23/08/2023

Code-A Phase 1

Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005,
Ph.011-47623456

MM : 720 Fortnightly Test 2023-24_RM(P1)-Test-04A **Time : 200 Min.**

PHYSICS

SECTION-A

1. (3)
2. (4)
3. (3)
4. (3)
5. (2)
6. (4)
7. (4)
8. (3)
9. (2)
10. (2)
11. (3)
12. (1)
13. (2)
14. (4)
15. (2)
16. (4)
17. (3)
18. (1)
19. (2)
20. (3)
21. (3)
22. (4)
23. (4)
24. (3)
25. (2)
26. (1)
27. (1)
28. (2)
29. (3)
30. (3)
31. (4)
32. (4)
33. (3)
34. (1)
35. (1)

SECTION-B

36. (2)
37. (3)
38. (3)
39. (1)
40. (3)
41. (2)
42. (3)
43. (3)
44. (4)
45. (4)
46. (4)
47. (4)
48. (2)
49. (2)
50. (4)

CHEMISTRY

SECTION-A

51. (4)
52. (4)
53. (4)
54. (4)
55. (1)
56. (4)
57. (3)
58. (1)
59. (2)
60. (1)
61. (2)
62. (3)
63. (2)
64. (2)
65. (2)
66. (3)
67. (2)
68. (3)
69. (4)
70. (4)
71. (3)
72. (4)
73. (4)
74. (4)
75. (1)
76. (1)
77. (3)
78. (4)
79. (1)
80. (2)
81. (2)
82. (2)
83. (3)
84. (2)
85. (3)

SECTION-B

86. (2)
87. (4)
88. (3)
89. (1)
90. (3)
91. (2)
92. (2)
93. (1)
94. (4)
95. (2)
96. (2)
97. (1)
98. (3)
99. (3)
100. (4)

BOTANY

SECTION-A

101. (4)
102. (3)
103. (2)
119. (1)
120. (4)
121. (1)

104. (2)
105. (3)
106. (4)
107. (1)
108. (3)
109. (3)
110. (2)
111. (4)
112. (3)
113. (4)
114. (2)
115. (3)
116. (2)
117. (2)
118. (2)

122. (4)
123. (4)
124. (2)
125. (4)
126. (2)
127. (3)
128. (2)
129. (2)
130. (1)
131. (2)
132. (2)
133. (2)
134. (3)
135. (3)

SECTION-B

136. (2)
137. (1)
138. (4)
139. (2)
140. (2)
141. (3)
142. (1)
143. (2)

144. (1)
145. (3)
146. (4)
147. (1)
148. (3)
149. (2)
150. (4)

ZOOLOGY

SECTION-A

151. (3)
152. (2)
153. (4)
154. (2)
155. (3)
156. (1)
157. (3)
158. (4)
159. (3)
160. (3)

169. (2)
170. (4)
171. (4)
172. (1)
173. (2)
174. (4)
175. (2)
176. (1)
177. (3)
178. (1)

161. (4)
162. (1)
163. (2)
164. (1)
165. (1)
166. (2)
167. (4)
168. (4)
179. (1)
180. (4)
181. (4)
182. (3)
183. (4)
184. (1)
185. (3)

SECTION-B

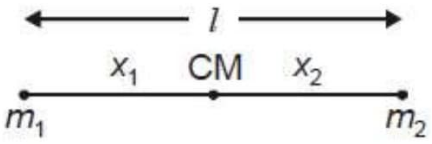
186. (2)
187. (3)
188. (3)
189. (1)
190. (4)
191. (2)
192. (2)
193. (4)
194. (4)
195. (1)
196. (3)
197. (3)
198. (3)
199. (4)
200. (2)

Hints and Solutions

PHYSICS

SECTION-A

(1) **Answer :** (3)
Solution:

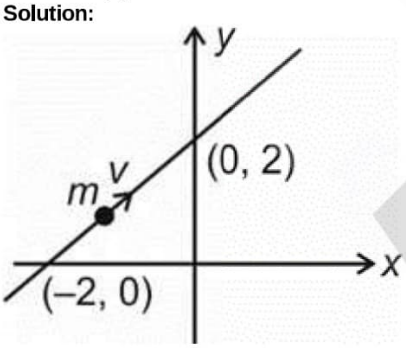


$x_1 = \frac{m_2 l}{m_1+m_2}$ and $x_2 = \frac{m_1 l}{m_1+m_2}$
$I = m_1 x_1^2 + m_2 x_2^2 = \frac{m_1 m_2}{m_1+m_2} l^2$

(2) **Answer :** (4)
Solution:
In the absence of external force, centre of mass of a system does not shift if initially at rest.

(3) **Answer :** (3)
Solution:
$v_{com} = \sqrt{\frac{2gh}{1+K}} = \sqrt{\frac{2gh}{1+\frac{2}{5}}}$
$= \sqrt{\frac{10gh}{7}}$

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



Angular momentum $\vec{r} = \vec{r} \times \vec{p}$
= ($r \perp p$)
$\because r \perp$ and $p = mv$ both are constant, hence $\vec{l}$ remain constant throughout.

(5) **Answer :** (2)
Solution:
$L = ml^2\omega$
$L_1 = m\left(\frac{3l}{4}\right)^2 \omega$
$= ml^2\omega \times \frac{9}{16}$
$L_1 = \frac{9}{16}L$

(6) **Answer :** (4)
Hint:
$\Delta\vec{x}_{com} = \frac{m_1\Delta\vec{x}_1 + m_2\Delta\vec{x}_2}{m_1+m_2}$
Solution:
$x \rightarrow y \quad \leftarrow y$
$\boxed{m} \quad \boxed{4m}$

$\frac{m(x)-4m(y)}{m+4m}=0$

$y=\frac{x}{4}$

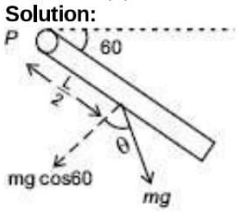
(7) **Answer :** (4)
Solution:
Rotational equilibrium $\Rightarrow \tau_{net}=0$
F_{net} may or may not be zero if body is in rotational equilibrium.

(8) **Answer :** (3)
Solution:
By angular momentum conservation

$\mathrm{mv}\frac{\mathrm{a}}{2}=\mathrm{l}\omega=\left[\frac{\mathrm{ma}^2}{6}+3\left(\frac{\mathrm{a}}{\sqrt{2}}\right)^2\right]\omega$

$\mathrm{mv}\frac{\mathrm{a}}{2}=\frac{2\,\mathrm{ma}^2}{3}\omega \text{ or, } \omega=\frac{3\mathrm{v}}{4\mathrm{a}}$

(9) **Answer :** (2)
Solution:



$\tau_p=mg\cos 60\times\frac{L}{2}=\frac{mg}{2}\times\frac{L}{2}$

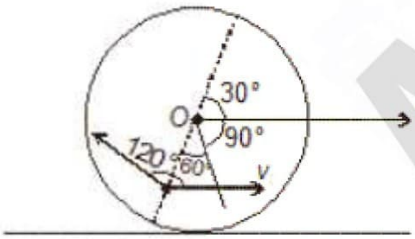
$\tau_\rho=mg\frac{L}{4}$

(10) **Answer :** (2)
Solution:

$K=\frac{1}{2}mv^2\left(1+\frac{l}{mR^2}\right)$

$K=\frac{1}{2}\times 10\times\left(\frac{50}{100}\right)^2\left(1+\frac{2}{5}\right)=1.75$

(11) **Answer :** (3)
Solution:



$v_1=\frac{R}{3}\times\omega$

$v_1=\frac{R}{3}\times\frac{v}{R}=\left(\frac{v}{3}\right)$

$v_P=\sqrt{v_1^2+v_0^2+2v_0v_1\cos(120^\circ)}$

$v_P=\frac{\sqrt{7}v}{3}$

(12) **Answer :** (1)
Solution:

$\vec{\mathrm{L}}=\mathrm{m}\left(\vec{\mathrm{r}}\times\vec{\mathrm{v}}\right)$

Only magnitude is constant, direction is continously changing

(13) **Answer :** (2)
Solution:
$I.\omega$ = constant and $\omega\propto\frac{1}{T}$
If 'I' will rise and 'ω' will reduce therefore time period will increase.

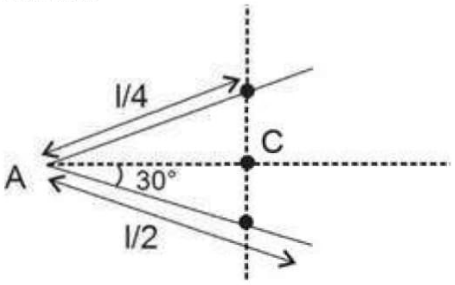
(14) **Answer :** (4)
Solution:

$\Delta L = 0$ and $\Delta L = \int \tau \cdot dt$
$\int \tau \cdot dt = \Delta L$
$\Rightarrow$ Area under τv/s *t* graph = ΔL
$\therefore$ For $\Delta L = 0$, area under τv/s *t* graph should be zero.

(15) **Answer :** (2)
Solution:
Due to force couple
$a_{com} = 0$ and v_{com} = constant
$\therefore$ Translation KE = constant.

(16) **Answer :** (4)
Solution:
As we know the bomb explodes by internal forces and in the absence of any change in external forces the centre of mass of bomb will continue to follow the same parabolic trajectory

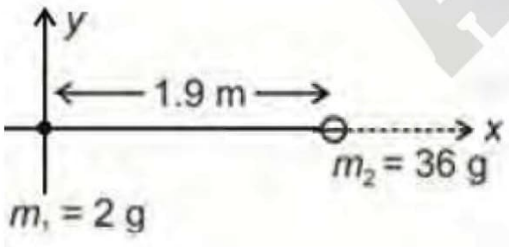
(17) **Answer :** (3)
Solution:



Distance CoM from Vertex A is
$= AC = \frac{l}{4}\cos 30^\circ$
$= \frac{l}{4}\left(\frac{\sqrt{3}}{2}\right) = \frac{\sqrt{3}l}{8}$

(18) **Answer :** (1)
Solution:
$f \geq mg$
$\Rightarrow \quad \mu m r\omega^2 \geq mg$
$\Rightarrow \quad \mu = \frac{g}{r\omega^2} = \frac{10}{1\times 100} = 0.1$

(19) **Answer :** (2)
Solution:



$x_{cm} = \frac{2\times 0 + 36\times 1.9}{2+36} = \frac{68.4}{38} = 1.8$ m

(20) **Answer :** (3)
Solution:
$k_{rot} = k = \frac{1}{2}I\omega^2 = \frac{L^2}{2I}$
$k \propto \frac{1}{I} \quad \Rightarrow \quad \frac{k_1}{k_2} = \frac{I_2}{I_1}$

(21) **Answer :** (3)
Solution:
$|\vec{V}_A| = \sqrt{V^2 + V^2}$
$= \sqrt{2}V$

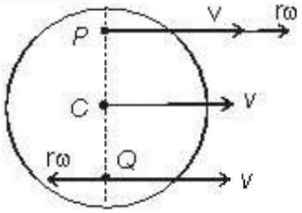
(22) **Answer :** (4)
Solution:

$$I = \frac{mr^2}{2} + \frac{mr^2}{2} + mr^2 + \frac{mr^2}{2} + mr^2 = \frac{7}{2}mr^2$$

(23) **Answer :** (4)
Solution:
The principle used by a gymnast to increase the number of somersault is law of conservation of angular momentum.

(24) **Answer :** (3)
Solution:
$x_{cm} = \frac{M\times0+M\times0+M\times2}{3M} = \frac{2}{3}$
$y_{cm} = \frac{M\times0+M\times0+M\times2}{3M} = \frac{2}{3}$
$\vec{r}_{om} = \frac{2}{3}(\hat{i}+\hat{j})$

(25) **Answer :** (2)
Solution:



Assume disk is rolling with will speed v, then
speed of C , $v_c = v$
speed of Q , $v_Q = v - r\omega$
Speed of P , $v_p = v + r\omega$

(26) **Answer :** (1)
Solution:
$\frac{1}{2}Mv^2 = \frac{1}{2}I\omega^2$
$\Rightarrow \quad \frac{1}{2}Mv^2 = \frac{1}{2}Mk^2\frac{v^2}{R^2}$
$\Rightarrow \quad \frac{k^2}{R^2} = 1$
So body is ring.

(27) **Answer :** (1)
Solution:
$\because \quad \mu = 1 > \frac{\tan\theta}{1+\frac{1}{k}} = \frac{1}{1+\frac{1}{1/2}} = \frac{1}{3}$
$\Rightarrow$ Pure rolling
$\therefore$ acceleration $a = \frac{g\sin\theta}{1+k}$
$= \frac{10\times1}{\sqrt{2}\left(1+\frac{1}{2}\right)}$
$= \frac{20}{3\sqrt{2}} = \frac{10\sqrt{2}}{3}$ m/s^2

(28) **Answer :** (2)
Solution:
Torque $\tau = I\alpha$
$\Rightarrow \frac{mg}{2}\times\frac{5L}{6} = \frac{mL^2}{3}\times\alpha$
$\Rightarrow \alpha = \frac{5g}{4L}$

(29) **Answer :** (3)
Solution:

I

$I = \frac{MR^2}{4}$ (M = mass of disc
R = radius of disc)
$MR^2 = 4I$ ...(1)

$I_t = \frac{MR^2}{2} + M(R)^2$

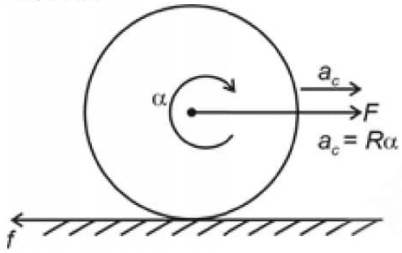
$= \frac{MR^2+2MR^2}{2} = \frac{3}{2}MR^2$

$I_t = \frac{3}{2}(4I) = 6I$

(30) **Answer :** (3)
Hint:
$KE = \frac{1}{2}I\omega^2 + \frac{1}{2}mv^2$
Solution:
$W = \Delta KE = K_f - K_i$
$= 0 - \left[\frac{1}{2}\left(6 \times 2^2\right)\left(\frac{4}{2}\right)^2 + \frac{1}{2} \times 6 \times 4^2\right]$
= –96 J

(31) **Answer :** (4)
Solution:
$\vec{\tau} = \vec{r} \times \vec{F} = \left(3\hat{i}\right) \times \left(\hat{i} - 2\hat{j}\right)$
$= 0 - 6\hat{i} \times \hat{j}$
$= -6\hat{k}$

(32) **Answer :** (4)
Solution:



Angle between F and f is 180°

(33) **Answer :** (3)
Solution:
By conservation of angular momentum,
$mv_0r = I\omega$
$\omega = \frac{mv_0r}{I}$
$= \frac{40\times5\times1}{100}$
= 2 rad/s

(34) **Answer :** (1)
Solution:
$P = \tau \cdot \omega$
P = 10 × 10 = 100 W

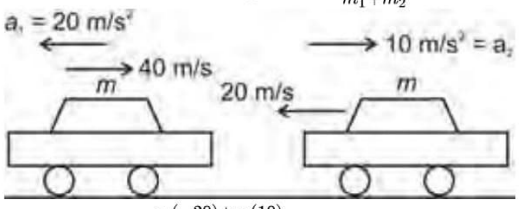
(35) **Answer :** (1)
Solution:
Rotational K.E.= $\frac{mv^2}{4}$
Translation K.E. = $\frac{mv^2}{2}$
Ratio = $\frac{1}{2}$

SECTION-B

(36) **Answer :** (2)
Solution:
By angular momentum conservation law,
$\frac{2}{5} \times MR^2 \times \frac{2\pi}{24} = \frac{2}{5}M\left(\frac{R}{4}\right)^2 \times \frac{2\pi}{T}$
T = 1.5 hr
ΔT = 24 – 1.5 = 22.5 hr

(37) **Answer :** (3)
Solution:

Acceleration of c.o.m., $\vec{a}_{\text{com}} = \frac{m_1\vec{B}_1+m_2\vec{B}_2}{m_1+m_2}$



$\therefore \quad a_{\text{com}} = \frac{m(-20)+m(10)}{2m}$

$\therefore |\vec{a}_{00m}| = 5\,\text{m/s}^2$

(38) **Answer :** (3)
Solution:
Here, given section is half of disc, then the mass of complete disc will be 4M.

$I_{disc} = \frac{1}{2} \times (4M)R^2$

$I_{\text{section}} = \frac{1}{2}\, I_{\text{disc}} = MR^2$

(39) **Answer :** (1)
Solution:
Let,

$$\bar{C} = \bar{A} \times \bar{B} = \begin{vmatrix} \hat{i} & j & \hat{k} \\ 1 & 2 & 3 \\ 1 & 2 & 1 \end{vmatrix}$$

$= \hat{i}(2-6) - \hat{j}(1-3) + \hat{k}(2-2)$

$\bar{C} = \bar{A} \times \bar{B} = -4\hat{i} + 2\hat{j}$

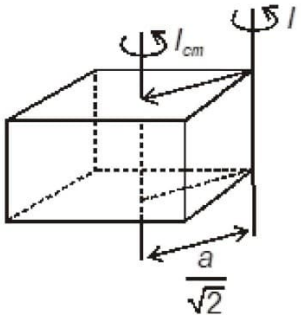
$\hat{c} = \frac{\bar{c}}{|\bar{C}|} = \frac{-2\hat{i}+\hat{j}}{\sqrt{5}}$

(40) **Answer :** (3)
Solution:
At bottom, minimum speed (v) is $\sqrt{4gl}$ using conservation of energy.

$\frac{1}{2}mu^2 + mgl = \frac{1}{2}mv^2 \Rightarrow \frac{u^2}{2} + gl = \frac{4gl}{2}$

$\therefore u = \sqrt{2g1}$

(41) **Answer :** (2)
Solution:



$I_{cm,\text{ cube}} = \frac{ma^2}{6}$

$I = I_{\text{cm}} + mx^2$

$= \frac{ma^2}{6} + m \cdot \left(\frac{a}{\sqrt{2}}\right)^2 = \frac{ma^2}{6} + \frac{ma^2}{2}$

$\boxed{I = \frac{2}{3}ma^2}$

(42) **Answer :** (3)
Solution:
$\overline{L} = \overline{r} \times \overline{P}$

$$L = \begin{vmatrix} i & j & k \\ 1 & 2 & -1 \\ 3 & 4 & -2 \end{vmatrix}$$

$\hat{I}(-4+4) - \hat{J}(-2+3) + \hat{k}(4-6)$

$-\hat{J} - 2\hat{k}$

This vector belongs to the y–z plane and so it is perpendicular to x–axis.

(43) **Answer :** (3)
Solution:
$w = w_0 - \alpha t$

$\alpha = \frac{W_0}{f} = \frac{2\pi(240)}{60\times60}$

$\alpha = \frac{8\pi}{60}\text{rad/s}^2$

$\tau = I\alpha$

$= 4\frac{8\pi}{60} = \frac{8\pi}{15}Nm$

(44) **Answer :** (4)
Solution:
Depends on the distribution of mass.

(45) **Answer :** (4)
Solution:
Moment of inertia depends on position of masses and distribution of its masses but not on angular speed.

(46) **Answer :** (4)
Solution:
$\omega = \omega_0 + \alpha t$

$= 2 + 2 \times 4 = 10$ rad/s

(47) **Answer :** (4)
Solution:
$\Rightarrow I_1\omega_1 = I_2\omega_2$

$\Rightarrow \frac{MR^2}{2}\omega = \left[\frac{MR^2}{2} + \frac{\left(\frac{M}{2}\right)R^2}{2}\right]\omega'$

$\Rightarrow \frac{MR^2\omega}{2} = \frac{3MR^2}{4}\omega'$

$\Rightarrow \boxed{\omega' = \frac{2\omega}{3}}$

(48) **Answer :** (2)
Solution:
$\tau = Fr_\perp$

$= 60 \times 100 \times 10^{-2}$

$= 60$ Nm

$\tau = I\alpha$

$\alpha = \frac{60}{24} = \frac{10}{4}$

$= \frac{5}{2}$ rad/s^2

$\omega = \omega_0 + \alpha t$

$\omega = \frac{5}{2} \times 2$

$= 5$ rad/s

K.E $= \frac{1}{2}I\omega^2$

$= \frac{1}{2} \times \left(24\right)(5)^2$

$= 12 \times 25$

$= 300$ J.

(49) **Answer :** (2)
Solution:
$(M+2m)r^2\omega_1 = Mr^2\omega$

$\Rightarrow \omega_1 = \frac{M\omega}{(M+2m)}$

(50) **Answer :** (4)
Solution:

$I = \frac{2}{5}mr^2$

I about tangent, $I_1 = \frac{2}{5}mr^2 + mr^2 = \frac{7}{5}mr^2$

$\therefore\ mK^2 = \frac{7}{5}mr^2$

$\Rightarrow\ K = r\sqrt{\frac{7}{5}}$

CHEMISTRY

SECTION-A

(51) **Answer :** (4)
Solution:
Work is path function.

(52) **Answer :** (4)
Solution:
Entropy increases when randomness increases.

(53) **Answer :** (4)
Solution:
When strong acid and base react then there is formation of water. The energy released in such process is –57.1 kJ/eq.
So, for 1 mole of H_2O dissociation energy required = +57.1 kJ/mol = 13.7 kcal/mol

(54) **Answer :** (4)
Solution:
(C–H) bond energy = $\frac{360}{4} = 90\,kcal/mol$
Now,
620 = (C–C) B.E. + 6(90)
(C–C) B.E. = 620 – 6(90) = 80 kcal/mol

(55) **Answer :** (1)
Solution:
Intensive properties depends only on the type of matter not on the amount of matter in the system.
Enthalpy is an extensive property.

(56) **Answer :** (4)
Solution:
For isothermal reversible process, $W = -2.303\,nRT \log\left(\frac{V_2}{V_1}\right)$ for expansion, work will be non zero

(57) **Answer :** (3)
Solution:
w = –5 J, q = –20 J
Using 1st law
ΔU = q + w = (–5) + (–20) = –25 J

(58) **Answer :** (1)
Solution:
If T > ΔH/ΔS then reaction becomes spontaneous.
$T > \frac{30\times10^3}{60} = 500$ K

(59) **Answer :** (2)
Solution:
Using ΔG = ΔH – TΔS
ΔH < 0 and ΔS > 0
∴ΔG < 0
So, always spontaneous.

(60) **Answer :** (1)
Solution:
ΔU = q + W
If q = 0 then $\boxed{\Delta U = W}$

(61) **Answer :** (2)
Solution:

$\Delta G^\circ = -2.303\ RT \log K$
$-2.303 = -2.303\ RT \log K$
$\frac{1}{RT} = \log K$
$K = 10^{1/RT}$

(62) **Answer :** (3)
Solution:
w = –1 × (0.75 – 0.5)
= –0.25 L-bar
= –25 J (Since 1 L-bar = 100 J)

(63) **Answer :** (2)
Hint:
For isothermal reversible process $\Delta S = nR\ln\frac{V_2}{V_1}$
Solution:
$\Delta S = 4 \times 8.314 \times 2.303 \log\frac{20}{5}$
= 4 × 8.314 × 2.303 log4
= 46.11 J/K

(64) **Answer :** (2)
Solution:
$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$
$\Delta H_{Rxn} = \left(\Delta H_f^0\right)_p - \left(\Delta H_f^0\right)_R$
$= [2 \times (-393.5) + 2 \times (-241.8)] - 52.3 + 0$
$= -1322.9\ kJ/\text{mole}$

(65) **Answer :** (2)
Hint:
Q = msΔT
Solution:
Q = 25 × 0.39(80 – 35) = 438.75 J

(66) **Answer :** (3)
Hint:
$\Delta S = \frac{Q}{T}$
Solution:
$\Delta S = \frac{11200}{320}$ = 35 J/mol K

(67) **Answer :** (2)
Solution:
$\Delta H - \Delta U = \Delta n_g RT$
Greater is the positive value of Δn_g, higher will be 'ΔH –ΔU'.

(68) **Answer :** (3)
Solution:
$a = \frac{PV^2}{n^2} = \text{atm L}^2\ \text{mol}^{-2}$

(69) **Answer :** (4)
Solution:
Real gas behaves as ideal at low pressure and high temperature.

(70) **Answer :** (4)
Solution:
$\frac{r_{H_2}}{r_{CH_4}} = \sqrt{\frac{M_{CH_4}}{M_{H_2}}} = \sqrt{\frac{16}{2}} = 2\sqrt{2} : 1$

(71) **Answer :** (3)
Solution:
Gasses mixture are homogenous in composition.

(72) **Answer :** (4)
Solution:
$u_{avg} = \sqrt{\frac{8RT}{\pi M}}$
$\therefore\ u_{avg\,(O_2)} = u_{avg\,(SO_2)}$

$\therefore \sqrt{\frac{300}{32}} = \sqrt{\frac{T}{64}} \Rightarrow T = 600\,K$

(73) **Answer :** (4)
Hint:
Vapour pressure of a liquid depends on temperature.

(74) **Answer :** (4)
Hint:
$d = \frac{PM}{RT}$
Solution:
$d_1T_1 = d_2T_2 \Rightarrow d \times 300 = 0.75d \times T_2$
$\therefore$ $T_2 = 400$ K = 127°C

(75) **Answer :** (1)
Solution:
Total kinetic energy = $\frac{3}{2}nRT$
= $\frac{3}{2} \times \frac{40}{20} \times RT = 3RT$

(76) **Answer :** (1)
Hint:
Boyle's temperature, $T_B = \frac{a}{Rb}$, $T_C = \frac{8}{27}\left(\frac{a}{Rb}\right)$
$\Rightarrow T_B = \frac{27}{8} \times T_C = \frac{27}{8} \times 300\ K = 1012\ K$ (Approx.)
Solution: A

(77) **Answer :** (3)
Solution:
Sum of fractions of molecules remains unaltered on changing the temperature.

(78) **Answer :** (4)
Hint:
$U_{rms} > U_{avg} > U_{mp}$
Solution:
If U_{rms}, U_{avg} and U_{mp} are equal then temperatures at which these occur will have reverse order.
i.e. $T_1 < T_2 < T_3$.

(79) **Answer :** (1)
Solution:
$v_{mps} = \sqrt{\frac{2RT}{M}}$

(80) **Answer :** (2)
Solution:
As temperature increases force of attraction weakens so surface tension decreases.

(81) **Answer :** (2)
Solution:
Critical volume = 3b

(82) **Answer :** (2)
Solution:
$PV = \frac{w}{m}RT$,
$\therefore\ V = \frac{4}{2} \times \frac{0.0821 \times 600}{2} \approx 49.2$ L

(83) **Answer :** (3)
Solution:
Hint : $Z = \frac{V_{real}}{V_{ideal}}$ at same temperature and pressure.
Sol. : Volume of 2 moles ideal gas at STP = 2 × 22.4 L
Volume of 2 moles real gas at STP = 11.2 L
$Z = \frac{V_{real}}{V_{ideal}} = \frac{11.2}{2 \times 22.4} = \frac{1}{4}$

(84) **Answer :** (2)
Solution:
Hint: With increase in molar mass, van der Waals forces increases and value of 'a' generally increases.
Sol.: Order of van der Waals constant 'a':
$CO_2 > CH_4 > O_2 > N_2$
Due to more interaction forces CO_2(g) show more negative deviation.

(85) **Answer :** (3)
Solution:
According to kinetic molecular theory of gases, different particles of a gas may have different speeds.

SECTION-B

(86) **Answer :** (2)
Solution:
For a process to be spontaneous, ΔG must be negative.
$\Delta G = \Delta H - T\Delta S < 0$

(87) **Answer :** (4)
Solution:
Third law of thermodynamics:
$\lim_{T \to O} S \to 0$

(88) **Answer :** (3)
Solution:
$\Delta H = \Delta U + \Delta n_g RT$
$\Delta U = \Delta H - \Delta n_g RT$
$= 176 - 8.314 \times 10^{-3} \times 1240$
= 165.7 kJ

(89) **Answer :** (1)
Solution:
$\Delta_{\text{reaction}}H = \sum \text{B.E of reactant} - \sum \text{B.E of products}$
$= \text{B.E}(I_2) + \text{B.E}(H_2) - 2\text{B.E}(HI)$
= y + x – 2z

(90) **Answer :** (3)
Solution:
In isothermal process ΔT = 0
$\Delta H = nC_P\Delta T = 0$

(91) **Answer :** (2)
Solution:
$\Delta_{\text{comb}}H_{CH_4} = -x$
16 g CH_4 gives x J of heat
1 g CH_4 gives $\frac{x}{16}$ J of heat
32 g CH_4 gives $\frac{x}{16} \times 32 = 2x$ J of heat.

(92) **Answer :** (2)
Solution:
Non-polar molecules have London forces as the only intermolecular forces.

(93) **Answer :** (1)
Solution:
$$\frac{(u_{rms})_{H_2}}{(u_{rms})_{O_2}} = \frac{\sqrt{\left(\frac{3RT}{M}\right)_{H_2}}}{\sqrt{\left(\frac{3RT}{M}\right)_{O_2}}} = \sqrt{\frac{M_{O_2}}{M_{H_2}}} = \sqrt{\frac{32}{2}} = 4:1$$

(94) **Answer :** (4)
Solution:
Rate of effusion $\propto \frac{1}{\sqrt{\text{Molar mass}}}$

(95) **Answer :** (2)
Solution:
Pressure correction term in van der Waals equation $= \frac{an^2}{V^2}$

(96) **Answer :** (2)
Solution:
Dalton's law of partial pressure is only applicable when gases do not react with each other.
$NH_3 + HCl \rightarrow NH_4Cl$

(97) **Answer :** (1)
Solution:
Let the mass of CH_4 and O_2 are 32 gm each.

$\therefore\ n_{O_2} = \frac{32}{32} = 1,\ n_{CH_4} = \frac{32}{16} = 2$

Fraction of total pressure exerted by oxygen is

$\frac{P_{O_2}}{P_T} = X_{O_2} = \frac{1}{1+2} = \frac{1}{3}$

(98) Answer : (3)
Solution:
Energy required to increase the surface area of the liquid by one unit is called surface energy of the liquid.

(99) Answer : (3)
Solution:
SI unit of viscosity is Ns m^{-2}

(100) Answer : (4)
Solution:
According to Charle's law, $\frac{V}{T}$ = constant, so graph of V v/s T is increasing in straight line.

BOTANY

SECTION-A

(101) Answer : (4)
Solution:
Most of the members of Deuteromycetes are decomposers of litter and help in mineral cycling.

(102) Answer : (3)
Solution:
Fungi imperfecti that is Deuteromycetes do not show sexual reproduction.

(103) Answer : (2)
Solution:
The dikaryophase is seen in members of Ascomycetes and Basidiomycetes.

(104) Answer : (2)
Solution:
Some hyphae are continuous tubes filled with multinucleated cytoplasm are known as coenocytic hyphae.
Coenocytic mycelium is present in members of Phycomycetes i.e., *Rhizopus*, *Mucor* and *Albugo.*

(105) Answer : (3)
Solution:
No virus contains both DNA and RNA.

(106) Answer : (4)
Solution:
Albugo causes white rust in crucifers.

(107) Answer : (1)
Solution:
Both viruses and viroids cause infection.

(108) Answer : (3)
Solution:
Prion is an infectious proteinaceous particle. It is devoid of nucleic acid.

(109) Answer : (3)
Solution:
Viruses that infect plants usually have ssRNA.

(110) Answer : (2)
Solution:
Mycorrhizal association is found between fungi and roots of higher plants.

(111) Answer : (4)
Solution:
Potato spindle tuber disease is caused by viroids.

(112) Answer : (3)
Solution:
Viroids are smaller than viruses, discovered by T.O. Diener and they lack protein coat.

(113) Answer : (4)

Solution:
Claviceps belong to class Ascomycetes and they produce conidia and have septate hyphae.

(114) Answer : (2)
Solution:
Neurospora is used extensively in biochemical and genetic work. *Colletotrichum* is imperfect fungi and only asexual phase is known. Morels are edible ascocarps. *Ustilago* are smut causing fungi.

(115) Answer : (3)
Solution:
In Neem, a number of leaflets are present on a common axis called rachis.

(116) Answer : (2)
Solution:
Dicot seeds have embryo and seed coat and they may have endosperm

(117) Answer : (2)
Solution:
In valvate aestivation, sepals or petals do not overlap. In imbricate aestivation sepals or petal overlap but not in any particular direction.

(118) Answer : (2)
Solution:
Plum, Peach Rose → Half inferior ovary
Brinjal, China rose → Superior ovary
Guava, Cucumber, Ray floret of sunflower → Inferior ovary

(119) Answer : (1)
Solution:
A lateral branch with short internodes and each node bearing a rosette of leaves and a tuft of roots is found in offsets, it is seen in *Pistia* and *Eichhornia.* Aquatic plants such as Pistiaand Eichhornia contain a lateral branch which bear short internodes. In these lateral b ranches the distance between the two nodesdecreases and eaxh node bears a rosette of leaves above and a cluster (tuft) of roots below.

(120) Answer : (4)
Solution:
Root hairs are present in the region of maturation

(121) Answer : (1)
Solution:
Thorns are modified axillary buds. These structures are found in *Bougainvillea*.

(122) Answer : (4)
Solution:
Tepals are present in the member of lily family. *eg*. tulip, *Gloriosa*, *Aloe*, *Asparagus* and *Colchicum autumnale*.

(123) Answer : (4)
Solution:
In parietal placentation, ovary is one-chambered but it becomes two-chambered due to the formation of the false septum.

(124) Answer : (2)
Solution:
Sunflower shows basal plantation.

(125) Answer : (4)
Solution:
Papilionaceous corolla is found in members of family Fabaceae.

(126) Answer : (2)
Solution:
Aleurone layer is triploid and proteinaceous.

(127) Answer : (3)
Solution:
Scutellum is single cotyledon of monocots.

(128) Answer : (2)
Solution:
Non-endospermous seeds are found in Fabaceae family.
Castor is an endospermous seed.
Pea, bean and gram have non endospermous seeds.

(129) Answer : (2)
Solution:

C A represents adhesion of stamens with corolla known as epipetalous stamens.

(130) Answer : (1)
Solution:
Mango and coconut are drupe fruits.
Mango and coconut develop from monocarpellary superior ovary.

(131) Answer : (2)
Solution:
Pea leaves modify to form tendrils.
In cucumber, axillary buds modify to form tendrils. Tendrils are sensitive structures, coil around the nearby support and help the plant in climbing.

(132) Answer : (2)
Solution:
In banyan tree, prop roots arise from the branches of stem for providing mechanical support.

(133) Answer : (2)
Solution:
Actinomorphic flower is with radial symmetry. Mustard, Chinarose, Petunia and Brinjal are with actinomorphic flower having superior ovary.

(134) Answer : (3)
Solution:
Male and female sex organs of a flower are essential whorls.

(135) Answer : (3)
Solution:
Chilli shows radial symmetry while pea shows bilateral symmetry.

SECTION-B

(136) Answer : (2)
Solution:
All members of Fungi show heterotrophic mode of nutrition.

(137) Answer : (1)
Solution:
Neurospora, *Claviceps* and morels belong to Ascomycetes.

(138) Answer : (4)
Solution:
Puccinia is a parasitic fungus which causes wheat rust.

(139) Answer : (2)
Solution:
The sex organs are absent but plasmogamy is seen in members of Basidiomycetes.

(140) Answer : (2)
Solution:
Asexual reproduction in fungi is by spores like conidia or sporangiospores or zoospores.

(141) Answer : (3)
Solution:
Rust and smut disease in wheat are caused by *Puccinia and Ustilago* respectively. They are the members of Basidiomycetes.

(142) Answer : (1)
Solution:
Scar of seed coat is known as hilum.
Pore found above hilum is known as micropyle.

(143) Answer : (2)
Solution:
Legumes are dicot plants. They have reticulate venation in leaves.

(144) Answer : (1)
Solution:
In cactus, leaves modify into small, sharp-pointed structures called leaf spines.

(145) Answer : (3)
Solution:
Muliathi belongs to the family Fabaceae.

(146) Answer : (4)
Solution:
Pericarp is the fruit wall and can be differentiated into endocarp, mesocarp and epicarp.
Nucellus remains persistent in the seeds of black pepper and is called perisperm.

(147) Answer : (1)
Solution:
In *Alstonia* whorled phyllotaxy is found.

(148) Answer : (3)
Solution:
In racemose inflorescence, arrangement of flowers is acropetal.

(149) Answer : (2)
Solution:
Ovary in the members of family Solanaceae is superior with oblique septa. It is bicarpellary, syncarpous and have swollen placenta.
Ashwagandha belongs to Solanaceae family.

(150) Answer : (4)
Solution:
In a few species such as apple, strawberry, cashew etc, the thalamus also contributes to fruit formation. Such fruits are called false fruits.

ZOOLOGY

SECTION-A

(151) Answer : (3)
Solution:
Closed circulation is present in most of the annelids.
Tunica intima consists of endothelium only.

(152) Answer : (2)
Solution:
If the blood groups is A^{-ve}, then the person has A antigen and anti-B antibodies, and no Rh antigen or antibodies.

(153) Answer : (4)
Solution:
In birds, lungs are respiratory organs. Air sacs only supplement respiration but being avascular, never participate in gaseous exchange.

(154) Answer : (2)
Solution:
4 ml CO_2/100 ml of deoxygenated blood diffuses from blood capillaries to alveoli.

(155) Answer : (3)
Solution:
Hint: 'O' blood group individuals are called universal donors.
Sol.: Persons with 'AB' group can accept blood from all other groups of blood and are called 'universal recipients. O^- blood group can accept blood only from O^- blood group donor.

(156) Answer : (1)
Hint:
Tidal volume.
Solution:
Tidal volume represents the volume of air inhaled in a normal inhalation which is approximately 500 ml.

(157) Answer : (3)
Solution:
Carotid and aortic bodies (chemoreceptors) are sensitive to pCO_2 of arterial blood and send signals to central chemoreceptor at medulla.

(158) Answer : (4)
Solution:
Neutrophils $\rightarrow$ 60 – 65%
Basophils $\rightarrow$ 0.5 – 1%
Monocytes $\rightarrow$ 6 – 8%
Eosinophils $\rightarrow$ 2 – 3%

(159) Answer : (3)
Hint:
Diffusion membrane is the respiratory membrane.
Solution:
Diffusion / respiratory / alveolar-capillary membrane is made up of three layers:
(i) Thin squamous epithelium of alveoli.
(ii) Endothelial lining of alveolar capillaries.
(iii) Between the above two layers acellular basement substance is present.

(160) Answer : (3)
Solution:
From the ascending aorta, right and left coronary arteries arise which supply oxygenated blood to the heart muscles and blood from musculature of heart returns to the right atrium through coronary sinus.

(161) Answer : (4)
Solution:
Secretion of inflammatory mediators is the function of basophils.

(162) Answer : (1)
Solution:
Contraction of diaphragm increases thoracic volume in cephalocaudal axis (antero-posterior axis).

(163) Answer : (2)
Solution:
Under high CO and low temperature the curve shifts left.

(164) Answer : (1)
Solution:
Opening of trachea is called glottis which is covered by a cartilaginous flap called epiglottis that prevents the entry of food into the tracheae or wind pipe during swallowing.

(165) Answer : (1)
Solution:
Hint: Atrio-ventricular valve.
Sol. : Opening between right atrium and right ventricle and opening between left atrium and left ventricle is guarded by tricuspid and bicuspid valve respectively.

(166) Answer : (2)
Solution:
Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body.

(167) Answer : (4)
Solution:
CO_2 is transported maximum in the form which also acts as blood buffer in combination with certain cations.
CO_2 is transported in
Dissolved form in plasma (7%),
as carbaminohaemoglobin (20–25%),
as bicarbonates (70%),

(168) Answer : (4)
Solution:
Lymph vessels- more number of valves and lymph can clot.

(169) Answer : (2)
Solution:
Renal portal system is present in fishes and amphibians, reduced in reptiles and birds and absent in mammals.

(170) Answer : (4)
Solution:
A special neural centre in the medulla oblongata can moderate the cardiac function through autonomic nervous system (ANS).

(171) Answer : (4)
Solution:
The end of T-wave marks the end of ventricular systole.

(172) Answer : (1)
Solution:
Neural signal from this center can reduce the duration of inspiration and thereby alter the respiratory rate.

(173) Answer : (2)
Solution:
The volume of air which remains in the lungs even after the forceful expiration is called residual volume.

(174) Answer : (4)
Solution:
Rate of heart beat can be affected by age, chemicals, hormones, emotions etc.

(175) Answer : (2)
Hint:
These are glycoproteins.
Solution:
Immunoglobulins that are gamma globulins help attack viruses and bacteria. RBCs contain haemoglobin.

(176) Answer : (1)
Solution:

Systemic veins	**Systemic arteries**
pO_2 = 40 mm Hg	pO_2 = 95 mm Hg
pCO_2 = 45 mm Hg	pCO_2 = 40 mm Hg

(177) Answer : (3)
Solution:
Nearly 23-25% CO_2 is transported as carbaminohemoglobin. Increase in H^+ ions increase transport of CO_2 & O_2. Strong signals from pneumotaxic center decrease duration of inspiration.

(178) Answer : (1)
Solution:
Electrocardiogram is the graphical representation.

(179) Answer : (1)
Solution:
Basophils secrete histamine, serotonin and heparin and lymphocytes are 20-25% of total WBCs. T-lymphocytes mature in thymus gland.

(180) Answer : (4)
Solution:
Carbon monoxide (CO) combines with haemoglobin 250 times faster at the same point on haemoglobin molecule as does oxygen.

(181) Answer : (4)
Solution:
Residual volume (RV) is air present in lungs after forceful expiration which cannot be measured by spirometer.

(182) Answer : (3)
Solution:
Trachea extends upto the mid-thoracic cavity.
Trachea runs as a straight tube till 5th thoracic vertebra and then divides into right and left primary bronchi.

(183) Answer : (4)
Solution:
Plasma is straw coloured, viscous fluid constituting nearly 55% of the blood. Albumins help in osmotic balance whereas globulins are involved in defence mechanism of the body.

(184) Answer : (1)
Solution:
It is one of the fastest enzyme.
Carbonic anhydrase plays important role in CO_2 transport. This enzyme facilitates the following reaction :

$$CO_2 + H_2O \underset{}{\overset{\text{Carbonic anydrase}}{\rightleftharpoons}} H_2CO_3 \overset{\text{Carbonic anhydrase}}{\rightleftharpoons} H^+ + HCO_3^-$$

(185) Answer : (3)
Hint:
Expulsion of air from lungs to atmosphere.
Solution:
Expiration is the moving of air out of lungs when the pressure within the lungs is more than the atmospheric pressure.

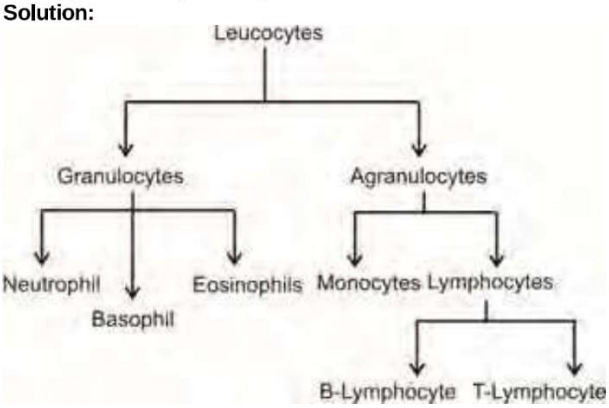
SECTION-B

(186) Answer : (2)
Solution:
Red blood cells lack cell organelles due to which they are incapable of metabolizing glucose aerobically.

(187) Answer : (3)
Hint:

Monocyte is an agranulocyte.

Solution:



(188) Answer : (3)

Solution:

The diagram indicates that air is expelled from the lungs.

Diaphragm and external intercostal muscles relax which brings the diaphragm, ribs and sternum to their original positions. Increase in intra pulmonary pressure takes place along with decrease in volume of thoracic chamber.

In forceful expiration, abdominal muscles and internal intercostal muscles are involved.

(189) Answer : (1)

Solution:

Heart failure can result due to congestion in lungs.

(190) Answer : (4)

Solution:

IC + FRC = RV + ERV + TV + IRV = TLC

and ERV + RV = FRC

(191) Answer : (2)

Solution:

The trachea, primary, secondary and tertiary bronchi and the initial bronchioles are supported by incomplete cartilaginous rings.

(192) Answer : (2)

Hint:

All ventricular valves remain closed during isovolumetric contraction of ventricles.

Solution:

AV valves close during initial phase of ventricular systole and semilunar valves close during initial phase of ventricular diastole. The time duration between above two events is 0.3 sec.

(193) Answer : (4)

Hint:

pO_2 in systemic vein is 40 mmHg & pCO_2 is 45 mmHg.

Solution:

The partial pressure of O_2 & CO_2 in the systemic veins is same as that in pulmonary artery.

(194) Answer : (4)

Solution:

The diffusion membrane is made up of three major layers, namely, thin squamous epithelium of alveoli (A), the endothelium of alveolar capillaries (C) and basement substance in between them (B).

(195) Answer : (1)

Solution:

Rise in cardiac output helps by enhancing the supply of nutrients and oxygen to the contracting muscles.

The athlete has to perform more work compared to that of an ordinary man. For performing those physical activities, more blood flow is required. Hence, both the assertion and reason are true and reason is the correct explanation.

(196) Answer : (3)

Hint:

Gaseous exchange occurs in respiratory part.

Solution:

The conducting part of the respiratory tract is involved in all the given functions except exchange of gases.

(197) Answer : (3)

Solution:

Platelets or thrombocytes are produced by special bone marrow cells called megakaryocytes. Erythrocytes are red blood cells.

(198) Answer : (3)
Solution:
Ribs and sternum return to their original position during normal expiration.

(199) Answer : (4)
Solution:
Rh incompatibility can occur in subsequent pregnancy if the female is Rh^{-ve} and foetus is Rh^{+ve}.

(200) Answer : (2)
Solution:
Perimetrium is an outer peritoneal layer present in the wall of uterus. Perimysium is a sheath of connective tissue that surrounds each fasciculus.