1. \[ F = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1 q_2}{r^2} \]

\[ \therefore \text{unit of } \varepsilon_0 = \left( \text{coulomb}^2 \right) / \text{newton-m}^2 \]

2. As truck and car are moving with equal velocities hence
   \[ \text{As } (KE)_{\text{Truck}} > (KE)_{\text{Car}} \]
   \[ S \propto KE \]
   Hence, truck will cover more distance as compared in car.

3. Magnitude of component of \( \vec{A} \) along \( \vec{B} \) = \( \frac{\vec{A} \cdot \vec{B}}{|B|} \)

\[ = \frac{(2\hat{i} + 3\hat{j}) \cdot (\hat{i} + \hat{j})}{|\sqrt{2}|} = \frac{2 + 3}{|\sqrt{2}|} = \frac{5}{\sqrt{2}} \]

4. Horizontal component of velocity
   \[ u_H = u \cos 60^\circ = \frac{u}{2} \]
   \[ \therefore \text{AC} = u_H \times t = \frac{ut}{2} \]
   And \( AB = AC \sec 30^\circ = \left( \frac{ut}{2} \right) \left( \frac{2}{\sqrt{3}} \right) = ut/\sqrt{3} \)

5. Resultant acceleration
   \[ a = \left[ \left( \frac{v^2}{r} \right) + (2)^2 \right]^{\frac{1}{2}} = \left[ \left( \frac{30 \times 30}{500} \right)^2 + 4 \right]^{\frac{1}{2}} \]
   \[ = \left[ \frac{81}{25} + 4 \right]^{\frac{1}{2}} = 2.7 \text{ ms}^2 \]

6. Net force on the rod = \( F_1 - F_2 \)  \( (\because F_1 > F_2) \)
   As mass of the rod is M, hence acceleration of the rod is
   \[ a = \frac{F_1 - F_2}{M} \]
   \[ \text{……..(i)} \]
   If we now consider the motion of part AB of the rod [whose mass is equal to \( M/L \)], then
   \[ F_1 - T = \frac{M}{L} y \times a \]
Where $T$ is the tension in the rod at the point B.

Now, \[ F_1 - T = \frac{M}{L} y \times \left( \frac{F_1 - F_2}{M} \right) \]

Or \[ T = F_1 \left( 1 - \frac{y}{L} \right) + F_2 \left( \frac{y}{L} \right) \]

**Alternative Method:** Consider motion of the other part BC of the rod also, we can calculate tension at the point B. In this case

\[ T - F_1 = \frac{M}{L} (L - y) \times a \]

OR \[ T = F_2 + \frac{M}{L} (L - y) \times \left( \frac{F_1 - F_2}{M} \right) \]

\[ = F_1 \left( 1 - \frac{y}{L} \right) + F_2 \left( \frac{y}{L} \right) \]

7.

Let $F$ be the upthrust of the air. As the balloon is descending down with an acceleration $a$,

\[ \therefore \quad mg - F = ma \quad \ldots (i) \]

Let mass $m_0$ be removed from the balloon so that it starts moving up with an acceleration $a$. Then,

\[ F - (m - m_0)g = (m - m_0) a \]

OR \[ F - mg + m_0g = ma - m_0a \quad \ldots (ii) \]

Adding eqns. (i) and (ii), we get

\[ m_0g = 2ma - m_0a \]

\[ m_0g + m_0a = 2ma \]

\[ m_0g + (g + a) = 2ma \]

\[ m_0 = \frac{2ma}{a + g} \]

8.

\[ P = Fv = mav \]

\[ a = \frac{P}{m} \]

\[ \frac{dv}{m} = \frac{P}{mv} \]

or \[ v^2 dv = \frac{P}{m} ds \]

or \[ \int_0^v \frac{P}{m} ds = \int_0^{v_2} v^2 dv \]

or \[ \frac{P}{m} s = \frac{1}{3} (v_2^3 - v_1^3) \]

\[ \therefore \quad s = \frac{m}{3P} (v_2^3 - v_1^3) \]
9. As the force of explosion is internal and system is initially at rest, hence
   \( p_1 + p_2 + p_3 = 0 \)
   Or \( p_3 = -(p_1 + p_2) \)
   As \( \theta = 90^\circ \)
   \( p_3 = \sqrt{p_1^2 + p_2^2} = \sqrt{2} mv \)
   (\( p_1 = p_2 = mv \))
   So, the final KE of the system
   \[
   K_F = \frac{p_1^2}{2m} + \frac{p_2^2}{2m} + \frac{p_3^2}{2(2m)}
   \]
   \[
   = \frac{1}{2} mv^2 + \frac{1}{2} mv^2 + \frac{1}{2} mv^2 = \frac{3}{2} mv^2
   \]
   As \( K_1 = 0 \), hence energy released in the explosion,
   \[
   E = K_F - K_1 = \frac{3}{2} mv^2
   \]

10. Power delivered in time \( T \) is
    \[ P = F \cdot V = MaV \]
    Or \( P = MV \frac{dV}{dT} \)
    Or \( pdT = MVdV \)
    Or \( PT = \frac{MV^2}{2} \)
    Or \( P = \frac{1}{2} \frac{MV^2}{T} \)

11. Horizontal distance travelled by the centre of mass before hitting the ground is
    \[ R = \frac{u^2 \sin^2 2\theta}{g} \] (Since the path of the centre of mass does not change due to the forces of explosion)

12. The desired moment of inertia is
    \[
    I = \int_{x=-l}^{x=+l} dI
    \]
    \[
    = I = \int_{-l}^{+l} \left( \frac{m}{2l} dx \right) (x \sin \alpha)^2
    \]
    \[
    = \frac{ml^2}{3} \sin^2 \alpha
    \]
13. Required fraction = \( \frac{\frac{1}{2} I \omega^2}{\frac{1}{2} I \omega^2 + \frac{1}{2} M \nu^2} \)

\[ = \frac{1}{1 + \frac{M \nu^2}{\frac{1}{2} I \omega^2}} \]

\[ = \frac{1}{1 + \frac{2}{M \nu^2} \times \frac{\omega^2}{I \omega^2}} \]

\[ = \frac{1}{1 + \frac{2}{\frac{1}{2} MR^2 \omega^2} \times \frac{\omega^2}{I \omega^2}} \]

\[ = \frac{1}{1 + \frac{2}{MR^2 (\nu^2 / R^2)} + \frac{M \nu^2}{MR^2 (\nu^2 / R^2) + M \nu^2}} \]

\[ = \frac{1}{2} \]

14. Here angular momentum is conserved, i.e. \( L = I \omega = \text{constant} \). At A, the moment of inertia \( I \) is least, so angular speed and therefore the linear speed of planet at A is maximum.

15. \( \)  

16. Radius of curvature at meniscus \( R = \left( \frac{r}{\cos \theta} \right) \)

Pressure difference across meniscus = \( \frac{2T}{R} \)

\[ \therefore \text{Pressure difference} = \frac{2T \cos \theta}{r} \]

17. Weight of wax in air = \( x \) g-wt  
Weight of wax and metal both in water = \( z \) g-wt  
Weight of wax alone in water = \( (z - y) \) g-wt  
Specific gravity of wax

\[ = \frac{\text{weight of wax in air}}{\text{loss of weight of wax in water}} \]

\[ = \frac{\text{weight of wax in air}}{\text{weight of wax in air - weight of wax in water}} \]

\[ = \frac{x}{x - (z - y)} \]

18. According to Bernouilli’s theorem

\[ P + \frac{1}{2} \rho v^2 = p_0 + 0 \]

Hence \( \Delta P = \frac{1}{2} \rho v^2 \)

\[ F_{\text{net}} = \Delta P \cdot A = \frac{1}{2} \rho v^2 A \]

\[ = \frac{1}{2} \times 1.2 \times 40 \times 40 \times 250 \]

\[ = 2.4 \times 10^5 \text{ N, upwards} \]

i.e. correction option is b.
19. When a bimetallic strip is heated, it bends with metal of lesser $\alpha$ on inner side i.e. concave side.

20. When a body cools by radiation, according to Stefan’s law,

$$\frac{dT}{dt} = \frac{eA\sigma}{mc} [T^4 - T_0^4]$$

Here $m$, $c$, $e$, $T$ and $T_0$ are same for all bodies; so

$$\frac{dT}{dt} \propto \text{area } A$$

Now, as for a given mass, area of the sphere is minimum, hence it will have the lowest rate of cooling.

21. For $\gamma = \frac{4}{3}$; $C_v = 3R, C_p = 4R$

$$\therefore \gamma_{\text{mix}} = \frac{\frac{2}{5} + \frac{4}{2}}{\frac{2}{5} + 3} = \frac{15}{11}$$

22.

$$PV = \frac{m}{M} RT$$

$$P'V = \frac{2m}{M} RT, \frac{P'}{P} = 2$$

$$\rho = \frac{m}{V} \quad \rho' = \frac{2m}{V}$$

$$\frac{\rho'}{\rho} = 2$$

23. For parallel combination of first two identical springs of spring constant $k_1$, effective spring constant $k_p = 2k_1$

Now, springs of spring constant $k_p$ and $k_2$ are joined in series, so the force constant or the spring constant of the system is

$$\frac{1}{k_s} = \frac{1}{k_p} + \frac{1}{k_2}$$

$$\therefore k_s = \left( \frac{1}{k_p} + \frac{1}{k_2} \right)^{-1} = \left( \frac{1}{2k_1} + \frac{1}{k_2} \right)^{-1}$$

24. As $P \propto I$

$$\therefore SL_2 - SL_1 = 10\log \left( \frac{I_2}{I_1} \right) = 10\log \left( \frac{P_2}{P_1} \right)$$

$$\therefore SL_2 - SL_1 = 10\log \left( \frac{I_2}{I_1} \right) = 10\log \left( \frac{P_2}{P_1} \right) = 10\log \left( \frac{400}{20} \right) = 10\log 20 \approx 13\text{ dB}$$
25. There will be no interference as the sources have random phases. Only general illumination occurs. Hence, intensity is $10I_0$.

26. $\nu = \frac{n}{2l} \sqrt{\frac{F}{\mu}}$

where $\mu$ is the mass per unit length.

$\therefore \frac{\nu_2}{\nu_1} = \frac{1}{2}$

$\therefore \nu_2 = \frac{25}{16} \times 256 = 400 \, \text{Hz}$

27. 

$f = f_0 \left( \frac{v_s + v_0}{v_s} \right) - f_0 \left( \frac{v + v}{5v} \right)$

$= \frac{6}{5} f_0$

28. The potential energy when $q_3$ is at point C

$U_1 = \frac{1}{4\pi\varepsilon_0} \left[ \frac{q_1 q_3}{0.40} + \frac{q_2 q_3}{\sqrt{(0.40)^2 + (0.30)^2}} \right]$

The potential energy when $q_3$ is at point D;

$U_2 = \frac{1}{4\pi\varepsilon_0} \left[ \frac{q_1 q_3}{0.40} + \frac{q_2 q_3}{0.10} \right]$

Thus, change in potential energy is

$\Delta U = U_2 - U_1$

Or $\frac{q_3K}{4\pi\varepsilon_0} = \frac{1}{4\pi\varepsilon_0} \left[ \frac{q_1 q_3}{0.40} + \frac{q_2 q_3}{0.10} - \frac{q_1 q_3}{0.40} - \frac{q_2 q_3}{0.50} \right]$

$K = \frac{5q_2 - q_2}{0.50} = \frac{4q_2}{0.50} = 8q_2$
Figure shows equilibrium positions of the two spheres.

\[ T \cos \theta = mg \]

and \[ T \sin \theta = F = \frac{1}{4 \pi \varepsilon_0} \frac{q^2}{d^2} \]

\[ \therefore \tan \theta = \frac{1}{4 \pi \varepsilon_0} \frac{q^2}{d^2 mg} \]

When charge begins to leak from both the spheres at a constant rate, then

\[ \tan \theta = \frac{1}{4 \pi \varepsilon_0} \frac{q^2}{x^2 mg} \]

\[ \frac{x}{2l} = \frac{1}{4 \pi \varepsilon_0} \frac{q^2}{x^2 mg} \]

\[ \therefore \tan \theta = \frac{x}{2l} \]

or

\[ \frac{x}{2l} \propto \frac{q^2}{x^2} \]

or

\[ q^2 \propto x^3 \Rightarrow q \propto x^{3/2} \]

\[ \frac{dq}{dt} \propto \frac{3}{2} x^{1/2} \frac{dx}{dt} \]

or

\[ v \propto x^{-1/2} \]

\[ \therefore \frac{dq}{dt} = \text{constant} \]
30. 
\[ V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2} = CV = \frac{V}{2} \]

Initial energy in each of the capacitor is
\[ U_{\text{initial}} = \frac{1}{2}CV^2 = U \]

\[ U_{\text{final}} = \frac{1}{2}(C)\left(\frac{V}{2}\right)^2 = \frac{1}{4}\left(\frac{1}{2}CV^2\right) = \frac{U_{\text{initial}}}{4} \]

31. Initially the current will pass through resistance between AB and capacitor C. The current will not pass through the resistance which is in parallel to C. The only resistance in the circuit = \( R_{AB} = 1000\, \Omega \).

\[ \therefore \text{Current} = \frac{2\, \text{volt}}{1000\, \Omega} = 2\, \text{mA} \]

The charging of capacitor takes place. Soon after the capacitor is fully charged, no current will pass through C the current will not flow through 1000\, \Omega across C. Total resistance of the circuit will be 1000 + 1000 = 2000\, \Omega.

Hence, new current = \[ \frac{2\, \text{volt}}{2000\, \Omega} = 1\, \text{mA} \]

32. Let R be the resistance of each lamp. If E be the applied emf, then the current in the circuit \( I_1 \) is given by
\[ I_1 = \frac{E}{R + (R/2)} = (2E/3R) \]

Current flowing through \( L_2 \) and \( L_3 \)
\[ = \frac{1}{2} \left[ \frac{2E}{3R} \right] = \frac{E}{3R} \]

When \( L_3 \) is fused, the whole current flows through \( L_1 \) and \( L_2 \).

Thus, \[ I_2 = \frac{E}{2R} \]

So, current through \( L_1 \) decreases and through \( L_2 \) increases.

33. Current in the ring \( I = q\omega = q\frac{\omega}{2\pi} \)

\[ B = \frac{\mu_0 I}{2r} = \frac{\mu_0}{2r} \times \frac{q\omega}{2\pi} \]

\[ = \frac{\mu_0}{4\pi} \left( \frac{q\omega}{r} \right) \]

34. The current through the galvanometer = \[ \frac{3}{2950 + 50} = 10^{-3} \, \text{A} \]

To reduce the deflection from 30 divisions to 20 divisions, the required current
\[ = \frac{20}{30} \times 10^{-3} = \frac{2}{3} \times 10^{-3} \, \text{A} \]

The required resistance \( R \) is given by
\[\frac{3}{R + 50} = \frac{2}{3} \times 10^{-3} \text{ A}\]

Or \(R = 4450\Omega\)

35. 
\[E = Blv\]
\[I = \frac{E}{r} = \frac{Blv}{R}\]
\[P = I^2R = \frac{B^2l^2v^2}{R}\]
\[p \propto v^2\]

36. Here, \(V_L = V_C\). They are in opposite phase. Hence, they will cancel each other. Now, resultant potential difference = applied potential difference = 100 volt
\[Z = R \quad \therefore X_L = X_C\]
\[\therefore I_{rms} = \frac{V_{rms}}{Z} = \frac{V_{rms}}{R} = \frac{100}{50} = 2\text{ amp.}\]

37. Radiation force = momentum transferred per sec by electromagnetic wave to the mirror
\[= \frac{2S_{av}A}{c} = \frac{2 \times 10 \times 20 \times 10^{-4}}{3 \times 10^8}\]
\[= 1.33 \times 10^{-10} \text{ N.}\]

38. From the figure,
\[\sin C = \frac{3}{\sqrt{(4)^2 + (3)^2}} = \frac{3}{5}\]
(where \(C\) is the critical angle)
Also, \(\sin C = \frac{\mu_a}{\mu_l}\)
\[\sin C = \frac{1}{\mu_l} \quad \text{since,} \quad \mu_a = \frac{1}{\mu_l}\]
Also, \(\frac{\mu_l}{\mu_i} = \frac{\text{velocity of light in air} (c)}{\text{velocity of light in liquid} (v)}\)
\[\therefore \quad \sin C = \frac{v}{c} = \frac{v}{3 \times 10^8}\]
\[\text{or} \quad v = 3 \times 10^8 \times \frac{3}{5} = 1.8 \times 10^8 \text{ ms}^{-1}\]
39. For condition of total internal reflection

\[ \sin \theta_c = \frac{1}{\mu} = \frac{3}{4} \]

\[ \therefore \tan \theta_c = \frac{3}{\sqrt{7}} = \frac{R}{12} \]

or \[ R = \frac{36}{\sqrt{7}} \text{ cm} \]

40. 1st minimum:

\[ a \sin \theta = n \lambda \]

\[ n = 1, \ a \sin 30^\circ = \lambda \]

or \[ a = 2\lambda \]

1st secondary maximum:

\[ a \sin \theta_1 = \frac{3\lambda}{2} \]

or \[ \sin \theta_1 = \frac{3\lambda}{2a} = \frac{3}{4} \]

or \[ \theta = \sin^{-1} \frac{3}{4} \]

41. de Broglie wavelength, \[ \lambda = \frac{h}{mv} \], when the rms speed of a gas particle at the given temperature is given as:

\[ \frac{1}{2} mv^2 = \frac{3}{2} kT \quad \text{or} \quad v = \sqrt{\frac{3kT}{m}} \]

or \[ mv = \sqrt{3mKT} \]

\[ \therefore \quad \lambda = \frac{h}{mv} = \frac{\ h }{ \sqrt{3mKT} } \]

Hence, \[ \frac{\lambda_H}{\lambda_{He}} = \sqrt{\frac{m_{He} T_{He}}{m_H T_H}} \]

\[ = \sqrt{\frac{(4 \text{ amu})(273 + 127)K}{(2 \text{ amu})(273 + 27)K}} = \sqrt{8/3}. \]
42. The wavelength of different spectral lines of Lyman series is given by
\[ \frac{1}{\lambda_L} = R \left[ \frac{1}{n^2} - \frac{1}{1^2} \right] \]
where \( n = 2, 3, 4, \ldots \)

For longest wavelength, \( n = 2 \)
\[ \therefore \frac{1}{\lambda_L^{\text{longest}}} = R \left[ \frac{1}{2^2} - \frac{1}{1^2} \right] = \frac{3}{4} R \] ... (i)

The wavelength of different spectral lines of Balmer series is given by
\[ \frac{1}{\lambda_B} = R \left[ \frac{1}{n^2} - \frac{1}{1^2} \right] \]
where \( n = 3, 4, 5, \ldots \)

For longest wavelength, \( n = 3 \)
\[ \therefore \frac{1}{\lambda_B^{\text{longest}}} = R \left[ \frac{1}{3^2} - \frac{1}{1^2} \right] = \frac{5R}{36} \] ... (ii)

Dividing eq. (ii) by eq. (i), we get:
\[ \frac{\lambda_L^{\text{longest}}}{\lambda_B^{\text{longest}}} = \frac{5R}{36} \times \frac{4}{3R} = \frac{5}{27} \]

Hence, correct answer is (d).

43. \[ \Delta \lambda = \lambda_{K_\alpha} - \lambda_{\text{min}}. \]

When \( V \) is halved, \( \lambda_{\text{min}} \) becomes two times but \( \lambda_{K_\alpha} \) remains the same.
\[ \therefore \Delta \lambda' = \lambda_{K_\alpha} - 2\lambda_{\text{min}} = 2(\Delta \lambda) - \lambda_{K_\alpha} \]
\[ \therefore \Delta \lambda' < 2(\Delta \lambda). \]

44. The number of \( \alpha \) particles emitted per second is the decay rate \( R \)
\[ \therefore n = R = \lambda_{\text{N}} = \frac{0.693N}{T} \]
\[ \therefore T = \frac{0.693N}{n} \text{ sec}. \]

45. The truth table corresponding to waveform is given by:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The given logic circuit gate is AND gate.
46.

(c) \( PV = nRT \) Ideal gas equation

\[
PV = \frac{W}{M} \times RT \quad \text{or}
\]

so \( V_{\text{Total}} = \left( \frac{5}{26} + \frac{2}{2} \right) \times \frac{0.0821 \times 323 \times 760}{740} = 32.46 \text{ L} \)

47.

(d) \( 9.1 \times 10^{-3} \text{ kg} \quad \text{1 electron weight} \); Accordingly

\[
1 \text{ kg} = \frac{1}{9.1} \times 10^{31} \text{ electrons}
\]

so \( \frac{1}{9.1} \times 10^{31} \text{ electrons} \rightarrow \frac{1}{6.023 \times 9.1} \times 10^8 \text{ moles} \)

48.

(b) 93% H\(_2\)SO\(_4\) (w/v) means 100 ml of solution contains 93 g of H\(_2\)SO\(_4\).

No. of moles of H\(_2\)SO\(_4\) = \( \frac{93}{98} \) g ; Also weight of solution = 1.84 \times 100 = 184 g

weight of solvent = 184 - 93 = 91 g

Molality = \( \frac{n_{\text{solute}}}{w_{\text{solvent}} \text{kg}} \) = \( \frac{93 \times 1000}{98 \times 91} \) = 10.42

49.

(b) As per the Aufbau principle \( Xe \ (54) = [Kr] 5s^2 \ 4d^{10} \ 5p^6 \) (in Fifth period)

50.

(a) Structure of inorganic benzene

Have 12 \( \sigma \) & 3\( \pi \) 12 bond
51. (a) **Full mixture**

\[ 2 \text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe} \quad \Delta H^* = ? \quad \text{target} \]

Liner, \[ 2 \text{Al} + \frac{3}{2} \text{O}_2 \rightarrow \text{Al}_2\text{O}_3 \quad \Delta H = 3.99 \text{ Kcal/mole } \quad (1) \]

\[ 2 \text{Fe} + \frac{3}{2} \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3 \quad \Delta H = 199 \text{ Kcal/mole } \quad (2) \]

Subtract (2) from (1) to get the target \( r \times n \)

\[ \Delta n^* = 3.99 - 199 = 200 \text{ Kcal/mole} \]

Molecular wt of Fuel mixture = \( (2 \times 27) + (2 \times 56) + (3 \times 16) = 214 \text{g} \)

214g \[ \rightarrow 200 \text{ kcal of heat} \]

Also, volume of Fusion mixture = \[ \frac{54}{2.7} + \frac{160}{5.2} = 20 + 3.76 = 50.76 \text{ ml} \]

Fuel value per kg = \[ \frac{200}{214} = 0.9346 \text{ kcal/g} \]

\[ \text{Hence,} \]

\[ 50.76 \text{ ml} \rightarrow 200 \text{ Kcal} \]

\[ 1 \text{ ml} \rightarrow \frac{200}{50.76} = 3.94 \text{ Kcal/ml} \]

**Fuel value per mL of Fuel mixture.**

52. (b) \( \text{Ca} (OH)_2 \leftrightarrow \text{Ca}^{2+} (aq) + 2 \text{OH} (aq) \)

\[ K_{sp}, \text{Ca} (OH)_2 = 453 = 4 \times \left( \frac{9.57 \times 10^{-3}}{74} \right)^3 = 8.6 \times 10^{-12} \text{ M}^3 \]

Now \[ K_{sp}, \text{Ca} (OH)_2 = [ \text{Ca}^{2+} ] [\text{OH} ]^2 \]

So \[ [\text{OH}] \text{ from different } [\text{Ca}^{2+}] \text{conc.} = \left( \frac{8.6 \times 10^{-12}}{0.02} \right)^{1/2} = 2.07 \times 10^{-5} \]

But \[ [\text{Ca}^{2+}] \text{solubility in g/L} = \frac{2.07 \times 10^{-5}}{2} \times 74 = 7.65 \times 10^{-4} \text{ g/L} \]

53. (d) **The Reducing power \( \alpha \) value of oxidation potential.**

54. (b) **Vant Hoff's factor**

\[ i = \frac{\text{mol.wt Normal}}{\text{mol.wt Ab normal}} = \frac{94 \times \Delta TF \times W}{1000 \times K_f \times W} = 1 - \frac{\alpha}{2} = \frac{94}{145} \]

or \( \alpha/2 = 0.35 \)
55. (b) 
\[ K = \frac{2.303}{t} \log \left( \frac{a}{1-x} \right) \quad a = 100g \quad \text{in first case} \]
\[ K = \frac{2.303}{10} \log \left( \frac{100}{80} \right) = 0.0223 \text{ min}^{-1} \quad a = 100g \quad \text{in second case} \]
\[ a = x = 25g \]
Using the value of k in the second equation,
than \[ t = \frac{2.303}{0.0223} \log \left( \frac{100}{25} \right) = 62.18 \text{ min} \] (Answer)

56.
\[ \ell = 0, \ m = 0 \quad 8 \]
\[ \ell = 1, \ m = -1 \quad 4 \]
\[ \ell = 2, \ m = -2 \quad 2 \] Assuming paired electron in \( m = -2 \) Orbital.

57. (c) Energy of one photon
\[ E = \frac{6.63 \times 3 \times 10^{-26}}{4 \times 10^{-7}} \quad J = 4.97 \times 10^{-19} \ J \]

Energy supplied by one mole of photon in KJ/mole
\[ 4.97 \times 10^{-19} \times 6.023 \times 10^{23} \times 10^{-3} = 297 \text{ KJ/mol} \]

% Energy converted to KE
\[ \frac{297 - 246.5}{297} = 17\% \]

58. (a) As per theoretical concept 1 to 1000 nm.

59. (d) As the electro negativity increases of the element, the non-metallic character & subsequently acidic strength of oxide increases.

60. (a) In \( \text{CH}_4 \) and \( \text{CCl}_4 \) being tetrahedral, symmetrical modulus, \( \mu_{\text{resultant}} = 0 \)

But as electro negativity difference between two bonded atoms increases, bond polarity increases & also increase in \( \mu_{\text{resultant}} \) value.
61. 

(c) 

\[ \begin{align*} 
\text{(i) } CH_3 & \quad mg \quad x \\
\text{(ii) } H_3O^+ & \\
\text{+ -- chiral centre} \\
2^3 = 8 \quad \text{Answer.} 
\end{align*} \]

62. 

(c) 

\[ \begin{align*} 
\text{Cl} & \quad H_2O \\
\text{ZnCl}_2/HCl & \\
\text{Cl} \text{ ether} & \\
\text{MgCl} & \\
\text{D}_2O & \\
\text{D} & 
\end{align*} \]

63. 

(d) 

\[ \begin{align*} 
d^8 & \rightarrow Ni^{3+} \quad \text{&} \quad d^7 \rightarrow Ni^{3+} \quad \text{so total charge of nickel} \\
& = (0.96 \times 2) + (0.04 \times 3) = 2.04 \\
\text{No: of } O^{3-} \text{ ion} & = \frac{2.04}{2} = 1.02 \\
\text{Hence, formula of solid} & = NiO_{1.02} = Ni_{0.98}O_{1.00} \quad \text{Answer} 
\end{align*} \]

64. 

(b) Let moles of FeO & Fe₂O₃ in mixture are a & b respectively, then by stochiometry \( a + 3b = 0.65 \times 2 = 1.3 \) \[ a + 2b = 1 \] & Hence on solving a : b is 4 : 3

65. 

(d) 

\[ \begin{align*} 
Fe^{2+} + 2k^+ + [Fe(CN)_6]^{4+} & \rightarrow K_2 Fe [Fe(CN)_6] \downarrow \text{white color} \\
Fe^{3+} + [Fe(CN)_6]^{4+} & \rightarrow Fe_4 [Fe(CN)_6]_3 \text{ Prussian Blue solution} \\
Zn^{2+} + 2k^+ + [Fe(CN)_6]^{4+} & \rightarrow K_2 Cr_3 [Fe(CN)_6]_2 \downarrow \text{Blaish-white} \\
Ca^{2+} + 2k^+ + [Fe(CN)_6]^{4+} & \rightarrow K_2 Ca [Fe(CN)_6] \downarrow \text{white} \\
Cu^{2+} + 2k^+ + [Fe(CN)_6]^{4+} & \rightarrow Cu_2 [Fe(CN)_6] \downarrow \text{Chocolate Brown}.
\end{align*} \]

66. 

(a) As per the concept of ozonolysis & reduction of hydrocarbon (Bicyclic).
67. 

(b) \(-\text{NH}_2\) group > \(-\text{NHCOCH}_3\) > \(-\text{NHCH}_2\text{CH}_3\)  
Ring activating tendency \(\alpha\) basic strength

68. 

(c) \(\text{XeF}_2\) - 2 Bond pair + 3 lone pairs.

69. 

(c) Aniline on reaction with \(\text{NaNO}_2 + \text{HCl}\) gives Diazonium compound which on reaction with \(\beta\) - Napthol gives Azodye.

70. 

(c) In the case of \(\text{IP}_{\Pi}\) oxygen becomes half-filled configuration

71. 

\[
\begin{array}{|c|c|}
\hline
\text{Ion} & \text{No of unpaired } e^- \\
\hline
\text{Fe}^{3+} & 5 \\
\text{CO}^{3+} & 4 \\
\text{V}^{3+} & 2 \\
\text{Ti}^{3+} & 1 \\
\hline
\end{array}
\]

\[
\mu_{BM} = \sqrt{n(n+2)}
\]

72. 

(a) Argentite \(-\text{Ag}_2\text{S}\)  
Cuperite \(-\text{Cu}_2\text{O}\)  
Siderite \(-\text{FeCO}_3\)  
Carnallite \(-\text{KCl. MgCl}_2 \cdot 6\text{H}_2\text{O}\)

73. 

(a) \(\text{NH}_4\text{ClO}_4 + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3 + \text{HClO}_4\)

\(\text{NH}_4\text{NO}_3 \xrightarrow{\Delta} \text{N}_2\text{O} + 2\text{H}_2\text{O}\)
74. (d) \( S_1 : 2Se_2Cl_2 \rightarrow SeCl_4 + 3Se \) (disproportional)  
\[ S_2 : 2PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O + O_2 \]
\[ S_3 : Fe^{2+} + 2S_2O_3^{2-} \rightarrow [Fe(S_2O_3)_2]^2- ; Fe^{3+} + [Fe(S_2O_3)_2] \rightarrow 2Fe^{2+} + S_4O_6^{2-} \] (Colourless)  
\[ S_4 : PbS_2O_3 + H_2O \rightarrow PbS \downarrow (black) + H_2SO_4 \]

75. (c) \( S_1 \) & \( S_2 \) are correct statements.

\[ S_3 : 2XeF_2 (s) + H_2O (l) \rightarrow 2Xe (g) + 4HF (aq) + O_2 (g) \]
\[ 6XeF_4 + 12H_2O \rightarrow 4Xe + XeO_3 + 24HF + 3O_2 \) (complete hydrolysis)  
\[ XeF_6 + 3H_2O \rightarrow XeO_2 + 6HF \]
\[ S_4 : XeF_2 + PF_5 \rightarrow [XeF]^+ [PF_5]^- \]
\[ XeF_4 + SbF_5 \rightarrow [XeF]^+ [SbF_5]^- \]
\[ XeF_6 + MF \rightarrow M^+ [XeF]^+ \]  
\( M = Na, K, Rb \) or \( Cs \) more electropositive elements.

76. 

77. Factual

78. 

\[ E \propto \frac{Z^2}{n^2} \] where \( Z \) = atomic number of the unielectron system  
\( n \) = orbit number
80. 

\[
\text{Pinacol-Pinacolone Rearrangement}
\]

81. 

\[
\alpha = \left( \frac{K_{eq}}{C_+ C_-} \right)^{\frac{1}{x+y}}
\]

82. 

\[
\text{O}_3/\text{H}_2\text{O}_2 \rightarrow \text{Adipic acid}
\]

83. 

\[
\text{C}_{8}^{3+} = [\text{Ar}] 3d^3 \quad \text{3 unpaired electrons.}
\]
84. 
\[
\begin{align*}
\text{\text{CH}_3} & \quad \text{H}^+ \\
\text{\text{CH}_3} & \quad \text{\text{CH}_3}
\end{align*}
\]

meta directing

85. 
\[
\text{CH}_3 \quad \text{CH}_3 \\
\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \quad \xrightarrow{\text{B}} \quad \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_3
\]

86. 
\[
\text{MnO}_4^- + \text{SO}_3^{2-} \rightarrow \text{Mn}^{2+} + \text{SO}_4^{2-}
\]

\[
\text{Mn}^{2+} + \text{Se}^{-} \rightarrow \text{Mn}^{2+}
\]

\[
\text{SO}_3^{2-} \rightarrow \text{SO}_4^{2-} + 2\text{e}^{-}
\]

87. 
Increasing the temperature favours endothermic reaction.

88. 
\[
\text{NH}_4\text{CN (s)} + 2\text{O}_2 \rightarrow \text{N}_2 + \text{CO}_2 + 2\text{H}_2\text{O (l)}
\]

\[
\Delta n = 0
\]

\[
\Delta H = \Delta E
\]
90.

Iodoform test is given by compounds with 
\[ CH_3-C_1=\text{group} \] and 
\[ CH_3-C=\text{group} \].

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Answer</th>
<th>Solution</th>
<th>Chapter name</th>
<th>Page number from NCERT</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>91.</td>
<td>3</td>
<td>BOD of water increases when organic matter of sewage mixes with it.</td>
<td>Environmental Issues</td>
<td>275</td>
<td>E</td>
</tr>
<tr>
<td>92.</td>
<td>2</td>
<td>CO(_2) has maximum contribution (60%), followed by CH(_4) (20%), then CFCs (14%) &amp; N(_2)O (6%).</td>
<td>Environmental Issues</td>
<td>281</td>
<td>E</td>
</tr>
<tr>
<td>93.</td>
<td>4</td>
<td>Man and Biosphere Programme (launched in 1971 by UNESCO) aims to establish a scientific basis for improvement of relationships between people &amp; their environments.</td>
<td>Biodiversity &amp; Conservation</td>
<td>Out of NCERT</td>
<td>M</td>
</tr>
<tr>
<td>94.</td>
<td>3</td>
<td>Cryopreservation is the technique of preservation of any specimen in liquid nitrogen at -195°C</td>
<td>Biodiversity &amp; Conservation</td>
<td>267</td>
<td>M</td>
</tr>
<tr>
<td>95.</td>
<td>2</td>
<td>C&amp;N follow gasesous nutrient cycles, whereas S&amp;P follow sedimentary nutrient cycles.</td>
<td>Ecosystem</td>
<td>253</td>
<td>E</td>
</tr>
</tbody>
</table>
| 96.    | 4      | Both xeric & hydric conditions leads to mesic conditions 
Xeric → Mesic [Xerarch succession]
Hydric → Mesic [Hydrarch succession] | Ecosystem | 251 | M |
<p>| 97.    | 2      | Biotic potential means the rate at which an organism will reproduce in the absence of any type of environmental barrier/unlimited resources. | Organisms &amp; Populations | 230 | E |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
<th>Description</th>
<th>Relevant Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>98. 3</td>
<td></td>
<td>Conduit → channel for transfer of energy form one tropic level to another. → Predator is not efficient &amp; does not over-exploit its prey. → It helps in maintaining species diversity by decreasing the intensity of competition among prey species. → Shows (+, −) interaction</td>
<td>Organisms &amp; Populations</td>
</tr>
<tr>
<td>99. 1</td>
<td></td>
<td>Citric acid is produced by <em>Aspergillus niger</em></td>
<td>Microbes in Human Welfare</td>
</tr>
<tr>
<td>100. 2</td>
<td></td>
<td>Secondary Treatment or Biological Treatment is the step in sewage treatment, wherein microbes reduce the BOD of sewage by aerobic breakdown of organic matter.</td>
<td>Microbes in Human Welfare</td>
</tr>
<tr>
<td>101. 2</td>
<td></td>
<td>Most plant tissue cultures are grown at pH 5.2 to 5.8</td>
<td>Strategies for Enhancement</td>
</tr>
<tr>
<td>102. 4</td>
<td></td>
<td>(i) Meristem (ii) Micronutrient (iii) Protein (iv) vitamin (v) SCP (vi) Spirulina (vii) explant (viii) totipotency</td>
<td>Strategies for Enhancement</td>
</tr>
<tr>
<td>103. 2</td>
<td></td>
<td>AA₁ + ATP $\rightarrow^{E_{1Mg}^{+}}$ AA₁ − AMP − E₁ complex + PPi $\rightarrow^{(charged +RNA)}$ AA₁ − AMP − E₂ complex + tRNA₁ $\rightarrow$ AA₁ − tRNA₁ + AMP + E₁</td>
<td>Molecular Basis of inheritance</td>
</tr>
<tr>
<td>104. 4</td>
<td></td>
<td>β−1′−9−N−glycosidic linkage → Present between pentose sugar &amp; Purine β−1′−1−N−glycosidic linkage → Present between Pentose sugar &amp; Pyrimidine 3′−5′ phosphodiester bond → present between two nucleotides</td>
<td>Molecular Basis of inheritance</td>
</tr>
<tr>
<td>105. 3</td>
<td></td>
<td>CCA − OH $\rightarrow$ At 3′ end (for binding with amino acid) <em>TPC loop</em> $\rightarrow$ for binding with ribosome <em>DHU loop</em> $\rightarrow$ for binding with Amino acyl synthetase enzyme. There are 4 recognition sites in tRNA (3 above +Anticodon loop)</td>
<td>Molecular Basis of inheritance</td>
</tr>
<tr>
<td>106. 3</td>
<td></td>
<td>Steven’s genotype will by X’Yaa (His father’s heterozygosity will be irrelevant since he is suffering from Cystic fibrosis) Hence, Steven will</td>
<td>Principles of Inheritance &amp; variation</td>
</tr>
<tr>
<td>Question</td>
<td>Marks</td>
<td>Description</td>
<td>Answer</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>-------------</td>
<td>--------</td>
</tr>
<tr>
<td>107.</td>
<td>4</td>
<td>If recessive genotypes will be, <img src="image1.png" alt="Diagram" /> So, the probability is $\frac{1}{2}$</td>
<td>Principles of Inheritance &amp; variation</td>
</tr>
<tr>
<td>108.</td>
<td>1</td>
<td>The male <em>Drosophila</em> will produce 2 types of gametes; (X) &amp; (Y) (There is no crossing over between X &amp; Y)</td>
<td>Principles of Inheritance &amp; variation</td>
</tr>
<tr>
<td>109.</td>
<td>1</td>
<td>Emasculation is removal of anther in bud condition from bisexual flower.</td>
<td>Sexual reproduction in flowering plants</td>
</tr>
<tr>
<td>110.</td>
<td>4</td>
<td>In castor &amp; maize, unisexual male &amp; female flowers are produced on the same plant. It prevents autogamy, but not geitonogamy.</td>
<td>Sexual reproduction in flowering plants</td>
</tr>
<tr>
<td>111.</td>
<td>2</td>
<td>III → Pollen grains are spherical, 25-50 µm in diameter IV → Sporopollenin can withstand strong acids &amp; alkali.</td>
<td>Sexual reproduction in flowering plants</td>
</tr>
<tr>
<td>112.</td>
<td>3</td>
<td>Bisexual condition</td>
<td>Reproduction in organisms</td>
</tr>
<tr>
<td>113.</td>
<td>2</td>
<td>NAA- Naphthalene Acetic Acid and 2,4-D → 2,4 Dichlorophenoxyacetic acid are synthetic auxins.</td>
<td>Plant growth &amp; development</td>
</tr>
<tr>
<td>114.</td>
<td>1</td>
<td>Ethylene Synchronizes fruit set in pineapples Cytokinins → overcomes senescence Gibberellins → seed maturation and development.</td>
<td>Plant growth &amp; development</td>
</tr>
<tr>
<td>115.</td>
<td>4</td>
<td>Vernalisation requires meristematic tissues.</td>
<td>Plant Growth &amp; development</td>
</tr>
</tbody>
</table>
| 116. | 2 | \( C_6H_6O_5 \rightarrow \text{Malic acid (RQ is) 1.33} \)  
\( C_6H_{12}O_6 \rightarrow \text{Glucose (RQ is 1)} \)  
\( C_{18}H_{36}O_2 \rightarrow \text{Stearic acid (RQ is <1)} \)  
Succulents (night) \( \rightarrow \) respiration of Glucose occurs, \( O_2 \) is utilized but \( CO_2 \) is not evolved. (They fix it)  
\( 2C_6H_{12}O_6 + 3O_2 \rightarrow 3C_4H_8O_5 + 3H_2O \)  
Malic acid  
\[ \text{RQ} = \frac{CO_2}{O_2} = \frac{O}{3} = 0 \]  
Therefore, the order of RQs will be:  
\( C \rightarrow H \rightarrow O \) \( \rightarrow C \rightarrow H \rightarrow O \)  
Respiration in plants | 237 | M |
| 117. | 1 | 3NADH\_2 + 1FADH\_2 is obtained from oxidation of one Acetyl CoA | Respiration in plants | 232 | E |
| 118. | 1 | Pyruvate dehydrogenase enzyme dehydrogenates pyruvic acid to form 1NADH\_2 | Respiration in plants | 231 | E |
| 119. | 3 | Cyclic photophosphorylation yields 2 ATP molecules only. No water splitting \( \rightarrow \) no \( O_2 \) evolved. No NADH\_2 produced. | Photosynthesis | 213 | E |
| 120. | 1 | D – 10% of full sunlight/light saturation point. E – Maximum photosynthesis | Photosynthesis | 222 | M |
| 121. | 1 | \( P_{700}, \ PSI \) are components of cyclic ETS | General Nutrition | 213 | E |
| 122. | 2 | 2NH\textsubscript{3} requires 16ATP. Hence, one NH\textsubscript{3} requires 8 ATP | General Nutrition | 203 | E |
| 123. | 4 | Bacteria carrying out nitrification steps are chemoaerotrophs | General Nutrition | 201 | M |
| 124. | 4 | Low temperature condition is not required for imbibition to occur. | Transport in plants | 183 | M |
| 125. | 1 | Water moves from low DPD to high DPD. [DPD \( \rightarrow \) Diffusion Pressure Deficit] | Transport in plants | Out of NCERT | M |
| 126. | 4 | Late wood is formed during Autumn season | Anatomy of flowering plants | 96 | E |
| 127. | 4 | Sunflower is a dicot and has cambium | Anatomy of flowering plants | 85 | E |
| 128. | 3 | 1. Vanda is a monocot, does not show tap root.  
2. Jasmine \( \rightarrow \) offset helps is propagation.  
4. Nepenthes \( \rightarrow \) Leaf base used for photosynthesis | Morphology of flowering plants | 68-70 | M |
| 129. | 1 | Root hairs \( \rightarrow \) exogenous origin from epidermis  
Lateral roots \( \rightarrow \) endogenous origin from pericycle | Morphology of flowering plants | 66, 67 | M |
<table>
<thead>
<tr>
<th>No.</th>
<th>130.</th>
<th>3</th>
<th>This formula indicates superior bicarpellary ovary, Gamosepalous, gamopetalous, epipetalous condition</th>
<th>Morphology of flowering plants</th>
<th>80</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>131.</td>
<td>1</td>
<td>At ( G_2 ) stage, the meiocyte has 20pg of DNA, which will be distributed in 4 daughter cells.</td>
<td>Cell Cycle &amp; Cell Division</td>
<td>163</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>132.</td>
<td>3</td>
<td>Telocentric chromosomes have their centromeres at terminal ends.</td>
<td>Cell The unit of Life</td>
<td>131</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>133.</td>
<td>3</td>
<td>Telocentric chromosomes have their centromeres at terminal ends.</td>
<td>Cell The unit of Life</td>
<td>Out of NCERT</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>134.</td>
<td>2</td>
<td>Peroxisomes is the organelle involved in photorespiration &amp; also has catalase &amp; oxidase activities.</td>
<td>Cell The unit of Life</td>
<td>Out of NCERT</td>
<td>M</td>
<td></td>
</tr>
</tbody>
</table>
| 135. | 1 | A \( \rightarrow \) Strobilus (\( Equisitum \)s monoecious)  
C \( \rightarrow \) Nodes are solid, internodes are hollow.  
D \( \rightarrow \) Common name is scouring rush / snake grass | Plant Kingdom | 37 | D |
| 136. | 4 | Obligate aerobe-\( Bacillus subtilis \)  
Facultative anaerobe-\( Pseudomonas \)  
Photoautotroph-\( Chlorobium \)  
Chemoautotroph-\( Nitrosomonas \) | Biological Classification | Out of NCERT | M |
| 137. | 1 | Late blight of potato is caused by \( Phytophthora infestans \).  
\( Alternaria solani \) causes early blight of potato.  
\( Melodogyna \) \( \rightarrow \) A genus of nematode | Biological classification | 23-24 | M |
| 138. | 3 | Azolla fixes nitrogen symbiotically with Azolla fern. | Biological classification | 17-18 | E |
| 139. | 4 | NBRI is a Botanical Garden, so has a collection of living plants for reference. | Living world. | 12 | E |
| 140. | NCERT-XI (Pg.279-280) | NCERT-XI (Pg.317) | The myelinated nerve fibres are enveloped with Schwann cells, which form a myelin sheath around the axon. The gaps between two adjacent myelin sheaths are called nodes of Ranvier. | NCERT-XI (Pg.145) |
144. Retinol is vitamin A fat soluble – deficiency causes Xerophthalmia.

145. NCERT-XI (Pg.272)
Total Lung Capacity: Total volume of air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

146. NCERT-XI (Pg.53)
147. NCERT-XI (Pg.290)
Mammals, many terrestrial amphibians and marine fishes mainly excrete urea and are called ureotelic.

148. NCERT-XI (Pg.311)

149. NCERT-XI (Pg.316-317)

150. NCERT-XI (Pg.275)
A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO₂ and hydrogen ion. Increase in these substances can activate this centre.
151. NCERT-XII (Pg.51)

![Image of ovum and sperm](image.png)

152. NCERT-XII (Pg.60-61)

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Chemical</td>
<td>s. Spermicidal jelly and foam</td>
</tr>
<tr>
<td>B. IUDs</td>
<td>q. Copper T and Loop</td>
</tr>
<tr>
<td>C. Barriers</td>
<td>r. Condom and Cervical cap</td>
</tr>
<tr>
<td>D. Sterilization</td>
<td>p. Tubectomy and Vasectomy</td>
</tr>
</tbody>
</table>

153. NCERT-XII (Pg.159)

Drugs like barbiturates, amphetamines, benzodiazepines, and other similar drugs, that are normally used as medicines to help patients cope with mental illnesses like depression and insomnia.

154. NCERT-XII (Pg.130)

Whales, bats, Cheetah and human (all mammals) share similarities in the pattern of bones of forelimbs.

155. NCERT-XII (Pg.211)

cDNA is used in Gene Therapy

156. NCERT-XII (Pg.167-168)

Continued inbreeding, especially close inbreeding, usually reduces fertility and even productivity. This is called inbreeding depression. Whenever this becomes a problem, selected animals of the breeding population should be mated with unrelated superior animals of the same breed. This usually helps restore fertility and yield. This process is called out-breeding.

157. NCERT-XI (Pg.279)

Globulins primarily are involved in defense mechanisms of the body and the albumins help in osmotic balance. Plasma without the clotting factors is called serum.

158. NCERT-XI (Pg.50)

Cnidarians exhibit two basic body forms called polyp and medusa. The former is a sessile and cylindrical form like Hydra, *Adamsia*, etc. whereas, the latter is umbrella-shaped and free-swimming like *Aurelia* or jelly fish.

159. NCERT-XI (Pg.146) Table 9.3

<table>
<thead>
<tr>
<th>Pigments</th>
<th>Carotenoids, Anthocyanins, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>Morphine, Codeine, etc.</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>Monoterpnes, Diterpenes etc.</td>
</tr>
<tr>
<td>Essential oils</td>
<td>Lemon grass oil, etc.</td>
</tr>
<tr>
<td>Toxins</td>
<td>Abrin, Ricin</td>
</tr>
<tr>
<td>Lectins</td>
<td>Concanavalin A</td>
</tr>
<tr>
<td>Drugs</td>
<td>Vinblastin, curcumin, etc.</td>
</tr>
<tr>
<td>Polymeric substances</td>
<td>Rubber, gums, cellulose</td>
</tr>
</tbody>
</table>
160. NCERT-XI (Pg.54)
The most distinctive feature of echinoderms is the presence of water vascular system. Adamsia is not an echinoderm.

161. NCERT-XI (Pg.272-273)
162. NCERT-XI (Pg.286)
The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole. The number of QRS complexes that occur in a given time period, one can determine the heart beat rate of an individual.

163. NCERT-XI (Pg.293)
Blood is filtered so finely through these membranes, that almost all the constituents of the plasma except the proteins pass onto the lumen of the Bowman’s capsule.

164. NCERT-XI (Pg.304-305)
1. The light bands contain actin and is called I-band or Isotropic band, whereas the dark band called ‘A’ or Anisotropic band contains.
2. The portion of the myofibril between two successive ‘Z’ lines is considered as the functional unit of contraction and is called a sarcomere.
3. Central part of thick filament, not overlapped by thin filaments is called the ‘H’ zone.

165. NCERT-XI (Pg.317)
The ionic gradients across the resting membrane are maintained by the active transport of ions by sodium-potassium pump.

166. NCERT-XI (Pg.336)
Insulin also stimulates conversion of glucose to glycogen (glycogenesis) in the target cells.

167. NCERT-XI (Pg.332-337) NCERT-XII (Pg. 51)
168. NCERT-XII (Pg. 61)
Pills like Saheli inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms.

169. NCERT-XII (Pg.126-128)
170. NCERT-XII (Pg.198)
Plasmids have ability to replicate within bacterial cells independently.

171. NCERT-XI (Pg.261-264)
Glucose cannot be further digested

172. NCERT-XII (Pg.149)
173. NCERT-XI (Pg.158)
When the binding of the chemical shuts off enzyme activity, the process is called inhibition and the chemical is called an inhibitor.

174. NCERT-XI (Pg.294)
Substances like glucose, amino acids, Na⁺ in the filtrate are reabsorbed actively.

175. NCERT-XI (Pg.334)
Thymus is degenerated in old individuals resulting in a decreased production of thymosin. As a result, the immune responses of old persons become weak.

176. NCERT-XI (Pg.332-334)

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
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</thead>
<tbody>
<tr>
<td>1. Calcitonin</td>
<td>b. Treatment of rickets</td>
</tr>
<tr>
<td>2. Gonadotropin</td>
<td>e. Treatment of infertility</td>
</tr>
<tr>
<td>3. Erythropoietin</td>
<td>d. Formation of erythrocytes</td>
</tr>
</tbody>
</table>
4. Interferon | a. Treatment of viral infections
5. Interleukin | c. Enhancement of immune action

177. NCERT-XII (Pg.140-141)
178. NCERT-XII (Pg.211)
   The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency. This enzyme is crucial for the immune system to function.
179. NCERT-XI (Pg.287)
180. NCERT-XI (Pg.57)
   Air bladder is present in Osteichthyes which regulates buoyancy whereas Dog Fish is chondrichthyes.