

NEET MOCK TEST 3

ANSWER KEY AND SOLUTION

ANSWER KEY

Physics

1.	(d)
2.	(a)
3.	(c)
4.	(b)
5.	(c)
6.	(b)
7.	(b)
8.	(c)
9.	(d)
10.	(b)
11.	(a)
12.	(c)
13.	(a)

14.	(b)
15.	(d)
16.	(d)
17.	(c)
18.	(d)
19.	(a)
20.	(a)
21.	(d)
22.	(c)
23.	(a)
24.	(c)
25.	(d)
26.	(b)

27.	(b)
28.	(c)
29.	(b)
30.	(c)
31.	(c)
32.	(b)
33.	(d)
34.	(a)
35.	(d)
36.	(d)
37.	(d)
38.	(b)
39.	(c)

40.	(c)
41.	(d)
42.	(b)
43.	(a)
44.	(b)
45.	(d)
46.	(a)
47.	(c)
48.	(b)
49.	(a)
50.	(b)

51.	(c)
52.	(c)
53.	(b)
54.	(a)
55.	(b)
56.	(b)
57.	(a)
58.	(b)
59.	(b)
60.	(d)
61.	(d)
62.	(c)
63.	(d)

Chemistry

64.	(c)
65.	(d)
66.	(c)
67.	(c)
68.	(c)
69.	(a)
70.	(c)
71.	(b)
72.	(d)
73.	(a)
74.	(a)
75.	(c)
76.	(d)

77.	(b)
78.	(a)
79.	(a)
80.	(c)
81.	(c)
82.	(d)
83.	(a)
84.	(a)
85.	(c)
86.	(b)
87.	(b)
88.	(d)
89.	(a)

90.	(a)
91.	(a)
92.	(d)
93.	(c)
94.	(a)
95.	(d)
96.	(c)
97.	(d)
98.	(a)
99.	(b)
100.	(c)

Botany

101. (b)	114. (d)	127. (b)	140. (d)
102. (d)	115. (a)	128. (c)	141. (c)
103. (d)	116. (c)	129. (b)	142. (b)
104. (a)	117. (c)	130. (a)	143. (d)
105. (a)	118. (d)	131. (a)	144. (a)
106. (b)	119. (b)	132. (a)	145. (d)
107. (a)	120. (c)	133. (b)	146. (a)
108. (b)	121. (d)	134. (b)	147. (b)
109. (a)	122. (a)	135. (b)	148. (c)
110. (c)	123. (c)	136. (a)	149. (d)
111. (b)	124. (d)	137. (d)	150. (b)
112. (a)	125. (d)	138. (c)	
113. (b)	126. (b)	139. (b)	

Zoology

151. (c)	164. (d)	177. (c)	190. (b)
152. (c)	165. (a)	178. (c)	191. (c)
153. (a)	166. (b)	179. (a)	192. (c)
154. (a)	167. (b)	180. (d)	193. (a)
155. (c)	168. (c)	181. (d)	194. (c)
156. (c)	169. (a)	182. (a)	195. (c)
157. (b)	170. (a)	183. (d)	196. (d)
158. (a)	171. (a)	184. (b)	197. (c)
159. (a)	172. (c)	185. (d)	198. (a)
160. (a)	173. (a)	186. (c)	199. (a)
161. (b)	174. (c)	187. (d)	200. (b)
162. (b)	175. (b)	188. (a)	
163. (d)	176. (c)	189. (d)	



ANSWERS WITH EXPLANATION

PHYSICS

Section A

1. Option (d) is correct.

As the acceleration is constant,

$$\text{Average velocity} = \frac{10 + 20}{2} = 15 \text{ m/s}$$

Displacement = average velocity × time

$$135 = 15 \times t$$

$$t = \frac{135}{15} = 9 \text{ s}$$

2. Option (a) is correct.

$$J = \frac{I}{A} = \frac{nev_d A}{A} = (ne)v_d$$

∴ Carrier charge density, i.e.

$$ne = \frac{J}{v_d} = \frac{6 \times 10^8 \times 10^4}{2} = 3 \times 10^{12} \text{ cm}^{-3}$$

3. Option (c) is correct.

Ratio of Maximum acceleration :

$$(a_{max})_1 / (a_{max})_2 = \omega_1^2 A / \omega_2^2 A = (100/1000)^2 = 1/10^2$$

4. Option (b) is correct.

The block of mass M = 10 kg is moving in the x-direction with a speed v = 10 m/s.

Its initial kinetic energy is

$$\text{K.E} = \frac{1}{2} mv^2 = \frac{1}{2} \times 10 \times (10)^2 = 500 \text{ J}$$

As subjected to a retarding force F = 0.1x J/m traveling from x = 20 m to 30 m, the work done will be :

$$W = \int_{20}^{30} F dx$$

$$= \int_{20}^{30} -(0.1x) dx$$

$$W = -0.1 \left[\frac{x^2}{2} \right]_{20}^{30}$$

$$= -0.1 \left[\frac{900}{2} - \frac{400}{2} \right] = -0.1 \times \frac{500}{2}$$

$$= -0.1 \times 250 = -25 \text{ J}$$

Hence, the final kinetic energy will be :

$$\text{KE} + W = (500 - 25) = 475 \text{ J}$$

5. Option (c) is correct.

Now,

$$\frac{V}{4l_{C.O.P.}} = \frac{3V}{2l_{op}}$$

$$l_{op} = 6l_{C.O.P} = 6 \times 20 = 120 \text{ cm}$$

6. Option (b) is correct.

From the question, deviation is zero, so

$$\delta = \delta_1 + \delta_2 = 0$$

$$(\mu_1 - 1)A + (\mu_2 - 1)A' = 0$$

$$A'(1.75 - 1) = -(1.5 - 1) 15^\circ$$

Now,

$$A' = \left(\frac{-0.5}{0.75} \right) \times 15^\circ$$

$$A' = -10^\circ$$

7. Option (b) is correct.

Let v be the final velocity of 3rd piece having mass 2m.

Initial momentum, p_i = 0 (As the body is at rest)

Final momentum,

$$\vec{p}_f = m\vec{v}_i + m\vec{v}_j + 2m\vec{v}'$$

According to law of conservation of momentum

$$\vec{p}_i = \vec{p}_f$$

$$0 = m\vec{v}_i + m\vec{v}_j + 2m\vec{v}'$$

$$\vec{v}' = -\frac{v}{2}\hat{i} - \frac{v}{2}\hat{j}$$

The magnitude of v' is

$$v' = \sqrt{\left(-\frac{v}{2}\right)^2 + \left(-\frac{v}{2}\right)^2} = \frac{v}{\sqrt{2}}$$

The total kinetic energy generated due to the explosion

$$\begin{aligned} &= \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{1}{2}(2m)\left(\frac{v}{\sqrt{2}}\right)^2 \\ &= mv^2 + \frac{mv^2}{2} = \frac{3}{2}mv^2 \end{aligned}$$

8. Option (c) is correct.

According to Coulomb's law, the force of repulsion between the two positive ions each of charge q , separated by a distance d is given by

$$\begin{aligned} F &= (1/4\pi\epsilon_0) \times (q)(q)/d^2 \\ F &= q^2/4\pi\epsilon_0 d^2 \\ q^2 &= 4\pi\epsilon_0 Fd^2 \\ q &= \sqrt{4\pi\epsilon_0 Fd^2} \end{aligned}$$

Since, $q = ne$ or $n = q/e$

$$n = \frac{\sqrt{4\pi\epsilon_0 Fd^2}}{e} = \sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$$

9. Option (d) is correct.

Saturation current \propto Intensity

It is noted that the number of photoelectrons emitted is independent of the incident frequency while it depends on the intensity of the incident light.

10. Option (b) is correct.

$$\Delta Q = \Delta U + \Delta W,$$

For the isothermal process $\Delta U = 0$

$$\Delta Q = 0 - 150 \text{ J} = -150 \text{ J}$$

So, heat has been removed from the gas.

11. Option (a) is correct.

The total energy of the solid sphere at the bottom of the inclined plane

= Kinetic energy (linear) + Kinetic energy (rolling)

$$E = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

Here, $\omega = \frac{v}{r}$

For a solid sphere, a moment of inertia,

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

On substituting values of ω and I

$$E = \frac{1}{2}mv^2 + \frac{1}{5}mv^2$$

$$E = \frac{7}{10}mv^2$$

Now, Potential energy of the solid sphere at the top of the inclined plane = Total kinetic energy at the bottom of the inclined plane

$$mgh = \frac{7}{10}mv^2$$

\therefore Velocity, $v = \sqrt{\frac{10gh}{7}}$

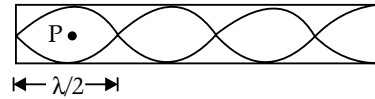
12. Option (c) is correct.

On diametrically opposite points, the velocities have the magnitude but opposite directions. Therefore, change in momentum in $MV - (-MV) = 2MV$

13. Option (a) is correct.

The figure shows variation of displacement of particles in a closed organ pipe for 3rd overtone. For third overtone ℓ

$$= \frac{7\lambda}{4} \text{ or } \lambda = \frac{4\ell}{7} \text{ or } \frac{\lambda}{4} = \frac{\ell}{7}$$



Hence the amplitude at P at a distance $\ell/7$ from closed end is 'a' because there is an antinode at that point.

14. Option (b) is correct.

Applying Bernoulli's theorem to two points just inside the house and outside the house,

$$P + \frac{1}{2}\rho v^2 = \text{constant}$$

Inside the pressure is P_{atm}

The pressure outside is P

v is zero inside.

$$\begin{aligned} \therefore P - P_{\text{atm}} &= \frac{1}{2}\rho v^2 \\ &= \frac{1}{2} \times 1.2 \times 40^2 = 960 \end{aligned}$$

$$\text{Force } F = (P - P_{\text{atm}}) \times \text{Area}$$

$$= 960 \times 500$$

$$= 4.8 \times 10^5 \text{ N, upwards.}$$

15. Option (d) is correct.

As both the points are at equal potential, work done = $W = q(V_A - V_B) = 0$

16. Option (d) is correct.

Error in measurement of radius:

$$\frac{\Delta r}{r} \times 100 = 2\%$$

Volume of sphere: $V = \frac{4}{3}\pi r^3$

Error in measurement of volume:

$$\frac{\Delta V}{V} \times 100 = 3\Delta r/r \times 100 = 6\%$$

17. Option (c) is correct.

Given vectors :

$$\vec{A} = 2\hat{i} + 3\hat{j} + 8\hat{k}$$

$$\vec{B} = 4\hat{j} - 4\hat{i} + \alpha\hat{k}$$

If we rewrite the above vectors as

$$\vec{A} = 2\hat{i} + 3\hat{j} + 8\hat{k}$$

$$\vec{B} = -4\hat{i} + 4\hat{j} + \alpha\hat{k}$$

Now dot product of vectors \vec{A} and \vec{B} will be equal to 0 as they are perpendicular, so

$$\vec{A} \cdot \vec{B} = -8 + 12 + 8\alpha = 0$$

$$8\alpha = -4$$

$$\alpha = -1/2$$

18. Option (d) is correct.

A simple harmonic progressive wave is

$$y = 0.25 \sin(10\pi x - 2\pi t)$$

which is compared with the standard wave equation

$$y = A \sin\left(\frac{2\pi x}{\lambda} - 2\pi nt\right)$$

$$\lambda = 0.2 \text{ m}$$

$$n = 1 \text{ Hz}$$

19. Option (a) is correct.

A plane of polarization is defined as the plane containing the direction of the polarized electric field vector and the direction of propagation of light. Hence the angle between the plane and the direction of propagation is zero.

20. Option (a) is correct.

The momentum of photon $p = \frac{E}{v}$

c represents the velocity of light. Then option (d) can also be correct.

\therefore velocity of photon $v = \frac{E}{p}$

21. Option (d) is correct.

At the closest distance r , its whole KE is converted into PE.

$\therefore \frac{1}{2}mv^2 = \frac{1}{4\pi\epsilon_0} \frac{Q \cdot q}{r}$

$\Rightarrow r = \frac{1}{4\pi\epsilon_0} \frac{2Q \cdot q}{mv^2}$

In the next case, $r' = \frac{1}{4\pi\epsilon_0} \frac{2Q \cdot q}{m(2v)^2}$

$\Rightarrow r' = \frac{1}{4} \left(\frac{1}{4\pi\epsilon_0} \frac{2Q \cdot q}{mv^2} \right) \Rightarrow r' = \frac{r}{4}$

22. Option (c) is correct.

The magnetic field at the center of the coil:

$B = N \times \frac{\mu_0 I}{2r}$

Further, $B \propto \frac{N}{r}$

So, $\frac{B_1}{B_2} = \frac{N_1 \times r_2}{N_2 \times r_1}$

As the radius gets halved ($2\pi r_1 = 2 \times 2\pi r_2 = L$):

$\frac{B_1}{B_2} = \frac{1}{2} \times \frac{1}{\frac{1}{2}}$

Hence, $B_2 = 4B_1$

23. Option (a) is correct.

$V + Ir = \epsilon$

Re-arranging, we get,

$V = -Ir + \epsilon$

Compare this with the equation of a straight line

$y = mx + c.$

Therefore the Slope, $m = -r$, and the intercept $c = \epsilon$

24. Option (c) is correct.

$a = 2.00$ has a lesser number of significant digits i.e., 3. Hence F should also have 3 digits.

$F = m \cdot a$
 $= 2.526 \times 2$
 $= 5.052 \approx 5.05 \text{ N.}$

25. Option (d) is correct.

From the figure shown, when the string is cut, the rod will rotate about end P and torque will be $mg/2$.

Here, the weight mg of the rod will act through center of gravity placed in the middle of the rod where the distance of action line of weight from the axis of rotation is $l/2$. As the torque is $I\alpha$, where I is the moment of inertia, and α is the angular acceleration, we have

$I\alpha = mgl/2$

Now the moment of inertia of the rod about the axis of rotation through its end is $ml^2/3$ as a result of parallel axes theorem.

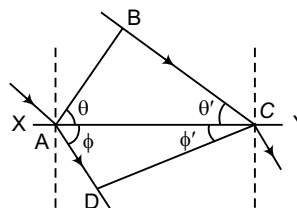
On substituting I in the first equation, we get

$(ml^2/3)\alpha = mgl/2$

Hence, $\alpha = 3g/2l$

26. Option (b) is correct.

From the figure, in refraction, when CD is refracted wavefront and v_1 and v_2 are speed of light in media, then in time t wavelet from B reaches C, wavelet from A will reach D, such that



$t = BC/v_a = AD/v_g$

$BC/AD = v_a/v_g$

In triangle ACB,

$BC = AC \times \sin \theta$

In triangle ACD,

$AD = AC \times \sin \phi'$

From above, $v_a/v_g = \sin \theta/\sin \phi'$

Further, $\mu \propto 1/v$

$v_a/v_g = \mu_g/\mu_a = \sin \theta/\sin \phi'$

Now,

$\mu_g = \sin \theta/\sin \phi'$

27. Option (b) is correct.

$C_p = \frac{5}{2}R$

$C_v = C_p - R = \frac{5}{2}R - R = \frac{3}{2}R$

$\therefore \frac{C_p}{C_v} = \frac{\frac{5}{2}R}{\frac{3}{2}R} = \frac{5}{3}$

28. Option (c) is correct.

The total mechanical energy of a closed system is always negative.

29. Option (b) is correct.

As the object moves from infinity to centre of curvature, the image formed by a concave mirror would be real and is moving from focus to centre of curvature, but as the object crosses centre of curvature and moves towards focus the image is still real but moves from centre of curvature towards infinity and when the object is at focus the real image would be formed at infinity.

So, image speed is smaller in beginning when the object is moving from infinity to centre of curvature and increases thereafter.

30. Option (c) is correct.

If a magnet retains its attracting power for a long time it is said to be permanent, otherwise temporary. Permanent magnets are made of ferromagnetic substances.

31. Option (c) is correct.

Intensity at any point on the screen in Young's double slit experiment is

$I = 4I_0 \cos^2 \phi/2$

where I_0 is the intensity of either wave and ϕ is the phase difference between two waves.

Phase difference, $\phi = (2\pi/\lambda) \times \text{Path difference}$

When path difference is λ , then

$\phi = (2\pi/\lambda) \times \lambda = 2\pi$

$\therefore I = 4I_0 \cos^2(2\pi/2)$

$= 4I_0 \cos^2(\pi)$

$= 4I_0 = K$

....(i)

When path difference is $\lambda/4$, then

$\phi = (2\pi/\lambda) \times \lambda/4 = \pi/2$

$\therefore I = 4I_0 \cos^2(\pi/2)/2 = 4I_0 \cos^2(\pi/4)$

$= 2I_0 = K/2$

32. Option (b) is correct.

If a man walking on a road carries a load on his head, then no work is done against gravity.

When a body moves with a uniform velocity, then its acceleration will be zero. Hence, no work will be done.

Both statements are correct but statement II is not correct explanation of statement I.

33. Option (d) is correct.

Now $1/f = (\mu_g - 1) \times 2/R = 1/R$, ($\mu_g = 3/2$), $R = f$

$$1/f_1 = -(\mu_w - 1) \times 2/R = -2/3R = -2/3f$$

$$1/f_{eq} = 1/f + 1/f_1 = 1/R + 1/R - 2/3R$$

$$1/f_{eq} = 1/f + 1/f - 2/3f = 2/f - 2/3f = 4/3f \text{ so } f_{eq} = 3f/4$$

34. Option (a) is correct.

$$\text{Current density } J = nqv$$

$$\Rightarrow J_e = n_e qv_e, J_h = n_h qv_h$$

$$= \frac{J_e}{J_h} = \frac{n_e}{n_h} \times \frac{v_e}{v_h}$$

$$\frac{3/4}{1/4} = \frac{n_e}{n_h} \times \frac{5}{2}$$

$$\Rightarrow \frac{n_e}{n_h} = \frac{6}{5}$$

35. Option (d) is correct.

The curvature of the trajectory depends on all the three.

Section B**36. Option (d) is correct.**

The stopping distance

$$s = \frac{u^2}{2\mu g} = \frac{m^2 u^2}{2\mu m^2 g} = \frac{p^2}{2\mu m^2 g}$$

37. Option (d) is correct.

$$\lambda = 600 \times 10^{-9} \text{ m}$$

$$D = 2 \text{ m}$$

$$d = 1 \text{ mm} = 10^{-3} \text{ m}$$

Now width of central maxima is given as:

$$W_0 = \frac{2\lambda D}{d} = 2 \times 600 \times 10^{-9} \times \frac{2}{10^{-3}}$$

$$= 2.4 \times 10^{-3} \text{ m} = 2.4 \text{ mm}$$

38. Option (b) is correct.

$$a = \frac{dv}{dt} = \frac{10-5}{2} = 2.5 \text{ m/s}^2$$

$$\alpha = \frac{a}{r} = \frac{2.5}{25 \times 10^{-2}} = 10 \text{ rad s}^{-2}$$

39. Option (c) is correct.

As per the law of periods, square of time period of revolution of a planet around the sun will be directly proportional to cube of semi-major axis of the elliptical orbit, so $T^2 \propto r^3$.

40. Option (c) is correct.

Given, Coil resistance $G = 60 \Omega$

Galvanometer Current $I_g = 1.0 \text{ A}$

Current through the circuit: $I = 5 \text{ A}$

Let S be the resistance connected in parallel with the Galvanometer.

$$I_g \times G = (I - I_g) \times S$$

$$S = \frac{I_g \times G}{(I - I_g)} = \frac{1 \times 60}{(5 - 1)} = 15 \Omega$$

For converting galvanometer into ammeter for reading currents up to 5.0 amp put resistance of 15Ω in parallel.

41. Option (d) is correct.

$$E = -\frac{dV}{dx}$$

$$E = -\frac{d}{dx} (5 + 4x^2)$$

$$E = -8x$$

$$F = qE$$

$$F = -2 \times 10^{-6} \times -8x$$

$$F = 16 \times 10^{-6} \times 0.5$$

$$F = 8 \times 10^{-6} \text{ N}$$

42. Option (b) is correct.

The magnetic moment = 4 J T^{-1}

Magnetic field at the equatorial line

$$B = \frac{\mu_0 M}{4\pi r^3}$$

$$B = \frac{4\pi \times 10^{-7} \times 4}{4\pi \times (2)^3}$$

$$B = 10^{-7} \times \frac{4}{8} = 10^{-7} \times 0.5$$

$$B = 5 \times 10^{-8} \text{ T}$$

43. Option (a) is correct.

$$\text{The momentum of photon} = \frac{h}{\lambda}$$

If recoil speed of atom is v

The momentum of atom = mv

From the conservation of momentum

The momentum of photon = Momentum of the atom

$$mv = \frac{h}{\lambda}$$

$$v = \frac{h}{m\lambda}$$

44. Option (b) is correct.

The energy of electron in n^{th} orbit

$$E_n = -\frac{13.6 \text{ eV}}{n^2}$$

$$-3.4 \text{ eV} = -\frac{13.6 \text{ eV}}{n^2}$$

$$n^2 = \frac{-13.6 \text{ eV}}{-3.4 \text{ eV}}$$

$$n^2 = 4$$

$$n = 2$$

The velocity of electron in n^{th} orbit $\propto \frac{1}{n}$

$$\frac{v_1}{v_2} = \frac{n_2}{n_1}$$

$$\frac{v}{v_2} = \frac{2}{1}$$

$$v_2 = \frac{v}{2}$$

45. Option (d) is correct.

$$\text{Energy stored } U = \frac{1}{2} CV^2$$

$$U' = \left(\frac{1}{2}\right) CV'^2$$

$$\frac{U}{U'} = \left(\frac{V}{V'}\right)^2$$

$$V' = V + 20\% \text{ of } V$$

$$V' = V + \frac{20}{100} V$$

$$V' = 1.2 V$$

$$\frac{U}{U'} = \left(\frac{V}{1.2 V} \right)^2$$

$$\frac{U}{U'} = \frac{1}{1.44}$$

$$\frac{U'}{U} = 1.44$$

$$\frac{U'}{U} - 1 = 1.44 - 1$$

$$\frac{U' - U}{U} = 0.44$$

$$\frac{U' - U}{U} \times 100 = 44\%$$

46. Option (a) is correct.

As particle moves from mean position to extreme position its velocity continuously decreases.

At mean position velocity is maximum and at extreme position velocity is zero.

So particle will take less time to cover first half of the journey and more time to cover next half of the journey.

Hence, $T_1 < T_2$.

47. Option (c) is correct.

When the body is at lowermost position

Spring force $F_s = k\Delta x$ in upward direction

$$F_s = 2 \times 10^3 \times 0.08 = 160 \text{ N}$$

Force of gravity acts in downward direction

$$F_g = mg = 10 \times 10 = 100 \text{ N}$$

$$F_{\text{net}} = F_s - F_g$$

$$F_{\text{net}} = 160 \text{ N} - 100 \text{ N}$$

$$F_{\text{net}} = 60 \text{ N upwards}$$

48. Option (b) is correct.

Velocity = frequency \times wavelength

$$v = f\lambda$$

$$\lambda = \frac{v}{f} = \frac{1.6 \times 10^3 \text{ m/s}}{3.2 \times 10^6 / \text{s}}$$

$$\Rightarrow \frac{1}{2} \times 10^{-3} \text{ m}$$

$$\Rightarrow 0.5 \times 10^{-3} \text{ m}$$

$$\Rightarrow 0.5 \text{ mm}$$

49. Option (a) is correct.

$$\cos \theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}| |\vec{B}|}$$

$$|\vec{A}| = \sqrt{3^2 + 4^2 + 5^2} = \sqrt{50}$$

$$|\vec{B}| = \sqrt{6^2 + 8^2 + 10^2} = \sqrt{200}$$

$$\vec{A} \cdot \vec{B} = 3 \times 6 + 4 \times 8 + 5 \times 10$$

$$\vec{A} \cdot \vec{B} = 100$$

$$\cos \theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}| |\vec{B}|} = \frac{100}{\sqrt{50} \sqrt{200}}$$

$$\cos \theta = \frac{100}{\sqrt{10000}} = \frac{100}{100} = 1$$

$$\cos \theta = 1$$

$$\theta = 0^\circ$$

50. Option (b) is correct.

$$\text{The velocity of sound} = \sqrt{\frac{\gamma RT}{M}}$$

$$v_1 = \sqrt{\frac{\gamma RT}{M_1}} \quad \text{and} \quad v_2 = \sqrt{\frac{\gamma RT}{M_2}}$$

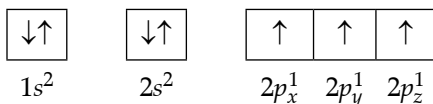
$$\frac{v_1}{v_2} = \frac{\sqrt{\frac{\gamma RT}{M_1}}}{\sqrt{\frac{\gamma RT}{M_2}}}$$

As both gases are monoatomic, so γ is the same and temperature is also the same

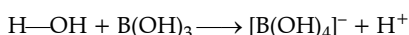
$$\frac{v_1}{v_2} = \sqrt{\frac{M_2}{M_1}}$$

CHEMISTRY**Section A****51. Option (c) is correct.**

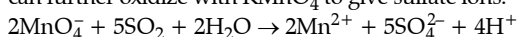
The correct configuration of the N atom is :

**52. Option (c) is correct.**

Boric acid behaves as a Lewis acid, by accepting a pair of electrons from OH^- ion of water thereby releasing a proton.

**53. Option (b) is correct.**

Acidified KMnO_4 is a strong oxidizing agent thus, among the given options, the one which readily undergoes oxidation with KMnO_4 will decolorize the solution. CO_2 , NO_2 , and P_2O_5 are already in their highest oxidation state while SO_2 can further oxidize with KMnO_4 to give sulfate ions.

**54. Option (a) is correct.**

(a) 18 mL water :

Since, density of $\text{H}_2\text{O} = 1 \text{ g/mL}$

The molar mass of $\text{H}_2\text{O} = 18 \text{ g}$

No. of moles = Given mass/Molar mass

No. of molecules = No. of moles

\times Avogadro's Number (N_A)

$$\text{No. of molecules of } \text{H}_2\text{O} = \frac{18}{18} \times N_A = 1 \times N_A$$

(b) 0.18 g of water :

$$\text{No. of molecules of } \text{H}_2\text{O} = \frac{0.18}{18} \times N_A = 0.01 \times N_A$$

(c) Volume of H_2O (g) STP = 0.00224 L

No. of molecules of H_2O

$$= \frac{V}{22.4} \times N_A = \frac{0.00224}{22.4} \times N_A = 0.0001 \times N_A$$

(d) $n\text{H}_2\text{O} = 10^{-3}$ moles

$$\text{No. of molecules of } \text{H}_2\text{O} = 10^{-3} \times N_A$$

55. Option (b) is correct.

$$\Lambda_m = \frac{\kappa \times 1000}{\text{Molarity}}$$

$$= \frac{5.76 \times 10^{-3} \times 1000}{0.5}$$

$$= 11.52 \text{ S cm}^2 \text{ mol}^{-1}$$

56. Option (c) is correct.

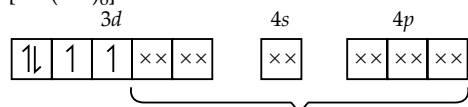
In $[\text{Mn}(\text{CN})_6]^{3-}$, Mn exists as Mn^{3+}

Electronic configuration of Mn^{3+} is $3d^4 4s^0$



CN^- being strong ligand causes pairing of electrons

$[\text{Mn}(\text{CN})_6]^{3-}$



d^2sp^3 hybridisation

The geometry of a complex with six bond pairs of electrons is octahedral.

57. Option (b) is correct.

Closed shell (Ne), half filled (P) and completely filled configuration (Mg) are the cause of higher value of I.E.

58. Option (b) is correct.

F Fluorine cannot be detected by Lassaigne's test because it does not form precipitate like other halogens (chlorine, Bromine, Iodine). Indeed it forms a precipitate of silver fluoride but the precipitate is soluble in water so it not possible to detect fluorine by Lassaigne's test.

59. Option (b) is correct.

Electronic configuration of CO , CN^- and NO^+ (14 electrons) is as follows:

$$\sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2$$

$$< \pi 2p_y^2 < \sigma 2p_z^2$$

As there are no unpaired electrons, thus, they are diamagnetic.

Electronic configuration of O_2^- (17 electrons) is as follows:

$$\sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_z^2 < \pi 2p_x^2$$

$$= \pi 2p_y^2 < \pi^* 2p_x^1 = \pi^* 2p_y^1$$

It contains 1 unpaired electron thus, it is paramagnetic in nature.

60. Option (d) is correct.

$$i = 1 + 3\alpha$$

$$\Rightarrow 1 \times 3 \times 0.3 = 3.7$$

$$\text{By } 1 + 3 \times 0.3 = 3.7$$

$$\Delta T_b = iK_b m$$

$$\Rightarrow 0.52 \times 0.1 \times 3.7 = 0.19$$

$$\therefore T_b = T_b^0 + 0.19$$

$$373 + 0.19 = 373.19$$

61. Option (d) is correct.

Max Number of Orbitals = $(n)^2 = 36$; Put $n = 6$

62. Option (c) is correct.

KOH is the base thus, it gives OH^- ions. So, it cannot remove OH^- ions from the reaction mixture but it adds on the concentration of OH^- ions. So, an acid must be added but if a strong acid is added to the reaction mixture then in acidic condition the MnO_4^- formed reduces to give Mn^{2+} . Thus, HCl (a strong acid) and SO_2 (on treating with water, forms strong H_2SO_4) cannot be used for this purpose because they are reducing agents. But, CO_2 is neither reducing nor oxidizing agent, so it forms H_2CO_3 (a weak acid) on reacting with OH^- but not that much acidic that MnO_4^- undergo reduction. Thus, CO_2 is used for the reaction completion.

63. Option (d) is correct.

$$\Delta E = q + w$$

$$\Delta E = -8.4 + 10$$

$$\Delta E = 1.6 \text{ kJ}$$

$$= 1600 \text{ J}$$

$$w = +10 \text{ kJ}$$

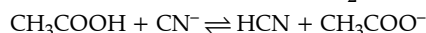
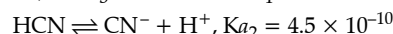
$$q = 2 \text{ kcal}$$

$$= -2 \times 4.2 \text{ kJ}$$

$$= -8.4 \text{ kJ}$$

64. Option (c) is correct.

Law of multiple proportion is applicable for the molecules made by two same types of atoms only.

65. Option (d) is correct.

$$K = \frac{K_{a1}}{K_{a2}} = \frac{1.5 \times 10^{-5}}{4.5 \times 10^{-10}}$$

$$= 3.33 \times 10^4$$

$$\approx 3.0 \times 10^4$$

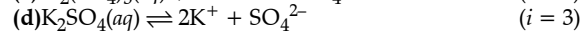
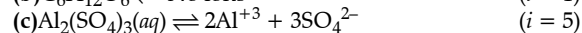
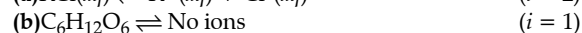
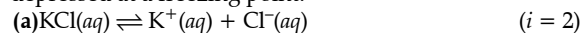
66. Option (c) is correct.

Depression in freezing point (ΔT_f) is given as

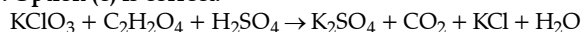
$$\Delta T_f = iK_f m$$

So, $\Delta T_f \propto i$

Thus, more value of i (van't Hoff factor), more will be depressed at a freezing point.

**67. Option (c) is correct.**

The central dogma of molecular genetics is:

**68. Option (c) is correct.**

The maximum change in oxidation number of chlorine, i.e., from +5 to -1.

69. Option (a) is correct.

Acidic strength \propto electronegativity

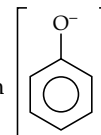
70. Option (c) is correct.

The order of reaction can be zero, the whole number or a fractional number.

71. Option (b) is correct.

Phenol is most acidic among the given options. In phenol, the electron withdrawing phenyl ring polarises the O—H bond thereby facilitating the release of H^+ .

In option (a), the -I effect of phenyl ring is diminished by $-\text{CH}_2$ group.



Moreover, the phenolate ion is stabilised by resonance.

72. Option (d) is correct.

According to Le-Chatelier's principle, the equilibrium shifts in that direction to oppose the applied change.

If the concentration of NH_3 increases then equilibrium shifts in a backward direction to oppose the increased concentration of NH_3 .

If pressure is decreased then equilibrium shifts to the direction in which there are more the number of gaseous moles present. Thus, it also shifts in backward direction as there are 4 moles in reactant side and 2 moles in product side. If concentration of $\text{N}_2(g)$ and $\text{H}_2(g)$ decreases then equilibrium shifts to backward direction to increase the concentration of reactants.

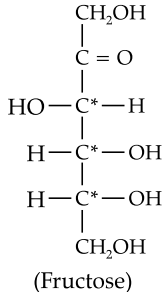
If pressure is increased, equilibrium shifts to the side where lower number of gaseous moles are present

i.e., forward direction. Also, when the temperature is decreased *i.e.*, the heat evolved in the reaction is consumed then reaction proceeds toward forwarding direction.

73. Option (a) is correct.

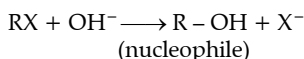
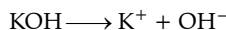
Number of chiral carbon = 3

Number of optical isomers = $2^3 = 8$



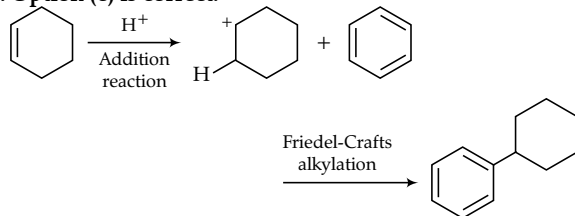
74. Option (a) is correct.

For nucleophilic reaction, it involves:



OH^- is a stronger nucleophile than halogen so, it replaces the weaker nucleophile easily. Thus, it is an example of nucleophilic substitution reaction.

75. Option (c) is correct.



76. Option (d) is correct.

In *ortho*-nitrophenol, there is intramolecular hydrogen bonding while in *para*-nitrophenol, there is intermolecular hydrogen bonding due to which *para*-isomers have a stronger attraction between molecules which results in it being less volatile. But *ortho*-isomer lack this interaction among their molecules which results in it to be more volatile. Thus, due to these properties these two isomers can be separated by steam distillation. Being volatile, *ortho*-nitrophenol vapourise with steam leaving behind non-volatile component that is *para*-nitrophenol. Being immiscible with water *ortho*-nitrophenol then separates with water (steam) at later stage.

77. Option (b) is correct.

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{For pH} = 3, 3 = -\log [\text{H}^+] \Rightarrow [\text{H}^+] = 10^{-3} \text{ M}$$

$$\text{For pH} = 4, 4 = -\log [\text{H}^+] \Rightarrow [\text{H}^+] = 10^{-4} \text{ M}$$

$$\text{For pH} = 5, 5 = -\log [\text{H}^+] \Rightarrow [\text{H}^+] = 10^{-5} \text{ M}$$

When all the given three solutions are mixed in equal volumes then total concentration of H^+ in the mixture is given as follows:

$$M(V_1 + V_2 + V_3) = M_1V_1 + M_2V_2 + M_3V_3$$

As $V_1 = V_2 = V_3 = V$

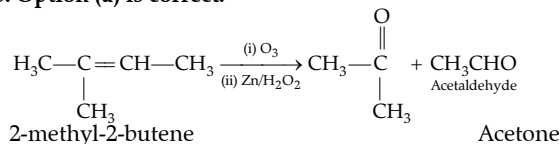
$$M(3V) = (M_1 + M_2 + M_3)V$$

$$3M = (10^{-3} + 10^{-4} + 10^{-5})$$

$$M = \frac{10^{-3}(1+0.1+0.01)}{3}$$

$$= \frac{1.11 \times 10^{-3}}{3} = 3.7 \times 10^{-4} \text{ M}$$

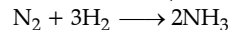
78. Option (a) is correct.



So, 2-methyl-2-butene yields acetone on ozonolysis.

79. Option (a) is correct.

For the reaction,



$$\text{Rate} = -\frac{d[\text{N}_2]}{dt} = -\frac{1}{3} \frac{d[\text{H}_2]}{dt} = +\frac{1}{2} \frac{d[\text{NH}_3]}{dt}$$

$$\begin{aligned}
 \therefore &= -\frac{d[\text{H}_2]}{dt} = \frac{3}{2} \times 2 \times 10^{-4} \\
 &= 3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}
 \end{aligned}$$

80. Option (c) is correct.

In arylamines, lone pair of electrons on nitrogen atom is delocalized over the benzene ring, thus not available for donation so arylamines are less basic than alkylamines ($\text{R}-\text{NH}_2$).

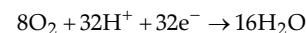
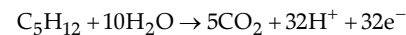
81. Option (c) is correct.

$$\Delta G_f^\circ(\text{H}_2\text{O}) = -237.2 \text{ kJ mol}^{-1}$$

$$\Delta G_f^\circ(\text{CO}_2) = -394.4 \text{ kJ mol}^{-1}$$

$$\Delta G_f^\circ(\text{pentane}) = -8.2 \text{ kJ mol}^{-1}$$

In pentane oxygen fuel cell, following reaction takes place,



$$\Delta G_{\text{reaction}}^\circ = \sum \Delta G_{\text{products}}^\circ - \sum \Delta G_{\text{reactants}}^\circ$$

$$\Delta G_{\text{reaction}}^\circ = (5 \times \Delta G_f^\circ(\text{CO}_2) + 6 \times \Delta G_f^\circ(\text{H}_2\text{O}))$$

$$- (\Delta G_f^\circ(\text{Pentane}) + 8 \times \Delta G_f^\circ(\text{O}_2))$$

$$= 5 \times (-394.4) + 6 \times (-237.2) - (-8.2 + 8 \times 0)$$

$$= -3387 \text{ kJ mol}^{-1}$$

$$= -3387 \times 10^3 \text{ J mol}^{-1}$$

$$\Delta G_{\text{reaction}}^\circ = -nFE_{\text{cell}}^\circ$$

$$-3387 \times 10^3 = -32 \times 96500 \times E_{\text{cell}}^\circ$$

$$E_{\text{cell}}^\circ = \frac{-3387 \times 10^3}{-32 \times 96500} = 1.0968 \text{ V}$$

82. Option (d) is correct.

$$\text{Mole fraction of P} = \frac{3}{3+2} = \frac{3}{5}$$

$$\text{Mole fraction of Q} = \frac{2}{3+2} = \frac{2}{5}$$

Hence, total vapor pressure

$$= [(\text{Mole fraction of P}) \times (\text{Vapour pressure of P})]$$

$$+ [(\text{Mole fraction of Q}) \times (\text{Vapour pressure of Q})]$$

$$= \left(\frac{3}{5} \times 80 + \frac{2}{5} \times 60 \right) = 48 + 24 = 72 \text{ torr}$$

83. Option (a) is correct.

ΔS° positive means the entropy of products is more than that of reactants. Among the given reactions only in option (a), the ΔS° is positive because the product has 1 mole of gaseous products CO while the reaction has half

a mole of gaseous O_2 and Carbon (C) in solid-state. Thus, reactions have less randomness than products. Also, the reaction is a combustion reaction which has a negative value of ΔH . According to Gibbs energy change (ΔG°):

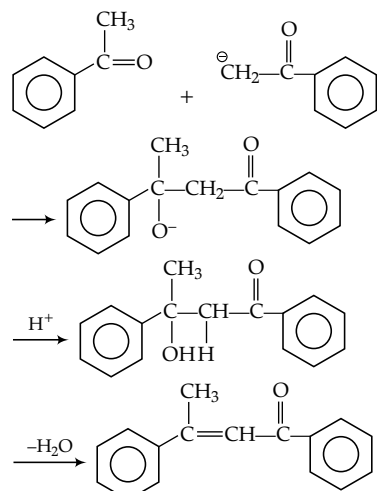
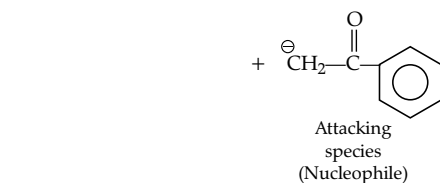
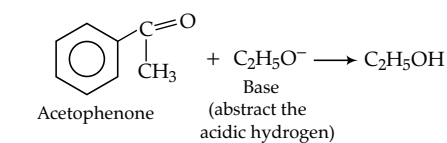
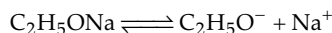
$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

$$\Delta G^\circ = -ve - T(+ve)$$

Hence, $\Delta G^\circ < 0$.

84. Option (a) is correct.

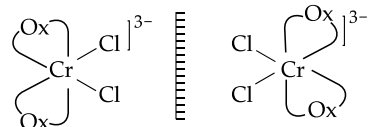
This reaction is known as aldol condensation,



85. Option (c) is correct.

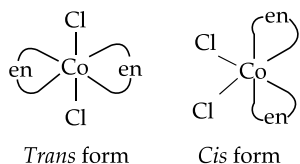
(a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

$Cis[CrCl_2(ox)_2]^{3-}$ shows optical isomerism.



$[Co(NH_3)_5SO_4]Br$ and $[Co(NH_3)Br]SO_4$ are ionization isomers.

$[Co(en)_2Cl_2]$ exhibits *cis* and *trans* forms *i.e.*, geometrical isomerism.



$[Co(NH_3)_5(NO_2)]^{2+}$ shows linkage isomers due to the presence of ambidentate ligand, NO_2 .

Section B

86. Option (b) is correct.

Electronegativity is ability of an atom to attract electrons towards itself.

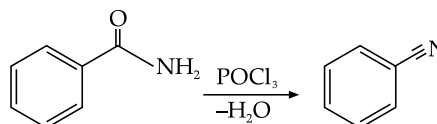
As atomic size increases electronegativity decreases.

So correct order is $C > B > Si > P$

87. Option (b) is correct.

Benzamide on treatment with phosphorous oxy chloride $POCl_3$ gives benzonitrile.

$POCl_3$ acts as a dehydrating agent.



88. Option (d) is correct.



89. Option (a) is correct.

Heat of atomisation = Bond dissociation energy
= 228 kcal/mol

$$P-H \text{ bond energy} = \frac{228}{3} = 76 \text{ kcal/mol}$$

For P_2H_4 ,

Bond energy of

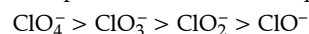
$$4(P-H) + 1(P-P) = 355$$

$$4 \times 76 + P-P = 355$$

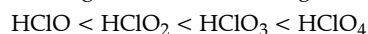
$$\therefore P-P \text{ bond energy} = 355 - 304 = 51 \text{ kcal/mol}$$

90. Option (a) is correct.

More lives the strength of the conjugate floor, more powerful stands the acid. The resilience of the conjugate underside of the provided acids stand as pursues:



\therefore The increasing order of acidic strength will be



91. Option (a) is correct.

The nitration of benzoic acid gives *m*-nitro benzoic acid. This is because $COOH$ is a deactivating group that deactivates the *o*- and *p*-positions more than the *m*-positions.

92. Option (d) is correct.

(a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

Work done during free expansion of ideal gas is zero.

Work done during isothermal reversible expansion = -

$$nRT \ln \frac{V_2}{V_1}$$

The entropy of all perfectly crystalline substances is zero when $T \rightarrow 0$

Criteria of spontaneity are changed in Gibb's free energy is negative, *i.e.*, $\Delta G < 0$.

93. Option (c) is correct.

Compounds that have chiral centers *i.e.*, all the groups attached to a carbon atom are different, will be optically active. Among the given molecules isobutyl alcohol has a chiral molecule and thus will have optically active isomers.

94. Option (a) is correct.

$[Co(NH_3)_6]Cl_3$ will give a white precipitate of $AgCl$ on treatment with $AgNO_3$. This is because only this coordination complex has free ions present in the

ionization sphere whereas in all the other complexes chloride ions are not free as they are present in coordination spheres.

95. Option (d) is correct.

The specific heat capacity of a substance is greater in solid state than in the liquid state.

96. Option (c) is correct.

Epimer are those compound which differs in configuration at any carbon atom.

97. Option (d) is correct.

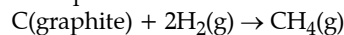
The ionization energy of Cu is more than that of K though both have a 4s configuration. This is because Cu has filled the 3d orbital which increases the attraction between the nucleus and electrons.

98. Option (a) is correct.

The IUPAC name nomenclature of the complex, $[\text{Pt}(\text{py})_4][\text{PtCl}_4]$ is tetrakispyridine platinum (II) tetrachloroplatinate (II).

99. Option (b) is correct.

The equation involved in the formation of methane is:



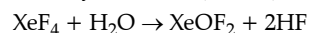
The above equation can be obtained by,

$$2 \times \text{eq (ii)} + \text{eq (iii)} - \text{eq (i)}$$

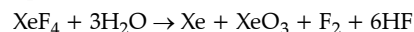
$$\begin{aligned} \therefore \Delta H_f(\text{CH}_4) &= 2 \times -258.84 + (-393.51) \\ &\quad - (-890.65) \\ &= -74.84 \text{ kJ mol}^{-1} \end{aligned}$$

100. Option (c) is correct.

The partial hydrolysis of XeF_4 at a low temperature produces xenon oxydifluoride (XeOF_2).



On complete hydrolysis:



BOTANY

Section A

101. Option (b) is correct.

The bacteria belonging to Archaeobacteria such as halophiles, thermoacidophiles and methanogens are the ones living in the most harsh habitats.

102. Option (d) is correct.

Anabaena – Biofertilizer

103. Option (d) is correct.

It is clear from the question that AA Bb CC contains only one heterozygous allelic pair 'Bb'. Hence the cross behave as a monohybrid cross leading to phenotypic ratio 3 : 1.

104. Option (a) is correct.

Fact.

105. Option (a) is correct.

Synapsis is the process that takes place during the zygotene stage of meiosis.

106. Option (b) is correct.

Lac operon of *E. coli* which involves the Lac gene product is negative and inducible, as the gene is turned on when repressor molecule is released which is released in the presence of inducible molecule.

107. Option (a) is correct.

The middle lamella is a layer mainly of calcium pectate which holds or glues the different neighbouring cells together.

108. Option (b) is correct.

Gibberellin or Gibberellic Acid (GA) is produced in embryos, roots, and young leaves and it enhances growth. Abscisic acid is a naturally occurring growth inhibitor found in wide variety of plants, synthesised in leaves. Gibberellin delays senescence in plants. Abscisic acid promotes the senescence of leaf, *i.e.*, fall of leaves happens due to abscisic acid. Gibberellin breaks dormancy of seeds and as opposed to Abscisic acid, which induces dormancy of buds and seeds.

Hence, due to their opposite effect on plant growth,

Gibberellins, and Abscisic acid can be said to be an antagonist to each other.

109. Option (a) is correct.

In a growing population the pre-reproductive individual or the younger population size is larger than the reproductive group.

110. Option (c) is correct.

Generation time = 1 minute

$t_{1/4}$ (time taken to reach one-fourth of cup) = 36 minutes

Since, Generation time (Tg) = 1 minutes

$$\therefore t_{1/2} = 36 + 1 = 37 \text{ minute}$$

$$\text{And, } t_{(\text{full cup})} = 37 + 1 = 38 \text{ minutes}$$

111. Option (b) is correct.

Red algae reproduce asexually by non-motile spore. *e.g.*, *-Polysiphonia, Porphyra.*

112. Option (a) is correct.

Mycoplasma is the smallest living cell which lacks cell wall and can survive without oxygen. They are facultative the anaerobic. So they can switch to anaerobic mode in the absence of oxygen.

113. Option (b) is correct.

R.Q. of oxalic acid = 4.0

114. Option (d) is correct.

In arid habitats, plants shed their leaves to conserve water loss through transpiration. In such plants, the stems become flattened, fleshy and photosynthetic and are called phylloclades.

115. Option (a) is correct.

RuBisCO binds with O_2 in the chloroplast and oxidizes RUBP to PGA and phosphoglycolate to form glycolate which is oxidized to glyoxalate in the peroxisome. This is converted to glycine. The glycine is then transported to the mitochondrion.

116. Option (c) is correct.

Cry II Ab controls cotton bollworm & *Cry I Ab* controls corn borer.

117. Option (c) is correct.

Fact.

118. Option (d) is correct.

Ampicillin resistant gene remains intact in pUC8 on insertional inactivation of lacZ gene.

119. Option (b) is correct.

Parthenocarpy is the natural or artificially induced production of fruit without fertilisation of ovules, which makes the fruit seedless.

120. Option (c) is correct.

Fact.

121. Option (d) is correct.

The Golgi apparatus has many functions. It produces materials for secretion, takes part in transformation of membranes, formation of a number of products from glycoproteins (For example, mucin from goblet cells), glycolipids, complex heteropolysaccharides (For example, mucilage from root cap cells), hormones, melanin, matrix of connective tissue, middle lamella of the plant cell wall, acrosome of human sperm and lysosomes.

122. Option (a) is correct.

Fatty acids would be broken down to acetyl CoA before entering the respiratory pathway when it is used as a substrate. But when the organism needs to synthesise fatty acids, acetyl CoA would be withdrawn from the respiratory pathway for it. Hence, the respiratory pathway comes into the picture both during breakdown and synthesis of fatty acids. Similarly, during breakdown and synthesis of protein too, respiratory intermediates form the link.

123. Option (c) is correct.

Organisms with K-selected traits include large organism and the small number of progeny.

124. Option (d) is correct.

Coenzyme is an organic substance essential for the activity of an enzyme.

125. Option (d) is correct.

Isolation, purification, formulation, packaging, storage and marketing of product are parts of downstream processing.

126. Option (b) is correct.

Androecium is diadelphous in the family Fabaceae. The plants belonging to this family are *Indigofera*, *Sesbania*, groundnut and gram.

127. Option (b) is correct.

The smooth endoplasmic reticulum is the major site for synthesis of lipid. In animal cells lipid-like steroidal hormones are synthesized in SER.

128. Option (c) is correct.

Ecotone is transition zone between two communities.

129. Option (b) is correct.

The primary structure is a linear chain of amino acids linked together by peptide/amide bonds.

130. Option (a) is correct.

Anthocyanins are water soluble vacuolar pigments

that may appear red, purple or blue depending upon the pH. The remaining are present in the chloroplasts. Carotenoids are also present in chromoplasts.

131. Option (a) is correct.

Endosperm may be completely consumed by the developing embryo as seen in pea, groundnut, beans etc., before seed maturation.

132. Option (a) is correct.

During anaphase I homologous chromosomes of a pair separate.

133. Option (b) is correct.

In RNA transcript base sequences are similar to coding strand except uracil at the place of thymine.

134. Option (b) is correct.

Carotene is a photosynthetic pigment important for photosynthesis.

135. Option (b) is correct.

The vascular bundles in rachis are arranged in an inverted omega shaped manner and vary in their structure at the base (endarch) centre (pseudomesarch) and apex of rachis (exarch).

Section B

136. Option (a) is correct.

The intercalary meristem is responsible for the increase in the length of the plant.

137. Option (d) is correct.

The endomembrane system in eukaryotic cells includes organelles like the endoplasmic reticulum and Golgi apparatus, involved in processes such as protein synthesis and sorting. Mitochondria, responsible for ATP synthesis, are not part of the endomembrane system, as they have a distinct origin and function.

138. Option (c) is correct.

The annual net primary productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter. Of this, despite occupying about 70 per cent of the surface, the productivity of the oceans are only 55 billion tons while terrestrial ecosystem contributes 115 billion tons.

139. Option (b) is correct.

Peroxisomes are membrane-bound organelles found in eukaryotic cells, and they play a crucial role in the detoxification of drugs and poisons. They contain enzymes, such as catalase, that break down harmful substances, particularly hydrogen peroxide, into water and oxygen. This process helps protect the cell from the damaging effects of reactive oxygen species and contributes to the overall cellular homeostasis.

140. Option (d) is correct.

Unlike domestic sewage, waste water from industries like petroleum, paper manufacturing, metal extraction and processing, chemical manufacturing, etc., often contain toxic substances, notably, heavy metals etc., BOD will be high which is not good for water bodies.

141. Option (c) is correct.

The intercalary meristem is primary. It helps in increasing length of the plants.

142. Option (b) is correct.

Bakane disease in rice is associated with the discovery of Gibberellins. They were first isolated from the fungus *Gibberella fujikuroi* by a Japanese scientist Kurosawa (1926). He observed that when rice plant was infected by fungus *Gibberella fujikuroi*, it shows extensive stem elongation called 'bakane disease'.

143. Option (d) is correct.

Flowers in china rose are bisexual. In many lower plants, the monoecious condition is present.

Pollen tube carries only male gametes.

144. Option (a) is correct.

Thus, PAR cannot be 100% of incident solar radiation. It is < 50% of incident solar radiation.

145. Option (d) is correct.

Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called plasticity, e.g., heterophyly in cotton, coriander and larkspur.

During differentiation, cells lose their ability to divide and form permanent cell.

Redifferentiation is a process by which a dedifferentiated cell attains a particular function and loses its ability to divide again.

Development includes all changes that an organism goes through during its life cycle from germination of the seed to senescence.

149. Option (d) is correct.

The division of algae and their characteristics are given below:

Classes of Algae	Common Name	Major pigments	Stored food	Examples
Chlorophyceae	Green algae	Chlorophyll-a, b, carotenes	Starch	<i>Spirogyra</i>
Phaeophyceae	Brown algae	Chlorophyll-a, c, fucoxanthin	Mannitol, laminarin	<i>Fucus</i>
Rhodophyceae	Red algae	Chlorophyll- a, d, phycoerythrins	Floridean Starch	<i>Polysiphonia</i>

150. Option (b) is correct.

Out of the given books, Carl Linnaeus wrote two books, namely, '*Systema Naturae* in 1735 and '*Species Plantarum*'

146. Option (a) is correct.

Homologous organs are those which shows similarity in the basic structure and embryonic development but have different functions. Examples are Thorns of *Bougainvillea* and tendrils of *Cucurbita*, Tendrils of pea, and spines of barberry. On the other hand, analogous organs are those which differ in their origin and structure but perform similar functions. Examples are sweet potato and potato, leaves of *Opuntia* and peepal, thorns of *pyracantha* and barberry.

147. Option (b) is correct.

Contrasting traits studied by Mendel in Pea plant are given below:

	Character	Contrasting Trait	
		Dominant	Recessive
1.	Stem height	Tall	Dwarf
2.	Flower color	Violet	White
3.	Flower position	Axial	Terminal
4.	Pod shape	Inflated	Constricted
5.	Pod color	Green	Yellow
6.	Seed shape	Round	Wrinkled
7.	Seed color	Yellow	Green

148. Option (c) is correct.

The nitrogenous bases in two strands of DNA are paired through hydrogen bonds to form base pairs Adenine is bonded with thymine of the opposite strand with the help of two hydrogen bonds, i.e., A = T and Guanine is bonded with cytosine of the opposite strand with the help of three hydrogen bonds, i.e., G ≡ C. Thus, it can be said that purine bonds with a pyrimidine always.

ZOOLOGY

Section A

151. Option (c) is correct.

Cnidarians exist in both form polyp and medusa and exhibit alternation of generation i.e., metagenesis – polyps produce medusae asexually and medusa form the polyps sexually.

152. Option (c) is correct.

Age-related disorder characterised by decreased bone mass and increased chances of fractures.

The decrease in the levels of estrogen is a common cause.

153. Option (a) is correct.

Fact.

154. Option (a) is correct.

Aschelminthes are triploblastic animals having bilateral symmetry whereas the rest are diploblastic animals.

155. Option (c) is correct.

H-zone skeletal muscle is the central gap between the actin filament extending through myosin filaments in the A-band.

156. Option (c) is correct.

$$FRC = ERV + RV$$

157. Option (b) is correct.

Pteropus is flying fox.

158. Option (a) is correct.

Fibrous joints do not allow any movement. This type of joint is shown by the flat skull bones which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures, to form the cranium.

159. Option (a) is correct.

Leydig cells or interstitial cells which are present in interstitial spaces produce a group of hormones called androgens, mainly testosterone.

160. Option (a) is correct.

The photosensitive compounds (photopigments) in the human eyes is composed of opsin (a protein) and retinal (an aldehyde of vitamin A).

161. Option (b) is correct.

Both physical and physiological barriers together form the first line of defense whereas cellular and cytokine barriers form the second line of defense.

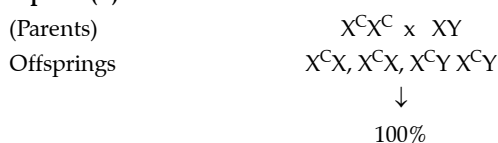
162. Option (b) is correct.

Ammonia is the most toxic, highly soluble nitrogenous waste which requires more water for its elimination than urea.

163. Option (d) is correct.

Syphilis is a sexually transmitted disease caused by bacterium *Treponema pallidum*. Genital herpes is an incurable STI that is caused by the Herpes simplex virus type 2 (HSV-2). Genital warts are usually caused by HPV (Human papillomavirus) and Chancroid is caused by *Haemophilus ducreyi*.

164. Option (d) is correct.



Sons are color blind

165. Option (a) is correct.

The minimum amount of urea is carried by renal vein.

166. Option (b) is correct.

Ichthyophis, Hyla and Salamander are Amphibians.

167. Option (b) is correct.

Emphysema is generally caused by long term irritation; cigarette smoking, air pollution and occupational exposure to industrial dust.

168. Option (c) is correct.

Only birds and mammals possess double circulation. The whale is a mammal.

169. Option (a) is correct.

Adrenaline is secreted by the adrenal medulla whereas the other three hormones are secreted by adrenal cortex.

170. Option (a) is correct.

The well-known plants with hallucinogenic properties are *Atropa*, *Belladonna* and *Datura*.

171. Option (a) is correct.

During the breeding season, when the female frog approaches the male frog, the male frog rides on the

back of the female. The copulatory pads are present in the forelimbs of the male frog that help them to hold the female firmly. The female releases the eggs in water and the male releases the sperms on top leading to fertilisation of the eggs.

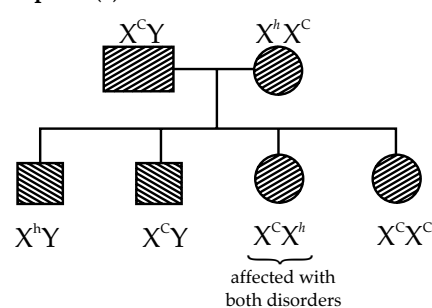
172. Option (c) is correct.

Annelids have a closed circulatory system except leeches; Angina pectoris/strangled heart is pain in the chest due to inadequate the flow of blood to the heart wall; anti-A and anti-B of blood group in the ABO system belongs to IgM the type which is the largest-sized antibody that is unable to cross the placenta.

173. Option (a) is correct.

Fact.

174. Option (c) is correct.



% of offspring to get affected by both disorders

$$\frac{1}{4} = 25\%$$

175. Option (b) is correct.

Bacterial artificial chromosomes (BAC) vectors are vectors which are based on fertility plasmid of bacteria. They are used for mapping of large eukaryotic genome. Yeast Artificial chromosomes (YAC) are used for the cloning of DNA fragments.

176. Option (c) is correct.

Human eggs are alecithal *i.e.*, devoid of yolk. In humans, these eggs get nourishment from mothers body.

177. Option (c) is correct.

Fact.

178. Option (c) is correct.

Once HIV is in your body the virus attaches to and gets into the CD₄ T cells. The virus then uses the DNA (the genetic code inside the cell) to replicate (make copies of itself). As new virus particles break out of a CD₄ T cell, the cell dies. The new virus particles then attach and enter new CD₄ T cells and so the process continues. Millions of new virus particles are made in CD₄ T cells each day and millions of CD₄ T cells die each day. To counter the virus destruction, the body continues to make new CD₄ T cells each day. However, over time, the virus usually wins and the number of CD₄ T cells gradually falls (usually over several years). Once the level of CD₄ T cells goes below a certain level, your immune system is weakened. If your immune system is severely weakened by HIV infection

then you are likely to develop various opportunistic infections. So, HIV that causes AIDS first starts destroying helper T lymphocytes and not B lymphocytes, leukocytes, and thrombocytes.

179. Option (a) is correct.

Heart failure is a state of the heart when it is not pumping blood effectively. Cardiac arrest is when the heart stops beating.

180. Option (d) is correct.

Chemoreceptors are primarily affected by CO₂ levels in blood and pons control the rate of breathing.

181. Option (d) is correct.

Cardiac muscles are involuntary striped muscles in the wall of the heart.

182. Option (a) is correct.

The otolith organ consists of two structures: saccule and the utricle. The vestibular apparatus is composed of three semi-circular canals and the otolith organ. The middle ear contains three delicate bones, called the ear ossicles. The three ear ossicles are the malleus, incus, and stapes.

183. Option (d) is correct.

Angiotensin-II increases glomerular blood pressure by causing arterioles to constrict. It also increases blood volume in two ways : Firstly, by signaling the PCT to reabsorb more NaCl and water and secondly by stimulating the adrenal gland to release aldosterone a hormone that induces the distal parts of tubule to reabsorb more Na⁺ and water. This leads to an increase in blood volume and pressure.

184. Option (b) is correct.

Pyrimidines are of three types, Cytosine, Uracil and Thymine. Out of the pyrimidines, cytosine is common for both DNA and RNA, while thymine is present in DNA and uracil is present in RNA.

185. Option (d) is correct.

The correct order of the phyla is :

Porifera → Coelenterata → Ctenophora → Platyhelminthes → Aschelminthes → Annelida → Arthropoda → Mollusca → Echinodermata → Hemichordata → Chordata.

Section B

186. Option (c) is correct.

Leydig cells or the interstitial cells are the primary source of testosterone or androgens in males. The androgens play a crucial role in many vital physiological processes in males, including sperm production or spermatogenesis, controlling sexual development, and maintaining secondary sexual characteristics and behaviors.

187. Option (d) is correct.

Wuchereria bancrofti, the filarial worms cause a slowly developing chronic inflammation of the organs in which they live for many years, usually the lymphatic vessels of the lower limbs and the disease is called elephantiasis

or filariasis. The genital organs are also often affected, resulting in gross deformities.

188. Option (a) is correct.

X chromosome has large amount of euchromatin (extended region) and small amount of heterochromatin (highly condensed region). Euchromatin has DNA in the extended state, hence it is metabolically more active than heterochromatin. Y chromosome has small amount of euchromatin and large amount of heterochromatin, hence it is genetically less active or inert. Therefore, from the given option 44+ XX has maximum genetically active DNA.

189. Option (d) is correct.

Non-random matings disturb Hardy Weinberg equilibrium.

190. Option (b) is correct.

Macrocytic anemia can be due to a deficiency of B₉ (folic acid) and B₁₂ (cyanocobalmin). In this condition, RBCs are large and exist in an immature form, so have less space available for hemoglobin.

191. Option (c) is correct.

Sexual reproduction generates new genetic combinations leading to variation. It produces offspring that are morphologically and genetically different.

192. Option (c) is correct.

Nearly all of the essential nutrients and 70-80 per cent of electrolytes and water are reabsorbed by PCT segment. PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions, ammonia and potassium ions into the filtrate and by absorption of bicarbonate ions from it.

193. Option (a) is correct.

Heroin is an opioid that is commonly called smack. It is a white, crystalline, odorless, and bitter compound.

Morphine is extracted from the latex of poppy plant, *i.e.*, *Papaver somniferum*.

Lysergic Acid Diethylamide is the most powerful hallucinogen derived from the fungus *Claviceps purpurea*.

The drug, cocaine is obtained from The *Erythroxylum coca* plant. It interferes with the transport of dopamine which is a neurotransmitter.

194. Option (c) is correct.

X represents honeybees. This figure represents the haploid-diploid method of sex determination. In honeybees, drones are males and are haploid (**n**), which developed from unfertilized eggs of females.

They produce haploid gametes by mitosis-like division. The females are diploid and develop from fertilized eggs.

195. Option (c) is correct.

Alec Jeffreys initially developed DNA fingerprinting, also known as DNA typing or DNA profiling, to find out markers for the inherited diseases. He used a satellite DNA as probe that shows very high degree of polymorphism

and called it variable number of Tandem Repeats (VNTRs). In one of the step of DNA fingerprinting, DNA is isolated and cut with the help of restriction endonucleases.

196. Option (d) is correct.

The correct order of eras and periods in the geological time scale is as follows:

Era	Period
Cenozoic	Quaternary Tertiary
	Neogene
	Paleogene
Mesozoic	Cretaceous
	Jurassic
	Triassic
Paleozoic	Permian
	Carboniferous
	Devonian
	Silurian
	Ordovician
	Cambrian

197. Option (c) is correct.

In the given diagrammatic representation of the biogas plant, A represents digester, B is the mixture of gases, *i.e.*, [CH_4 (50–70%), CO_2 (30–40%) and H_2 (remaining)] which is produced with the help of methanogens and C is inlet for cattle dung and water.

198. Option (a) is correct.

Codons	Amino acids
AGG	Arginine
UGG	Tryptophan
UGU	Cysteine
GAA, GAG	Glutamic acid
GUG	Valine

199. Option (a) is correct.

The practice eugenics is used for the improvement of the human race by selectively mating human beings with specific desirable hereditary traits. It aims to reduce the undesirable characteristics of the human race. On the other hand, eugenics is the study of the improvement of human functioning and well-being by improving their living conditions.

200. Option (b) is correct.

Graph (i) and (ii) represents disruptive, (iii) represents directional and (iv) represents stabilizing type of natural selection. When large number of individuals acquire mean character value, then the type of natural selection is stabilizing. If a large number of individuals acquire value other than mean character value, then it is directional change. When a large number of individuals acquire peripheral character value at both ends of the distribution curve, then it is disruptive natural selection.

□□□