

## PHYSICS

### 1. (c)

From the graph is clear that this is an isobaric process,

$P = \text{constant}$

At constant pressure

$$W = nR \Delta T \dots (1)$$

$$\Delta Q = nC_p \Delta T \text{ (for constant pressure)}$$

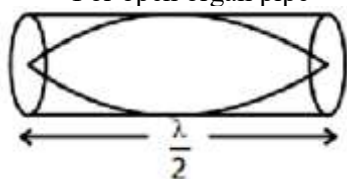
$$\Delta Q = n \left( \frac{5}{2} R \right) \Delta T \dots (1)$$

Equation (1)/(2)

$$\Rightarrow \frac{nR \Delta T}{n \left( \frac{5}{2} R \right) \Delta T} \Rightarrow \frac{2}{5}$$

### 2. (c)

For open organ pipe



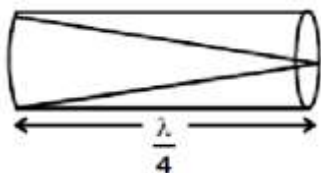
$$l = \frac{\lambda}{2}$$

$$\Rightarrow \lambda = 2l$$

$$\text{General formula } f = \frac{nv}{2l}$$

$$f_{\text{open}} = \frac{v}{\lambda} = \frac{v}{2l}$$

For pipe closed at one end



$$\text{General formula } f = \frac{nv}{4l}$$

$$\text{Fundamental } f = \frac{v}{4l}$$

As given:

$$\frac{3v}{4l_1} = \frac{v}{2l_2} = \frac{3}{4 \times 20} = \frac{1}{2l_2}$$

$$= 13.2$$

### 3. (c)

Efficiency of heat engine

$$Q_1 = W + Q_2$$

$$\text{Efficiency} = \frac{\text{work done}}{\text{Energy available}}$$

$$\eta = \frac{Q_1 - Q_2}{Q_1}$$

$$h = 1 - \frac{T_2}{T_1}$$

$$= 1 - \frac{273}{373}$$

$$= 1 - 0.731$$

$$26.8\%$$

4. (b)

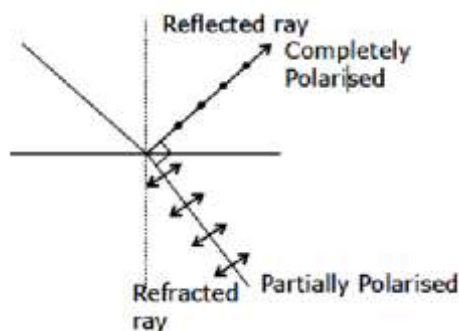
$$\text{Escape velocity} = 11.2 \text{ km/s} = 11200 \text{ m/s}$$

$$V_{rms} = \sqrt{\frac{3RT}{M_0}}$$

$$\sqrt{\frac{30 \times 1.38 \times 10^{-23} \times T}{2.76 \times 10^{-26}}} = (11.2 \times 10^3)^2$$

$$T = 8.360 \times 10^4$$

5. (b)



This is the condition of polarization in which light is incident on an interface at Brewster's angle. Thus reflected light is polarised with its  $\vec{E}$  perpendicular to the plane of incidence.

6. (b)

$$\text{Angular width } \omega = \frac{\lambda}{d}$$

$$\omega = \frac{\lambda}{d}$$

For new separation

$$\omega' = \frac{\lambda}{d'}$$

$$\therefore \frac{0.20}{0.21} = \frac{d'}{d}$$

$$\Rightarrow \frac{0.20}{0.21} = \frac{d'}{2}$$

$$\Rightarrow d' = 1.904$$

7. (a)

$$\text{angular magnification} = \frac{f_o}{f_e}$$

And

$$\text{Resolving power} = \frac{\text{Aperture of objective}}{\text{wavelength}}$$

$\therefore$  Greater the focal length of the objective, more is the magnification. Also for a telescope to have high resolution the aperture of objective lens should be large.

8. (b)

We know that angular momentum remains conserved In motion of a planet around the

$$\text{sun } m(\vec{r} \times \vec{v}) = \text{constant}$$

The nearest point in perigee which is point A. Next nearest is B and then C Therefore

$$V_A > V_B > V_C$$

$$\Rightarrow K_A > K_B > K_C$$

9. (b)

moment of inertia for solid sphere

$$I_{\text{solid sphere}} = \frac{2}{5}MR^2$$

$$KE_T = \frac{1}{2}m(r\omega)^2 = \frac{1}{2}mr^2\omega^2$$

$$KE_{(R+T)} = \frac{1}{2}\frac{2}{5}mR^2\omega^2 + \frac{1}{2}m(r\omega)^2$$

$$KE_R + KE_T = \frac{1}{5}mR^2\omega^2 + \frac{1}{2}mR^2\omega^2$$

$$= \frac{7}{10}mR^2\omega^2$$

$$\frac{K_T}{K_T + K_R} = \frac{\frac{1}{2}mr^2\omega^2}{\frac{7}{10}mR^2\omega^2}$$

$$= \frac{5}{7}$$

**10. (d)**

$$g = \frac{GM_e}{R_e}$$

$$g_{\text{new}} = \frac{10GM_e}{R_e^2} = 10g$$

∴ g changes

**11. (d)**

As we see that the torque acting on the body is zero, thus we can say that angular momentum is conserved.

$$\tau_{\text{ext}} = 0$$

$$\frac{d\vec{L}}{dt} = \text{constant}$$

**12. (d)**

$$\text{limb} \cos 30^\circ = mg \sin 30^\circ$$

$$i = \frac{mg \tan 30^\circ}{lB}$$

$$i = \frac{0.5 \times 9.8}{0.25 \times \sqrt{3}}$$

$$i = 11.32A$$

**13. (c)**

$$\omega = 314$$

$$= 100\Omega$$

Inductive reactance

$$X_L = \omega L$$

$$= 100\pi \times 20 \times 10^{-3}$$

$$X_L = 2\pi$$

$$\text{Capacitive reactance } X_C = \frac{1}{\omega C}$$

$$= \frac{1}{100\pi \times 100 \times 10^{-6}}$$

$$= \frac{100}{\pi}$$

$$= \sqrt{R^2 + (X_L - X_C)^2}$$

$$= \sqrt{(50)^2 + \left(2\pi - \frac{100}{\pi}\right)^2}$$

$$= \sqrt{(50)^2 + (25.56)^2}$$

$$= \sqrt{3153.31}$$

$$p = V_{rms} I_{rms} \cos \phi$$

$$= \frac{V_{rms}^2 R}{Z^2}$$

$$= \left(\frac{10}{\sqrt{2}}\right)^2 \times 50$$

$$p = \frac{\left(\frac{10}{\sqrt{2}}\right)^2 \times 50}{3153.31}$$

$$p = 0.79 \text{ watt}$$

**14. (c)**

Energy due to current source is responsible,

**15. (a)**

$$5 \text{ div} \rightarrow 1 \text{ mA}$$

$$20 \text{ div} \rightarrow 4 \text{ mA}$$

$$V = iR$$

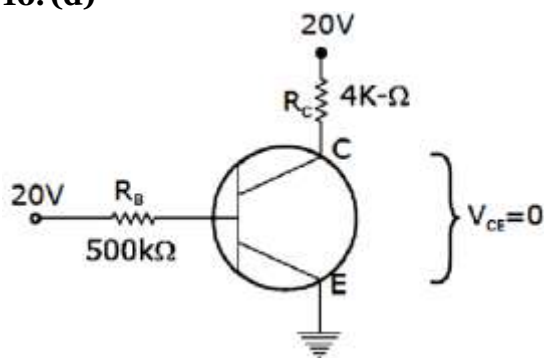
$$I = 4 \times 10^{-3} \times R$$

$$R = \frac{1}{4 \times 10^{-3}}$$

$$= \frac{1000}{4}$$

$$= 250 \Omega$$

**16. (d)**



$$I_B = \frac{20}{500 \times 10^3} = \frac{20}{5 \times 10^4}$$

$$= 4 \times 10^{-5}$$

$$= 40 \mu A$$

$$I_C = \frac{20}{4 \times 10^3} = 5 \text{ mA}$$

$$\therefore \beta = 125$$

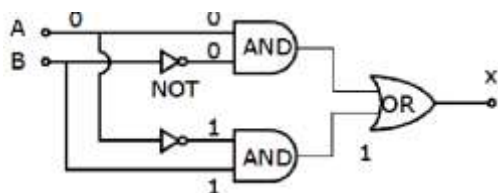
**17. (d)**

on increasing the temperature

The resistances falls.

Current increases in both cases. The overall V-I characteristics of a p-n junction changes.

**18. (b)**



| A | B   | Y    |
|---|-----|------|
| 0 | 0   | 0    |
| 0 | 1   | 1    |
| 1 | 0   | 1    |
| 1 | 1   | 0    |
| X | -OR | gate |

19. (b)

$$R = (47 \pm 4.7) k\Omega$$

$$= 47 \times 10^3 \pm 4700$$

$$R = 47 \times 10^3 \pm 10\%$$

BBROYGBVGVGS

0123456789

20. (c)

$$I = \frac{E}{E + nR}$$

Where parallel combination current  $10I$  is given by

$$\frac{E}{R} + \frac{R}{n} = 10I$$

$$\frac{E}{R} + \frac{R}{n} = 10 \left( \frac{E}{R} + nR \right)$$

How according to problem

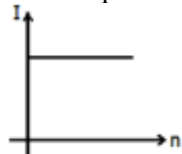
$$1 + n/I + I/n = 10$$

$$10 = (1 + n/n + 1) n$$

$$n = 10$$

21. (c)

$I$  is independent of the no. of batteries as the terminals of the battery are short circuited.



22. (d)



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

$$v = \sqrt{2gh}$$

$$\frac{1}{2}m(\sqrt{2gh})^2 = \frac{1}{2}mg\frac{D}{2} + MgD$$

$$h = \frac{D}{4} + D$$

$$h = \frac{5D}{4}$$

**23.(c)**

A - Solid sphere

B - Thin circular disc

C - Circular ring

As all are rotating about their own symmetry axis, they have rotational KE

$$I_{ss} = \frac{2}{5} MR^2$$

$$I_{dis} = \frac{MR^2}{2}$$

$$I_{ring} = MR^2$$

$$\therefore I_R > I_{Dis} > I_{ss}$$

$$W_C > W_B > W_A$$

**24.(d)**

Coefficient of sliding friction has dimensions of length.

**25.(b)**

Before:



After:



$$p_i = p_f$$

$$mv + 4m \times 0 = 4mv' + m \times 0$$

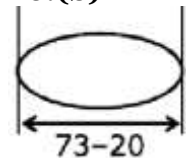
$$\Rightarrow mv = 4mv'$$

$$\Rightarrow v' = \frac{v}{4}$$

$$e = \frac{v_2 - v_1}{u_1 - u_2} \Rightarrow ev = \frac{v}{4}$$

$$\Rightarrow e = \frac{1}{4} = 0.25$$

**26.(b)**



$$53 = \lambda / 2$$

$$f = \frac{v}{\lambda}$$

$$320 = \frac{v}{106 \times 10^{-2}}$$

$$v = 339 \text{ m/s}$$

**27.(c)**

$$F = \frac{Q^2}{2A\epsilon_0}$$

the force F is independent of the distance between the plates.

**28.(b)**

$$a = -\omega^2 x$$

taking magnitude only

$$\omega = 2\text{rad/sec}$$

time period of oscillation

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{2} = \pi \text{ sec}$$

**29.(c)**

$$S = ut + \frac{1}{2}at^2$$

$$h = \frac{eE}{2m_e}t^2$$

As a result

$$t \propto m^{\frac{1}{2}} \quad h$$

But the  $m_e < m_p$

Therefore

$$t_e < t_p$$

**30. (c)**

$$v = v_0 \hat{i}, \vec{E} = -E_0 \hat{j}$$

$$v = v_0 + \frac{E_0 e t}{m}$$

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

$$\lambda = \frac{h}{m \left( v_0 + \frac{E_0 e t}{m} \right)}$$

$$\lambda = \frac{h}{mv_0 \left( 1 + \frac{E_0 e t}{mv_0} \right)}$$

$$\lambda = \frac{\lambda_0}{1 + \left( \frac{eE_0}{mv_0} \right) t} \quad \left( \lambda_0 = \frac{h}{mv_0} \right)$$

**31. (c)**

$$N_0 = 600$$

$$N_0 \xrightarrow{\frac{T}{2}} \frac{N_0}{2} \xrightarrow{\frac{T}{2}} \frac{N_0}{4}$$

$$600 \rightarrow 300 \rightarrow 150$$

450 nuclei disintegration in  $2t_{1/2}$  life

$$N = \frac{N_0}{2^n}$$

$$150 = \frac{600}{2^n}$$

$$2^n = 4$$

$$n = 2$$

$$\frac{T}{t_{1/2}} = 2$$

$$t_{1/2}$$

$$T = 2 \times 10 = 20 \text{ min}$$

**32. (c)**

$KE_{\text{max}} = \text{Energy} - \text{Work function}$

$$\frac{1}{2}mv_1^2 = h(2\nu_0 - \nu_0)$$

$$\frac{1}{2}mv_1^2 = h\nu_0 \dots (1)$$

$$\frac{1}{2}mv_2^2 = h(5\nu_0 - \nu_0)$$

$$\frac{1}{2}mv_2^2 = 4h\nu_0 \dots (2)$$

Dividing (1) by [2]

$$\frac{\frac{1}{2}mv_1^2}{\frac{1}{2}mv_2^2} = \frac{h\nu_0}{4h\nu_0}$$

$$\frac{v_1^2}{v_2^2} = \frac{1}{4} \Rightarrow \frac{V_1}{V_2} = \sqrt{\frac{1}{4}}$$

$$\frac{V_1}{V_2} = \frac{1}{2}$$

**33.(b)**

$$\text{Kinetic Energy} = \frac{13.6z^2}{n^2}$$

$$\text{Total Energy} = -13.6 \frac{z^2}{n^2}$$

$$TE = -KE$$

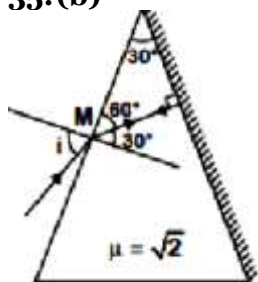
$$\therefore \frac{KE}{TE} = 1:-1$$

**34.(b)**

$$\vec{S} = \vec{E} \times \vec{B}$$

The direction of propagation of EM wave is towards positive x-axis (i) and  $E$  is given in positive direction of y axis direction  $[j]$ , So by using right hand thumb rule we can say that the direction of B is along positive direction of Z- axis.

**35.(b)**



To retrace its path the ray should incident normally on the silvered surface,

$$r_2 = 0$$

$$r_1 = A$$

On applying snell's law

$$1 \times \sin i = n \sin A$$

$$\sin i = \sqrt{2} \sin 30^\circ$$

$$i = 45^\circ$$

Here  $e = 0$

(No emergence)

**36.(d)**

$$\frac{1}{2}LI^2 = 25 \times 10^{-3}$$

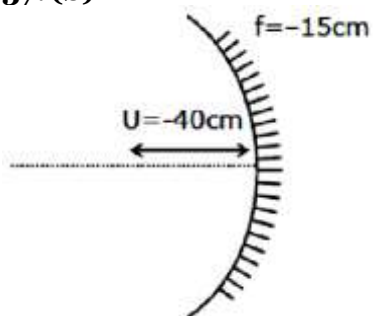
$$L = \frac{2 \times 25 \times 10^{-3}}{(60 \times 10^{-3})^2}$$

$$= \frac{50 \times 10^{-3}}{36 \times 10^{-4}}$$

$$= 1.389 \times 10$$

$$= 1.389 \times 10$$

37. (b)



Initial position of the image

$$\frac{1}{v_1} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v_1} - \frac{1}{40} = -\frac{1}{15}$$

$$\frac{1}{v_1} = \frac{1}{40} - \frac{1}{15}$$

$$\frac{1}{v_1} = \frac{15 - 40}{600}$$

$$v_1 = -\frac{600}{25} \Rightarrow -24 \text{ cm}$$

Final position of the image after the object is displaced by 20 cm towards the mirror.

$$\frac{1}{v_2} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v_2} - \frac{1}{20} = -\frac{1}{15}$$

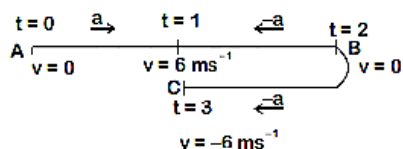
$$\frac{1}{v_2} = \frac{1}{20} - \frac{1}{15}$$

$$\frac{1}{v_2} = \frac{15 - 20}{300}$$

$$v_2 = \frac{300}{-5} \Rightarrow -60 \text{ cm}$$

Displacement of image =  $60 - 24 = 36 \text{ cm}$

38. (b)



$t=0, v=0$  and  $t=1, v=6$

$$6 = 0 + at$$

$$a = 6$$

Displacement for 1st second

Displacement for 2<sup>nd</sup> second

$$x = \frac{1}{2} \times 6(1)^2 = 3$$

Displacement for 2<sup>nd</sup> second

$$S = 6 \times 1 - \frac{1}{2} \times 6 \times 1^2 = 3$$

After 2 second the car will stop and starts moving backward

$$V = u + at$$

$$0 = 6 - 6t$$

$$t = 1 \text{ second}$$

Displacement for 3<sup>rd</sup> second

$$S = 0 - \frac{1}{2} \times 6 \times 1^2 = -3$$

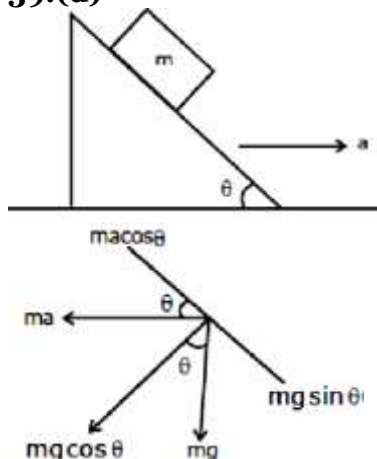
$$\text{Total displacement} = 3 + 3 - 3 = 3 \text{ m}$$

$$\text{Total distance} = 3 + 3 + 3 = 9 \text{ m}$$

$$|\vec{v}_{\text{avg}}| = \frac{3}{3} = 1 \text{ m/s}$$

$$V_{\text{avg}} = \frac{9}{3} = 3 \text{ m/s}$$

39. (d)



The component of forces along the inclined plane should be balanced

$$\therefore ma \cos \theta = mg \sin \theta$$

$$\Rightarrow a = g \tan \theta$$

40. (d)

$$LC = 0.001 \text{ cm}$$

$$\text{Main scale reading} = 5 \text{ mm}$$

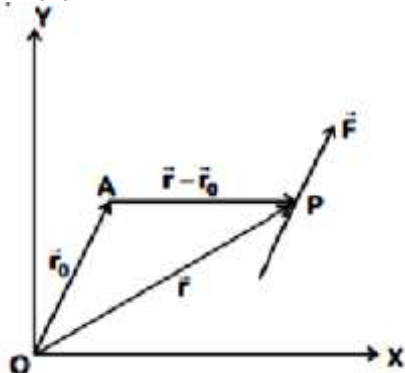
$$\text{Zero error} = -0.004$$

$$\text{GSR (least count)} = 0.025 \text{ cm}$$

$$D = 0.5 + 0.025 + 0.004$$

$$= 0.529 \text{ cm}$$

41. (d)



$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$\vec{r} = \vec{r} - \vec{r}_0$$

$$\vec{r} = (2i + 0j - 3k) - (2i - 2j - 2k)$$

$$\vec{r} = 2j - k$$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 2 & -1 \\ 4 & 5 & -6 \end{vmatrix}$$

$$\hat{i}(-12 + 5) - \hat{j}(+4) + \hat{k}(8)$$

$$\Delta \vec{r} = (2 - 2)\hat{i} + (0 + 2)\hat{j} + (-3 + 2)\hat{k}$$

$$= -7\hat{i} - 4\hat{j} - 8\hat{k}$$

**42.(a)**

$$P = eA\sigma T^4$$

$$P \propto T^4$$

According to wien's displacement law

$$\lambda_m \times T = \text{constant}$$

$$\lambda_1 \times T_1 = \lambda_2 \times T_2$$

$$\frac{T_1}{T_2} = \frac{\lambda_2}{\lambda_1}$$

$$P \propto \frac{1}{\lambda^4} \Rightarrow \frac{P_1}{P_2} = \left( \frac{\lambda_2}{\lambda_1} \right)^4$$

$$P_2 = P_1 \times \left( \frac{\lambda_1}{\lambda_2} \right)^4$$

$$= P_1 \left( \frac{\lambda_0}{3\lambda_0} \times 4 \right)^4$$

$$P_2 = P_1 \times \frac{256}{81}$$

**43.(c)**

$$\gamma = \frac{\text{stress}}{\text{strain}}$$

$$\gamma = \frac{F \times L}{A \Delta L}$$

$$\therefore \frac{FL}{A} = (\gamma \Delta L) = \text{constant}$$

$$\frac{F_1 L_1}{A_1} = \frac{F_2 L_2}{A_2}$$

$$F_2 = \frac{A_2 F_1 L_1}{A_1 L_2}$$

As the volume is same for both

$$A L_1 = 3 A L_2$$

$$L_2 = \frac{L_1}{3}$$

$$= \frac{F_1 \times L_1 \times 3A}{A \times \frac{L_1}{3}} = 9F_1$$

44. (b)

According to first law of thermodynamics

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

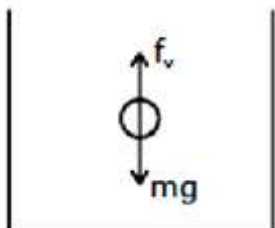
$$\Delta U = \Delta Q - \Delta W$$

$$\Delta U = 54 \times 4.2 - P(\Delta V)$$

$$\Rightarrow 54 \times 4.2 - [1,013 \times 10^5 \times 167.1 \times 10^{-6}]$$

$$\Rightarrow 208.7 \text{ Joule}$$

45. (a)



When terminal velocity is attained all the forces are balanced Viscous force = Weight

$$6\eta r v = \rho \left( \frac{4}{3} \pi r^3 \right) g$$

$$v \propto r^2$$

Rate of heat generated

$$\text{Power} = Fv$$

$$\text{Power} \propto (mg) v$$

$$\text{Power} \propto \rho \frac{4}{3} \pi r^3 g v$$

$$\text{Power} \propto r^5$$

## CHEMISTRY

46. (d)

$$\text{Total volume} = 75 \text{ mL } \frac{M}{5} \text{ HCl} + 25 \text{ mL } \frac{M}{5} \text{ NaOH} = 100 \text{ mL}$$

$$25 \text{ mL } \frac{M}{5} \text{ NaOH will neutralise } 25 \text{ mL } \frac{M}{5} \text{ HCl}$$

$$\text{Remaining HCl} = 75 - 25 = 50 \text{ mL}$$

$$[H^+] = \frac{M}{10} \times \frac{50}{100}$$

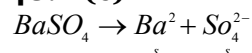
$$= \frac{M}{10}$$

$$\therefore pH = -\log \frac{1}{10} = 1$$

47. (c)

Coagulating power of an ion depends on both magnitude and sign of the charge on the ion.

48. (c)



$$K_{sp} = s^2$$

$$= \left( \frac{2.42 \times 10^{-3}}{233} \right)^2$$

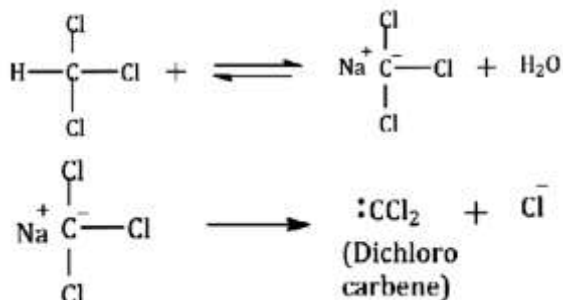
$$= 1.08 \times 10^{-10} \text{ mol}^2 / \text{L}^2$$

49. (c)

Ease of liquefaction depends on van der Waal's constant 'a'. It depends on the intermolecular force of attraction,

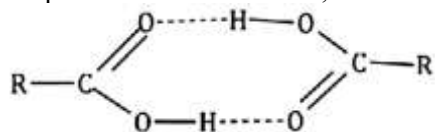
50. (d)

The electrophile involved in the reaction is dichlorocarbene ( $\text{:CCl}_2$ )

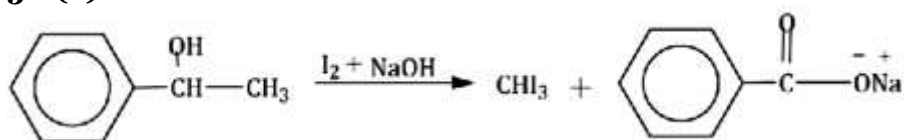


51. (d)

Carboxylic acids have higher boiling points than aldehydes, ketones and even alcohols of comparable molecular mass, It is due to formation of intermolecular H - bonding,



52. (a)



$\text{CHI}_3$  gives yellow precipitate and a characteristic medical smell.

53. (d)

Electronic configuration of (X) :  $1s^2 2s^2 2p^3$

Valence of X = 3

Electronic configuration of (Mg) :  $1s^2 2s^2 2p^6 3s^2$

Valence of Mg = 2

The formula of compound formed is  $\text{Mg}_3\text{X}_2$

54. (a)

For fcc lattice:  $Z = 4$

$$a = \frac{4r}{\sqrt{3}}$$

For bcc lattice:  $Z = 2$

$$a = 2\sqrt{2}r$$

$$\frac{d_{bcc}}{d_{fcc}} = \frac{(ZM / N_A \times a^3)_{bcc}}{(ZM / N_A \times a^3)_{fcc}}$$

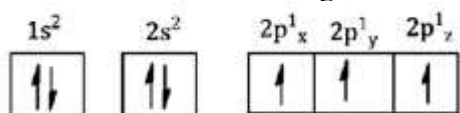
$$= \frac{2}{\left(\frac{2}{\sqrt{2}}\right)^3}$$

$$= \frac{\left(\frac{4r}{\sqrt{3}}\right)^3}{\left(2\sqrt{2}r\right)^3}$$

$$\frac{d_{bcc}}{d_{fcc}} = \frac{3\sqrt{3}}{4\sqrt{2}}$$

55. (a)

The correct electronic configuration of N- atom is



56. (b)

In  $\text{CN}^-$

$$\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2, \sigma 2p_z^2$$

$$BO = \frac{BMO - ABMO}{2}$$

$$= \frac{10-4}{2} = 3$$

In CN

$$\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2, \sigma 2p_z^1$$

$$BO = \frac{BMO - ABMO}{2}$$

$$= \frac{9-4}{2} = 2.5$$

In CN<sup>+</sup>

$$\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2$$

$$BO = \frac{BMO - ABMO}{2} = \frac{8-4}{2} = 2$$

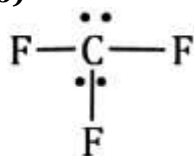
In NO

$$\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^1 = \pi^* 2p_y^0$$

$$BO = \frac{BMO - ABMO}{2}$$

$$= \frac{10-5}{2} = 2.5$$

57. (b)



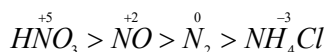
58. (d)

B < Ga < Al < In < Tl

Ga, Tl, In have d- electrons, which are less efficient at shielding the nuclear charge than s and p electrons, Due to the poor shielding, the outer electron are firmly held by the nucleus, Therefore the size of atoms with d<sup>10</sup> shell are smaller than expected,

59. (c)

The correct order of N - compounds in its decreasing order of oxidation states is



60. (a)

B (5): 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>1</sup>

Due to absence of vacant d-orbitals in boron it is unable to form MF<sub>6</sub><sup>3-</sup> ion

61. (a)

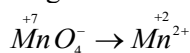
Fluorine has high ionisation energy due small size. It forms oxyacid HOF. The oxidation number of F in HOF is + 1.

62. (a)

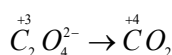
Metals with more negative ΔG value can reduce the metal oxides with low negative AG value, MgO is in the lower part of the Ellingham diagram as it has more negative ΔG value than alumina.

63. (b)

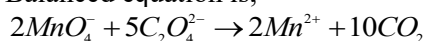
5e<sup>-</sup> gain



Loss of 2e<sup>-</sup>



Balanced equation is,



On balancing charge, the equation can be written as,  
 $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

**64.(c)**

On Increasing pressure, reaction will shift in to the direction where number of moles decreases i.e. forward direction. For exothermic reactions lower temperature favors product,

**65.(d)**

The correction factor, 'a' to the ideal gas equation corresponds to the force of attraction between the gas molecules

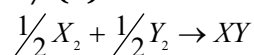
**66.(b)**

$$t_{1/2} = \frac{\text{Initial concentration}}{2k}$$

$$t_{1/2} \propto \text{Initial concentration}$$

Therefore, the half-life period of a zero order reaction is will be doubled, when initial concentration of the reactant is doubled,

**67. (a)**



$$\Delta_r H = \sum B.E_{(\text{reactants})} - \sum B.E_{(\text{products})}$$

$$-200 = \frac{1}{2}a + \frac{0.5}{2}a - a$$

$$= \frac{1}{2}a + \frac{1}{4}a - a$$

$$= \frac{3}{4}a - a$$

$$= -\frac{1}{4}a$$

$$a = 800 \text{ kJ / mol}$$

**68. (c)**

$$Co^{3+} - [Ar]3d^6, \text{ unpaired } e^-(n) = 4, \mu = \sqrt{n(n+2)}BM = \sqrt{24}BM$$

$$Cr^{3+} - [Ar]3d^3, \text{ unpaired } e^-(n) = 3, \mu = \sqrt{n(n+2)}BM = \sqrt{15}BM$$

$$Fe^{3+} - [Ar]3d^5, \text{ unpaired } e^-(n) = 5, \mu = \sqrt{n(n+2)}BM = \sqrt{35}BM$$

$$Ni^{2+} - [Ar]3d^8, \text{ unpaired } e^-(n) = 2, \mu = \sqrt{n(n+2)}BM = \sqrt{8}BM$$

**69.(d)**

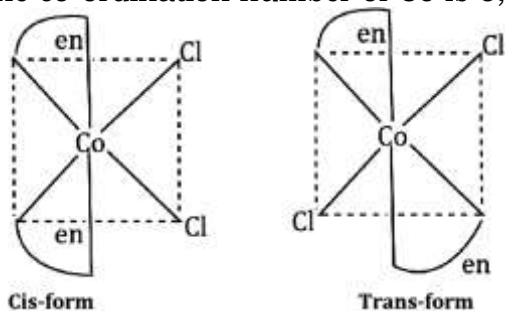


Unpaired electron = 1

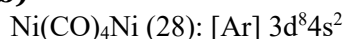
Therefore it is paramagnetic and it will show d-d transition,

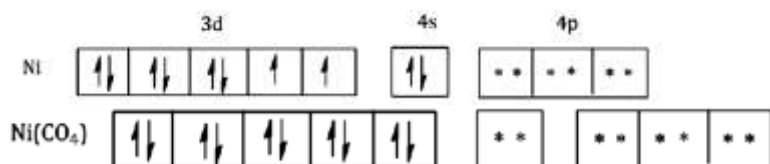
**70.(c)**

The co-ordination number of Co is 6, The complex has octahedral geometry.



**71. (b)**





The hybridization is  $sp^3$ , so the geometry is tetrahedral and it is diamagnetic.

72. (b)

$Fe(CO)_5$  is mononuclear as only one central metal atom is present.

73. (b)

For first order reaction:

$$t_{1/2} = \frac{0.693}{k}$$

k (independent of Initial concentration)

For second order reaction:

$$t_{1/2} = \frac{1}{k \times \text{Initial concentration}}$$

(depends on initial concentration)

74. (c)



Polarisation ↓ Ionic character ↑

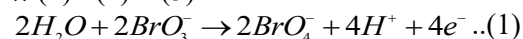
75. (b)

As,  $BrO_4^-$  is present in its highest oxidation

State (+7), so it will not undergo disproportionation,

Fro,  $BrO_3^-$

$$\therefore (1) + (2) = (3)$$



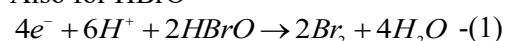
$$E_1^0 = -1.82$$



$$E_3^0 = \frac{-1.82 \times 4 + 1.5 \times 4}{4}$$

= -ve

Also for HBrO

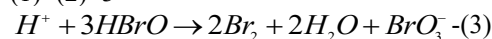


$$E_1^0 = 1.595$$



$$E_2^0 = -1.5V$$

$$(1) + (2) = 3$$



$$\therefore E_3^0 = \frac{1.595 \times 4 - 1.5 \times 4}{4} +ve$$

So, HBrO will disproportionate

76. (c)

$$(1) \text{ No, or moles} = \frac{0.00224}{22.4}$$

$$= 10^{-4} \text{ mole}$$

$$\text{No, of molecules} = 10^{-4} \times N_A$$

$$(2) \text{ No, of moles} = \frac{0.18}{18}$$

$$= 0.01 \text{ mole}$$

$$\text{No. of molecules} = 10^{-2} \times N_A$$

$$(3) d_{H_2O} = 1 \text{ gm / ml}$$

$$\therefore w = 18 \text{ gm}$$

$$\text{No. of moles} = \frac{18}{18}$$

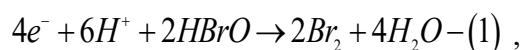
$$= 1 \text{ mole}$$

$$\text{No. of molecules} = 1 \times N_A$$

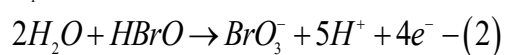
$$(4) 10^{-3} \text{ mole}$$

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

Also for HBrO

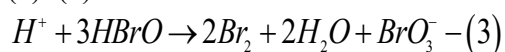


$$E_1^0 = 1.595$$



$$E_2^0 = -1.5V$$

$$(1) + (2) = 3$$

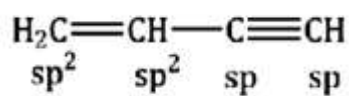


$$\therefore E_3^0 = \frac{1.595 \times 4 - 1.5 \times 4}{4} = +ve$$

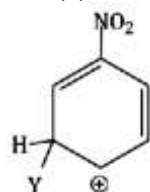
So, HBrO will disproportionate

**77. (b)**

Carbon - carbon double bonds:  $sp^2$  hybridised carbon atoms Carbon - carbon triple bonds:  $sp$  hybridized carbon atoms



**78. (a)**



is more stable as more number of resonating structures due less electron withdrawing group  $-NO_2$ .

**79. (c)**

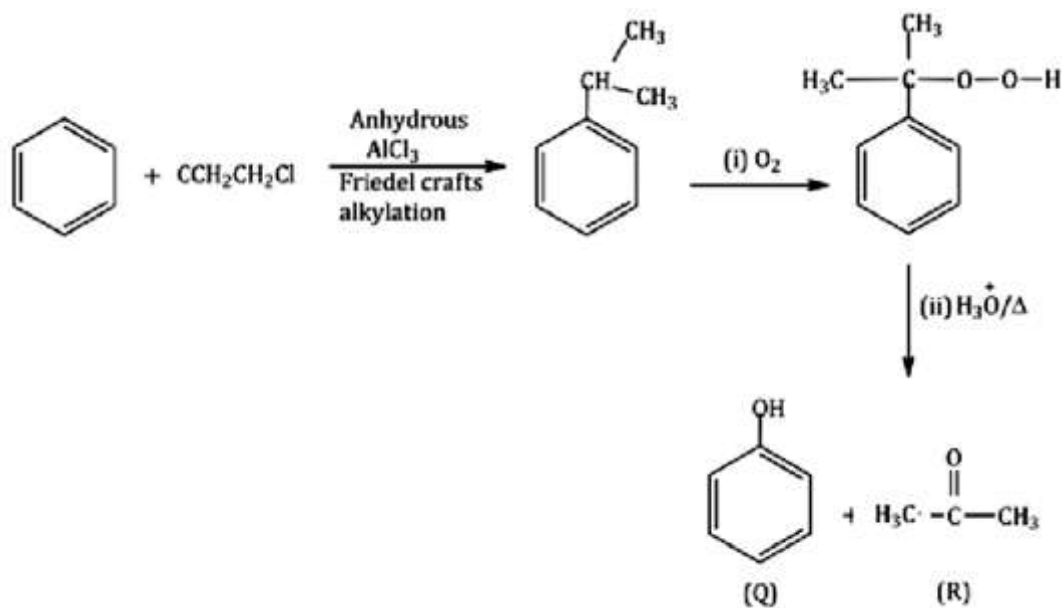
The correct with respect to -I effect is  $-NH_2 < OR < -F$

As the electronegativity increases -I effect also increases.

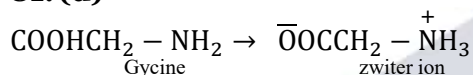
$-NR_2 < -OR < -F$  is also correct order.

**80. (d)**

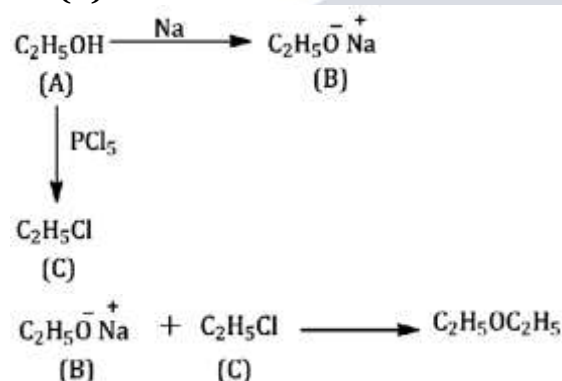
edu



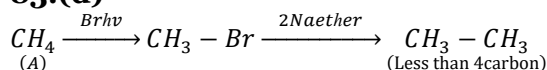
81. (d)



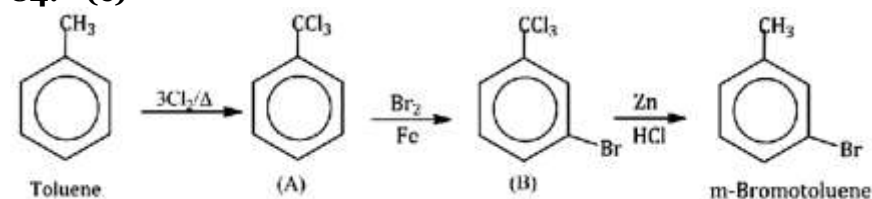
82. (d)



83. (d)



84. (c)



85. (c)

$\text{N}_2\text{O}_5$   
 $\text{NO}_2$  and  $\text{NO}$  are formed during the fuel combustion in automobile engines.  
 $\text{N}_2\text{O}$  occurs naturally in the atmosphere

86. (d)

Cross-linked or network polymers contain strong covalent bonds in their polymer chains. They are formed from bi-functional and tri-functional monomers.

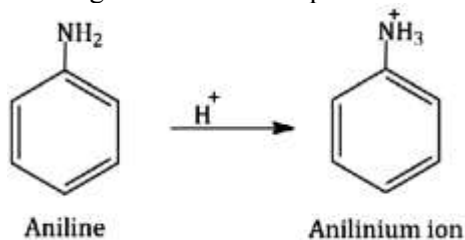
87. (b)

On moving down the group the atomic size increases and ionization energy decreases and elements become more basic. So the acidic strength decreases moving down the group.

88. (d)

In acidic medium, aniline is protonated to form anilinium ion, which is Meta

directing. Therefore Meta product is formed.



**89. (a)**

No. of moles of HCOOH are:

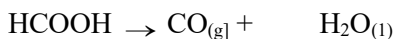
$$n = \frac{2.3}{46}$$

n = 0.05 moles

No. of moles of H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> are:

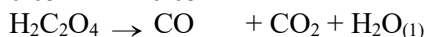
$$n = \frac{4.5}{90}$$

n = 0.05 moles



Initial 0.05 mol 0 0

Final 0.05 mol 0.05mol



Initial 0.05mol 0 0

Final 0 0.05 mol 0.05mol

CO<sub>2</sub> is absorbed by KOH and the remaining product is CO.

Therefore total no. of moles of CO formed in both the reactions is,

$$0.05 + 0.05 = 0.1 \text{ mole}$$

$$\text{Mass of CO formed} = 0.1 \times 28 = 2.8 \text{ gm}$$

**90. (c)**

Amylose and amylopectin are polymers of α - D glucose.

Amylose have linear 1 → 4α - linkage and amylopectin is branched and have 1 → 4α - linkage and 1 → 6α -linkage

## BIOLOGY

**91. (b)**

NAD<sup>+</sup> molecule acts as a shuttle for electrons during cellular respiration.

**92.(c)**

Green sulphur bacteria utilise H<sub>2</sub>S instead of H<sub>2</sub>O and performs an oxygenic photosynthesis, So, they do not evolve oxygen,

**93.(d)**

In angiosperms, double fertilisation refers to the fusion of one sperm cell with an egg (syngamy), and another sperm cell with the polar nuclei to yield a triploid endosperm (triple fusion),

**94.(c)**

Plants absorb iron mostly in the form of ferric (Fe<sup>3+</sup>) ions (as per NCERT). However, plants in the acidic soil can absorb iron in ferrous (Fe<sup>2+</sup>) as well as ferric (Fe<sup>3+</sup>) form. Iron is reversibly oxidised from Fe<sup>2+</sup> to Fe<sup>3+</sup> during electron transfer.

**95.(a)**

Among the given elements, potassium (K<sup>+</sup>) is responsible for maintaining turgor pressure in cells because it regulates the proton pumps involved in opening and closing of stomata,

Magnesium (Mg<sup>2+</sup>) is a constituent of chlorophyll pigment which helps in photosynthesis in green plants, Calcium (Ca<sup>2+</sup>) provides selective permeability to the cell membrane, Sodium (Na<sup>+</sup>) is involved in membrane permeability.

**96.(b)**

Yucca gloriosa has developed an obligate symbiotic relationship with pronuba moth, The female yucca moth is the sole pollinator of the yucca plant, and the yucca is the only caterpillar host plant of the yucca moth.

**97.(a)**

Pollen grains can be stored for several years in liquid nitrogen having temperature of  $-196^{\circ}\text{C}$ . This method is called cryopreservation. The low temperature allows storage for a longer period by reducing the growth rate of cells, The cry protective agents delay the aging of plants and protect the plants from the damages due to cold,

**98. (c)**

The given data depicts an inverted pyramid of biomass, usually found in an aquatic ecosystem. Upright pyramid of biomass and numbers are not possible since the data depicts that the biomass of primary producer is less than that of the primary consumer which again is less than the secondary consumers. Pyramid of energy is always upright,

**99.(b)**

Natality is the birth rate within a population. Natalty when compared with mortality rate can be used to determine the growth or decrease in a population,

**100. (b)**

CFCs and other halogenated ozone depleting substances are mainly responsible for man-made chemical ozone depletion. CFCs rise into the stratosphere where they are eventually broken down by UV rays from the Sun. This causes them to release free chlorine, The chlorine reacts with oxygen which leads to the chemical process of destroying ozone molecules,

**101. (b)**

CFCs and other halogenated ozone depleting substances are mainly responsible for man-made chemical ozone depletion. CFCs rise into the stratosphere where they are eventually broken down by UV rays from the Sun. This causes them to release free chlorine, The chlorine reacts with oxygen which leads to the chemical process of destroying ozone molecules,

**102. (d)**

Joseph Grinnell in 1917 coined the term niche which he used as largely equivalent to a species habitat, Niche refers to the functional role played by the organism where it lives

**103. (d)**

A primary pollutant is a pollutant emitted directly from a source, A secondary pollutant is not directly emitted from the source but gets formed when other primary pollutants react in the atmosphere, Ozone ( $\text{O}_3$ ) is a secondary pollutant,

**104. (c)**

In gymnosperms, ovules are not enclosed by ovary wall, Seeds are not enclosed within the fruit They are naked, Horsetail is the common name of Equisetum. Pteridophytes like Selaginella and Salvinia are heterosporous and possess two types of spores, i.e, microspores and megaspores, Cycas has an unbranched columnar stem while Cedrus possess branched stem.

**105. (c)**

Some lateral roots of mangroves become specialised as pneumatophores in saline mud flats. These are lateral roots that grow upward for varying distances and function as the site of oxygen intake for the submerged primary root system,

**106. (b)**

Sweet potato is a modified adventitious root for the storage of food, Rhizomes are underground modified stem. Tap root is a primary root directly elongated from the radicle,

**107. (b)**

Secondary tissues are generated from the growth of cambium, Vascular cambium gives rise to secondary xylem on the inside, and secondary phloem on the outside,

**108. (a)**

Sporozoans such as Plasmodium are end parasites, They lack Locomotors organelles like cilia, flagella and pseudopodia, Pseudopodia are found in amoeboid protozoans, e.g., Amoeba and Entamoeba.

**109. (d)**

Casparian strip is a band of cell wall material deposited in the radial and transverse walls of the endodermis. Casparian strip is made of suberin and sometimes lignin,

**110. (c)**

Grasses are monocots and monocots usually do not exhibit secondary growth, Palm like monocots have anomalous secondary growth.

**111. (d)**

In 1997, an American company got patent rights on Basmati rice through the US patent and trademark office. This variety was actually been derived from Indian farmer's varieties. Indian basmati was crossed

with semi-dwarf varieties and claimed as an invention or a novelty. Sharbati Sonora and Lerma Rojo are varieties of wheat.

**112. (c)**

Retrovirus is commonly used as a vector for introducing a DNA fragment in human lymphocytes.

**113. (b)**

Biopiracy refers to the use of bioresources by multinational companies and organization without authorisation from the country and the people concerned with compensatory payment,

**114. (c)**

Ribozyme is a catalytic RNA which is a nucleic acid.

**115. (d)**

PCR involves three major steps in the synthesis of DNA - (a) denaturation of the template into single strands [b] annealing of primers to each original strand for the synthesis of new strand (c) extension of the new DNA strands from the primers.

**116. (d)**

Indian Government has set up an organisation called Genetic Engineering Appraisal Committee (GEAC) which makes decisions regarding the validity of the GM research and safety of introducing GM organisms for public services.

**117. (b)**

During diplotene stage of meiosis, there is dissolution of synaptonemal complex and the recombined homologous chromosomes of the bivalents tend to separate.

**118. (b)**

Golgi complex after processing, packages the substances into vesicles and either stores them for later use or sends them out of the cell, It is also involved in the synthesis of lysosomes.

**119. (a)**

Light, temperature and CO<sub>2</sub> concentration affect the opening and closing of stomata. O<sub>2</sub> concentration has not effect on this activity.

**120. (c)**

Grass being a monocot, has dumb-bell shaped stomata in its leaves.

**121. (d)**

Sugar is a carbohydrate, Carbohydrates are polyhydroxy aldehydes, ketone or their derivatives. This implies that they have carbonyl and hydroxyl groups in their structure.

**122. (b)**

ATP, NADPH and oxygen are products of light reaction while NADH is a product of respiration.

**123. (d)**

The nucleolus is a large, distinct, spherical sub-compartment of the nucleus in eukaryotic cells. It acts as the site for the synthesis of ribosomal RNA and assembly of ribosomal subunits.

**124. (c)**

Saccharomyces [yeast] is a unicellular fungi (eukaryote). Mycobacterium is a bacterium, Oscillatoria and Nostoc are cyanobacteria

**125. (d)**

Winged pollen grains are present in Pinus. Each pollen grain has two wing-like structures which enable it to float in air as an adaptation for dispersal by wind.

**126. (a)**

In Agaricus (a genus of basidiomycetes), basidiospores or meiospores are produced exogenously. Neurospora (a genus of ascomycetes) produces ascospores as meiospores but endogenously inside the ascus, Alternaria (a genus of deuteromycetes) does not produce sexual spores, Saccharomyces (unicellular ascomycetes) produces ascospores, endogenously.

**127. (c)**

Polysiphonia is a genus of red algae where asexual spores and gametes are non-motile or non-flagellated,

**128. (d)**

Herbarium is a place where dried and pressed plant specimens mounted on sheets are kept, Key is a booklet containing a list of characters and their alternates which are helpful in identification of various taxa, Museum is a place having a collection of preserved plants and animals, Catalogue is a list that enumerates methodically all the species found in an area with brief description aiding identification.

**129. (c)**

A monocarpic flowers and produces seeds only once before drying, e.g. bamboo. A polycarpic plant

reproduces sexually more than once in its lifetime, e.g., Jackfruit mango and papaya,

**130. (c)**

Starch synthesis in pea is controlled by pleiotropic gene, Pleiotropy occurs when one gene influences two or more seemingly unrelated phenotypic traits,

**131. (b)**

Offset is a vegetative part of the plant formed by mitosis.

**132. (d)**

Solution: Sporopollenin cannot be degraded by enzymes, strong acids and alkalis, Therefore, it is helpful in preserving pollen as fossils

**133. (b)**

Punnett, a British scientist devised the 'Punnett Square' to depict the number and variety of genetic combinations, Franklin Stahl proved the semi-conservative mode of DNA replication. Transduction was discovered Zinder and Lederberg. Spliceosome formation is a part of the post-transcriptional change in eukaryotes.

**134. (b)**

Semiconservative replication of DNA was first shown in a bacterium, Escherichia coli by Matthew Meselson and Franklin Stahl.

**135. (d)**

Francois Jacob and Jacques Monod proposed the model of gene regulation called operon model (lac operon). Alec Jeffreys gave the DNA fingerprinting technique, Matthew Meselson and F. Stahl gave the semi conservative DNA replication in E.coli. Alfred Hersbey and Martha Chase proved DNA as the genetic material and not protein.

**136. (b)**

Tidal volume (TV) is the volume of air inspired or expired during normal respiration, It is approximately 500 mL, Inspiratory reserve volume (IRV) is additional volume of air a person can inspire by forceful inspiration, It is around 2500-3000 mL, Expiratory reserve volume (ERV) is additional volume of air a person can expire by forceful expiration. This averages 1000-1100 mL, Residual volume (RV) is volume of air remaining in lungs even after forceful expiration, This averages 1100-1200 mL,

**137. (c)**

Asthma is a long-term inflammatory disease of the airway of the lungs. It results in difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles. Emphysema is a chronic disorder in which alveolar walls are damaged due to which the respiratory surface is decreased. It is primarily caused by smoking.

**138. (c)**

Tricuspid valves are AV valves present between the right atrium and right ventricle of the heart, Bicuspid valves are AV valves present between the left atrium and left ventricle, Semilunar valves are present at the openings of the aortic and pulmonary aorta,

**139. (a)**

Unlike eukaryotes, in prokaryotes, the genes are organized into an operon. An operon is made up of several structural genes arranged under a common promoter and regulated by a common operator.

**140. (c)**

Coding strand and mRNA have similar nucleotide sequence except, thymine (T) is replaced by uracil (U) in mRNA,

**141. (b)**

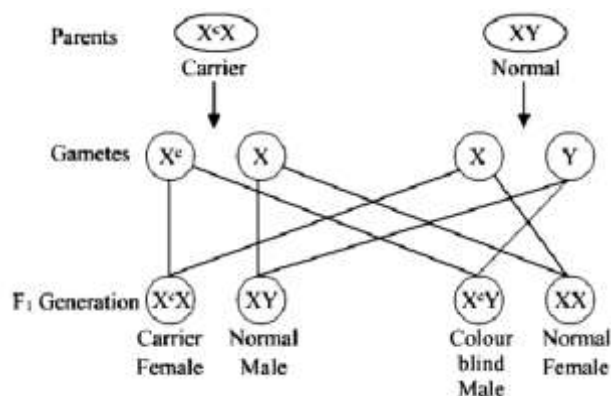
As per the mutation theory given by Hugo de vries, evolution is a discontinuous phenomenon or saltatory phenomenon or saltation,

**142. (a)**

In proliferative phase, the follicles start developing, Hence, it is also called follicular phase, Secretory phase also called luteal phase is mainly controlled by progesterone secreted by corpus luteum, Menstruation involves breakdown of overgrown endometrial lining,

**143. (d)**

woman acts as a carrier. Both son and daughter inherit the X chromosome, although only the son would be the deceased one.



144. (d)

Ciliates differ from other protozoans in having two types of nuclei, E.g. Paramecium has two types of nuclei, macronucleus and micronucleus.

145. (a)

The digestive tract of Aves has additional chambers called crop and gizzard. Crop is associated with the storage of foodgrains whereas gizzard is a masticatory organ in birds used to crush foodgrains.

146. (b)

Diatoms are the chief producers in some oceans and in some seasons as they are the primary producers of food and the food chain in marine ecosystem depends on them.

147. (b)

Male cockroaches bear a pair of short thread-like anal styles which are absent in females. Anal/caudal styles arise from the 9<sup>th</sup> abdominal segment in male cockroaches.

148. (c)

Metamorphosis refers to the transformation of larva into an adult, Animals that undergo metamorphosis are said to have indirect development, Earthworms have a direct development which means no larval stage is formed. Hence, there is no metamorphosis in earthworms

149. (b)

Homeotherms are organisms which have a body temperature that is relatively constant and independent of the environmental temperature. Most mammals including humans as well as birds are endothermic homeotherms. Most fishes, invertebrates, reptiles and amphibians are ectothermic poikilotherms, Chelone (turtle) belongs to class Reptilia. Hence, it is a poikilotherm or cold-blooded animal.

150. (c)

The muscles that move the eyeball are attached to the sclera, Suspensory ligament of lens- a series of fibres that connect the ciliary body of the eye with the lens holding it in place.

151. (b)

The limbic system is responsible for the experience and expression of emotion but not movement. It is located in the core of the brain and includes the amygdala, hippocampus and hypothalamus.

152. (a)

Osteoporosis is mainly caused due to excess of parathyroid hormone, advanced age and lack of estrogen in older females. Estrogen promotes the activity of osteoblast and inhibits osteoclast. Parathormone promotes mobilisation of calcium from bone into blood. Excessive activity of parathormone causes demineralisation leading to osteoporosis.

153. (c)

Epinephrine is derived from tyrosine by the removal of carboxyl group. It is a catecholamine.

154. (d)

Glycosuria denotes presence of glucose in the urine. Gout is due to deposition of uric acid crystals in the joint. Renal calculi are precipitates of calcium phosphate produced in the pelvis of the kidney. Glomerular nephritis is the inflammatory condition of glomerulus characterised by proteinuria and haematuria.

155. (b)

In renal physiology, ultrafiltration occurs at the barrier between the blood and the filtrate in the

glomerular capsule in the kidneys. Concentration of urine refers to water absorption from glomerular filtrate created by counter-current mechanism in Henle's loop. Urine is carried from the kidney to bladder through ureter. Urinary bladder is for storage of urine.

**156. (d)**

Parietal or oxyntic cell is a source of HCl and intrinsic factor, HCl converts iron present in the diet from ferric to ferrous form so that it can be absorbed easily and used during erythropoiesis, Intrinsic factor is essential for the absorption of vitamin B<sub>12</sub> and its deficiency causes pernicious anaemia.

**157. (d)**

Fibrinogen forms fibrin strands during coagulation. These strands form a network, the meshes of which are occupied by blood cells. This structure finally forms a clot. Antibodies are derived from gamma-globulin fraction of plasma proteins which means globulins are involved in defence mechanisms. Albumin is a plasma protein mainly responsible for Blood Colloidal Osmotic Pressure (BCQP)

**158. (c)**

The sarcoplasmic reticulum releases calcium ions into the muscle interior where they bind to troponin, thus causing tropomyosin to shift from the face of the actin filament to which myosin heads need to bind to produce contraction.

**159. (b)**

Silicosis is an occupational disease caused due to excess inhalation of silica dust in the workers involved in grinding or stone breaking industries.

**160. (d)**

Oxidative phosphorylation takes place in the inner mitochondrial membrane,

**161. (d)**

Nissl bodies are present in the cell body of a neuron. When observed under an electron microscope, they appear to be composed of rough endoplasmic reticulum (RER) and free ribosomes and thus, help in protein synthesis.

**162. (d)**

Polytene chromosomes are found in the salivary glands of insects of order Diptera,

**163. (c)**

A polyribosome or polysome is a complex of an mRNA molecule and two or more ribosomes that act to translate the mRNA instructions into polypeptides.

**164. (d)**

Phospholipid synthesis does not take place in rough endoplasmic reticulum (RER), Smooth endoplasmic reticulum (SER) is involved in lipid synthesis

**165. (b)**

In thecodont dentition, teeth are present in the sockets of the jaw bone called alveoli. In diphyodont dentition, teeth erupt twice, temporary milk or deciduous teeth are replaced by a set of permanent or adult teeth. In heterodont dentition, it consists of different types of teeth namely incisors, canines, premolars and molars.

**166. (c)**

Whenever the pre-reproductive individuals or the younger population size is larger than the reproductive group, the population will be an increasing population,

**167. (a)**

Eutrophication is the nutrient enrichment of a water body. Sanitary landfill is a method of solid waste disposal. Snow blindness is characterised by the burning of the cornea by UV-B radiation. Jhum cultivation is the process of growing crops by first clearing the land of trees and vegetation and burning them thereafter,

**168. (b)**

Smack also called brown sugar or heroin is formed by the acetylation of morphine. It is obtained from the latex of unripe capsule of Poppy plant [*Papaver somniferum*].

**169. (d)**

Amensalism is an association between organisms of two different species in which one organism is inhibited or destroyed and the other is unaffected. Antibiotics are chemicals secreted by one microbial group (e.g, *Penicillium*) which harm the other microbes (e.g, *Staphylococcus*). They have no effect on *Penicillium* or the organism which produces them,

**170. (b)**

In-situ conservation is the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species, e.g. sacred groves

**171. (a)**

Placenta is an endocrine gland which is present only during pregnancy. It releases hCG, hPL, progesterone and estrogens, Human chorionic gonadotropic hormone (hCG) stimulates the corpus luteum during pregnancy to release estrogen and progesterone. Human placental lactogen (hPL) is involved in the growth of the body of mother and the breasts. Progesterone maintains pregnancy.

**172. (c)**

Saheli is world's first and the only oral, non-steroidal contraceptive pill which can be consumed once a week. Its functioning is based on selective estrogen receptor modulation and prevents the egg from getting implanted.

**173. (d)**

Spermiogenesis is the conversion of spermatids into spermatozoa whereas spermiation is the release of the sperms from the Sertoli cells into the cavity of seminiferous tubule.

**174. (c)**

The extraembryonic membranes are amnion, chorion, allantois and yolk sac. Amnion is derived from mesoderm on the outer side and ectoderm on the inner side. Chorion is formed from trophoblast and mesoderm whereas allantois and yolk sac membrane have mesoderm on the outside and endoderm on inner side.

**175. (c)**

The similarity of bone structure in the forelimbs of many vertebrates is an example of homology. The homologous organs have the same fundamental structure but are adapted to perform different functions, e.g, forelimbs of man, cheetah, whale and bat. Analogous organs show convergent evolution. These organs have similar functions but are different in their structural details and origin.

**176. (c)**

Lymphatic filariasis also known as elephantiasis is a human disease caused by parasitic filarial worms. It is caused by round worm *Wuchereria bancrofti* and is transmitted by the *Culex* mosquito

**177. (a)**

Alzheimer's disease is a neuro degenerative disorder caused due to the deficiency of neurotransmitter acetylcholine. Rheumatoid arthritis is an autoimmune disorder in which antibodies are produced against the synovial membrane and cartilage. Vitiligo is also an autoimmune disorder which causes white patches on the skin, Psoriasis is an autoimmune skin disease which causes itchy or sore patches of thick red skin.

**178. (b)**

For blood groups in humans,

$I^A I^O$ ,  $I^B I^O$  - Dominant-recessive relationship

$I^A I^B$  - Codominance

$I^A$ ,  $I^B$ ,  $I^O$  - Three different allelic forms of a gene (multiple allelism)

**179. (d)**

Divergent evolution occurs when two separate species evolve differently from a common ancestor. Divergent evolution demonstrates how species can have common anatomical structures (homologous). Convergent evolution occurs when species have different ancestral origins but have developed similar features. Eye of octopus, bat and man are examples of analogous organs showing convergent evolution

**180. (a)**

Curd has increasing amount of vitamins specially vitamin  $B_{12}$ . This improves its nutritional value than milk.