All India Aakash Test Series for NEET-2024

TEST - 2 (Code-E)

Test Date : 31/12/2023

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

SECTION - A

1. Answer (2)

Hint: $a = \dfrac{(m_1 - m_2)g}{m_1 + m_2}$

Sol.: $a = \dfrac{(3-2)g}{3+2}$

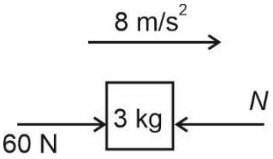
$a = \dfrac{10}{5} = 2\ \text{m/s}^2$

2. Answer (3)

Hint: Normal reaction is contact force which is normal to contact surface.

Sol.: $a = \dfrac{60-20}{5} = \dfrac{40}{5} = 8\ \text{m/s}^2$

F.B.D of 3 kg



$60 - N = 3 \times 8$

$N = 60 - 24$

$N = 36$ newton

3. Answer (4)

Hint: Area under $F - t$ graph = Change in momentum

Sol.: Change in momentum

$= \dfrac{1}{2} \times (9+4) \times 8 - \dfrac{1}{2} \times 3 \times 6$

= 52 – 9

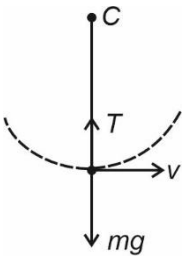
= 43 N s

4. Answer (3)

Hint: At the lowest point,

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

Sol.:



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

$T - mg = \dfrac{m}{r}\left(\sqrt{9gr}\right)^2$

$T = 9mg + mg$

$T = 10mg$

5. Answer (3)

Hint: Impulse = Change in momentum

Sol.: Initial momentum

$\vec{P}_i = mv\sin 45°\hat{i} - mv\cos 45°\hat{j}$

Final momentum

$\vec{P}_f = mv\sin 45°\hat{i} + mv\cos 45°\hat{j}$

Change in momentum

$\Delta\vec{P} = \vec{P}_f - \vec{P}_i = 2mv\cos 45°\hat{j}$

$|\Delta\vec{P}| = 2mv\cos 45°$

$= \sqrt{2}mv$

6. Answer (4)

Hint: $P = gh\dfrac{dm}{dt}$

Sol.: $P = gh\dfrac{dm}{dt}$

= 10 × 100 × 20

P = 20000 W = 20 kW

80% power is generated

$P_{\text{generated}} = \dfrac{80}{100} \times 20\ \text{kW}$

= 16 kW

7. Answer (2)

Hint: For equilibrium of a body $\vec{F}_{\text{net}} = \vec{0}$

Sol.: Resultant of applied forces = $2\hat{i} - 2\hat{j}$

Force required to balance = $-2\hat{i} + 2\hat{j}$

Force required = $2\sqrt{2}$ N in magnitude at angle 135° with +ve x-axis

8. Answer (3)

Hint: Use Newton's second law of motion, $F = ma$

Sol.: $a = \frac{F}{m} = \frac{F}{13}$ m/s^2

$v = u + at$

$v = 0 + \frac{F}{13}26$

$v = 2F$ m/s

For next 15 s

$s = vt$

$75 = 2F \times 15$

$F = 2.5$ N

9. Answer (2)

Hint and Sol.: Principle of conservation of linear momentum can explain the recoiling of gun during firing.

10. Answer (4)

Hint : $T_{up} = m(g + a)$

$T_{down} = m(g - a)$

Sol.: $T_{down} = m(g - a)$

$= 30(10 - 2)$

$T_{down} = 240$ N

$T_{up} = m(g + a)$

$= 30(10 + 4)$

$T_{up} = 420$ N

Since $T_{max} = 400$ N

$\therefore$ Rope will break when monkey tries to climb upward with 4 m/s^2

11. Answer (3)

Hint: Conservation of mechanical energy

Sol.: $\frac{1}{2}mv^2 = \frac{1}{2}kx^2 + \frac{1}{2}m\left(\frac{v}{2}\right)^2$

$\frac{3}{8}mv^2 = \frac{1}{2}kx^2$

$k = \frac{3}{4}\frac{mv^2}{x^2}$

$= \frac{3}{4}\times\frac{1\times(24)^2}{(0.2)^2}$

$= \frac{3}{4}\times\frac{24\times24}{4}\times100$

$K = 10800$ N/m

12. Answer (1)

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

Sol.: $\vec{v} = \frac{d\vec{r}}{dt} = \left(10t\,\hat{i} + 3\hat{j}\right)$

$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d^2\vec{r}}{dt^2} = \left(10\hat{i}\right)$

$\vec{F} = m\vec{a} = m\left(10\hat{i}\right)$

13. Answer (4)

Hint: $W = \int F dx$

Sol.: $W = \int_4^6 10x\,dx$

$= 10\left[\frac{x^2}{2}\right]_4^6$

$= 5\left[(6)^2 - (4)^2\right]$

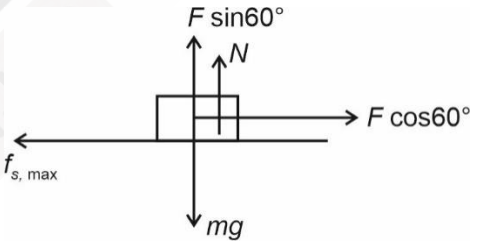
$= 5(36 - 16)$

$= 100$ J

14. Answer (4)

Hint: In the condition when block is just about to move, applied horizontal force = limiting friction

Sol.:



$N = mg - F\sin60°$

$F\cos60° = \mu(N)$

$F\cos60° = \mu(mg - F\sin60°)$

$F(\cos60° + \mu\sin60°) = \mu mg$

$F = \frac{\mu mg}{\cos60° + \mu\sin60°}$

$F = \frac{0.5\times20\times10}{\frac{1}{2} + 0.5\frac{\sqrt{3}}{2}}$

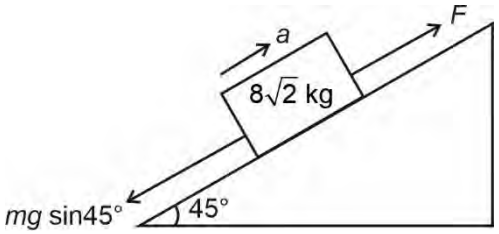
$= \frac{100}{0.93}$

$F = 107.5$ N

15. Answer (2)

Hint: Instantaneous power $= \vec{F} \cdot \vec{v}$

Sol.:



$F - mg \sin 45° = ma$

$F = ma + mg \sin 45°$

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

F = 16 + 80 = 96 N

Velocity at $t = \sqrt{8}$ s

$v = u + at$

$v = 0 + \sqrt{2} \times \sqrt{8}$ = 4 m/s

$P = Fv$

P = 96 × 4

P = 384 W

16. Answer (3)

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

Sol.: $a = v\frac{dv}{dx}$

$a = 8\sqrt{x}\frac{d}{dx}\left(8\sqrt{x}\right)$

$a = 64\sqrt{x}\frac{1}{2\sqrt{x}} = 32 \text{ m/s}^2$

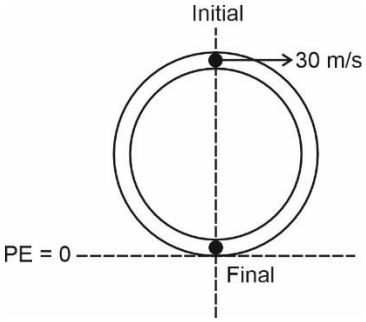
$F = ma = \frac{200}{1000} \times 32$

$= \frac{32}{5} = 6.4$ N

17. Answer (3)

Hint: Change in energy = work done by tube

Sol.:



Initial energy of block = $\frac{1}{2}mv^2 + mgh$

$= \frac{1}{2} \times 2 \times (30)^2 + 2 \times 10 \times \frac{40}{100}$

= 900 + 8 = 908 J

Final energy = 0

Work done by tube on the block = ΔTME

$\therefore \quad W = 0 - 908$

$|W|$ = 908 J

18. Answer (1)

Hint and Sol.: When there is relative motion between two surfaces, then kinetic friction acts between them.

19. Answer (4)

Hint: Body will retard due to friction force

Sol.: $a = -\mu g$

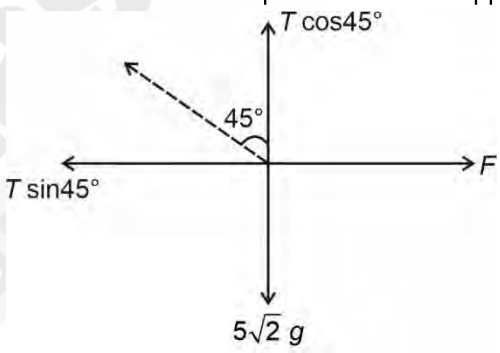
$v = u + at$

$0 = 30 - \mu \times 10 \times 6$

$\mu = \frac{30}{60} = 0.5$

20. Answer (1)

Hint & Sol.: F.B.D of point where F is applied



$T\cos 45° = 5\sqrt{2}g$

$T \times \frac{1}{\sqrt{2}} = 5\sqrt{2} \times 10$

T = 100 N

21. Answer (3)

Hint: $W = \vec{F} \cdot \vec{S}$

Sol.: $\vec{S} = \vec{r_2} - \vec{r_1}$

$\vec{S} = \left(3\hat{i} - \hat{j} + 2\hat{k}\right) - \left(\hat{i} + 3\hat{j} - 2\hat{k}\right)$

$\vec{S} = 2\hat{i} - 4\hat{j} + 4\hat{k}$

$W = \vec{F} \cdot \vec{S}$

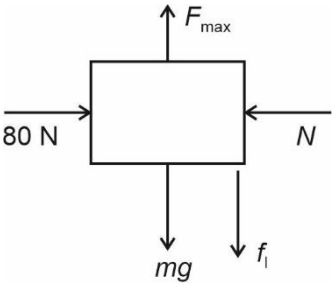
= 12 – 12 + 32

W = 32 J

22. Answer (4)

Hint: When the block has tendency to move upwards, then friction will act on it downward.

Sol.: F.B.D of block



$N = 80$

$f_l = \mu_s N$

$f_l = 0.4 \times 80 = 32$ N

$F_{max} = 5 \times 10 + 32$

$F_{max} = 82$ N

23. Answer (2)

Hint: Conservation of mechanical energy

Sol.: $KE_A + PE_A = KE_B + PE_B$

$$0 + 30 \times 10 \times 20 = \frac{1}{2} \times 20 \times v^2 + 20 \times 10 \times 10$$

$10v^2 = 6000 - 2000 = 4000$

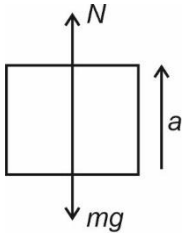
$v^2 = 400$

$v = 20$ m/s

24. Answer (4)

Hint: Normal force applied by the box on the block is $\frac{5}{4} mg$

Sol.:



$N - mg = ma$

$$\frac{5}{4}mg - mg = ma$$

$$\frac{mg}{4} = ma$$

$$a = \frac{g}{4}$$

25. Answer (4)

Hint and Sol.:

- Net work done on a body is equal to change in kinetic energy.
- Work done by friction force can be positive, negative or zero.
- Potential energy stored by spring is always positive.
- Potential energy is defined for conservative forces only.

26. Answer (2)

Hint: $KE = \frac{P^2}{2m}$

Sol.: $K = \frac{P^2}{2m}$

$$K \propto \frac{1}{m}$$

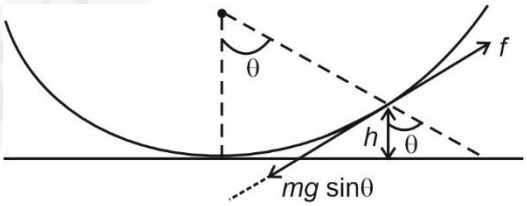
$$\frac{K_1}{K_2} = \frac{m_2}{m_1}$$

$$\frac{m_1}{m_2} = \frac{4}{3}$$

27. Answer (3)

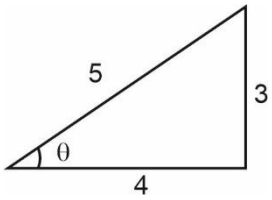
Hint : Insect starts slipping at the point where $f_{s,\,max}$ becomes equal to $mg\sin\theta$.

Sol.:



$mg \sin\theta = f \Rightarrow mg \sin\theta = \mu mg \cos\theta$

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



$$\cos\theta = \frac{4}{5}$$

$$h = R - R\cos\theta = R(1 - \cos\theta)$$

$$h = 2\left(1 - \frac{4}{5}\right) = \frac{2}{5} = 0.4 \text{ m}$$

28. Answer (1)

Hint & Sol.: $(KE)_i = \frac{1}{2}mu^2$

$(KE)_H = \frac{1}{2}m(u\cos 45°)^2 = \frac{1}{2}mu^2\left(\frac{1}{2}\right)$

$\frac{(KE)_i}{(KE)_H} = \frac{2}{1}$

29. Answer (3)

Hint and Sol.: For any collision, if $0 < e < 1$ then the collision is partially inelastic.

30. Answer (4)

Hint : Since retardation is constant, therefore equations of motion can be applied

Sol.: Initial velocity:

$\frac{1}{2}mv^2 = 80$

$\frac{1}{2}\times 0.1\times v^2 = 80$

v = 40 m/s

Velocity after 2 s

$\frac{1}{2}mv_1^2 = 20$

$\frac{1}{2}\times 0.1\times v_1^2 = 20$

v_1 = 20 m/s

Retardation:

$v = u + at$

$20 = 40 + a \times 2$

$a = -10$ m/s^2

$v^2 = u^2 + 2as$

$0 = (40)^2 + 2 \times (-10) \times s$

$s = \frac{1600}{20}$

s = 80 m

31. Answer (3)

Hint: Work-energy theorem

Sol.: $W_{net} = KE_f - KE_i$

$\Rightarrow \quad -5\times 10^{-2}\times 100\times 10^{-2} = \frac{1}{2}m\left(v^2 - (4)^2\right)$

$\Rightarrow \quad 50\times 10^{-3} = \frac{1}{2}\times 50\times 10^{-3}\left((4)^2 - v^2\right)$

$\Rightarrow \quad 16 - v^2 = 2$

$\Rightarrow \quad v^2 = 14$

$\Rightarrow \quad v = \sqrt{14}$ m/s

32. Answer (1)

Hint: Instantaneous power $P = \vec{F}\cdot\vec{v}$

Sol.: $F = v\frac{dm}{dt} = 10\times 0.8$

F = 8 N

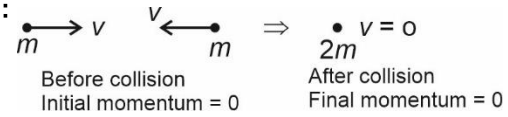
$P = Fv = 8 \times 10$

P = 80 W

33. Answer (3)

Hint : In collision, linear momentum of the system always remains conserved

Sol.:



34. Answer (4)

Hint : $\vec{F} = \frac{-\partial U\hat{i}}{\partial x} - \frac{\partial U\hat{j}}{\partial y} - \frac{\partial U\hat{k}}{\partial z}$

Sol.: $\vec{F} = -4\hat{i} - 3\hat{j}$

$|\vec{F}| = 5$ N

$\Rightarrow \quad a = \frac{|\vec{F}|}{m} = 5$ m/s^2

35. Answer (2)

Hint & Sol.: Velocity of parachutist when parachute opens at 80 m is

$u = \sqrt{2gh} = \sqrt{2\times 10\times 80} = 40$ m/s

Velocity at ground v = 20 m/s

$s = \frac{v^2 - u^2}{2a} = \frac{(20)^2 - (40)^2}{2(-3)}$

$s = \frac{400 - 1600}{-6} = 200$ m

Total height from ground where he bailed out

= 200 + 80 = 280 m

SECTION - B

36. Answer (4)

Hint: Total distance $= \frac{h\left(1+e^2\right)}{\left(1-e^2\right)}$

Sol.: Before it hits the ground

$KE = \frac{1}{2}mv^2$

After hitting the ground

$KE = \frac{1}{2}mv_1^2$

$\frac{1}{2}mv_1^2 = \frac{80}{100}\frac{1}{2}mv^2$

$v_1 = \frac{2v}{\sqrt{5}}$

$e = \frac{\frac{2v}{\sqrt{5}}}{v} = \frac{2}{\sqrt{5}}$

Total distance = $h\left(\frac{1+\frac{4}{5}}{1-\frac{4}{5}}\right) = 9h$

37. Answer (2)

Hint: Apply work energy-theorem.

Sol.: $S = \frac{v^2}{2\mu_k g}$

$= \frac{(60)^2}{2\times 0.4\times 10}$

$= \frac{3600}{8}$

S = 450 m

38. Answer (3)

Hint: Apply work-energy theorem

Sol.: $F = 10t$

$ma = 10t \Rightarrow 2a = 10t$

$a = 5t$

$\frac{dv}{dt} = 5t$

$\int_0^v dv = \int_0^2 5t\, dt$

$v = \left[\frac{t^2}{2}\right]_0^2 \times 5$

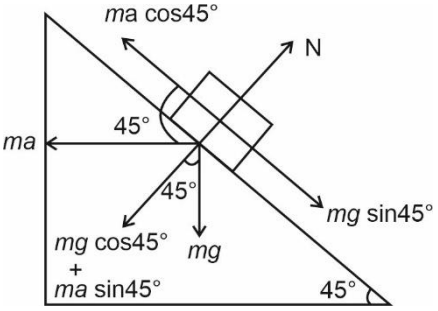
v = 10 m/s

$W = \frac{1}{2}\times 2\times(10)^2 - 0$

W = 100 J

39. Answer (1)

Hint & Sol.: F.B.D of m



$ma\cos45° = mg\sin45°$

$a = g$

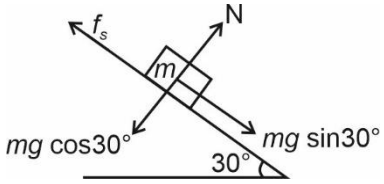
40. Answer (1)

Hint and Sol.: Action and reaction forces act on different bodies at the same time. They are always equal in magnitude and have same nature.

41. Answer (4)

Hint: $f_s = mg\sin\theta$

Sol.:



$f_s = mg\sin30°$

$14 = m\times 10\times\frac{1}{2}$

$\Rightarrow$ m = 2.8 kg

42. Answer (2)

Hint: Work done = change in kinetic energy

Sol.: $a = \frac{-10}{5} = -2\ \text{m/s}^2$

Velocity at t = 3 s

$v = u + at$

$v = 10 - 2\times 3$

v = 4 m/s

$W = \frac{1}{2}m\left(v^2 - u^2\right)$

$= \frac{1}{2}\times 8\times\left((4)^2 - (10)^2\right)$

= 4 × (16 – 100)

W = – 336 J

43. Answer (2)

Hint: $a = -\mu g$

Sol.: $a = -10\mu$

$v = u + at$

$0 = 10 - 10\mu\times 5$

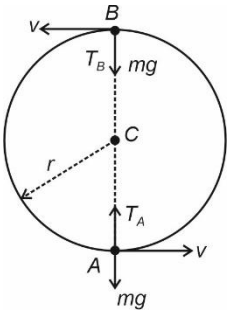
$\mu = \frac{10}{50} = \frac{1}{5}$

μ = 0.2

44. Answer (2)

Hint: Use equation $\vec{F}_{net} = m\vec{a}$

Sol.:



For point A : $T_A = mg + \frac{m(v_A)^2}{r}$

For point B : $T_B = \frac{m(v_B)^2}{r} - mg$

Tension in the string is maximum at point A and minimum at point B.

45. Answer (3)

Hint: $F = m(g + a)$

Sol.: $F = (4.5 \times 10^4)(20 + 10)$

$F = 13.5 \times 10^5$ N

46. Answer (4)

Hint: Impulse = Change in momentum

Sol.: $I = m(v - u)$

$= 10 (0 - 5)$

$I = -50$ Ns

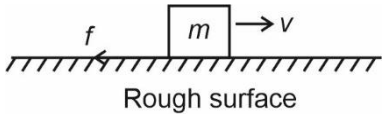
47. Answer (3)

Hint & Sol.: Water stored in a dam possesses potential energy.

48. Answer (3)

Hint: Friction force opposes the relative motion between the surfaces.

Sol.: The mentioned condition can be shown as



The angle between v and f is π or 180°.

49. Answer (3)

Hint: $\Delta U = mgh$

Sol.: $\Delta U = \frac{1000}{1000} \times 10 \times \frac{80}{100}$

$\Delta U = 8$ J

50. Answer (1)

Hint: $w = \int F\, dx$

Sol.: $w = \int_0^5 \left(7 - 2x + 3x^2\right) dx$

$= \left[7x - x^2 + x^3\right]_0^5$

$= 7 \times 5 - (5)^2 + (5)^3 - 0$

$= 35 - 25 + 125$

$w = 135$ J

[CHEMISTRY]

SECTION - A

51. Answer (3)

Hint: The normal oxide formed by the elements in the centre of periodic table are amphoteric or neutral.

Sol.:

	Oxide	Nature of oxide
(i)	Na_2O	Basic
(ii)	SO_3	Acidic
(iii)	As_2O_3	Amphoteric
(iv)	N_2O	Neutral

52. Answer (4)

Hint: According to Modern Periodic Law "The physical and chemical properties of elements are periodic functions of their atomic numbers".

Sol.:

- Metals comprise more than seventy eight percent of the known elements.
- Elements belonging to same group have similar electronic configuration of their valence shell electrons.

53. Answer (3)

Hint & Sol.: 'A' is true but 'R' is false as isoelectronic species have the same number of electrons but may have different number of nuclear charge *i.e.*, protons.

54. Answer (2)

Hint: Size of corresponding anion and cation is respectively larger and smaller than its parent atom, due to decrease and increase in effective nuclear charge respectively.

Sol.: Correct order of radii is

$Na^- > Na > Na^+$

55. Answer (4)

Hint: Ne : $1s^2 2s^2 2p^6$

Sol.: Mg^{2+}, Na^+, F^-, O^{2-} are isoelectronic species having 10 electrons each.

Ionic radii decreases as $O^{2-} > F^- > Na^+ > Mg^{2+}$ due to increase in effective nuclear charge.

56. Answer (3)

Hint: Moving left to right across a period, electronegativity of elements generally increases.

Sol.: On Pauling scale electronegativity (E.N.) of the given elements is

Element	E.N.
C	2.5
N	3
O	3.5
Si	1.8

57. Answer (4)

Hint: Completely filled or half filled subshells are associated with greater stability than partially filled subshells.

Sol.: Increasing order of first I.E. of the elements is

B < Be < O < N

58. Answer (3)

Hint: Smaller size of first element of the groups 16, 17 leads to greater repulsion when an electron is added to it. So, lesser amount of energy is released.

Sol.:

Element	$\Delta_{eg}H$ (kJ mol^{-1})
O	– 141
S	– 200
Se	– 195
Te	– 190

So, correct order of negative $\Delta_{eg}H$ value is O < Te < Se < S

59. Answer (3)

Hint: Metallic nature generally increases down the group and decreases left to right in a period.

Sol.: K shows metallic character more than that of Mg or Al. So, correct decreasing metallic nature is

K > Mg > Al

60. Answer (4)

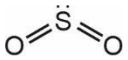
Hint & Sol.: Group 16 elements are called chalcogens.

61. Answer (3)

Hint: AB_2E type molecules have bent structure.

Sol.: $BeCl_2$, CO_2 and XeF_2 molecules have linear structures

SO_2 has 2 bp and 1 lp, so it has bent shape



62. Answer (2)

Hint: The species which contains paired electrons in orbitals are called diamagnetic in nature.

Sol.: H_2 : $(\sigma 1s)^2$

N_2 : $(\sigma 1s)^2$ $(\sigma^* 1s)^2$ $(\sigma 2s)^2$ $(\sigma^* 2s)^2$ $(\pi 2p_x^2 = \pi 2p_y^2)$ $(\sigma 2p_z)^2$

All the electrons in H_2 and N_2 are paired therefore, these are diamagnetic in nature.

63. Answer (2)

Hint: Mathematically, the formation of MO may be described by LCAO method.

Sol.: For He_2 molecule, BO = 0, so it does not exist.

Energy of $\sigma 2p_z$ MO is not always higher than $\pi 2p_x$ and $\pi 2p_y$ orbitals for example in case of N_2 and C_2 molecules.

64. Answer (2)

Hint: Species having net dipole moment zero are called non-polar.

Sol.: XeF_4 has 4 bp and 2 lp so acquires square planar geometry and net dipole moment of four Xe-F bonds is found to be zero, so it is a non-polar species.

65. Answer (3)

Hint & Sol.: The electronic configuration of C_2 molecule is $(\sigma 1s)^2$ $(\sigma^* 1s)^2$ $(\sigma 2s)^2$ $(\sigma^* 2s)^2$ $(\pi 2p_x^2 = \pi 2p_y^2)$

Bond order of C_2 is $\frac{8-4}{2} = 2$

As four electrons are present in two pi molecular orbitals so double bond consists of both pi bonds.

66. Answer (2)

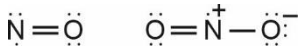
Hint:

Sol.: In the structure of ClF_5, there are 5 F – Cl bonds and one lone pair on central atom 'Cl'.

67. Answer (3)

Hint: Molecules which have an odd number of electrons are called odd-electron molecules.

Sol.: Molecules like NO and NO_2 are odd-electron molecules.



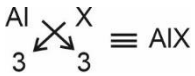
68. Answer (4)

Hint: Aluminium forms Al^{3+} ion to attain stable electronic configuration.

Al^{3+} : $1s^2, 2s^2, 2p^6$

While (X) gains 3 electrons to attain stable electronic configuration as X^{3-} : $1s^2, 2s^2, 2p^6$

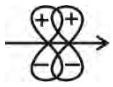
Sol.: Electrovalency of Al and (X) both is 3, so simplest formula of the compound is



69. Answer (2)

Hint: Sigma bond is formed due to head-on and positive overlap of bonding orbitals along the internuclear axis.

Sol.:  ; This end to end overlap of orbitals along the axis results in σ-bond formation.

 This overlap, above & below the nuclear axis results into pi-bond formation.

70. Answer (4)

Hint: For isoelectronic species, radius $\propto \frac{1}{ENC}$

Sol.: All the species N^{3-}, O^{2-}, Mg^{2+} and Al^{3+} have 10 electrons each. The number of protons in N^{3-}, O^{2-}, Mg^{2+} and Al^{3+} species are 7, 8, 12 and 13 respectively so, ENC is greatest for Al^{3+} and lowest N^{3-} thus Al^{3+} ion is smallest and N^{3-} is largest in size.

71. Answer (4)

Hint and Sol.: The first element of each of the groups 1, 2 and groups 13 – 17 differs in chemical behaviour from the other members of their respective group. It is attributed to their smallest size in the group, large (charge/radius) ratio, high electronegativity and absence of *d*-orbitals.

72. Answer (3)

Hint: Transition elements have incomplete inner (n – 1) *d*-orbitals.

Sol.: ns^2 represents a *s*-block element.

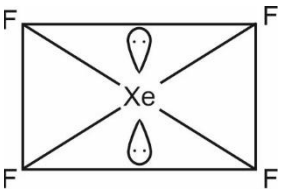
$ns^2\ np^4$ and $(n-1)d^{10}\ ns^2\ np^3$ represent *p*-block elements.

$(n-1)d^6\ ns^2$ represents a transition element.

73. Answer (3)

Hint: Central atom having 4 bp and 2 lp is sp^3d^2 hybridized.

Sol.:



(sp^3d^2 hybridized Xe in XeF_4)

- Hybridisation of Xe in XeO_3 is sp^3. In XeO_2F_2 and XeF_2 hybridisation of Xe is sp^3d.

74. Answer (3)

Hint: In some compounds, the number of electrons surrounding the central atom is less than eight. These are called electron deficient molecules.

Sol.:

- In H—Be—H, there are 4 electrons surrounding the central atom Be.
- In CH_4, H_2O and SO_2, central atom has 8 electrons around it.

75. Answer (3)

Hint: When a molecule/species cannot be described by a single Lewis structure, it is represented by different structures called resonating structures.

Sol.: Molecules like O_3, CO_2 and ion like CO_3^{2-} can have resonating structures. H_2O has a single Lewis structure.

76. Answer (4)

Hint: In an ionic compound, larger the size of cation, greater is the ionic character.

Sol.: Since, size increases as

$Li^+ < Na^+ < K^+ < Cs^+$

So, CsF has highest ionic character.

77. Answer (3)

Hint:

- AB_3E_2 type molecules acquire bent T-shape
- AB_4E type molecules acquire See-saw shape where E denotes lone pair of electrons.

Sol.:

	Molecule		**Shape**
a.	NH_3	(i)	Trigonal pyramidal
b.	BrF_3	(ii)	Bent T-shape
c.	BF_3	(iii)	Trigonal planar
d.	SF_4	(iv)	See-saw

78. Answer (2)

Hint & Sol.:

a.	Iron	Transition element
b.	Chlorine	Non-metal
c.	Germanium	Metalloid
d.	Uranium	Actinoid

79. Answer (3)

Hint: First element of group I and II shows similar characteristics with second element of upcoming group which is known as diagonal relationship.

Sol.: Group 1 Group 2 Group 13 Group 14

Li → Be → B → C

Na → Mg → Al → Si

diagonal relationship

80. Answer (2)

Hint: A species having all electrons paired is called diamagnetic while paramagnetic species have one or more unpaired electron(s).

Sol.:

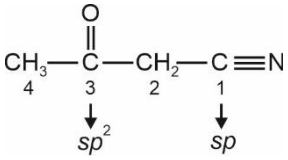
Species	Bond order	Magnetic nature
C_2	2	Diamagnetic
C_2^-	2.5	Paramagnetic
N_2	3	Diamagnetic
N_2^+	2.5	Paramagnetic
O_2	2	Paramagnetic
O_2^-	1.5	Paramagnetic
O_2^{2-}	1	Diamagnetic

81. Answer (3)

Hint: According to IUPAC naming of molecules having more than one functional groups, priority order is

$$-CN > -CHO > \overset{|}{\underset{|}{C}}=O > -OH$$

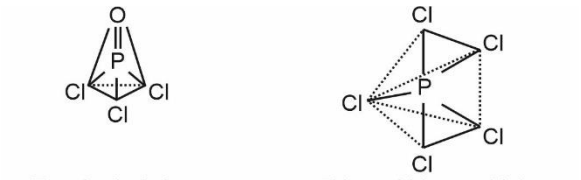
Sol.: Given molecule is numbered as



82. Answer (3)

Hint: Hybridisation of 'P' in $POCl_3$ is sp^3, while in PCl_5 is sp^3d.

Sol.:



Tetrahedral shape of $POCl_3$ has equal P–Cl bond lengths

Trigonal bipyramidal shape of PCl_5 has two different P–Cl bond lengths

83. Answer (1)

Hint: In sp^3d hybridisation, there is 20% *d*-character.

Sol.:

Molecule	Hybridisation
SF_4	sp^3d
BrF_5	sp^3d^2
IF_7	sp^3d^3
XeF_6	sp^3d^3

84. Answer (2)

Hint: Species having bond order zero are found to be unstable.

Sol.: Be_2 : $(\sigma 1s^2)$ $(\sigma^* 1s^2)$ $(\sigma 2s^2)$ $(\sigma^* 2s^2)$

$$\text{Bond order} = \frac{4-4}{2} = 0$$

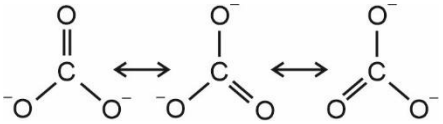
so, Be_2 does not exist.

85. Answer (4)

Hint: In case of resonating structures of a molecule/ion

$$\text{Bond order} = \frac{\text{Total number of bonds}}{\text{Total no. of sigma bonds}}$$

Sol.: In CO_3^{2-} ion, we have resonating forms as



so, bond order $= \frac{4}{3} = 1.33$

SECTION - B

86. Answer (2)

Hint & Sol.: Correct IUPAC official names of the elements are as

101	Unnilunium	Mendelevium
105	Unnilpentium	Dubnium
111	Unununnium	Roentgenium
112	Ununbium	Copernicium

87. Answer (3)

Hint & Sol.:

- $_{47}Ag$ is a transition element.
- Silicon and germanium are semi-metals or metalloids.
- *f*-block elements are also called inner-transition elements.

88. Answer (3)

Hint: Covalency of a metal is defined as the number of covalent/coordinate bonds formed by it in its compound.

Sol.: In complex ion $[AlCl(H_2O)_5]^{2+}$, oxidation state of Al is +3 and covalency is 6.

89. Answer (2)

Hint: % ionic character $= \frac{\mu_{observed}}{\mu_{calculated}} \times 100$

Sol.: $\mu_{calculated} = q \times d$

$= 1.6 \times 10^{-19} \times 156 \times 10^{-12}$ C m

$= 2.5 \times 10^{-29}$ C m

$\mu_{observed} = 1.5$ D $= 1.5 \times 3.33 \times 10^{-30}$ C m

$= 5 \times 10^{-30}$ C m

% ionic character $= \frac{5 \times 10^{-30}}{2.5 \times 10^{-29}} \times 100 = 20\%$

90. Answer (4)

Hint: Bond length $\propto \frac{1}{\text{Bond order}}$

Sol.:

Bond order	Species
3	CO
2	CO_2
1.33	CO_3^{2-}

Hence, order of bond length is CO < CO_2 < CO_3^{2-}

91. Answer (3)

Hint: Noble gases have stable electronic configuration.

Sol.: $O^- \rightarrow O^{2-}$ is an endothermic process as –vely charge species repels the incoming electron.

Ne has large positive electron gain enthalpy due to addition of an electron makes it very unstable.

92. Answer (4)

Hint: Down the group, atomic size generally increases.

Sol.:

Atom	Atomic radius (pm)
C	77
O	66
Mg	160
Al	143
Li	152
F	64
Br	114
I	133

93. Answer (1)

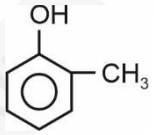
Hint: *f*-block consists of Lanthanoids Z = 58 to Z = 71 and Actinoids Z = 90 to Z = 103

Sol.: Element with atomic number 59 is a Lanthanoid which belongs to *f*-block.

94. Answer (1)

Hint: In o-nitrophenol intramolecular hydrogen bonding is possible.

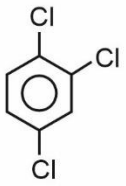
Sol.:

- In m-nitrophenol and p-nitrophenol intermolecular H-bonding takes place
- In  , H-bonding is not possible.

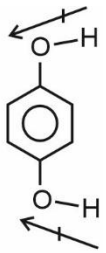
95. Answer (2)

Hint: Two equal and opposite dipole vectors have net resultant zero.

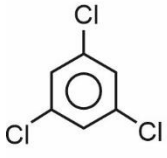
Sol.:



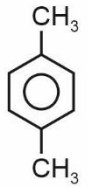
$\mu_{net} \neq 0$,



$\mu_{net} \neq 0$



$\mu_{net} = 0$



$\mu_{net} = 0$

96. Answer (2)

Hint: Bond order $= \frac{1}{2}[N_b - N_a]$

Sol.: Bond order in $O_2 = \frac{10-6}{2} = 2$

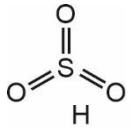
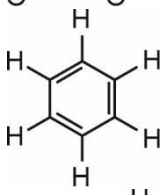
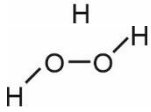
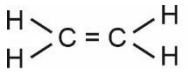
Bond order in $O_2^+ = \frac{10-5}{2} = 2.5$

Bond order in $O_2^- = \frac{10-7}{2} = 1.5$

Bond order in $O_2^{2-} = \frac{10-8}{2} = 1$

97. Answer (4)

Hint & Sol.:

-  3σ and 3π bonds
-  12σ and 3π bonds
-  3σ bonds
-  5σ and 1π bond

98. Answer (3)

Hint & Sol.:

Species	B.O
	3
	3
CO^+	3.5
	3

99. Answer (2)

Hint: NO_2 has an odd electron

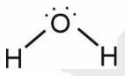
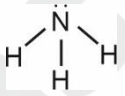
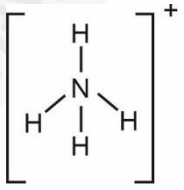
Sol.: In PF_5, P has 10 valence electrons so, it has expanded octet.

100. Answer (4)

Hint: Bond angle of molecule depends on repulsive interaction of electron pairs, which decreases in the order:

lp-lp > lp-bp > bp-bp

Sol.:

Species	Shape	Bond angle
	Bent	104.5°
	Pyramidal	107°
	Linear	180°
	Tetrahedral	109°28′

[BOTANY]

SECTION-A

101. Answer (3)

Hint: CJD is an analogous variant of mad cow disease in cattle.

Sol.: CJD in humans is caused by prions.

102. Answer (2)

Hint: It is caused by a flagellated protozoan.

Sol.: The parasitic forms of flagellated protozoans cause diseases such as sleeping sickness, *e.g.*, *Trypanosoma*.

103. Answer (3)

Hint: Comma-shaped bacteria are known as vibrium.

Sol.: Rod-shaped bacteria are known as bacillus.

Spiral-shaped bacteria are known as spirillum.

Spherical-shaped bacteria are known as coccus.

104. Answer (1)

Hint: Marine forms of amoeboid protozoans have silica shells on their surface.

Sol.: Sporozoans include diverse organisms that have an infectious spore-like stage in their life

cycle. Ciliated protozoans have a cavity (gullet) that opens to the outside of the cell surface. The members of flagellated protozoans are either free-living or parasitic.

105. Answer (2)

Hint: Aristotle was the earliest to attempt a more scientific basis for classification.

Sol.: Aristotle used simple morphological characters to classify plants into trees, shrubs and herbs. The main criteria used by R. H. Whittaker for classification include cell structure, body organisation, mode of nutrition, reproduction and phylogenetic relationships. In earlier classification systems, *Paramoecium* and *Amoeba* were placed in the animal kingdom which lack a cell wall.

Bacteria are the sole members of the kingdom Monera. They are the most abundant micro-organisms.

106. Answer (3)

Hint: Cyanobacteria are also referred to as blue-green algae.

Sol.: The cyanobacteria have chlorophyll a similar to green plants. Chemosynthetic autotrophic bacteria play a great role in recycling nutrients like nitrogen, phosphorus, iron and sulphur. Cyanobacteria (photosynthetic autotrophs) often form blooms in polluted water bodies. The colonies of cyanobacteria (*Nostoc*) are generally surrounded by gelatinous sheath.

107. Answer (4)

Hint: This group includes diatoms and golden algae (desmids).

Sol.: Chrysophytes are microscopic and float passively in water currents (plankton). Most of them are photosynthetic. In diatoms, the cell walls form two thin overlapping shells, which fit together as in a soap box. The walls are embedded with silica and thus the walls are indestructible.

108. Answer (4)

Hint: Dinoflagellates are photosynthetic in nature.

Sol.: Euglenoids are photosynthetic in the presence of sunlight, when deprived of sunlight they behave like heterotrophs. Majority of them are fresh water organisms found in stagnant water. Dinoflagellates are mostly marine. Both euglenoids and dinoflagellates have two flagella. Euglenoids lack cell wall, while the cell wall of dinoflagellates has stiff cellulose plates on the outer surface.

109. Answer (4)

Hint: By taking example of slime moulds, we can justify that Protista forms a connecting link with plants, animals and fungi

Sol.: The pigments of euglenoids are identical to those present in higher plants. Amoeboid protozoans move and capture their prey by putting out pseudopodia. In slime moulds.

Fungi-like feature : Formation of fruiting bodies.

Plant-like feature : Cell wall around spores.

Animal-like feature : Plasmodium is without cell wall.

110. Answer (4)

Hint: The viruses are non-cellular organisms.

Sol.: The viruses are characterized by having an inert crystalline structure outside the living cell. Viroids are found to be a free RNA. Prions consisted of abnormally folded protein. Lichens are very good pollution indicators–they do not grow in polluted areas.

111. Answer (3)

Hint: The most notable diseases caused by prions are bovine spongiform encephalopathy.

Sol.: A virus is a nucleoprotein. The RNA of the viroid is of low molecular weight. Prions are similar in size to viruses. Lichens are the symbiotic association between algae and fungi.

112. Answer (2)

Hint: This agent is a nucleoprotein.

Sol.: In plants, the symptoms caused by viruses can be mosaic formation, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth.

113. Answer (2)

Hint: Conidia are exogenously produced asexual spores.

Sol.: The Ascomycetes and Deuteromycetes have septate mycelia and reproduce by asexual spores called conidia. The asexual spores are generally not found in the members of Basidiomycetes. Members of phycomycetes generally reproduce asexually through endogenously produced spores.

114. Answer (4)

Hint: The organism responsible for red tides belongs to dinoflagellates.

Sol.: Very often, red dinoflagellates *e.g.*, *Gonyaulax* undergo such rapid multiplication that they make the sea appear red (red tides).

115. Answer (2)

Hint: Oomycetes is commonly known as algal fungi.

Sol.:

Alternaria → Imperfect fungi (Deuteromycetes)

Agaricus → Club fungi (Basidiomycetes)

Mucor → Conjugation fungi (Zygomycetes)

Claviceps → Sac fungi (Ascomycetes)

116. Answer (3)

Hint: All single-celled eukaryotes are placed under protista

Sol.: Members of protista are primarily aquatic. Being eukaryotes, the protistan cell body contains a well-defined nucleus and other membrane-bound organelles.

117. Answer (2)

Hint: *Paramoecium* is a ciliated protozoan.

Sol.: In *Paramoecium* the coordinated movement of rows of cilia causes the water laden with food to be steered into the gullet. With the exception of yeasts which are unicellular, fungi are filamentous.

118. Answer (4)

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

Sol.: RNA is the genetic material in TMV. Bacterial viruses or Bacteriophages (viruses that infect the bacteria) are usually double-stranded DNA viruses.

119. Answer (3)

Hint: *Aloe* belongs to the Liliaceae family. Ashwagandha belongs to the Solanaceae family.

Sol.: Liliaceae family members have actinomorphic flowers with syncarpous ovary and epitepalous stamen. Ebracteate and actinomorphic flowers with syncarpous ovary and epipetalous stamens are found in the members of Solanaceae family.

120. Answer (1)

Hint: In epigynous flowers, the margin of thalamus grows upwards enclosing the ovary completely and getting fused with it.

Sol.: There may be a variation in the length of filaments within a flower, as in *Salvia* and mustard. In mustard, the ovules develop on the inner wall of the ovary. In mustard, superior ovary is found and the flower is actinomorphic.

121. Answer (2)

Hint: Cells proximal to region of elongation constitute region of maturation.

Sol.: The primary roots and its branches constitute the tap root system, as seen in the mustard plant. The cells of the elongation zone gradually differentiate and mature. Hence, this zone, proximal to the region of elongation, is called the region of maturation.

In turnip roots modify to store food. In *Chrysanthemum* each node bears rosette of leaves and tuft of roots.

122. Answer (1)

Hint: In marginal placentation, the placenta forms a ridge along the ventral suture of the ovary and the ovules are borne of this ridge forming two rows.

Sol.:

	Placentation		**Example**
a.	Marginal	–	Pea
b.	Axile	–	China rose
c.	Parietal	–	*Argemone*
d.	Free central	–	Primrose
e.	Basal	–	Marigold

123. Answer (2)

Hint: Corm acts as an organ of perennation to tide over condition unfavourable for growth.

Sol.: Underground stem of *Colocasia* is modified to store food in them and it also acts as organ of perennation.

124. Answer (4)

Hint: When stamens are attached to the petals, they are epipetalous.

Sol.: When stamens are attached to the perianth, they are epiphyllous. A sterile stamen is called staminode.

125. Answer (4)

Hint: Phyllotaxy is the pattern of arrangement of leaves on the stem or branch.

Sol.:

Phyllotaxy	**Example**
Alternate	Sunflower
Opposite	Guava
Whorled	*Alstonia*

126. Answer (4)

Hint: The mode of arrangement of petals in floral bud w.r.t. the outer members of the same whorl is called aestivation.

Sol.:

Aestivation	**Example**
Valvate	*Calotropis*
Twisted	Cotton
Imbricate	*Cassia*, Gulmohur
Vexillary	Pea

127. Answer (3)

Hint: Aleurone layer is a proteinous layer.

Sol.: In monocot seeds (Maize), the outer covering of endosperm separates the embryo by a proteinous layer called aleurone layer.

The root is covered at the apex by a thimble-like structure called the root cap.

128. Answer (1)

Hint: In racemose type of inflorescence, the flowers are borne laterally in an acropetal succession.

Sol.: Sweet pea shows racemose inflorescence. All others are either solitary or show cymose inflorescence, in which flowers are borne in basipetal order.

129. Answer (1)

Hint: Makoi belongs to the Solanaceae family

Sol.: Makoi plant shows bicarpellary obligately placed gynoecium, five stamens, persistent calyx and endospermous seed.

130. Answer (1)

Hint: The petiole helps hold the blade to light.

Sol.: In some leguminous plants, the leaf base may become swollen, which is called the pulvinus. The lamina or the leaf blade is the green expanded part of the leaf with veins and veinlets. Veins provide rigidity to the leaf blade. Leaf base may bear two lateral small leaf-like structures called stipules.

131. Answer (2)

Hint: Prop roots are found in banyan trees.

Sol.: The stems of maize and sugarcane have supporting roots coming out of the lower nodes of the stem called stilt roots.

132. Answer (4)

Hint: Mango is a drupe fruit.

Sol.: Mango develops from monocarpellary superior ovary and is one seeded.

133. Answer (4)

Hint: The outermost covering of a seed is the seed coat.

Sol.: The seed coat has two layers, the outer testa and the inner tegmen.

134. Answer (2)

Hint: Tegmen is the inner layer of the seed coat.

Sol.: The hilum is a scar on the seed coat through which the developing seeds were attached to the fruit.

135. Answer (1)

Hint: $\male$ is designated as male in floral formula.

Sol.: $\underline{G}$ refer to superior ovary, $\bar{\underline{G}}$ refers to inferior ovary and G refers to gynoecium.

SECTION-B

136. Answer (1)

Hint: Cilia represent the locomotory structures in ciliated protozoans.

Sol.: Ciliated protozoans are aquatic, actively moving organisms because of the presence of thousands of cilia.

137. Answer (2)

Hint: Fungi which show only vegetative phase are known as imperfect fungi.

Sol.: Deuteromycetes is commonly known as imperfect fungi. *Albugo*, the parasitic fungi on mustard. *Neurospora* used extensively in biochemical and genetic work. *Ustilago* causes smut disease.

138. Answer (1)

Hint: Euglenoids lack cell wall.

Sol.: Instead of a cell wall, euglenoids have a protein-rich layer called pellicle which makes their body flexible.

139. Answer (1)

Hint: In ascomycetes and basidiomycetes, an intervening dikaryotic stage (n + n, *i.e.*, two nuclei per cell) occurs.

Sol.: The sex organs are absent, but plasmogamy is brought about by the fusion of two vegetative or somatic cells of different strains or genotypes. The resultant structure is dikaryotic which ultimately gives rise to basidium. Deuteromycetes only exhibit vegetative phase. In phycomycetes, the mycelium is aseptate and coenocytic and a zygospore is formed by fusion of two gametes.

140. Answer (1)

Hint: Methanogens inhabit marshy areas.

Sol.: Halophiles inhabit extreme salty areas and thermoacidophiles inhabit hot springs.

141. Answer (4)

Hint: *Plasmodium* causes malaria.

Sol.: Monera includes prokaryotes (bacteria). Bacteria reproduce by a sort of sexual reproduction by adopting a primitive type of DNA

transfer from one bacterium to the other. *Plasmodium* causes malaria, a disease which has a staggering effect on human population. *Saccharomyces* is unicellular. Some hyphae are continuous tubes filled with multinucleated cytoplasm–these are called coenocytic hyphae.

142. Answer (3)

Hint: D. J. Ivanowsky recognized certain microbes as causal organisms of the mosaic disease of tobacco.

Sol.: W. M. Stanley showed that viruses could be crystallized. M. W. Beijerinck demonstrated that the extract of the infected plants of tobacco could cause infection in healthy plants and called the fluid as *Contagium vivum fluidum* (infectious living fluid).

143. Answer (2)

Hint: Mustard belongs to the family Brassicaceae

Sol.:

Family	Floral formula
Brassicaceae	$\oplus \female K_{2+2}\, C_4\, A_{2+4}\, \underline{G}_{(2)}$
Fabaceae	$\% \female K_{(5)}\, C_{1+2+(2)}\, A_{(9)+1}\, \underline{G}_{(1)}$
Solanaceae	$\oplus \female K_{(5)}\, \overset{\frown}{C}_{(5)}\, A_5\, \underline{G}_{(2)}$
Liliaceae	$Br \oplus \female \overset{\frown}{P}_{(3+3)}\, A_{3+3}\, \underline{G}_{(3)}$

144. Answer (2)

Hint: Belladonna is a medicinal plant.

Sol.: Brinjal and potato are the sources of food, while tobacco is fumigatory plant.

145. Answer (1)

Hint: Lupin belongs to Fabaceae.

Sol.: Lupin acts as an ornamental plant. Soyabean acts as a source of edible oil. *Indigofera* is used in the preparation of dye. *Muliathi* is a medicinal plant.

146. Answer (3)

Hint: Adhesion is denoted by a line drawn above the symbols of the floral parts.

Sol.: Fusion is indicated by enclosing the figure within bracket. 'Br' stands for bracteate condition.

147. Answer (4)

Hint: Seeds showing the presence of endosperm even at the mature seeds are called endospermous seed.

Sol.: Castor is an endospermous seed. In plants such as bean, gram and pea, the endosperm is not present in mature seeds and such seeds are called non-endospermous.

148. Answer (3)

Hint: *Euphorbia* inhabits arid regions.

Sol.: In *Euphorbia,* stems are modified into fleshy cylindrical structures.

Axillary buds of stems get modified into woody, straight and pointed thorns *e.g.*, Citrus.

Stem tendrils which develop from axillary buds, are slender and spirally coiled *e.g.*, Cucumber.

In plants like mint and jasmine, a slender lateral branch arises from the base of the main axis and after growing aerially for some time arch downwards to touch the ground.

149. Answer (3)

Hint: Keel is found in flowers that show vexillary aestivation.

Sol.: In pea and bean flowers, there are five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel), this type of aestivation is known as vexillary or papilionaceous. Lady's finger and China rose show twisted aestivation. Chilli shows valvate aestivation.

150. Answer (2)

Hint: Above the hilum is a small pore called the micropyle.

Sol.: The plumule and radicle are enclosed in sheaths which are called coleoptile and coleorhiza, respectively.

[ZOOLOGY]

SECTION - A

151. Answer (3)

Hint: Performed by conducting part of respiratory system

Sol.: The process of exchange of O_2 from the atmosphere with CO_2 produced by cells is called breathing. Cellular respiration is breakdown of food substances within cells to release energy. Oxidation-reduction takes place during respiration.

152. Answer (4)

Hint: Buccal cavity opens into it

Sol.: The nasal chamber opens into pharynx, a portion of which is the common passage for food and air. The pharynx opens through the larynx region into the trachea.

153. Answer (4)

Hint: The part of respiratory tract which gives rise to alveoli

Sol.: Trachea, primary, secondary and tertiary bronchi and initial bronchioles are supported by incomplete cartilaginous rings. Terminal bronchioles lack cartilaginous rings and give rise to alveoli.

154. Answer (1)

Hint: Dome-shaped in relaxed state

Sol.: The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by the dome-shaped diaphragm.

155. Answer (2)

Hint: A bone present in mid-ventral line

Sol.: Sternum is a bone which cannot generate a force to change in pressure. Diaphragm and inter-costal muscles generate pressure gradients for both inspiration and expiration.

156. Answer (2)

Hint: Amphibian feature

Sol.: In amphibians, left atrium receives oxygenated blood from both lungs and skin as amphibians perform both pulmonary and cutaneous respiration in adult stage of their life. *Balaenoptera* (whale), *Aptenodytes* (penguin) and *Crocodilus* (crocodile) can perform only pulmonary respiration.

157. Answer (1)

Hint: Basement membrane is an acellular layer.

Sol.: Diffusion membrane is made up of three major layers *i.e.*, simple squamous epithelium of alveolar wall, endothelium of alveolar blood vessels and acellular basement membrane in between these two layers. Its total thickness is less than one millimetre.

158. Answer (4)

Hint: Branchial respiration

Sol.: Gills are used for exchange of gases by aquatic forms. Lungs are used by the terrestrial forms for exchange of gases. Lower invertebrates like sponges, coelenterates, *etc.*, exchange O_2 with CO_2 by simple diffusion over their entire body surface. Frogs can respire through moist skin also.

159. Answer (2)

Hint: Possess highest number of vertebral bones in humans

Sol.: Trachea is a straight tube extending upto the mid-thoracic cavity, which divides at the level of 5^{th} thoracic vertebra into a right and left primary bronchi.

160. Answer (2)

Hint: Similarity with epiglottis

Sol.: Larynx is a cartilaginous box, which helps in sound production and hence called the sound box. The intercellular material of cartilage is solid and pliable. Cranium is commonly known as brain box.

161. Answer (3)

Hint: Universal solvent

Sol.: 90 – 92 per cent of plasma is water and proteins contribute 6 – 8 per cent of it. Fibrinogens, globulins and albumins are the major proteins present in the blood plasma.

162. Answer (1)

Hint: Associated with allergic reactions

Sol.:

Formed elements	Percentage of total WBCs
Eosinophils	2 – 3
Basophils	0.5 – 1
Monocytes	6 – 8
Neutrophils	60 – 65
Lymphocytes	20 – 25

163. Answer (3)

Hint: Exclude agranulocytes

Sol.: Platelets are fragments of megakaryocytes. Erythrocytes are red blood cells, the most abundant of all the cells in blood. Lymphocytes and monocytes are agranulocytes.

164. Answer (2)

Hint: Active form of prothrombin

Sol.: Prothrombin is converted into thrombin by an enzyme complex, thrombokinase. Now, thrombin acts on fibrinogens and converts it into fibrins. Carbonic anhydrase present in RBCs catalyses the formation of H_2CO_3.

165. Answer (2)

Hint: Phylogenetically closest to birds

Sol.: Reptiles have 3-chambered heart, except crocodiles which possess 4-chambered heart with two atria and two ventricles.

166. Answer (2)

Hint: Red coloured fluid connective tissue

Sol.: Blood is the most commonly used body fluid by most of the higher organisms including humans for this purpose. Lymph in vertebrates and haemolymph in certain invertebrates help in

transport of certain substances. Water is present inside and outside the body cells of higher animals but it circulates in body of sponges and coelenterates.

167. Answer (2)

Hint: A connective tissue fibre

Sol.: Blood is a fluid connective tissue consisting of a fluid matrix, plasma and formed elements. It does not contain connective tissue fibres and fibroblasts which are responsible for formation of matrix and fibres in connective tissues.

168. Answer (2)

Hint: Present in minimum number in blood

Sol.: Basophils secrete heparin, histamine and serotonin. Histamine is a vasodilator and participates in inflammatory reactions of the body. Histamine and serotonin are responsible for allergic reactions of the body. Neutrophils and macrophages participate in phagocytosis.

169. Answer (1)

Hint: Site of formation of formed elements

Sol.: Platelets are produced from special cells in bone marrow called megakaryocytes. Formed elements are present in blood. The tissue fluid which is absorbed in lymph capillaries is called lymph.

170. Answer (4)

Hint: Antibodies against blood group antigens are nil in plasma.

Sol.: Due to absence of blood group antigens on surface of RBCs, the 'O' blood group individuals are considered as universal donors. 'AB' blood group individuals are universal recipients due to the absence of antibodies against blood group antigens in their blood plasma.

171. Answer (4)

Hint: Tidal volume is 500 mL.

Sol.: Pressure exerted by an individual gas in a gaseous mixture is called partial pressure of that individual gas. Diffusion of gas is mainly based on pressure/concentration gradient of a particular gas across diffusion membrane.

172. Answer (2)

Hint: Transport of gases is the third step.

Sol.: Respiration involves the following steps:

- Atmospheric air is drawn in and CO_2 rich alveolar air is released out
- Diffusion of gases across alveolar membrane
- Transport of gases by the blood.
- Diffusion of O_2 and CO_2 between blood and tissues.
- Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2.

173. Answer (4)

Hint: Includes TV also

Sol.: Total volume of air a person can expire after a normal inspiration is called expiratory capacity.

TV + IRV = Inspiratory Capacity (IC)

ERV + RV = Functional Residual Capacity (FRC)

VC + RV = Total Lung Capacity (TLC)

174. Answer (3)

Hint: Divide minute volume by tidal volume

Sol.: Minute volume = Tidal volume × Breathing rate

9000 mL/minute = 500 mL × Breathing rate

$$\therefore \text{Breathing rate} = \frac{9000 \text{ mL per minute}}{500 \text{ mL}}$$

= 18 times per minute

175. Answer (3)

Hint: Includes alveolar wall

Sol.: The diffusion membrane is made up of three major layers namely thin squamous epithelium of alveoli, the endothelium of alveolar blood capillaries and the basement substance in between them.

176. Answer (2)

Hint: Maximum amount of O_2 is transported by RBCs

Sol.: 3% of O_2 and 7% of CO_2 are carried in dissolved state through plasma.

97% of O_2 is transported by RBCs in blood.

70% of CO_2 is carried as bicarbonate through blood plasma.

177. Answer (1)

Hint: Located in medulla oblongata of brain

Sol.: Receptors associated with chemosensitive area, aortic arch and carotid artery are highly sensitive to CO_2 and H^+ concentration. Any change in CO_2 and H^+ concentration is recognised by these receptors and they send signals to the rhythm centre for necessary adjustment. Hippocampus and amygdala are the parts of limbic system.

178. Answer (4)

Hint: Cell fragments

Sol.: Decreased count of platelets leads to clotting disorders. Decreased count of erythrocytes lead to anaemia and that of leucocyte is leucopenia.

179. Answer (2)

Hint: Bundle branches give rise to Purkinje fibres

Sol.: The correct sequence of origin and conduction of impulses in heart is

SA node → AV node → Bundle of His → Purkinje fibres.

180. Answer (3)

Hint: Identify CAD

Sol.:

Angina	Acute chest pain
Cardiac arrest	Heart stops beating
Atherosclerosis	Lumen of arteries become narrower due to deposits of calcium, fat, cholesterol, *etc*.
Heart attack	Heart muscle damaged by an inadequate blood supply.

181. Answer (2)

Hint: Covering of the heart

Sol.: Pericardium is a double walled membranous bag that protects the heart.

The pleural membrane protects the lungs. Basement membrane is a non-cellular substance at which epithelium lies.

182. Answer (3)

Hint: End of T-wave marks the end of ventricular systole

Sol.: The P-wave represents depolarisation of the atria. The QRS complex represents the depolarisation of the ventricles.

183. Answer (4)

Hint: Cardiac output is 5 litres

Sol.: During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the stroke volume.

184. Answer (1)

Hint: Three muscular flaps

Sol.: Tricuspid valve guards the opening between right atrium and right ventricle. Bicuspid or mitral valve guards the opening between left atrium and left ventricle. Semilunar valves guard openings of the right and the left ventricles into pulmonary artery and aorta, respectively.

185. Answer (4)

Hint: Right ventricle pumps deoxygenated blood.

Sol.: The wall of left ventricle is thicker than the wall of right ventricle, because left ventricle needs to pump blood in systemic circulation. Right ventricle pumps blood in pulmonary circulation.

SECTION - B

186. Answer (3)

Hint: It is a lymph vessel which absorbs fats

Sol.: The fluid present in lymphatic system is called lymph. Fats are absorbed through lymph in a large lymph capillary called lacteal which is present in the centre of each villus.

187. Answer (2)

Hint: TLC-RV

Sol.: All the lung volumes/capacities can be measured by using a spirometer, except RV, FRC and TLC. It is used to measure TV, IRV, ERV, IC, EC and VC.

188. Answer (3)

Hint: Auricular systole occurs during ventricular diastole.

Sol.: All the four chambers of heart remain in a relaxed state only during joint diastole. 'Lub' sound is produced during ventricular systole due to closure of AV valves and 'dub' sound is produced during ventricular diastole due to closure of semilunar valves.

189. Answer (2)

Hint: Difficulty in breathing

Sol.:

Asthma	Inflammation of bronchi and bronchiole
Emphysema	Decreased respiratory surface area
Fibrosis	Occupational Respiratory Disorders

190. Answer (3)

Hint: One-fourth of a century

Sol.: Every 100 mL of oxygenated blood can deliver around 5 mL of O_2 to the tissues therefore,

500 mL will deliver $\frac{5\text{ mL}}{100\text{ mL}} \times 500\text{ mL}$

= 25 mL

191. Answer (4)

Hint: High temperature favours right shift of oxygen-dissociation curve.

Sol.: Low temperature, low H^+, low pCO_2 and high pO_2, favour the formation of oxyhaemoglobin in the alveoli.

192. Answer (2)

Hint: Diffusion of gases through tracheoles

Sol.: Insects have tracheal tubes for the transport of gases. In sponges, coelenterates and earthworms, exchange of gases occurs by diffusion through their body surface. Earthworms respire through moist cuticle.

193. Answer (1)

Hint: Last part of colon

Sol.: A sigmoid curve is obtained when percentage saturation of haemoglobin with O_2 is plotted against the pO_2. This curve is called oxygen dissociation curve.

194. Answer (2)

Hint: Systemic veins carry deoxygenated blood.

Sol.: The pO_2 in systemic vein is 40 mmHg and in systemic artery, it is 95 mmHg. The pCO_2 in systemic vein is 45 mmHg and in systemic artery, it is 40 mmHg.

195. Answer (3)

Hint: Ten times to the normal breathing rate

Sol.: 100 mL of blood has 12 – 16 gm of haemoglobin. Therefore, 1000 mL of blood has 120 to 160 gm of haemoglobin.

196. Answer (4)

Hint: Characterised by relaxed ventricles and atria

Sol.: During joint diastole of a cardiac cycle maximum filling of blood takes place in ventricles. During atrial systole blood enters into ventricles. During ventricular systole blood is pumped into pulmonary artery and aorta.

197. Answer (2)

Hint: Less than the number of thrombocytes

Sol.: Erythrocytes – 5 - 5.5 million/mm^3 of blood

Leucocytes – 6000 - 8000/mm^3 of blood

Thrombocytes – 1.5 lakhs - 3.5 lakhs/mm^3 of blood

198. Answer (3)

Hint: A unique vascular connection

Sol.: Hepatic portal vein carries blood from intestine to the liver. Hepatic vein carries deoxygenated blood from liver towards the heart and hepatic artery carries oxygenated blood towards the liver. Renal artery supplies blood to the kidney.

199. Answer (1)

Hint: Pulmonary circulation

Sol.: Pulmonary artery carries deoxygenated blood from right ventricle of the heart to the lungs.

200. Answer (4)

Hint: SAN can generate 70 – 75 action potentials per minute.

Sol.: SAN is present in the right upper corner of the right atrium, while AVN is present in the lower left corner of the right atrium. SAN is responsible for initiating and maintaining the rhythmic contractile activity of the heart.

❑ ❑ ❑

All India Aakash Test Series for NEET-2024

TEST - 2 (Code-F)

Test Date : 31/12/2023

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

SECTION - A

1. Answer (2)

Hint: $a=\frac{(m_1-m_2)g}{m_1+m_2}$

Sol.: $a=\frac{(3-2)g}{3+2}$

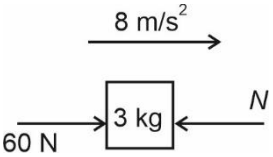
$a=\frac{10}{5}=2\ \text{m/s}^2$

2. Answer (3)

Hint: Normal reaction is contact force which is normal to contact surface.

Sol.: $a=\frac{60-20}{5}=\frac{40}{5}=8\ \text{m/s}^2$

F.B.D of 3 kg



$60 - N = 3 \times 8$

$N = 60 - 24$

$N = 36$ newton

3. Answer (4)

Hint: Area under $F - t$ graph = Change in momentum

Sol.: Change in momentum

$=\frac{1}{2}\times(9+4)\times 8-\frac{1}{2}\times 3\times 6$

$= 52 - 9$

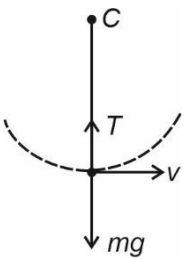
$= 43$ N s

4. Answer (3)

Hint: At the lowest point,

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

Sol.:



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

$T-mg=\frac{m}{r}\left(\sqrt{9gr}\right)^2$

$T = 9mg + mg$

$T = 10mg$

5. Answer (3)

Hint: Impulse = Change in momentum

Sol.: Initial momentum

$\vec{P}_i = mv\sin 45°\hat{i} - mv\cos 45°\hat{j}$

Final momentum

$\vec{P}_f = mv\sin 45°\hat{i} + mv\cos 45°\hat{j}$

Change in momentum

$\Delta\vec{P} = \vec{P}_f - \vec{P}_i = 2mv\cos 45°\hat{j}$

$|\Delta\vec{P}| = 2mv\cos 45°$

$=\sqrt{2}mv$

6. Answer (4)

Hint: $P=gh\frac{dm}{dt}$

Sol.: $P=gh\frac{dm}{dt}$

$= 10 \times 100 \times 20$

$P = 20000$ W $= 20$ kW

80% power is generated

$P_{\text{generated}}=\frac{80}{100}\times 20\ \text{kW}$

$= 16$ kW

7. Answer (2)

Hint: For equilibrium of a body $\vec{F}_{\text{net}}=\vec{0}$

Sol.: Resultant of applied forces = $2\hat{i}-2\hat{j}$

Force required to balance = $-2\hat{i}+2\hat{j}$

Force required = $2\sqrt{2}$ N in magnitude at angle 135° with +ve x-axis

8. Answer (3)

Hint: Use Newton's second law of motion, $F = ma$

Sol.: $a = \frac{F}{m} = \frac{F}{13}$ m/s^2

$v = u + at$

$v = 0 + \frac{F}{13}26$

$v = 2F$ m/s

For next 15 s

$s = vt$

$75 = 2F \times 15$

$F = 2.5$ N

9. Answer (2)

Hint and Sol.: Principle of conservation of linear momentum can explain the recoiling of gun during firing.

10. Answer (4)

Hint : $T_{up} = m(g + a)$

$T_{down} = m(g - a)$

Sol.: $T_{down} = m(g - a)$

$= 30(10 - 2)$

$T_{down} = 240$ N

$T_{up} = m(g + a)$

$= 30(10 + 4)$

$T_{up} = 420$ N

Since $T_{max} = 400$ N

$\therefore$ Rope will break when monkey tries to climb upward with 4 m/s^2

11. Answer (2)

Hint & Sol.: Velocity of parachutist when parachute opens at 80 m is

$u = \sqrt{2gh} = \sqrt{2 \times 10 \times 80} = 40$ m/s

Velocity at ground $v = 20$ m/s

$s = \frac{v^2 - u^2}{2a} = \frac{(20)^2 - (40)^2}{2(-3)}$

$s = \frac{400 - 1600}{-6} = 200$ m

Total height from ground where he bailed out

$= 200 + 80 = 280$ m

12. Answer (4)

Hint : $\vec{F} = \frac{-\partial U\hat{i}}{\partial x} - \frac{\partial U\hat{j}}{\partial y} - \frac{\partial U\hat{k}}{\partial z}$

Sol.: $\vec{F} = -4\hat{i} - 3\hat{j}$

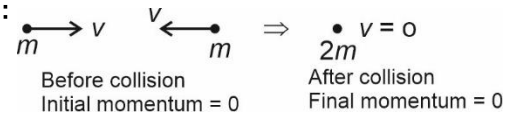
$|\vec{F}| = 5$ N

$\Rightarrow \quad a = \frac{|\vec{F}|}{m} = 5$ m/s^2

13. Answer (3)

Hint : In collision, linear momentum of the system always remains conserved

Sol.:



14. Answer (1)

Hint: Instantaneous power $P = \vec{F} \cdot \vec{v}$

Sol.: $F = v\frac{dm}{dt} = 10 \times 0.8$

$F = 8$ N

$P = Fv = 8 \times 10$

$P = 80$ W

15. Answer (3)

Hint: Work-energy theorem

Sol.: $W_{net} = KE_f - KE_i$

$\Rightarrow \quad -5 \times 10^{-2} \times 100 \times 10^{-2} = \frac{1}{2}m\left(v^2 - (4)^2\right)$

$\Rightarrow \quad 50 \times 10^{-3} = \frac{1}{2} \times 50 \times 10^{-3}\left((4)^2 - v^2\right)$

$\Rightarrow \quad 16 - v^2 = 2$

$\Rightarrow \quad v^2 = 14$

$\Rightarrow \quad v = \sqrt{14}$ m/s

16. Answer (4)

Hint : Since retardation is constant, therefore equations of motion can be applied

Sol.: Initial velocity:

$\frac{1}{2}mv^2 = 80$

$\frac{1}{2} \times 0.1 \times v^2 = 80$

$v = 40$ m/s

Velocity after 2 s

$\frac{1}{2}mv_1^2 = 20$

$\frac{1}{2} \times 0.1 \times v_1^2 = 20$

$v_1 = 20$ m/s

Retardation:

$v = u + at$

$20 = 40 + a \times 2$

$a = -10$ m/s^2

$v^2 = u^2 + 2as$

$0 = (40)^2 + 2 \times (-10) \times s$

$s = \frac{1600}{20}$

s = 80 m

17. Answer (3)

Hint and Sol.: For any collision, if $0 < e < 1$ then the collision is partially inelastic.

18. Answer (1)

Hint & Sol.: $(KE)_i = \frac{1}{2}mu^2$

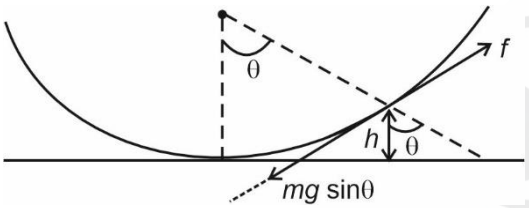
$(KE)_H = \frac{1}{2}m(u\cos 45°)^2 = \frac{1}{2}mu^2\left(\frac{1}{2}\right)$

$\frac{(KE)_i}{(KE)_H} = \frac{2}{1}$

19. Answer (3)

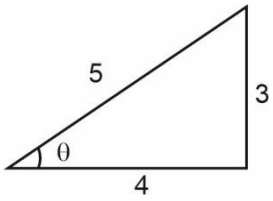
Hint : Insect starts slipping at the point where $f_{s,\max}$ becomes equal to $mg\sin\theta$.

Sol.:



$mg\sin\theta = f \Rightarrow mg\sin\theta = \mu mg\cos\theta$

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



$\cos\theta = \frac{4}{5}$

$h = R - R\cos\theta = R(1-\cos\theta)$

$h = 2\left(1-\frac{4}{5}\right) = \frac{2}{5} = 0.4$ m

20. Answer (2)

Hint: $KE = \frac{P^2}{2m}$

Sol.: $K = \frac{P^2}{2m}$

$K \propto \frac{1}{m}$

$\frac{K_1}{K_2} = \frac{m_2}{m_1}$

$\frac{m_1}{m_2} = \frac{4}{3}$

21. Answer (4)

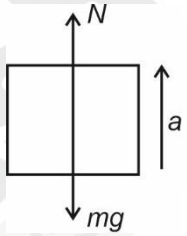
Hint and Sol.:

- Net work done on a body is equal to change in kinetic energy.
- Work done by friction force can be positive, negative or zero.
- Potential energy stored by spring is always positive.
- Potential energy is defined for conservative forces only.

22. Answer (4)

Hint: Normal force applied by the box on the block is $\frac{5}{4}mg$

Sol.:



$N - mg = ma$

$\frac{5}{4}mg - mg = ma$

$\frac{mg}{4} = ma$

$a = \frac{g}{4}$

23. Answer (2)

Hint: Conservation of mechanical energy

Sol.: $KE_A + PE_A = KE_B + PE_B$

$0 + 30\times10\times20 = \frac{1}{2}\times20\times v^2 + 20\times10\times10$

$10v^2 = 6000 - 2000 = 4000$

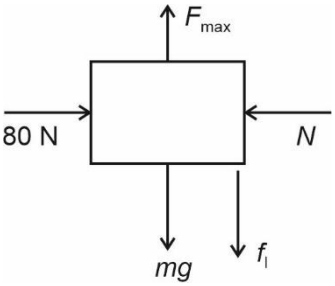
$v^2 = 400$

v = 20 m/s

24. Answer (4)

Hint: When the block has tendency to move upwards, then friction will act on it downward.

Sol.: F.B.D of block



$N = 80$

$f_l = \mu_s N$

$f_l = 0.4 \times 80 = 32$ N

$F_{max} = 5 \times 10 + 32$

$F_{max} = 82$ N

25. Answer (3)

Hint: $W = \vec{F} \cdot \vec{S}$

Sol.: $\vec{S} = \vec{r_2} - \vec{r_1}$

$\vec{S} = \left(3\hat{i} - \hat{j} + 2\hat{k}\right) - \left(\hat{i} + 3\hat{j} - 2\hat{k}\right)$

$\vec{S} = 2\hat{i} - 4\hat{j} + 4\hat{k}$

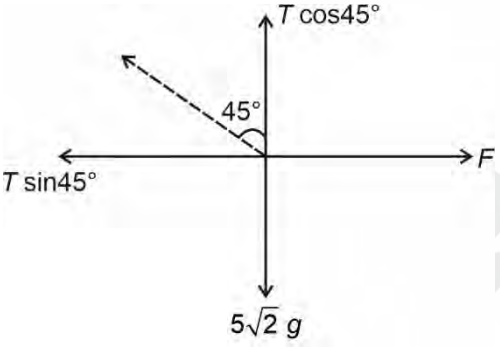
$W = \vec{F} \cdot \vec{S}$

$= 12 - 12 + 32$

$W = 32$ J

26. Answer (1)

Hint & Sol.: F.B.D of point where F is applied



$T\cos45° = 5\sqrt{2}g$

$T \times \frac{1}{\sqrt{2}} = 5\sqrt{2} \times 10$

$T = 100$ N

27. Answer (4)

Hint: Body will retard due to friction force

Sol.: $a = -\mu g$

$v = u + at$

$0 = 30 - \mu \times 10 \times 6$

$\mu = \frac{30}{60} = 0.5$

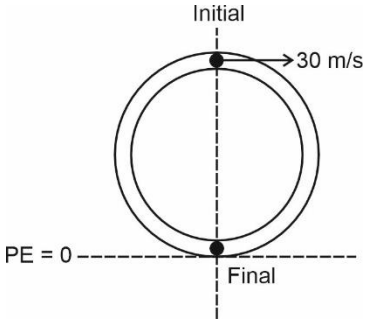
28. Answer (1)

Hint and Sol.: When there is relative motion between two surfaces, then kinetic friction acts between them.

29. Answer (3)

Hint: Change in energy = work done by tube

Sol.:



Initial energy of block = $\frac{1}{2}mv^2 + mgh$

$= \frac{1}{2} \times 2 \times (30)^2 + 2 \times 10 \times \frac{40}{100}$

$= 900 + 8 = 908$ J

Final energy = 0

Work done by tube on the block = ΔTME

$\therefore \quad W = 0 - 908$

$|W| = 908$ J

30. Answer (3)

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

Sol.: $a = v\frac{dv}{dx}$

$a = 8\sqrt{x}\frac{d}{dx}\left(8\sqrt{x}\right)$

$a = 64\sqrt{x}\frac{1}{2\sqrt{x}} = 32\ \text{m/s}^2$

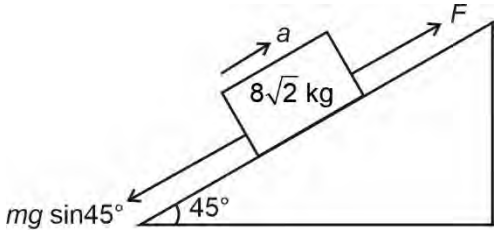
$F = ma = \frac{200}{1000} \times 32$

$= \frac{32}{5} = 6.4$ N

31. Answer (2)

Hint: Instantaneous power $= \vec{F} \cdot \vec{v}$

Sol.:



$F - mg\sin45° = ma$

$F = ma + mg\sin45°$

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

F = 16 + 80 = 96 N

Velocity at $t = \sqrt{8}$ s

$v = u + at$

$v = 0 + \sqrt{2} \times \sqrt{8}$ = 4 m/s

$P = Fv$

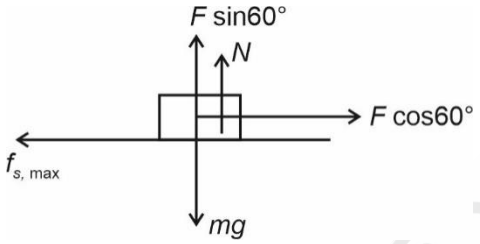
P = 96 × 4

P = 384 W

32. Answer (4)

Hint: In the condition when block is just about to move, applied horizontal force = limiting friction

Sol.:



$N = mg - F\sin60°$

$F\cos60° = \mu(N)$

$F\cos60° = \mu(mg - F\sin60°)$

$F(\cos60° + \mu\sin60°) = \mu mg$

$$F = \frac{\mu mg}{\cos60° + \mu\sin60°}$$

$$F = \frac{0.5 \times 20 \times 10}{\frac{1}{2} + 0.5\frac{\sqrt{3}}{2}}$$

$$= \frac{100}{0.93}$$

F = 107.5 N

33. Answer (4)

Hint: $W = \int F dx$

Sol.: $W = \int_4^6 10x dx$

$$= 10\left[\frac{x^2}{2}\right]_4^6$$

$$= 5\left[(6)^2 - (4)^2\right]$$

= 5 (36 – 16)

= 100 J

34. Answer (1)

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

Sol.: $\vec{v} = \frac{d\vec{r}}{dt} = \left(10t\,\hat{i} + 3\hat{j}\right)$

$$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d^2\vec{r}}{dt^2} = \left(10\hat{i}\right)$$

$$\vec{F} = m\vec{a} = m\left(10\hat{i}\right)$$

35. Answer (3)

Hint: Conservation of mechanical energy

Sol.: $\frac{1}{2}mv^2 = \frac{1}{2}kx^2 + \frac{1}{2}m\left(\frac{v}{2}\right)^2$

$$\frac{3}{8}mv^2 = \frac{1}{2}kx^2$$

$$k = \frac{3}{4}\frac{mv^2}{x^2}$$

$$= \frac{3}{4} \times \frac{1 \times (24)^2}{(0.2)^2}$$

$$= \frac{3}{4} \times \frac{24 \times 24}{4} \times 100$$

K = 10800 N/m

SECTION - B

36. Answer (1)

Hint: $w = \int F\,dx$

Sol.: $w = \int_0^5 \left(7 - 2x + 3x^2\right)dx$

$$= \left[7x - x^2 + x^3\right]_0^5$$

= 7 × 5 – (5)² + (5)³ – 0

= 35 – 25 + 125

w = 135 J

37. Answer (3)

Hint: $\Delta U = mgh$

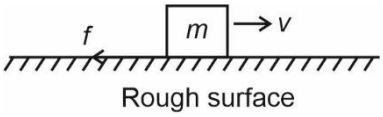
Sol.: $\Delta U = \frac{1000}{1000} \times 10 \times \frac{80}{100}$

ΔU = 8 J

38. Answer (3)

Hint: Friction force opposes the relative motion between the surfaces.

Sol.: The mentioned condition can be shown as



The angle between v and f is π or 180°.

39. Answer (3)

Hint & Sol.: Water stored in a dam possesses potential energy.

40. Answer (4)

Hint: Impulse = Change in momentum

Sol.: $I = m(v - u)$

$= 10\,(0 - 5)$

$I = -50$ Ns

41. Answer (3)

Hint: $F = m(g + a)$

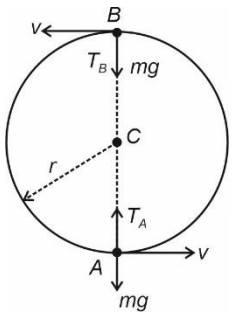
Sol.: $F = (4.5 \times 10^4)\,(20 + 10)$

$F = 13.5 \times 10^5$ N

42. Answer (2)

Hint: Use equation $\vec{F}_{net} = m\vec{a}$

Sol.:



For point A : $T_A = mg + \dfrac{m(v_A)^2}{r}$

For point B : $T_B = \dfrac{m(v_B)^2}{r} - mg$

Tension in the string is maximum at point A and minimum at point B.

43. Answer (2)

Hint: $a = -\mu g$

Sol.: $a = -10\mu$

$v = u + at$

$0 = 10 - 10\mu \times 5$

$\mu = \dfrac{10}{50} = \dfrac{1}{5}$

$\mu = 0.2$

44. Answer (2)

Hint: Work done = change in kinetic energy

Sol.: $a = \dfrac{-10}{5} = -2$ m/s^2

Velocity at $t = 3$ s

$v = u + at$

$v = 10 - 2 \times 3$

$v = 4$ m/s

$W = \dfrac{1}{2}m\left(v^2 - u^2\right)$

$= \dfrac{1}{2} \times 8 \times \left((4)^2 - (10)^2\right)$

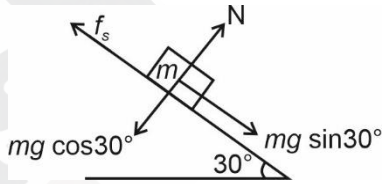
$= 4 \times (16 - 100)$

$W = -336$ J

45. Answer (4)

Hint: $f_s = mg\sin\theta$

Sol.:



$f_s = mg\sin30°$

$14 = m \times 10 \times \dfrac{1}{2}$

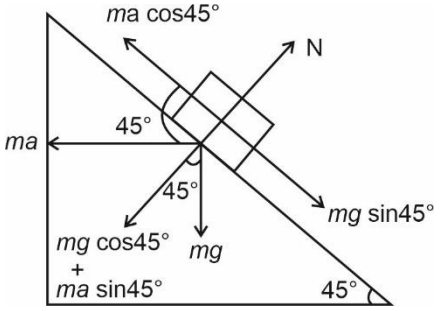
$\Rightarrow \quad m = 2.8$ kg

46. Answer (1)

Hint and Sol.: Action and reaction forces act on different bodies at the same time. They are always equal in magnitude and have same nature.

47. Answer (1)

Hint & Sol.: F.B.D of m



$ma\cos45° = mg\sin45°$

$a = g$

48. Answer (3)

Hint: Apply work-energy theorem

Sol.: $F = 10t$

$ma = 10t \Rightarrow 2a = 10t$

$a = 5t$

$$\frac{dv}{dt} = 5t$$

$$\int_0^v dv = \int_0^2 5t\, dt$$

$$v = \left[\frac{t^2}{2}\right]_0^2 \times 5$$

$v = 10$ m/s

$$W = \frac{1}{2} \times 2 \times (10)^2 - 0$$

$W = 100$ J

49. Answer (2)

Hint: Apply work energy-theorem.

Sol.: $S = \dfrac{v^2}{2\mu_k g}$

$$= \frac{(60)^2}{2 \times 0.4 \times 10} = \frac{3600}{8}$$

$S = 450$ m

50. Answer (4)

Hint: Total distance $= \dfrac{h\left(1+e^2\right)}{\left(1-e^2\right)}$

Sol.: Before it hits the ground

$$\text{KE} = \frac{1}{2}mv^2$$

After hitting the ground

$$\text{KE} = \frac{1}{2}mv_1^2$$

$$\frac{1}{2}mv_1^2 = \frac{80}{100}\frac{1}{2}mv^2$$

$$v_1 = \frac{2v}{\sqrt{5}}$$

$$e = \frac{\frac{2v}{\sqrt{5}}}{v} = \frac{2}{\sqrt{5}}$$

Total distance = $h\left(\dfrac{1+\frac{4}{5}}{1-\frac{4}{5}}\right) = 9h$

[CHEMISTRY]

SECTION - A

51. Answer (3)

Hint: The normal oxide formed by the elements in the centre of periodic table are amphoteric or neutral.

Sol.:

	Oxide	Nature of oxide
(i)	Na_2O	Basic
(ii)	SO_3	Acidic
(iii)	As_2O_3	Amphoteric
(iv)	N_2O	Neutral

52. Answer (4)

Hint: According to Modern Periodic Law "The physical and chemical properties of elements are periodic functions of their atomic numbers".

Sol.:

- Metals comprise more than seventy eight percent of the known elements.
- Elements belonging to same group have similar electronic configuration of their valence shell electrons.

53. Answer (3)

Hint & Sol.: 'A' is true but 'R' is false as isoelectronic species have the same number of electrons but may have different number of nuclear charge *i.e.*, protons.

54. Answer (2)

Hint: Size of corresponding anion and cation is respectively larger and smaller than its parent atom, due to decrease and increase in effective nuclear charge respectively.

Sol.: Correct order of radii is

$Na^- > Na > Na^+$

55. Answer (4)

Hint: Ne : $1s^2 2s^2 2p^6$

Sol.: Mg^{2+}, Na^+, F^-, O^{2-} are isoelectronic species having 10 electrons each.

Ionic radii decreases as $O^{2-} > F^- > Na^+ > Mg^{2+}$ due to increase in effective nuclear charge.

56. Answer (3)

Hint: Moving left to right across a period, electronegativity of elements generally increases.

Sol.: On Pauling scale electronegativity (E.N.) of the given elements is

Element	E.N.
C	2.5
N	3
O	3.5
Si	1.8

57. Answer (4)

Hint: Completely filled or half filled subshells are associated with greater stability than partially filled subshells.

Sol.: Increasing order of first I.E. of the elements is

B < Be < O < N

58. Answer (3)

Hint: Smaller size of first element of the groups 16, 17 leads to greater repulsion when an electron is added to it. So, lesser amount of energy is released.

Sol.:

Element	$\Delta_{eg}H$ (kJ mol^{-1})
O	– 141
S	– 200
Se	– 195
Te	– 190

So, correct order of negative $\Delta_{eg}H$ value is O < Te < Se < S

59. Answer (3)

Hint: Metallic nature generally increases down the group and decreases left to right in a period.

Sol.: K shows metallic character more than that of Mg or Al. So, correct decreasing metallic nature is

K > Mg > Al

60. Answer (4)

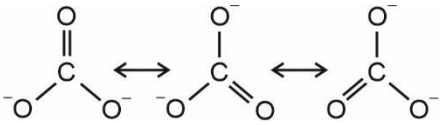
Hint & Sol.: Group 16 elements are called chalcogens.

61. Answer (4)

Hint: In case of resonating structures of a molecule/ion

$$\text{Bond order} = \frac{\text{Total number of bonds}}{\text{Total no. of sigma bonds}}$$

Sol.: In CO_3^{2-} ion, we have resonating forms as



so, bond order $= \frac{4}{3} = 1.33$

62. Answer (2)

Hint: Species having bond order zero are found to be unstable.

Sol.: Be_2 : $(\sigma 1s^2)$ $(\sigma^* 1s^2)$ $(\sigma 2s^2)$ $(\sigma^* 2s^2)$

Bond order $= \frac{4-4}{2} = 0$

so, Be_2 does not exist.

63. Answer (1)

Hint: In sp^3d hybridisation, there is 20% *d*-character.

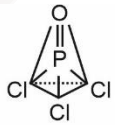
Sol.:

Molecule	Hybridisation
SF_4	sp^3d
BrF_5	sp^3d^2
IF_7	sp^3d^3
XeF_6	sp^3d^3

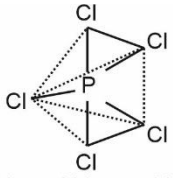
64. Answer (3)

Hint: Hybridisation of 'P' in $POCl_3$ is sp^3, while in PCl_5 is sp^3d.

Sol.:



Tetrahedral shape of $POCl_3$ has equal P–Cl bond lengths



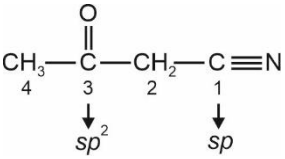
Trigonal bipyramidal shape of PCl_5 has two different P–Cl bond lengths

65. Answer (3)

Hint: According to IUPAC naming of molecules having more than one functional groups, priority order is

$$-CN > -CHO > \overset{|}{\underset{|}{C}}=O > -OH$$

Sol.: Given molecule is numbered as



66. Answer (2)

Hint: A species having all electrons paired is called diamagnetic while paramagnetic species have one or more unpaired electron(s).

Sol.:

Species	Bond order	Magnetic nature
C_2	2	Diamagnetic
C_2^-	2.5	Paramagnetic
N_2	3	Diamagnetic
N_2^+	2.5	Paramagnetic
O_2	2	Paramagnetic
O_2^-	1.5	Paramagnetic
O_2^{2-}	1	Diamagnetic

67. Answer (3)

Hint: First element of group I and II shows similar characteristics with second element of upcoming group which is known as diagonal relationship.

Sol.: Group 1 Group 2 Group 13 Group 14

Li → Be → B → C

Na → Mg → Al → Si

diagonal relationship

68. Answer (2)

Hint & Sol.:

a.	Iron	Transition element
b.	Chlorine	Non-metal
c.	Germanium	Metalloid
d.	Uranium	Actinoid

69. Answer (3)

Hint:

- AB_3E_2 type molecules acquire bent T-shape
- AB_4E type molecules acquire See-saw shape where E denotes lone pair of electrons.

Sol.:

	Molecule		Shape
a.	NH_3	(i)	Trigonal pyramidal
b.	BrF_3	(ii)	Bent T-shape
c.	BF_3	(iii)	Trigonal planar
d.	SF_4	(iv)	See-saw

70. Answer (4)

Hint: In an ionic compound, larger the size of cation, greater is the ionic character.

Sol.: Since, size increases as

$Li^+ < Na^+ < K^+ < Cs^+$

So, CsF has highest ionic character.

71. Answer (3)

Hint: When a molecule/species cannot be described by a single Lewis structure, it is represented by different structures called resonating structures.

Sol.: Molecules like O_3, CO_2 and ion like CO_3^{2-} can have resonating structures. H_2O has a single Lewis structure.

72. Answer (3)

Hint: In some compounds, the number of electrons surrounding the central atom is less than eight. These are called electron deficient molecules.

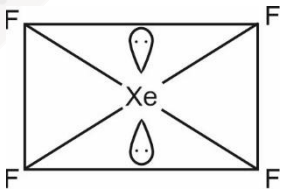
Sol.:

- In H—Be—H, there are 4 electrons surrounding the central atom Be.
- In CH_4, H_2O and SO_2, central atom has 8 electrons around it.

73. Answer (3)

Hint: Central atom having 4 bp and 2 lp is sp^3d^2 hybridized.

Sol.:



(sp^3d^2 hybridized Xe in XeF_4)

- Hybridisation of Xe in XeO_3 is sp^3. In XeO_2F_2 and XeF_2 hybridisation of Xe is sp^3d.

74. Answer (3)

Hint: Transition elements have incomplete inner (n – 1) *d*-orbitals.

Sol.: ns^2 represents a *s*-block element.

$ns^2\ np^4$ and $(n-1)d^{10}\ ns^2\ np^3$ represent *p*-block elements.

$(n-1)d^6\ ns^2$ represents a transition element.

75. Answer (4)

Hint and Sol.: The first element of each of the groups 1, 2 and groups 13 – 17 differs in chemical

behaviour from the other members of their respective group. It is attributed to their smallest size in the group, large (charge/radius) ratio, high electronegativity and absence of *d*-orbitals.

76. Answer (4)

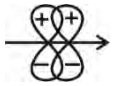
Hint: For isoelectronic species, radius $\propto \frac{1}{ENC}$

Sol.: All the species N^{3-}, O^{2-}, Mg^{2+} and Al^{3+} have 10 electrons each. The number of protons in N^{3-}, O^{2-}, Mg^{2+} and Al^{3+} species are 7, 8, 12 and 13 respectively so, ENC is greatest for Al^{3+} and lowest N^{3-} thus Al^{3+} ion is smallest and N^{3-} is largest in size.

77. Answer (2)

Hint: Sigma bond is formed due to head-on and positive overlap of bonding orbitals along the internuclear axis.

Sol.:  ; This end to end overlap of orbitals along the axis results in σ-bond formation.

 This overlap, above & below the nuclear axis results into pi-bond formation.

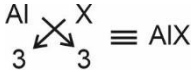
78. Answer (4)

Hint: Aluminium forms Al^{3+} ion to attain stable electronic configuration.

Al^{3+} : $1s^2$, $2s^2$, $2p^6$

While (X) gains 3 electrons to attain stable electronic configuration as X^{3-} : $1s^2$, $2s^2$, $2p^6$

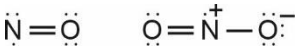
Sol.: Electrovalency of Al and (X) both is 3, so simplest formula of the compound is



79. Answer (3)

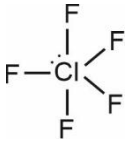
Hint: Molecules which have an odd number of electrons are called odd-electron molecules.

Sol.: Molecules like NO and NO_2 are odd-electron molecules.



80. Answer (2)

Hint:



Sol.: In the structure of ClF_5, there are 5 F – Cl bonds and one lone pair on central atom 'Cl'.

81. Answer (3)

Hint & Sol.: The electronic configuration of C_2 molecule is $(\sigma 1s)^2$ $(\sigma^* 1s)^2$ $(\sigma 2s)^2$ $(\sigma^* 2s)^2$ $(\pi 2p_x^2 = \pi 2p_y^2)$

Bond order of C_2 is $\frac{8-4}{2} = 2$

As four electrons are present in two pi molecular orbitals so double bond consists of both pi bonds.

82. Answer (2)

Hint: Species having net dipole moment zero are called non-polar.

Sol.: XeF_4 has 4 bp and 2 lp so acquires square planar geometry and net dipole moment of four Xe-F bonds is found to be zero, so it is a non-polar species.

83. Answer (2)

Hint: Mathematically, the formation of MO may be described by LCAO method.

Sol.: For He_2 molecule, BO = 0, so it does not exist.

Energy of $\sigma 2p_z$ MO is not always higher than $\pi 2p_x$ and $\pi 2p_y$ orbitals for example in case of N_2 and C_2 molecules.

84. Answer (2)

Hint: The species which contains paired electrons in orbitals are called diamagnetic in nature.

Sol.: H_2 : $(\sigma 1s)^2$

N_2 : $(\sigma 1s)^2$ $(\sigma^* 1s)^2$ $(\sigma 2s)^2$ $(\sigma^* 2s)^2$ $(\pi 2p_x^2 = \pi 2p_y^2)$ $(\sigma 2p_z)^2$

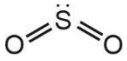
All the electrons in H_2 and N_2 are paired therefore, these are diamagnetic in nature.

85. Answer (3)

Hint: AB_2E type molecules have bent structure.

Sol.: $BeCl_2$, CO_2 and XeF_2 molecules have linear structures

SO_2 has 2 bp and 1 lp, so it has bent shape



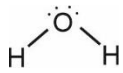
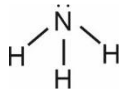
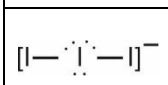
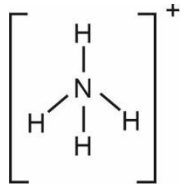
SECTION - B

86. Answer (4)

Hint: Bond angle of molecule depends on repulsive interaction of electron pairs, which decreases in the order:

lp-lp > lp-bp > bp-bp

Sol.:

Species	Shape	Bond angle
	Bent	104.5°
	Pyramidal	107°
	Linear	180°
	Tetrahedral	109°28′

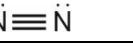
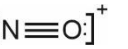
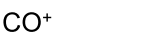
87. Answer (2)

Hint: NO_2 has an odd electron

Sol.: In PF_5, P has 10 valence electrons so, it has expanded octet.

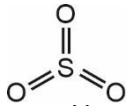
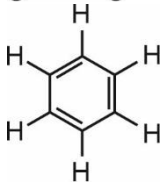
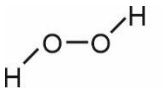
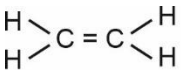
88. Answer (3)

Hint & Sol.:

Species	B.O
	3
	3
CO^+	3.5
	3

89. Answer (4)

Hint & Sol.:

-  3σ and 3π bonds
-  12σ and 3π bonds
-  3σ bonds
-  5σ and 1π bond

90. Answer (2)

Hint: Bond order $= \frac{1}{2}[N_b - N_a]$

Sol.: Bond order in $O_2 = \frac{10-6}{2} = 2$

Bond order in $O_2^+ = \frac{10-5}{2} = 2.5$

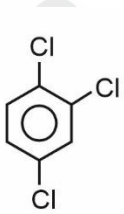
Bond order in $O_2^- = \frac{10-7}{2} = 1.5$

Bond order in $O_2^{2-} = \frac{10-8}{2} = 1$

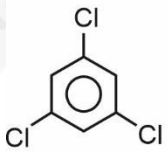
91. Answer (2)

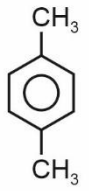
Hint: Two equal and opposite dipole vectors have net resultant zero.

Sol.:

 $\mu_{net} \neq 0$

 $\mu_{net} \neq 0$

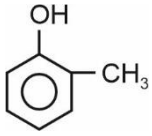
 $\mu_{net} = 0$

 $\mu_{net} = 0$

92. Answer (1)

Hint: In o-nitrophenol intramolecular hydrogen bonding is possible.

Sol.:

- In m-nitrophenol and p-nitrophenol intermolecular H-bonding takes place
- In  , H-bonding is not possible.

93. Answer (1)

Hint: *f*-block consists of Lanthanoids Z = 58 to Z = 71 and Actinoids Z = 90 to Z = 103

Sol.: Element with atomic number 59 is a Lanthanoid which belongs to *f*-block.

94. Answer (4)

Hint: Down the group, atomic size generally increases.

Sol.:

Atom	Atomic radius (pm)
C	77
O	66
Mg	160
Al	143
Li	152
F	64
Br	114
I	133

95. Answer (3)

Hint: Noble gases have stable electronic configuration.

Sol.: $O^- \rightarrow O^{2-}$ is an endothermic process as –vely charge species repel the incoming electron.

Ne has large positive electron gain enthalpy due to addition of an electron makes it very unstable.

96. Answer (4)

Hint: Bond length $\propto \frac{1}{\text{Bond order}}$

Sol.:

Bond order	Species
3	CO
2	CO_2
1.33	CO_3^{2-}

Hence, order of bond length is $CO < CO_2 < CO_3^{2-}$

97. Answer (2)

Hint: % ionic character $= \frac{\mu_{observed}}{\mu_{calculated}} \times 100$

Sol.: $\mu_{calculated} = q \times d$

$= 1.6 \times 10^{-19} \times 156 \times 10^{-12}$ C m

$= 2.5 \times 10^{-29}$ C m

$\mu_{observed} = 1.5$ D $= 1.5 \times 3.33 \times 10^{-30}$ C m

$= 5 \times 10^{-30}$ C m

% ionic character $= \frac{5 \times 10^{-30}}{2.5 \times 10^{-29}} \times 100 = 20\%$

98. Answer (3)

Hint: Covalency of a metal is defined as the number of covalent/coordinate bonds formed by it in its compound.

Sol.: In complex ion $[AlCl(H_2O)_5]^{2+}$, oxidation state of Al is +3 and covalency is 6.

99. Answer (3)

Hint & Sol.:

- $_{47}Ag$ is a transition element.
- Silicon and germanium are semi-metals or metalloids.
- *f*-block elements are also called inner-transition elements.

100. Answer (2)

Hint & Sol.: Correct IUPAC official names of the elements are as

101	Unnilunium	Mendelevium
105	Unnilpentium	Dubnium
111	Unununnium	Roentgenium
112	Ununbium	Copernicium

[BOTANY]

SECTION-A

101. Answer (3)

Hint: CJD is an analogous variant of mad cow disease in cattle.

Sol.: CJD in humans is caused by prions.

102. Answer (2)

Hint: It is caused by a flagellated protozoan.

Sol.: The parasitic forms of flagellated protozoans cause diseases such as sleeping sickness, *e.g.*, *Trypanosoma*.

103. Answer (3)

Hint: Comma-shaped bacteria are known as vibrium.

Sol.: Rod-shaped bacteria are known as bacillus.

Spiral-shaped bacteria are known as spirillum.

Spherical-shaped bacteria are known as coccus.

104. Answer (1)

Hint: Marine forms of amoeboid protozoans have silica shells on their surface.

Sol.: Sporozoans include diverse organisms that have an infectious spore-like stage in their life

cycle. Ciliated protozoans have a cavity (gullet) that opens to the outside of the cell surface. The members of flagellated protozoans are either free-living or parasitic.

105. Answer (2)

Hint: Aristotle was the earliest to attempt a more scientific basis for classification.

Sol.: Aristotle used simple morphological characters to classify plants into trees, shrubs and herbs. The main criteria used by R. H. Whittaker for classification include cell structure, body organisation, mode of nutrition, reproduction and phylogenetic relationships. In earlier classification systems, *Paramoecium* and *Amoeba* were placed in the animal kingdom which lack a cell wall.

Bacteria are the sole members of the kingdom Monera. They are the most abundant micro-organisms.

106. Answer (3)

Hint: Cyanobacteria are also referred to as blue-green algae.

Sol.: The cyanobacteria have chlorophyll a similar to green plants. Chemosynthetic autotrophic bacteria play a great role in recycling nutrients like nitrogen, phosphorus, iron and sulphur. Cyanobacteria (photosynthetic autotrophs) often form blooms in polluted water bodies. The colonies of cyanobacteria (*Nostoc*) are generally surrounded by gelatinous sheath.

107. Answer (4)

Hint: This group includes diatoms and golden algae (desmids).

Sol.: Chrysophytes are microscopic and float passively in water currents (plankton). Most of them are photosynthetic. In diatoms, the cell walls form two thin overlapping shells, which fit together as in a soap box. The walls are embedded with silica and thus the walls are indestructible.

108. Answer (4)

Hint: Dinoflagellates are photosynthetic in nature.

Sol.: Euglenoids are photosynthetic in the presence of sunlight, when deprived of sunlight they behave like heterotrophs. Majority of them are fresh water organisms found in stagnant water. Dinoflagellates are mostly marine. Both euglenoids and dinoflagellates have two flagella. Euglenoids lack cell wall, while the cell wall of dinoflagellates has stiff cellulose plates on the outer surface.

109. Answer (4)

Hint: By taking example of slime moulds, we can justify that Protista forms a connecting link with plants, animals and fungi

Sol.: The pigments of euglenoids are identical to those present in higher plants. Amoeboid protozoans move and capture their prey by putting out pseudopodia. In slime moulds.

Fungi-like feature : Formation of fruiting bodies.

Plant-like feature : Cell wall around spores.

Animal-like feature : Plasmodium is without cell wall.

110. Answer (4)

Hint: The viruses are non-cellular organisms.

Sol.: The viruses are characterized by having an inert crystalline structure outside the living cell. Viroids are found to be a free RNA. Prions consisted of abnormally folded protein. Lichens are very good pollution indicators–they do not grow in polluted areas.

111. Answer (1)

Hint: $\male$ is designated as male in floral formula.

Sol.: $\underline{G}$ refer to superior ovary, $\bar{G}$ refers to inferior ovary and G refers to gynoecium.

112. Answer (2)

Hint: Tegmen is the inner layer of the seed coat.

Sol.: The hilum is a scar on the seed coat through which the developing seeds were attached to the fruit.

113. Answer (4)

Hint: The outermost covering of a seed is the seed coat.

Sol.: The seed coat has two layers, the outer testa and the inner tegmen.

114. Answer (4)

Hint: Mango is a drupe fruit.

Sol.: Mango develops from monocarpellary superior ovary and is one seeded.

115. Answer (2)

Hint: Prop roots are found in banyan trees.

Sol.: The stems of maize and sugarcane have supporting roots coming out of the lower nodes of the stem called stilt roots.

116. Answer (1)

Hint: The petiole helps hold the blade to light.

Sol.: In some leguminous plants, the leaf base may become swollen, which is called the pulvinus. The lamina or the leaf blade is the green expanded part of the leaf with veins and veinlets. Veins provide rigidity to the leaf blade. Leaf base may bear two lateral small leaf-like structures called stipules.

117. Answer (1)

Hint: Makoi belongs to the Solanaceae family

Sol.: Makoi plant shows bicarpellary obligately placed gynoecium, five stamens, persistent calyx and endospermous seed.

118. Answer (1)

Hint: In racemose type of inflorescence, the flowers are borne laterally in an acropetal succession.

Sol.: Sweet pea shows racemose inflorescence. All others are either solitary or show cymose inflorescence, in which flowers are borne in basipetal order.

119. Answer (3)

Hint: Aleurone layer is a proteinous layer.

Sol.: In monocot seeds (Maize), the outer covering of endosperm separates the embryo by a proteinous layer called aleurone layer.

The root is covered at the apex by a thimble-like structure called the root cap.

120. Answer (4)

Hint: The mode of arrangement of petals in floral bud w.r.t. the outer members of the same whorl is called aestivation.

Sol.:

Aestivation	Example
Valvate	*Calotropis*
Twisted	Cotton
Imbricate	*Cassia*, Gulmohur
Vexillary	Pea

121. Answer (4)

Hint: Phyllotaxy is the pattern of arrangement of leaves on the stem or branch.

Sol.:

Phyllotaxy	Example
Alternate	Sunflower
Opposite	Guava
Whorled	*Alstonia*

122. Answer (4)

Hint: When stamens are attached to the petals, they are epipetalous.

Sol.: When stamens are attached to the perianth, they are epiphyllous. A sterile stamen is called staminode.

123. Answer (2)

Hint: Corm acts as an organ of perennation to tide over condition unfavourable for growth.

Sol.: Underground stem of *Colocasia* is modified to store food in them and it also acts as organ of perennation.

124. Answer (1)

Hint: In marginal placentation, the placenta forms a ridge along the ventral suture of the ovary and the ovules are borne of this ridge forming two rows.

Sol.:

	Placentation		Example
a.	Marginal	–	Pea
b.	Axile	–	China rose
c.	Parietal	–	*Argemone*
d.	Free central	–	Primrose
e.	Basal	–	Marigold

125. Answer (2)

Hint: Cells proximal to region of elongation constitute region of maturation.

Sol.: The primary roots and its branches constitute the tap root system, as seen in the mustard plant. The cells of the elongation zone gradually differentiate and mature. Hence, this zone, proximal to the region of elongation, is called the region of maturation.

In turnip roots modify to store food. In *Chrysanthemum* each node bears rosette of leaves and tuft of roots.

126. Answer (1)

Hint: In epigynous flowers, the margin of thalamus grows upwards enclosing the ovary completely and getting fused with it.

Sol.: There may be a variation in the length of filaments within a flower, as in *Salvia* and mustard. In mustard, the ovules develop on the inner wall of the ovary. In mustard, superior ovary is found and the flower is actinomorphic.

127. Answer (3)

Hint: *Aloe* belongs to the Liliaceae family. Ashwagandha belongs to the Solanaceae family.

Sol.: Liliaceae family members have actinomorphic flowers with syncarpous ovary and epitepalous stamen. Ebracteate and actinomorphic flowers with syncarpous ovary and epipetalous stamens are found in the members of Solanaceae family.

128. Answer (4)

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

Sol.: RNA is the genetic material in TMV. Bacterial viruses or Bacteriophages (viruses that infect the bacteria) are usually double-stranded DNA viruses.

129. Answer (2)

Hint: *Paramoecium* is a ciliated protozoan.

Sol.: In *Paramoecium* the coordinated movement of rows of cilia causes the water laden with food to be steered into the gullet. With the exception of yeasts which are unicellular, fungi are filamentous.

130. Answer (3)

Hint: All single-celled eukaryotes are placed under protista

Sol.: Members of protista are primarily aquatic. Being eukaryotes, the protistan cell body contains a well-defined nucleus and other membrane-bound organelles.

131. Answer (2)

Hint: Oomycetes is commonly known as algal fungi.

Sol.:

Alternaria → Imperfect fungi (Deuteromycetes)

Agaricus → Club fungi (Basidiomycetes)

Mucor → Conjugation fungi (Zygomycetes)

Claviceps → Sac fungi (Ascomycetes)

132. Answer (4)

Hint: The organism responsible for red tides belongs to dinoflagellates.

Sol.: Very often, red dinoflagellates *e.g.*, *Gonyaulax* undergo such rapid multiplication that they make the sea appear red (red tides).

133. Answer (2)

Hint: Conidia are exogenously produced asexual spores.

Sol.: The Ascomycetes and Deuteromycetes have septate mycelia and reproduce by asexual spores called conidia. The asexual spores are generally not found in the members of Basidiomycetes. Members of phycomycetes generally reproduce asexually through endogenously produced spores.

134. Answer (2)

Hint: This agent is a nucleoprotein.

Sol.: In plants, the symptoms caused by viruses can be mosaic formation, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth.

135. Answer (3)

Hint: The most notable diseases caused by prions are bovine spongiform encephalopathy.

Sol.: A virus is a nucleoprotein. The RNA of the viroid is of low molecular weight. Prions are similar in size to viruses. Lichens are the symbiotic association between algae and fungi.

SECTION-B

136. Answer (2)

Hint: Above the hilum is a small pore called the micropyle.

Sol.: The plumule and radicle are enclosed in sheaths which are called coleoptile and coleorhiza, respectively.

137. Answer (3)

Hint: Keel is found in flowers that show vexillary aestivation.

Sol.: In pea and bean flowers, there are five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel), this type of aestivation is known as vexillary or papilionaceous. Lady's finger and China rose show twisted aestivation. Chilli shows valvate aestivation.

138. Answer (3)

Hint: *Euphorbia* inhabits arid regions.

Sol.: In *Euphorbia,* stems are modified into fleshy cylindrical structures.

Axillary buds of stems get modified into woody, straight and pointed thorns *e.g.*, Citrus.

Stem tendrils which develop from axillary buds, are slender and spirally coiled *e.g.*, Cucumber.

In plants like mint and jasmine, a slender lateral branch arises from the base of the main axis and after growing aerially for some time arch downwards to touch the ground.

139. Answer (4)

Hint: Seeds showing the presence of endosperm even at the mature seeds are called endospermous seed.

Sol.: Castor is an endospermous seed. In plants such as bean, gram and pea, the endosperm is not present in mature seeds and such seeds are called non-endospermous.

140. Answer (3)

Hint: Adhesion is denoted by a line drawn above the symbols of the floral parts.

Sol.: Fusion is indicated by enclosing the figure within bracket. 'Br' stands for bracteate condition.

141. Answer (1)

Hint: Lupin belongs to Fabaceae.

Sol.: Lupin acts as an ornamental plant. Soyabean acts as a source of edible oil. *Indigofera* is used in the preparation of dye. *Muliathi* is a medicinal plant.

142. Answer (2)

Hint: Belladonna is a medicinal plant.

Sol.: Brinjal and potato are the sources of food, while tobacco is fumigatory plant.

143. Answer (2)

Hint: Mustard belongs to the family Brassicaceae

Sol.:

Family	Floral formula
Brassicaceae	$\oplus\ \male\ K_{2+2}\ C_4\ A_{2+4}\ \underline{G}_{(2)}$
Fabaceae	$\%\ \male\ K_{(5)}\ C_{1+2+(2)}\ A_{(9)+1}\ \underline{G}_{(1)}$
Solanaceae	$\oplus\ \male\ K_{(5)}\ \overset{\frown}{C}_{(5)}\ A_5\ \underline{G}_{(2)}$
Liliaceae	$Br\ \oplus\ \male\ \overset{\frown}{P}_{(3+3)}\ A_{3+3}\ \underline{G}_{(3)}$

144. Answer (3)

Hint: D. J. Ivanowsky recognized certain microbes as causal organisms of the mosaic disease of tobacco.

Sol.: W. M. Stanley showed that viruses could be crystallized. M. W. Beijerinck demonstrated that the extract of the infected plants of tobacco could cause infection in healthy plants and called the fluid as *Contagium vivum fluidum* (infectious living fluid).

145. Answer (4)

Hint: *Plasmodium* causes malaria.

Sol.: Monera includes prokaryotes (bacteria). Bacteria reproduce by a sort of sexual reproduction by adopting a primitive type of DNA transfer from one bacterium to the other. *Plasmodium* causes malaria, a disease which has a staggering effect on human population. *Saccharomyces* is unicellular. Some hyphae are continuous tubes filled with multinucleated cytoplasm–these are called coenocytic hyphae.

146. Answer (1)

Hint: Methanogens inhabit marshy areas.

Sol.: Halophiles inhabit extreme salty areas and thermoacidophiles inhabit hot springs.

147. Answer (1)

Hint: In ascomycetes and basidiomycetes, an intervening dikaryotic stage (n + n, *i.e.*, two nuclei per cell) occurs.

Sol.: The sex organs are absent, but plasmogamy is brought about by the fusion of two vegetative or somatic cells of different strains or genotypes. The resultant structure is dikaryotic which ultimately gives rise to basidium. Deuteromycetes only exhibit vegetative phase. In phycomycetes, the mycelium is aseptate and coenocytic and a zygospore is formed by fusion of two gametes.

148. Answer (1)

Hint: Euglenoids lack cell wall.

Sol.: Instead of a cell wall, euglenoids have a protein-rich layer called pellicle which makes their body flexible.

149. Answer (2)

Hint: Fungi which show only vegetative phase are known as imperfect fungi.

Sol.: Deuteromycetes is commonly known as imperfect fungi. *Albugo*, the parasitic fungi on mustard. *Neurospora* used extensively in biochemical and genetic work. *Ustilago* causes smut disease.

150. Answer (1)

Hint: Cilia represent the locomotory structures in ciliated protozoans.

Sol.: Ciliated protozoans are aquatic, actively moving organisms because of the presence of thousands of cilia.

[ZOOLOGY]

SECTION - A

151. Answer (3)

Hint: Performed by conducting part of respiratory system

Sol.: The process of exchange of O_2 from the atmosphere with CO_2 produced by cells is called breathing. Cellular respiration is breakdown of food substances within cells to release energy. Oxidation-reduction takes place during respiration.

152. Answer (4)

Hint: Buccal cavity opens into it

Sol.: The nasal chamber opens into pharynx, a portion of which is the common passage for food and air. The pharynx opens through the larynx region into the trachea.

153. Answer (4)

Hint: The part of respiratory tract which gives rise to alveoli

Sol.: Trachea, primary, secondary and tertiary bronchi and initial bronchioles are supported by incomplete cartilaginous rings. Terminal bronchioles lack cartilaginous rings and give rise to alveoli.

154. Answer (1)

Hint: Dome-shaped in relaxed state

Sol.: The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by the dome-shaped diaphragm.

155. Answer (2)

Hint: A bone present in mid-ventral line

Sol.: Sternum is a bone which cannot generate a force to change in pressure. Diaphragm and inter-costal muscles generate pressure gradients for both inspiration and expiration.

156. Answer (2)

Hint: Amphibian feature

Sol.: In amphibians, left atrium receives oxygenated blood from both lungs and skin as amphibians perform both pulmonary and cutaneous respiration in adult stage of their life. *Balaenoptera* (whale), *Aptenodytes* (penguin) and *Crocodilus* (crocodile) can perform only pulmonary respiration.

157. Answer (1)

Hint: Basement membrane is an acellular layer.

Sol.: Diffusion membrane is made up of three major layers *i.e.*, simple squamous epithelium of alveolar wall, endothelium of alveolar blood vessels and acellular basement membrane in between these two layers. Its total thickness is less than one millimetre.

158. Answer (4)

Hint: Branchial respiration

Sol.: Gills are used for exchange of gases by aquatic forms. Lungs are used by the terrestrial forms for exchange of gases. Lower invertebrates like sponges, coelenterates, *etc.*, exchange O_2 with CO_2 by simple diffusion over their entire body surface. Frogs can respire through moist skin also.

159. Answer (2)

Hint: Possess highest number of vertebral bones in humans

Sol.: Trachea is a straight tube extending upto the mid-thoracic cavity, which divides at the level of 5^{th} thoracic vertebra into a right and left primary bronchi.

160. Answer (2)

Hint: Similarity with epiglottis

Sol.: Larynx is a cartilaginous box, which helps in sound production and hence called the sound box. The intercellular material of cartilage is solid and pliable. Cranium is commonly known as brain box.

161. Answer (4)

Hint: Right ventricle pumps deoxygenated blood.

Sol.: The wall of left ventricle is thicker than the wall of right ventricle, because left ventricle needs to pump blood in systemic circulation. Right ventricle pumps blood in pulmonary circulation.

162. Answer (1)

Hint: Three muscular flaps

Sol.: Tricuspid valve guards the opening between right atrium and right ventricle. Bicuspid or mitral valve guards the opening between left atrium and left ventricle. Semilunar valves guard openings of the right and the left ventricles into pulmonary artery and aorta, respectively.

163. Answer (4)

Hint: Cardiac output is 5 litres

Sol.: During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the stroke volume.

164. Answer (3)

Hint: End of T-wave marks the end of ventricular systole

Sol.: The P-wave represents depolarisation of the atria. The QRS complex represents the depolarisation of the ventricles.

165. Answer (2)

Hint: Covering of the heart

Sol.: Pericardium is a double walled membranous bag that protects the heart.

The pleural membrane protects the lungs. Basement membrane is a non-cellular substance at which epithelium lies.

166. Answer (3)

Hint: Identify CAD

Sol.:

Angina	Acute chest pain
Cardiac arrest	Heart stops beating
Atherosclerosis	Lumen of arteries become narrower due to deposits of calcium, fat, cholesterol, *etc*.
Heart attack	Heart muscle damaged by an inadequate blood supply.

167. Answer (2)

Hint: Bundle branches give rise to Purkinje fibres

Sol.: The correct sequence of origin and conduction of impulses in heart is

SA node $\rightarrow$ AV node $\rightarrow$ Bundle of His $\rightarrow$ Purkinje fibres.

168. Answer (4)

Hint: Cell fragments

Sol.: Decreased count of platelets leads to clotting disorders. Decreased count of erythrocytes lead to anaemia and that of leucocyte is leucopenia.

169. Answer (1)

Hint: Located in medulla oblongata of brain

Sol.: Receptors associated with chemosensitive area, aortic arch and carotid artery are highly sensitive to CO_2 and H^+ concentration. Any change in CO_2 and H^+ concentration is recognised by these receptors and they send signals to the rhythm centre for necessary adjustment. Hippocampus and amygdala are the parts of limbic system.

170. Answer (2)

Hint: Maximum amount of O_2 is transported by RBCs

Sol.: 3% of O_2 and 7% of CO_2 are carried in dissolved state through plasma.

97% of O_2 is transported by RBCs in blood.

70% of CO_2 is carried as bicarbonate through blood plasma.

171. Answer (3)

Hint: Includes alveolar wall

Sol.: The diffusion membrane is made up of three major layers namely thin squamous epithelium of alveoli, the endothelium of alveolar blood capillaries and the basement substance in between them.

172. Answer (3)

Hint: Divide minute volume by tidal volume

Sol.: Minute volume = Tidal volume × Breathing rate

9000 mL/minute = 500 mL × Breathing rate

$$\therefore \text{Breathing rate} = \frac{9000 \text{ mL per minute}}{500 \text{ mL}}$$

= 18 times per minute

173. Answer (4)

Hint: Includes TV also

Sol.: Total volume of air a person can expire after a normal inspiration is called expiratory capacity.

TV + IRV = Inspiratory Capacity (IC)

ERV + RV = Functional Residual Capacity (FRC)

VC + RV = Total Lung Capacity (TLC)

174. Answer (2)

Hint: Transport of gases is the third step.

Sol.: Respiration involves the following steps:

- Atmospheric air is drawn in and CO_2 rich alveolar air is released out
- Diffusion of gases across alveolar membrane
- Transport of gases by the blood.
- Diffusion of O_2 and CO_2 between blood and tissues.
- Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2.

175. Answer (4)

Hint: Tidal volume is 500 mL.

Sol.: Pressure exerted by an individual gas in a gaseous mixture is called partial pressure of that individual gas. Diffusion of gas is mainly based on pressure/concentration gradient of a particular gas across diffusion membrane.

176. Answer (4)

Hint: Antibodies against blood group antigens are nil in plasma.

Sol.: Due to absence of blood group antigens on surface of RBCs, the 'O' blood group individuals are considered as universal donors. 'AB' blood group individuals are universal recipients due to the absence of antibodies against blood group antigens in their blood plasma.

177. Answer (1)

Hint: Site of formation of formed elements

Sol.: Platelets are produced from special cells in bone marrow called megakaryocytes. Formed elements are present in blood. The tissue fluid which is absorbed in lymph capillaries is called lymph.

178. Answer (2)

Hint: Present in minimum number in blood

Sol.: Basophils secrete heparin, histamine and serotonin. Histamine is a vasodilator and participates in inflammatory reactions of the body. Histamine and serotonin are responsible for allergic reactions of the body. Neutrophils and macrophages participate in phagocytosis.

179. Answer (2)

Hint: A connective tissue fibre

Sol.: Blood is a fluid connective tissue consisting of a fluid matrix, plasma and formed elements. It does not contain connective tissue fibres and fibroblasts which are responsible for formation of matrix and fibres in connective tissues.

180. Answer (2)

Hint: Red coloured fluid connective tissue

Sol.: Blood is the most commonly used body fluid by most of the higher organisms including humans for this purpose. Lymph in vertebrates and haemolymph in certain invertebrates help in transport of certain substances. Water is present inside and outside the body cells of higher animals but it circulates in body of sponges and coelenterates.

181. Answer (2)

Hint: Phylogenetically closest to birds

Sol.: Reptiles have 3-chambered heart, except crocodiles which possess 4-chambered heart with two atria and two ventricles.

182. Answer (2)

Hint: Active form of prothrombin

Sol.: Prothrombin is converted into thrombin by an enzyme complex, thrombokinase. Now, thrombin acts on fibrinogens and converts it into fibrins. Carbonic anhydrase present in RBCs catalyses the formation of H_2CO_3.

183. Answer (3)

Hint: Exclude agranulocytes

Sol.: Platelets are fragments of megakaryocytes. Erythrocytes are red blood cells, the most abundant of all the cells in blood. Lymphocytes and monocytes are agranulocytes.

184. Answer (1)

Hint: Associated with allergic reactions

Sol.:

Formed elements	Percentage of total WBCs
Eosinophils	2 – 3
Basophils	0.5 – 1
Monocytes	6 – 8
Neutrophils	60 – 65
Lymphocytes	20 – 25

185. Answer (3)

Hint: Universal solvent

Sol.: 90 – 92 per cent of plasma is water and proteins contribute 6 – 8 per cent of it. Fibrinogens, globulins and albumins are the major proteins present in the blood plasma.

SECTION - B

186. Answer (4)

Hint: SAN can generate 70 – 75 action potentials per minute.

Sol.: SAN is present in the right upper corner of the right atrium, while AVN is present in the lower left corner of the right atrium. SAN is responsible for initiating and maintaining the rhythmic contractile activity of the heart.

187. Answer (1)

Hint: Pulmonary circulation

Sol.: Pulmonary artery carries deoxygenated blood from right ventricle of the heart to the lungs.

188. Answer (3)

Hint: A unique vascular connection

Sol.: Hepatic portal vein carries blood from intestine to the liver. Hepatic vein carries deoxygenated blood from liver towards the heart and hepatic artery carries oxygenated blood towards the liver. Renal artery supplies blood to the kidney.

189. Answer (2)

Hint: Less than the number of thrombocytes

Sol.: Erythrocytes – 5 - 5.5 million/mm^3 of blood

Leucocytes – 6000 - 8000/mm^3 of blood

Thrombocytes – 1.5 lakhs - 3.5 lakhs/mm^3 of blood

190. Answer (4)

Hint: Characterised by relaxed ventricles and atria

Sol.: During joint diastole of a cardiac cycle maximum filling of blood takes place in ventricles. During atrial systole blood enters into ventricles. During ventricular systole blood is pumped into pulmonary artery and aorta.

191. Answer (3)

Hint: Ten times to the normal breathing rate

Sol.: 100 mL of blood has 12 – 16 gm of haemoglobin. Therefore, 1000 mL of blood has 120 to 160 gm of haemoglobin.

192. Answer (2)

Hint: Systemic veins carry deoxygenated blood.

Sol.: The pO_2 in systemic vein is 40 mmHg and in systemic artery, it is 95 mmHg. The pCO_2 in systemic vein is 45 mmHg and in systemic artery, it is 40 mmHg.

193. Answer (1)

Hint: Last part of colon

Sol.: A sigmoid curve is obtained when percentage saturation of haemoglobin with O_2 is plotted against the pO_2. This curve is called oxygen dissociation curve.

194. Answer (2)

Hint: Diffusion of gases through tracheoles

Sol.: Insects have tracheal tubes for the transport of gases. In sponges, coelenterates and earthworms, exchange of gases occurs by diffusion through their body surface. Earthworms respire through moist cuticle.

195. Answer (4)

Hint: High temperature favours right shift of oxygen-dissociation curve.

Sol.: Low temperature, low H^+, low pCO_2 and high pO_2, favour the formation of oxyhaemoglobin in the alveoli.

196. Answer (3)

Hint: One-fourth of a century

Sol.: Every 100 mL of oxygenated blood can deliver around 5 mL of O_2 to the tissues therefore, 500 mL will deliver $\frac{5\text{ mL}}{100\text{ mL}} \times 500\text{ mL}$

= 25 mL

197. Answer (2)

Hint: Difficulty in breathing

Sol.:

Asthma	Inflammation of bronchi and bronchiole
Emphysema	Decreased respiratory surface area
Fibrosis	Occupational Respiratory Disorders

198. Answer (3)

Hint: Auricular systole occurs during ventricular diastole.

Sol.: All the four chambers of heart remain in a relaxed state only during joint diastole. 'Lub' sound is produced during ventricular systole due to closure of AV valves and 'dub' sound is produced during ventricular diastole due to closure of semilunar valves.

199. Answer (2)

Hint: TLC-RV

Sol.: All the lung volumes/capacities can be measured by using a spirometer, except RV, FRC and TLC. It is used to measure TV, IRV, ERV, IC, EC and VC.

200. Answer (3)

Hint: It is a lymph vessel which absorbs fats

Sol.: The fluid present in lymphatic system is called lymph. Fats are absorbed through lymph in a large lymph capillary called lacteal which is present in the centre of each villus.

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