l}{l} \times 100 = \alpha\, \Delta\, \theta \times 100$

Solution:

Percentage change in length due to temperature change

$\frac{\Delta l}{l}$ × 100 = αΔθ ×100= $2\times10^{-5} \times 10^4$ = 0.2%

(22) Answer : (3)

Solution:

$\omega^2 = 4$

ω = 2 rad/s

(23) Answer : (3)

Solution:

Magnetic suscepblity $\chi = \mu_r - 1 = 5999 - 1 = 5998$

(24) Answer : (2)

Solution:

$KE_{max} = eV_0$

$= 1.6 \times 10^{-19} \times 1.6$

$= 2.56 \times 10^{-19}$ J

(25) Answer : (2)

Solution:

(1) $F_e = \frac{Kq_1q_2}{r^2}$

(2) $\sigma = \frac{Q}{A}$

(3) $Q = ne$

(4) $\phi = \int \vec{E} \cdot d\vec{s}$

(26) Answer : (1)

Solution:

$V = \frac{\pi d^2 L}{4}$

$\frac{\Delta V}{V} = \frac{2\Delta d}{d} + \frac{\Delta L}{L}$

$= \frac{2 \times 0.001}{0.500} + \frac{0.1}{75}$

$\frac{\Delta V}{V} \times 100 = (0.133 + 2 \times 0.2) = 0.533\%$

(27) Answer : (1)

Solution:

[Impulse] = [Force] [Time]

= $[MLT^{-2}]$ [T] ⇒ $[MLT^{-1}]$

(28) Answer : (1)

Solution:

$s = \int v dt$

$s = 6t - \frac{3}{2}t^2 + c$

At $t = 0$, $s = 0 \Rightarrow c = 0$

s again becomes zero after time t

$6t - \frac{3}{2}t^2 = 0 \quad \Rightarrow \quad t = 4$ s

(29) Answer : (3)

Solution:

Distance between scooter and car

s = 1.5 km

= 1500 m

$v_C = v_{car} = 20$ m/s

time taken to overtake = 60 s

$v_{s/c} = v_{\text{scooter/car}} = \frac{1500}{60} = 25$ m/s

v_S = velocity of scooterist

$v_{S/C} = v_S - v_C$

$v_S = v_{S/C} + v_C$

= 25 + 20 = 45 m/s

(30) Answer : (2)

Solution:

$H_{\max} = \frac{u_y^2}{2g} \quad \Rightarrow \quad H_{\max} \propto u_y^2$

$T = \frac{2u_y}{g} \quad \Rightarrow \quad T \propto u_y$

$(u_y)_B > (u_y)_A$

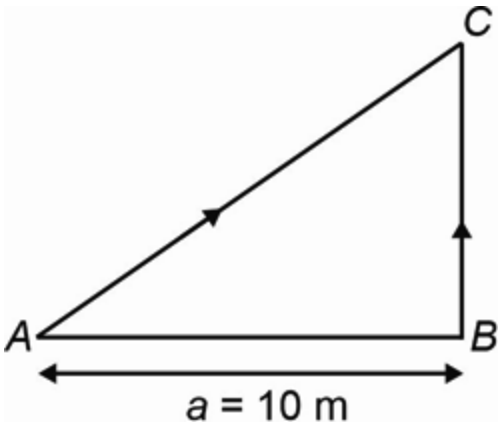
(31) Answer : (2)

Solution:

Let the two boys meet at point *C* after time '*t*'.

AC = *vt*

BC = $v_1 t$



$AC^2 = AB^2 + BC^2$

$v^2t^2 = a^2 + v_1^2t^2$

$t = \sqrt{\frac{a^2}{v^2 - v_1^2}}$

$= \sqrt{\frac{100}{16}} = \frac{10}{4} = 2.5$ s

(32) Answer : (4)
Solution:
The dishes will remain on the table due to inertia of rest.

(33) Answer : (2)
Solution:
L = constant

$K.E_{\text{rotational}} = \frac{L^2}{2I} \quad \Rightarrow \quad \frac{(K.E)_{\text{new}}}{(K.E)_{\text{initial}}} = \frac{4}{1}$

(34) Answer : (1)
Solution:
If no external force acts on a system, its total momentum remains conserved, meaning the velocity of centre of mass remains constant.

$Ma_{\text{CM}} = F_{\text{ext}}$

$F_{\text{ext}} = 0, \quad a_{\text{CM}} = 0$

$\therefore$ constant velocity

(35) Answer : (2)
Solution:
If a particle is inside a homogeneous solid sphere, the force on the particle acts toward, the centre of the sphere. The force is exerted by the spherical mass interior to particle.

(36) Answer : (4)
Solution:
Acceleration due to gravity at a height h from the surface of Earth is

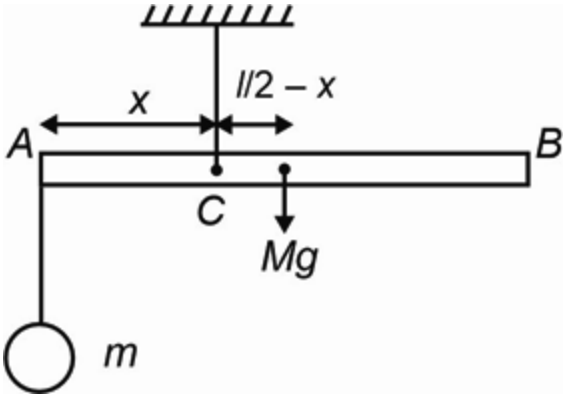
$g_h = \frac{gR^2}{(R+h)^2}$

$g_h = g\frac{(6400)^2}{(6400+100)^2} = g\left(\frac{6400}{8000}\right)^2$

% change in acc^n due to gravity

$= \left(\frac{g - g_h}{g}\right) \times 100\% = \left(1 - \frac{g_h}{g}\right) \times 100\% \simeq 36\%$

(37) Answer : (4)
Solution:



balancing torque about *C*

$mgx = Mg\left(\frac{l}{2} - x\right)$

$mx = \frac{Ml}{2} - Mx$

$m = \frac{Ml}{2x} - M$

$\therefore$ Variables are *m* and $\frac{1}{x}$

(38) Answer : (3)
Solution:
Nuclides with same atomic number *Z*, but different neutron number *N* are called isotopes.

(39) Answer : (2)
Solution:

$R_{eq} = \frac{500}{3}\ \Omega$

$I = \frac{V}{R_{eq}} = 0.036$ A

(40) Answer : (2)
Solution:

$I_1 = \frac{2.5}{(2.5+2)} \times 2 = \frac{10}{9}$ A

$I_2 = \frac{2}{(2.5+2)} \times 2 = \frac{4}{4.5}$ A = $\frac{8}{9}$ A

$V_A - V_B = I_1 \times 1 = \frac{10}{9} \times 1 = \frac{10}{9}$V

$V_A - V_D = I_2 \times 1.5 = \frac{8}{9} \times 1.5 = \frac{12}{9}$V

$V_B - V_D = (V_A - V_D) - (V_A - V_B)$

$= \frac{2}{9}$ V

(41) Answer : (3)
Solution:

$V_A - IR + E - \frac{LdI}{dt} = V_B$

$V_B - V_A = -5 \times 1 + 15 - 5 \times 10^3\left(-10^3\right) = 15$ V

(42) Answer : (1)
Solution:

$X_C = \frac{1}{\omega C} = \frac{1}{2\pi fC}$

$X_C \propto \frac{1}{f}$

(43) Answer : (3)
Solution:

$\frac{1}{f} = (\mu - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$

$\mu = \frac{\mu_L}{\mu_M}$

f = 30 cm

R_1 = 10 cm and $R_2 = \infty$

$\frac{1}{30} = (\mu - 1)\left(\frac{1}{10} - \frac{1}{\infty}\right)$

3μ – 3 = 1

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

(44) Answer : (3)

Solution:

Each part will have focal length 2*f*

$\frac{1}{F} = \frac{1}{2f} + \frac{1}{2f} \quad \Rightarrow \quad F = f$

(45) Answer : (2)

Solution:

$d\sin\theta = n\lambda$

$\sin\theta \approx \theta \approx \frac{y}{D}$

$d\left(\frac{y}{D}\right) = n\lambda$

$y = \left(\frac{D}{d}\right)(n\lambda)$

$y_3 - y_1 = \frac{D}{d}(3\lambda - \lambda)$

$= \frac{D}{d}(2\lambda)$

$\therefore$ *d* = 0.2 mm

CHEMISTRY

(46) Answer : (4)

Solution:

Aliphatic amines are stronger bases than aromatic amines.

Compound	pK_b value
Benzenamine	9.38
Phenylmethanamine	4.70
N-Methylaniline	9.30
N, N-Dimethylaniline	8.92

(47) Answer : (1)

Solution:

For minimum molecular mass of biomolecule, each molecule should have one Zn^{2+} ion.

0.04g of Zn^{2+} is present in 100 g of biomolecule

1g of Zn^{2+} is present in $\frac{100}{0.04}$ g of biomolecule

65.4g of Zn^{2+} is present in $\frac{100}{0.04} \times 65.4$

= 1.6×10^5 u

(48) Answer : (2)

Solution:

Value of l	Subshell
0	*s*
1	*p*
2	*d*
3	*f*

(49) Answer : (2)

Hint:

$\frac{1}{\lambda} = R_H Z^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$, $n_1 = 2\left(Balmer\ series\right)$

Solution:

For second line :

$\frac{1}{\lambda} = R_H \left(\frac{1}{(2)^2} - \frac{1}{(4)^2} \right)$

$= R_H \cdot \frac{3}{16}$

$\lambda = \frac{16}{3R_H}$

For third line

$\frac{1}{\lambda} = R_H \left(\frac{1}{(2)^2} - \frac{1}{(5)^2} \right)$

$\frac{1}{\lambda} = R_H \left(\frac{21}{100} \right)$

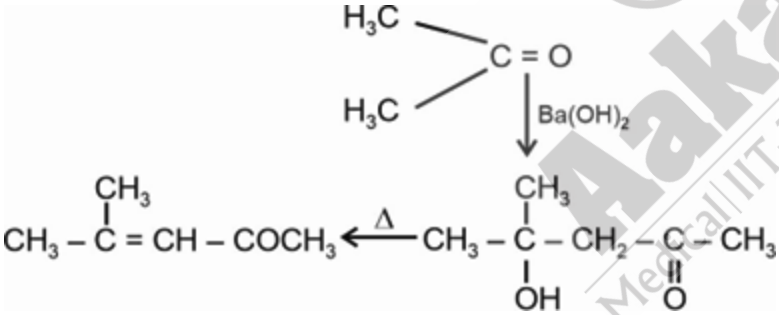
$\lambda = \frac{100}{21 R_H}$

$\frac{\lambda_{2^{nd}\,line}}{\lambda_{3^{rd}\,line}} = \frac{16 \times 21\, R_H}{3\, R_H \times 100} = \frac{28}{25}$

(50) **Answer :** (2)
Hint:
17 group elements are called halogens
Solution:
Vanadium → Transition metal
Iodine → Halogen
Cerium → Lanthanoid
Thorium → Actinoid

(51) **Answer :** (1)
Solution:
The magnitude of H-bonding depends on physical state of the compound. It is maximum in the solid state and minimum in gaseous state.

(52) **Answer :** (3)
Solution:



(53) **Answer :** (3)
Hint:
$\Delta H = \Delta U + \Delta n_g RT$
Solution:
$\Delta H - \Delta U = \Delta n_g RT$
$2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$
$\Delta n_g = -3$
$\Delta H - \Delta U = \frac{-3 \times 8.314}{1000} \times 298 = -7.43 \text{ kJ}$

(54) **Answer :** (1)
Hint:
$\Delta_r H^o = \sum (BE)_{Reactants} - \sum (BE)_{Products}$
Solution:
$N_2H_2\,(g) + H_2\,(g) \rightarrow N_2H_4\,(g)$
$\Delta_r H^o = \{BE_{N=N} + 2\ BE_{N-H} + BE_{H-H}\} - \{BE_{N-N} + 4\,BE_{N-H}\}$
$-109 = \{400 + 2 \times 391 + 436\} - \{BE_{N-N} + 4 \times 391\}$
$-109 = 400 + 782 + 436 - BE_{N-N} - 1564$
BE_{N-H} = 163 kJ/mol

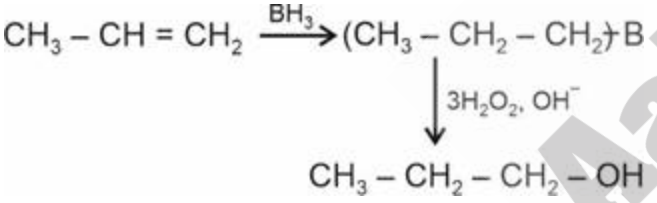
(55) **Answer :** (3)
Solution:
$3C_2O_4^{2-} \rightarrow 6\,CO_2$ change in oxidation states = 6
$\therefore$ Moles of $KMnO_4$ required = 6/5

(56) **Answer :** (3)
Hint:
Distillation under reduced pressure is used to purify liquids which decompose at or below their boiling points.
Solution:
Fractional distillation is used to separate liquids if difference in boiling points of liquids is not much. Crude oil is purified by this method.

(57) **Answer :** (3)
Solution:
Greater is the resonance and hyperconjugation, more is the stability of free radicals.

(58) **Answer :** (2)
Hint:
• Higher the value of ΔT_f, lower will be the freezing point of the solution.
• $\Delta T_f = i \times K_f \times m$
$\therefore \Delta T_f \propto i$ (when K_f and molality are constant)
Solution:
• For 0.1 m NaCl (α = 60%), i = 1+(n – 1)α
= 1 + (2 – 1) × 0.6 = 1.6
• For 0.1 m $MgCl_2$ (α = 50%), i = 1 +(n – 1)α
1 + 2 × 0.5 = 2
• For 0.1 m $AlCl_3$ (α = 40%), i = 1+(n – 1)α
= 1 + 3 × 0.4 = 2.2
So the order of ΔT_f is III > II > I
$\therefore$ Order of T_f is I > II > III

(59) **Answer :** (1)
Solution:

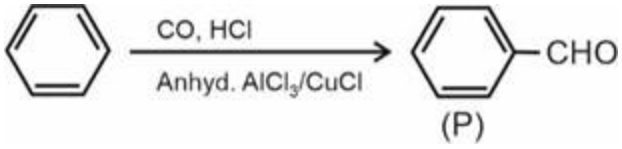


(60) **Answer :** (3)
Solution:
Q = 9.65 × 20 × 60 C
Number of equivalent of silver deposited
$= \frac{9.65 \times 20 \times 60}{96500} = 0.12$
Mass of silver deposited = 0.12 × 108 = 12.96 g.

(61) **Answer :** (4)
Solution:
• MnO_4^{2-} (Manganate) ion → Mn^{6+}
$Mn^{6+} \rightarrow [Ar]\ 4s^{\circ}3d^1$
It is paramagnetic and green in colour
• Scandium show only +3 oxidation state
• Mn_2O_7 is covalent green oil

(62) **Answer :** (2)
Hint:
r = $-\frac{d[H_2O_2]}{dt} = 2\frac{d[O_2]}{dt}$
Solution:
$-\frac{d[H_2O_2]}{dt} = 2\frac{d[O_2]}{dt} \Rightarrow 0.2 = 2\frac{d[O_2]}{dt}$
$\frac{d[O_2]}{dt}$ = 0.1 mol $L^{-1}s^{-1}$

(63) Answer : (3)
Solution:



(P)

- It does not have $-\overset{\overset{O}{\|}}{C}-CH_3$ group. So, it does not give haloform reaction.
- Aromatic aldehydes do not give Fehling's test.

(64) Answer : (2)
Solution:
With the increase in size and mass of halogen atom, the magnitude of Van der Waals forces increases, so methyl iodide has higher boiling point than methyl bromide.

(65) Answer : (4)
Solution:
F_2 is not used in the synthesis of methyl fluoride.

(66) Answer : (4)
Solution:
3º alcohol with Lucas reagent show instant turbidity due to formation of stable carbocation.

(67) Answer : (4)
Hint:
Amylose is a water soluble component which constitutes about 15 – 20% of starch.

(68) Answer : (3)
Hint:
Myosin is an example of fibrous protein
Solution:
• Keratin and myosin are fibrous proteins
• Insulin and albumin are globular proteins

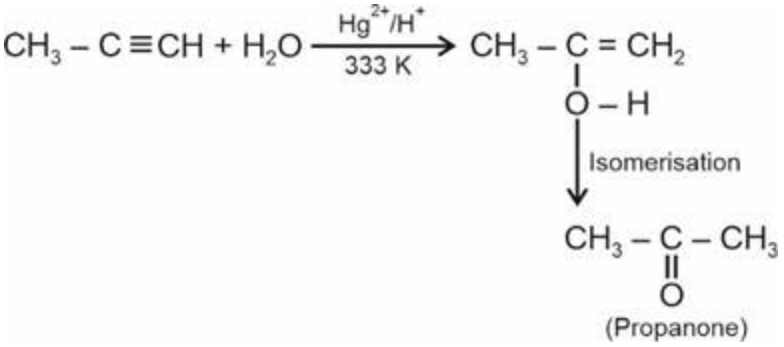
(69) Answer : (4)
Solution:
Methyl orange is orange red in acidic medium and turns yellow in basic medium.

(70) Answer : (2)
Solution:

Pb^{2+}, Cu^{2+}, As^{3+} – Group II
Al^{3+}, Fe^{3+} – Group III
Ba^{2+}, Ca^{2+}, Sr^{2+} – Group V
Mg^{2+} – Group VI

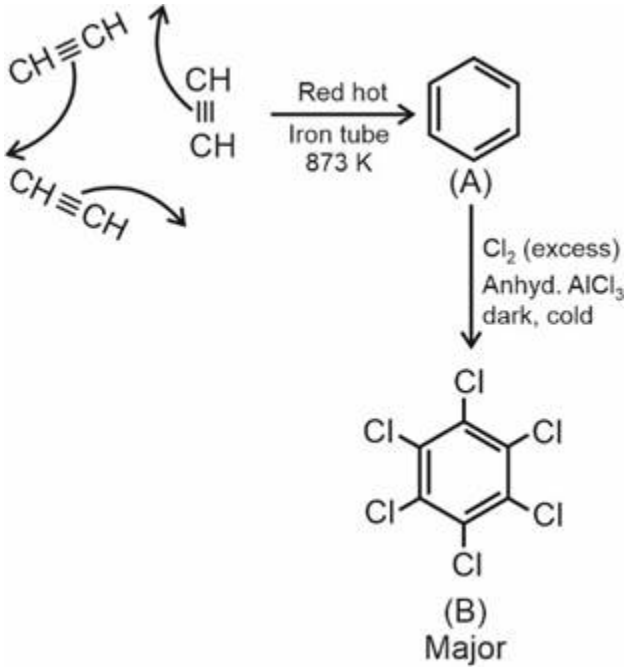
(71) Answer : (1)
Solution:
$N_2 : \sigma 1s^2, \sigma * 1\, s^2, \sigma 2s^2, \sigma * 2s^2, \pi 2p_x{}^2 \equiv \pi 2p_y^2, \sigma 2p_z^2$

(72) Answer : (3)
Solution:

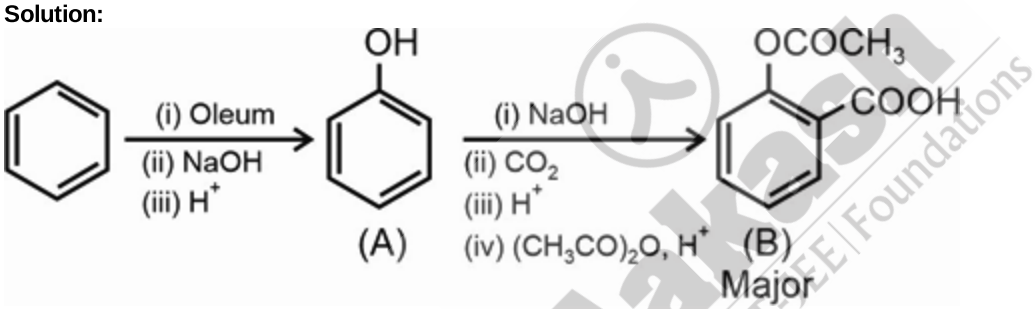


(Propanone)

(73) Answer : (4)
Solution:



(74) Answer : (1)
Solution:

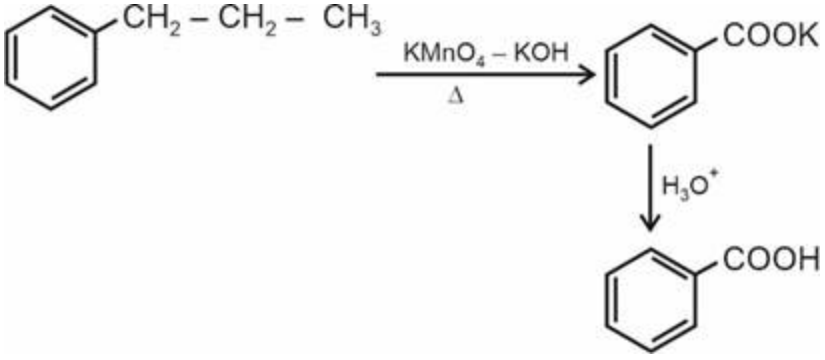


(75) Answer : (4)
Solution:
Mole of methanol = 0.2
Mole of H_2O = 0.8
Mass of H_2O = 0.8 × 18 = 14.4

$$m = \frac{\text{Moles of methanol}}{\text{Mass of } H_2O \text{ in Kg}}$$

$$= \frac{0.2}{14.4} \times 1000 = 13.9$$

(76) Answer : (3)
Solution:



(77) Answer : (2)

Solution:
Boiling point of propan-1-ol is higher than acetone due to hydrogen bonding.

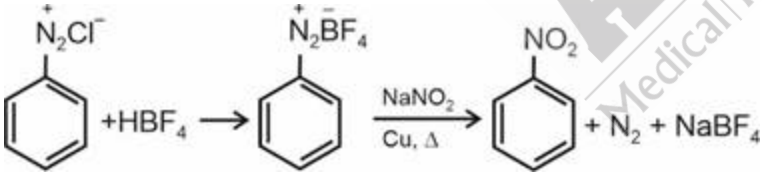
Compound		Boiling point/(K)
Methoxyethane	–	281
Propanal	–	322
Acetone	–	329
Propan-1-ol	–	370

(78) Answer : (3)
Solution:
$t_{99.9\%} = \frac{3}{2} t_{99\%}$
$t_{99.9\%} = \frac{3}{2} \times 32 = 48$

(79) Answer : (3)
Hint:
% purity = $\frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$
Solution:
$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
100 g 44 g
50 g $\frac{44}{100} \times 50 = 22$
$\therefore$ % purity = $\frac{20}{22} \times 100 = 90.9\bullet \approx 91\bullet$

(80) Answer : (1)
Solution:
Tetrahedral complexes do not show geometrical isomerism because the relative positions of the unidentate ligands attached to the central metal atom are the same with respect to each other.

(81) Answer : (1)
Solution:
Ligands can be arranged in a series in the order of increasing field strength as given below
$I^- < Br^- < SCN^- < Cl^- < S^{2-} < F^- < OH^- < NCS^- <$ en < CO
such a series is termed as spectrochemical series.

(82) Answer : (4)
Solution:


(83) Answer : (3)
Solution:
$\Lambda^\circ_m (CH_3COOH) = \Lambda^\circ_m (CH_3COONa) + \Lambda^\circ_m (HCl) - \Lambda^\circ_m (NaCl)$
= z + y – x

(84) Answer : (1)
Solution:
Actinoids have a greater range of oxidation states.
• Uranium shows +3, +4, +5 and +6 oxidation states
• Neptunium shows +3, +4, +5, +6 and +7 oxidation states
• Americium shows +3, +4, +5 and +6 oxidation states
• Plutonium shows +3, +4, +5, +6 and +7 oxidation states

(85) Answer : (1)
Solution:
$NH_4SH(s) \rightleftharpoons \underset{P'}{NH_3(g)} + \underset{P'}{H_2S(g)}$
2P′ = 20
P′ = 10 atm

$K_p = 10 \times 10 = 100$

(86) Answer : (2)
Solution:
• For salt of weak acid and weak base
$pH = 7 + \frac{1}{2}[pK_a - pK_b]$
• For salt of weak acid and strong base
$pH = 7 + \frac{1}{2}[pK_a + \log C]$
• For salt of weak base and strong acid
$pH = 7 - \frac{1}{2}[pK_b + \log C]$

(87) Answer : (4)
Solution:

$BaSO_4$	$\longrightarrow$	Ba^{2+} +	SO_4^{2-}
S		S	S
		S	S + 0.2

$K_{sp} = S(S + 0.2)$
$= S^2 + 0.2S$
$0.2S = K_{sp}$
$S = \frac{1.1 \times 10^{-10}}{0.2}$
$S = 5.5 \times 10^{-10}$ M

(88) Answer : (3)
Solution:
• $PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3HCl$
• $4H_3PO_3 \rightarrow 2H_3PO_4 + PH_3$

(89) Answer : (2)
Solution:
$XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$

(90) Answer : (2)
Solution:

Element	First ionization enthalpy/(kJ mol^{-1})
Si	786
Ge	761
Sn	708
Pb	715

BIOLOGY

(91) Answer : (3)
Solution:
Family comprises a group of related genera. *Petunia* and *Datura* are placed under Solanaceae. Order primata is placed in the class Mammalia.

(92) Answer : (2)
Solution:
M.W. Beijerinek demonstrated that the extract of infected plants of tobacco could cause infection in healthy plants.

(93) Answer : (2)
Solution:
The organism in the given figure is *Dictyota* and it belongs to phaeophyceae. They produce pyriform gametes.

(94) Answer : (4)
Solution:
In China rose, androecium is monoadelphous.

(95) **Answer :** (2)
Solution:
Members of solanaceae have epipetalous stamens and persistent sepals.

(96) **Answer :** (3)
Solution:
Rudolf Virchow modified the hypothesis of Schleiden and Schwann to give cell theory a final shape.

(97) **Answer :** (2)
Solution:
Animal cells contain a non-membrane bound organelle called centrosome, while ribosome is seen in all prokaryotes and eukaryotes.

(98) **Answer :** (3)
Solution:
Mesosomes – Helps in DNA replication
Golgi complex – Formation of glycolipids
Lysosomes – Digestion of proteins
Vacuoles – Storage of sap

(99) **Answer :** (3)
Solution:
Photochemical phase or light reactions of photosynthesis include water splitting.
Reaction centre of photosystem is chlorophyll *a*.

(100) **Answer :** (2)
Solution:
Fructose is phosphorylated by the activity of the enzyme hexokinase.

(101) **Answer :** (4)
Solution:
Meristematic cells keep on adding new cells to the plant body, which results in the open form of growth.

(102) **Answer :** (3)
Solution:
Auxins are widely used as herbicides and are used to prepare weed-free lawns.

(103) **Answer :** (3)
Solution:
Vegetative cell has abundant food reserve and it is bigger and have large irregular shaped nucleus.

(104) **Answer :** (1)
Solution:
Papaya shows dioecy.

(105) **Answer :** (3)
Solution:
Seed of castor is endospermous

(106) **Answer :** (4)
Solution:
In all connective tissues, except blood, the cells secrete fibres of structural proteins called collagen or elastin. The fibres provide strength, elasticity and flexibility to the tissue. These cells also secrete modified polysaccharides, which accumulate between cells and fibres and act as the matrix (ground substance).

(107) **Answer :** (2)
Solution:
Flame cells/protonephridia are excretory structures in platyhelminths *etc.,* while nephridia perform excretion in earthworms and other annelids.

(108) **Answer :** (4)
Solution:
The shifting of the oxygen dissociation curve from normal to the left indicates an increase in the affinity of haemoglobin for oxygen which occurs when factors like high pO_2, low pCO_2, lesser H^+ concentration and lower temperature exist.

(109) **Answer :** (3)
Solution:
Cytosine is a nitrogenous base.

(110) **Answer :** (2)

Solution:
Ammonia (most toxic nitrogenous waste) produced by metabolic reactions is converted into urea in the liver of mammals and then released into the blood which is filtered and excreted out by the kidneys.

(111) Answer : (1)
Solution:
Ball and socket joint is present between humerus and glenoid cavity of scapula; Ball and socket joint is also present between femur and acetabulum of coxal bone.
Cartilaginous joint is present in between the 12^{th} thoracic and 1^{st} lumbar vertebrae.
Hinge joint is present between femur and tibia.

(112) Answer : (4)
Solution:
In humans, unmyelinated nerve fibers are enclosed by Schwann cells that do not form myelin sheath around the axon, and is commonly found in autonomous and the somatic neural systems.
The plasma membrane of axon is called axolemma.

(113) Answer : (4)
Solution:
Thyroid gland secretes a proteinaceous hormone called thyrocalcitonin which regulates the blood calcium levels.
Parathyroid gland secretes parathormone.

(114) Answer : (4)
Solution:
Rana tigrina shows sexual dimorphism as the male possesses copulatory pads and vocal sacs. Male cockroaches possess anal style. In aschelminthes, females are longer in length as compared to males.

(115) Answer : (1)
Solution:
Members of the class chondrichthyes have a persistent notochord and in males, pelvic fins bear claspers.
Cycloid scales, air bladder and operculum are present in the members of the class Osteichthyes.

(116) Answer : (1)
Solution:
In a monohybrid cross, the phenotypic ratio of the F_2 generation is typically 3 : 1.

(117) Answer : (3)
Solution:
Incomplete dominance is characterised by expression of a third phenotype which is a blend of the phenotypes of the two alleles.

(118) Answer : (1)
Solution:

♀ \ ♂	T	t
T	TT	Tt
t	Tt	tt

In the above cross, 25% offsprings are homozygous dominant (TT).

(119) Answer : (2)
Solution:
A nitrogenous base is linked to the OH of 1′C of a pentose sugar.

(120) Answer : (4)
Solution:
Erwin Chargaff observed that in a double stranded DNA, the ratios between Adenine and Thymine and Guanine and Cytosine are constant and equals one.

(121) Answer : (4)
Solution:
Okazaki fragments are formed during replication on the lagging strand during DNA replication.

(122) Answer : (3)
Solution:
Zooplanktons and bottom dwellers represent the consumers in a pond ecosystem.

(123) Answer : (2)
Solution:
Sacred groves of Khasi and Jaintia hills are located in Meghalaya.

(124) Answer : (4)
Solution:
Fig and wasp show mutualism.

(125) Answer : (1)
Solution:
'X' represents the histone octamer which is formed of a unit of eight molecules.

(126) Answer : (3)
Solution:
In lichens, mycobionts are heterotrophic and phycobionts are autotrophic.

(127) Answer : (3)
Solution:
Algin is obtained from brown algae. *Gracilaria* is a red alga.

(128) Answer : (2)
Solution:
The companion cells are specialised parenchymatous cells, which are closely associated with sieve tube elements.

(129) Answer : (1)
Solution:
Stomata is present on epidermis of stem and leaf. Stomatal pore is surrounded by guard cells.

(130) Answer : (2)
Solution:
Tail and head of phospholipids is hydrophobic and hydrophilic in nature respectively. Human erythrocyte plasma membrane contains 40% lipids & 52% proteins.

(131) Answer : (2)
Solution:
The wall of the uterus has three layers of tissues. The external thin membranous perimetrium; middle thick layer of smooth muscle, myometrium; and inner glandular layer called endometrium. The endometrium undergoes cyclical changes during the menstrual cycle while the myometrium exhibits strong contractions during the delivery of the baby.
Endometrium is the site of implantation; it is vascular.

(132) Answer : (1)
Solution:
Diaphragm, cervical caps and vaults are barrier methods. Spermicidal creams, jellies and foams are chemical barriers. Progestasert and LNG-20 are hormone releasing IUDs. Lippes loop is a non-medicated IUD.

(133) Answer : (3)
Solution:
Whales, bats, cheetahs, and humans (all mammals) share similarities in the pattern of bones of their forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structures – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs.

(134) Answer : (1)
Solution:
DNA ligase is termed as molecular glue whereas restriction endonuclease/restriction enzyme is termed as molecular scissor. DNA polymerase replicates DNA whereas reverse transcriptase converts RNA into DNA.

(135) Answer : (3)
Solution:
With the help of gene therapy, a functional ADA cDNA (using a disarmed retroviral vector) can be introduced into the lymphocytes isolated from the patient. Biolistics/gene gun is a method used for transferring genes into plant cells. *Agrobacterium tumefaciens* is a natural genetic engineer of plants.

(136) Answer : (4)
Solution:
By the end of the second month of pregnancy, the foetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well-developed. The

first movements of the foetus and the appearance of hair on the head are usually observed during the fifth month. By the end of about 24 weeks (end of the second trimester), the body is covered with fine hair, eye-lids separate and eyelashes are formed. By the end of nine months of pregnancy, the foetus is fully developed and is ready for delivery.

(137) Answer : (4)
Solution:
In an adult human, there are 14 facial bones; 26 bones are present in the vertebral column, and there are 6 false ribs.

(138) Answer : (3)
Solution:
Human heart is myogenic in nature which means it is auto-excitable. Mitral or bicuspid valve regulates the flow of oxygenated blood from the left atrium to the left ventricle.
The conduction of impulses is initiated by SAN.
AV bundle continues from the AVN which passes through the atrio-ventricular septa.

(139) Answer : (2)
Hint:
Enzymes are temperature specific in action.
Solution:
Enzymes differ from inorganic catalysts in many ways, but one major difference is that the inorganic catalysts work efficiently at high temperatures and high pressures, while enzymes get damaged at high temperatures. However, enzymes isolated from organisms who normally live under extremely high temperatures are stable and retain their catalytic power even at higher temperature.

(140) Answer : (3)
Solution:
Hormone-receptor complex is formed inside the cell in case of hydrophobic hormones or steroid hormones.

(141) Answer : (3)
Solution:
Directional selection occurs when more individuals acquire value other than the mean character value.

(142) Answer : (3)
Solution:
Decline in hCG leads to regression of corpus luteum in a pregnant female. Acrosome is a feature of sperm.
Removal of ovaries leads to an increase in the level of GnRH due to lack of negative feedback.

(143) Answer : (2)
Solution:
In mammals, fertilization is internal and most of them are viviparous with few exceptions. Members of subclass Prototheria are egg laying mammals, *e.g.*, *Platypus* and *Echidna*.

(144) Answer : (2)
Hint:
Also called CD4 cells
Solution:
HIV mainly destroys the helper T-cells. Macrophages act as HIV-factories.

(145) Answer : (1)
Solution:
Since the DNA is enclosed within membranes, the cell has to be opened to release DNA. Fungal cell wall is made of chitin which is broken down by chitinase and bacterial cell wall is broken down by lysozyme.

(146) Answer : (4)
Solution:

Respiratory Gas	O_2 (Partial pressure in mm Hg)	CO_2 (Partial pressure in mm Hg)
Atmospheric Air	159	0.3
Alveoli	104	40
Blood (Deoxygenated)	40	45
Blood	95	40

(Oxygenated)		
Tissues	40	45

(147) Answer : (2)
Solution:
Bile and pancreatic juice reach to first part of intestine through a common duct. Gall bladder is present in frog.

(148) Answer : (2)
Hint:

*	Leucocytes (WBCs)	–	6000-8000 mm^{-3} of blood
*	Erythrocytes (RBCs)	–	5-5.5 million mm^{-3} of blood
*	Thrombocytes (Platelets)	–	1,50,000-3,50,000 mm^{-3} of blood

(149) Answer : (3)
Solution:
Proteins are heteropolymers of amino acids. The chemical and physical properties of amino acids are essentially of the amino, carboxyl, and (R) functional groups. A particular property of amino acid is the ionizable nature of $–NH_2$ and –COOH groups. Hence, in solutions of different pH, the structure of amino acids changes.

(150) Answer : (2)
Solution:
Ommatidia are considered as the visual units of cockroach's eye. They are 2000 in number in each eye.

(151) Answer : (1)
Solution:
Wuchereria has organ-system level of body organisation.

(152) Answer : (2)
Solution:
Glomerulus is a tuft of capillaries formed by the branching of afferent arteriole which is a fine branch of renal artery. Glomerular capillaries join to form efferent arteriole.

(153) Answer : (4)
Solution:
The overhanging stretches also called sticky ends facilitate the action of DNA ligase.

(154) Answer : (2)
Solution:
Graafian follicle ruptures to release ovum during ovulation. Ovum is also called secondary oocyte that remains arrested in metaphase-II.

(155) Answer : (1)
Solution:
RNAi is a post-transcriptional gene silencing method. Rosie is a transgenic cow.

(156) Answer : (1)
Solution:
Condensation of chromosomal material occurs in prophase.

(157) Answer : (2)
Solution:
In anaphase I, the pair of homologous chromosomes separates but each chromosome still contains both sister chromatids.

(158) Answer : (2)
Solution:
Tetrad consists of a pair of homologous chromosomes or four chromatids. It is clearly visible in the pachytene stage.

(159) Answer : (2)
Solution:
Since, splitting of the water molecule takes place on the inner side of the thylakoid membrane, the protons or hydrogen ions that are produced by the splitting of water accumulate within the lumen of the thylakoids.

(160) Answer : (2)
Solution:

Trait under study is autosomal recessive.

(161) Answer : (3)
Solution:
Coding strand of DNA has same sequence as RNA formed from template DNA. But it has T in place of U (found in RNA)

(162) Answer : (2)
Hint:
RNA polymerase II catalyses the synthesis of hnRNA (the primary transcript)
Solution:
Tailing is the addition of adenylate residues (about 200-300) at 3' end in a template-independent manner on newly formed hnRNA.
$\rightarrow$ ρ factor in prokaryotes is required for termination of transcription.
Splicing is the process of removal of introns and joining of exons in a defined order.

(163) Answer : (1)
Solution:
Trichoderma is frequently seen in root ecosystem.
Trichoderma are free living fungi that are effective against several root pathogens.

(164) Answer : (2)
Hint:
Among animals, invertebrates form the most species-rich group.
Solution:
Among animals, insects form the most species-rich taxonomic group, making more than 70 per cent of the total.

(165) Answer : (3)
Solution:
Parenchyma tissue can have small intercellular spaces.

(166) Answer : (3)
Solution:
Meiosis involves two sequential cycles of nuclear division but one cycle of DNA replication resulting in the formation of four haploid daughter cells.

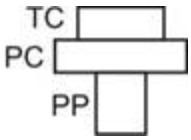
(167) Answer : (3)
Solution:
Decarboxylation occurs at two steps of Krebs cycle.

(168) Answer : (3)
Solution:
Aeration tanks have aerobic bacteria and fungal filaments

(169) Answer : (4)
Solution:
Biotic potential of organisms represents their intrinsic rate of natural increase

(170) Answer : (1)
Solution:
Pyramid of number is spindle-shaped for single tree.

Tree (T_1) $\rightarrow$ Frugivorous birds (T_2) $\rightarrow$ Carnivorous birds (T_3)



(171) Answer : (3)
Solution:
The brain capacity of *Homo habilis* was 650-800 cc. They were considered as the first human like being, the hominid.

(172) Answer : (3)
Solution:
Vinblastin is a chemotherapy medication used to treat a number of cancers.

(173) Answer : (4)
Solution:
MTP is generally safe during first trimester.

(174) Answer : (1)

Solution:

Annelids and most chordates have a closed circulatory system, in which the blood pumped by the heart is always circulated through a closed network of blood vessels. This circulatory pattern is considered to be more advantageous, as the fluid flow can be more precisely regulated.

(175) Answer : (2)

Solution:

DNA is negatively charged and thus, it moves towards the anode (which is a positively charged electrode). Smaller fragments move faster than larger fragments.

(176) Answer : (1)

Solution:

Adrenaline and noradrenaline are rapidly secreted in response to stress of any kind and during emergency situations and are called emergency hormones or hormones of fight or flight. These hormones increase alertness, pupillary dilation, piloerection (raising of hair), sweating, *etc*. Both hormones increase the rate of heart beat, the strength of ventricular contraction, and the rate of respiration. Catecholamines also stimulate the breakdown of glycogen resulting in an increased concentration of glucose in blood. In addition, they also stimulate the breakdown of lipids and proteins.

(177) Answer : (4)

Solution:

Using *Agrobacterium* vectors, nematode-specific genes can be introduced into the host plant. The introduction of DNA produces both sense and anti-sense RNA in the host cells. These two RNAs being complementary to each other forms a double-stranded RNA (dsRNA) that initiates RNAi and thus, silences the specific mRNA of the nematode.

(178) Answer : (1)

Solution:

Humans have dicondylic skull. Femur articulates with acetabulum which is a cavity formed by the fusion of ilium, ischium and pubis. The two halves of the pelvic girdle meet ventrally to form the pubic symphysis containing the fibrous cartilage.

(179) Answer : (4)

Solution:

Except for hepatitis-B, genital herpes and HIV infections, all other sexually transmitted diseases are curable if detected early and treated properly.

(180) Answer : (1)

Solution: