SOLUTIONS

PHYSICS

1. (d)

2. (c): Acceleration $= \frac{d^2x}{dt^2}$

For part OP, the acceleration is positive as the velocity is increasing. Slope is increasing. For part PQ, the acceleration is zero. Horizontal straight line shows that the velocity is zero. For part QR, acceleration is negative. It is retarded motion. Velocity is decreasing as the slope decreases with time. Hence option (c) is correct.

3. (a): Centripetal force $(F) = \frac{mv^2}{r}$ $\therefore$ $v = \sqrt{\frac{Fr}{m}}$

4. (b): Momentum of rifle = Momentum of bullet $m_1v_1 = m_2v_2$, Also $m_1 > m_2$

$$\frac{\text{K.E. of rifle}}{\text{K.E. of bullet}} = \frac{\frac{1}{2}m_1v_1^2}{\frac{1}{2}m_2v_2^2}$$

$$= \frac{m_1^2v_1^2}{m_1} \cdot \frac{m_2}{m_2^2v_2^2} = \frac{m_2}{m_1}$$

K.E. of rifle is less than K.E. of bullet.

5. (a): Distance of corner mass from opposite side $= r$

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

$$I = mr^2 = \frac{3}{4}ml^2$$

6. (c) : Using Lami's theorem, we have

$$\frac{P}{\sin\theta_1} = \frac{R}{\sin 150^\circ} \Rightarrow \frac{P}{\sin\theta_1} = \frac{R}{\sin(180^\circ - 30^\circ)}$$

$$\Rightarrow \frac{1.9318 \text{ kgwt}}{0.9659} = \frac{R}{1/2}$$

$$\Rightarrow R = \frac{1.9318}{0.9659} \times \frac{1}{2} \text{ kgwt} = 1 \text{ kgwt}.$$

7. (a) : Gravitational force, $F \propto \frac{1}{r^n}$

$$F = \frac{k}{r^n}$$ where k is a constant.

For a planet, moving in a circular orbit of radius R, $F = \frac{k}{R^n}$

But, $F = m\omega^2R$

$$\Rightarrow \frac{k}{R^n} = mR \cdot \left(\frac{2\pi}{T}\right)^2 \Rightarrow \frac{k}{R^{n+1}} = \frac{m(2\pi)^2}{T^2}$$

$$\Rightarrow T^2 \propto R^{n+1}$$

$$\therefore T \propto R^{\frac{n+1}{2}}$$

8. (a) : $n_h = 10^{21}$ atoms/m^3

$n_i = 10^{19}$ atoms/m^3, $n_e = ?$

$n_en_h = n_i^2$

$$n_e = \frac{n_i^2}{n_h} = \frac{(10^{19})^2}{10^{21}} = \frac{10^{38}}{10^{21}} = 10^{17} \text{ atoms/m}^3.$$

9. (a) : In series combination, $\frac{t}{K_1} + \frac{t}{K_2} = \frac{2t}{K}$

$$\Rightarrow \frac{1}{K_1} + \frac{1}{K_2} = \frac{2}{K} \Rightarrow k = \frac{2K_1K_2}{K_1 + K_2}.$$

10. (d) : Fringe width, $\beta = \frac{\lambda D}{d}$

From question, $d' = 3d$

$\therefore$ New fringe width, $\beta' = \frac{\lambda D}{d'}$

$$\therefore \beta' = \frac{\lambda D}{3d} = \frac{\beta}{3}.$$

11. (a)

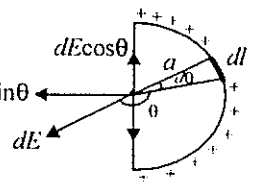
12. (d) : Due to insertion of slab, the optical path increases by x/μ, where x is thickness of slab. Therefore the converging point will shift away by

$$\left[x - \frac{x}{\mu}\right] = x\left(1 - \frac{1}{\mu}\right).$$

13. (a) : Velocity of electromagnetic wave is

$$c = \frac{1}{\sqrt{\mu_0\varepsilon_0}}.$$

14. (d) :



Electric field intensity at O due to small elemental length dl of charged ring,

$$dE = \frac{1}{4\pi\varepsilon_0}\cdot\frac{\lambda dl}{a^2} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{\lambda a d\theta}{a^2}$$

$$dE = \frac{1}{4\pi\varepsilon_0}\cdot\frac{\lambda}{a}d\theta$$

$\therefore$ Net electric field at centre O is

$$E = \int dE\sin\theta = \int_0^{\pi}\frac{1}{4\pi\varepsilon_0}\frac{\lambda}{a}\sin\theta d\theta$$

$$= \frac{\lambda}{4\pi\varepsilon_0 a}\left[-\cos\theta\right]_0^{\pi}$$

$$\therefore \quad E = \frac{\lambda}{2\pi\varepsilon_0 a}.$$

15. **(a)** : Impedance of RL circuit is

$$Z = \sqrt{R^2 + X_L^2}$$

where $X_L = \omega L = 2\pi f L$

$$\therefore\ Z = \sqrt{R^2 + (2fL)^2}.$$

16. **(c)** : Frequency of fundamental mode of vibrations of 1st closed organ pipe,

$$\upsilon_1 = \frac{v}{4l_1} = \frac{v}{4\times 100} \qquad \ldots (i)$$

Frequency of fundamental mode of vibrations of 2nd closed organ pipe,

$$\upsilon_2 = \frac{v}{4l_2} = \frac{v}{4\times 101} \qquad \ldots (ii)$$

From question, $\upsilon_1 - \upsilon_2 = \frac{16}{20}$

$$\Rightarrow \quad \frac{v}{4\times 100} - \frac{v}{4\times 101} = \frac{16}{20}$$

$$\Rightarrow \quad \frac{v}{4}\cdot\left[\frac{1}{100} - \frac{1}{101}\right] = \frac{16}{20}$$

$$\Rightarrow \quad \frac{v}{4}\left[\frac{101-100}{101}\right] = \frac{16}{20} \quad \Rightarrow \quad \frac{v}{4}\times\frac{1}{101} = \frac{16}{20}$$

$$\Rightarrow \quad v = \frac{16\times 101\times 4}{20} = 323.2 \text{ m/s}.$$

17. **(a)** : Stages 1 and 2 are at the same temperature. Also stages 4 and 5 are at same temperature. As V_p is more at higher temperature and same at all stages at equal temperature.

$\therefore \quad V_{P_3} > V_{P_1} = V_{P_2} > V_{P_4} = V_{P_5}$.

18. **(b)** : $-\frac{dN}{dt} = \lambda N \Rightarrow N_2 = \lambda N_1$

19. **(c)** : Kinetic energy is +ve (A)

|total energy| < |P.E.|

$\therefore$ $C \rightarrow$ total energy, B the P.E.

20. **(b)** : Net charge on system = 0

$\therefore$ Net force on system = 0.

Now consider one charge : $T = qvB$.

21. **(c)** : $Y = \frac{F/A}{\frac{\Delta l}{l}}$

$$\therefore\ F = \frac{YA}{l}\cdot\Delta l = k\cdot\Delta l$$

Force $\propto$ extension

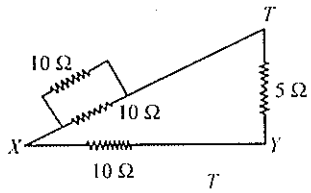
If the extension is x, work done in extending by dx

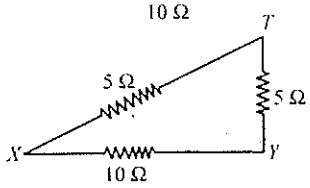
$$dW = kx\,dx \qquad \therefore\ W = \frac{1}{2}k\cdot x^2$$

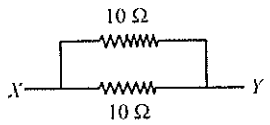
If x is $l' - l$, $W = \frac{1}{2}k(l'-l)^2$

i.e. work done is $\frac{1}{2}\frac{YA}{l}(l-l')^2$.

22. **(b)** :







$$R_{XY} = \frac{10\times 10}{10+10} = 5\ \Omega.$$

23. **(a)** : The magnetic intensity due to an isolated pole of strength m_p at a distance $(r) = \frac{m_p}{r^2}$

24. **(a)** : With increase in frequency, reactance of LC circuit will increase. As a result, voltage increases. So, brightness will increase.

25. **(c)** : When heater wires are connected in series then equivalent resistance,

$$R_s = R_1 + R_2 = 2R \qquad (\because\ R_1 = R_2)$$

Rate of heat produced, $H_s = \frac{V^2}{R_s}$

$$H_s = \frac{V_2}{2R} \quad \text{... (i)}$$

In second case, $R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{R \cdot R}{2R}$

or $R_p = \frac{R}{2}$

$\therefore$ Rate of heat produced, $H_p = \frac{V^2}{R_p}$

$$H_p = \frac{2V^2}{R} \quad \text{... (ii)}$$

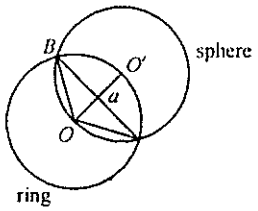
Dividing (i) by (ii), we get

$$\frac{H_s}{H_p} = \frac{(V^2/2R)}{(2V^2/R)} = \frac{v^2}{2R} \times \frac{R}{2V^2} = \frac{1}{4}.$$

26. **(a)**

27. **(a) :** Lumen is the S.I. unit of luminous flux.

28. **(c) :**



Charge on ring q, centre of ring = O

Centre of sphere = O'

Linear charge density of ring, $\lambda = \frac{q}{2\pi a}$

Charge on arc AB of ring,

$$q_{AB} = \lambda (\text{arc } AB) = \frac{1}{2\pi a} \cdot a \cdot \frac{2\pi}{3}$$

$q_{AB} = q/3$

i.e., charged enclosed by sphere = $q/3$

$\therefore$ Flux coming out of sphere = $q/3\varepsilon_0$.

29. **(a) :** For dc, $V = IR$ (R is resistance of inductor)

$100 = 1 \times R \implies R = 100\ \Omega$.

For ac, $Z = \sqrt{R^2 + X_L^2}$

$\because V = IZ$

$\Rightarrow 100 = 0.5\sqrt{R^2 + X_L^2}$

$\Rightarrow 100 = 0.5\sqrt{(100)^2 + X_L^2}$

$\Rightarrow 100 = \frac{5}{10}\sqrt{(100)^2 + X_L^2}$

$X_L^2 = (200)^2 - (100)^2 = 300 \times 100$

$\Rightarrow X_L = \sqrt{3 \times (100)^2} = 100\sqrt{3}$

$\Rightarrow \omega L = 100\sqrt{3} \implies 2\pi \upsilon L = 100\sqrt{3}$

$\Rightarrow 2 \times \pi \times 50 \times L = 100\sqrt{3}$

$\Rightarrow 100 \times \pi L = 100\sqrt{3}$

$\therefore L = \frac{\sqrt{3}}{\pi} = \frac{\sqrt{3}}{3.14} \implies L = 0.55$ H.

30. **(c) :** Resistance of 25 W, 200 V bulb

$$R_1 = \frac{(200)^2}{25}\ \Omega.$$

Resistance of 100 W, 200 V bulb

$$R_2 = \frac{(200)^2}{100}\ \Omega.$$

Clearly, $R_1 > R_2$. $\therefore$ $H_1 > H_2$.

$\therefore$ 25 W bulb will glow more brightly.

31. **(d)**

32. **(b) :** The forbidden gap in the energy band of Si = 1.1 eV.

33. **(a) :** Since the wavelength of violet light is the smallest, therefore maximum deviation will occur for violet light.

34. **(d) :** By truth table, $Y = \overline{A + B}$. Therefore it is a NOR gate operation.

35. **(d) :** Angle of first order diffraction (θ_1) = 32°.

We know that the angle of diffraction for the nth order (θ_n) is given by $d \sin \theta_n = n\lambda$.

For first order diffraction we get

$d \sin 32° = 1 \times \lambda$ or, $\lambda = d \sin 32°$.

Now for second order diffraction,

$d \sin \theta_2 = 2 \times \lambda$ or, $d \sin \theta_2 = 2 \times d \sin 32°$

or $\sin \theta_2 = 2 \times \sin 32° = 2 \times 0.529 = 1.06$.

Since the sine of any angle cannot be greater than 1, therefore there is no second order diffraction.

36. **(a)**

37. **(a) :** We know that $J = AT^2 e^{-b/T}$

$$\frac{J}{T^2} = Ae^{-b/T}$$

Taking log both side, we get

$$\log_e \frac{J}{T^2} = \log_e (A \cdot e^{-b/T})$$

$$\log_e \frac{J}{T^2} = \log_e A - \frac{b}{T}$$

Comparing with $y = mx + C$
we get correct option (a).

38. **(c)** : $h_0 = 5$ cm, $h_i = ?$
$u = -100$ cm, $R = -20$ cm. $\therefore$ $f = -10$ cm
Using mirror formula,

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f} \Rightarrow \frac{1}{v}-\frac{1}{100}=-\frac{1}{10}$$

$$\frac{1}{v}=\frac{1}{100}-\frac{1}{10}=\frac{1-10}{100}=-\frac{9}{100}$$

$$\therefore v=-\frac{100}{9}\text{ cm.}$$

$$\frac{h_i}{h_0}=\frac{v}{u} \Rightarrow \frac{h_i}{5\text{ cm}}=\frac{(100/9)}{100}=\frac{1}{9}$$

$\therefore$ $h_i = 5/9 = 0.55$ cm.

39. **(b)** : Magnifying power of compound microscope

$$M=-\frac{v_o}{u_o}\left(1+\frac{D}{f_e}\right)=-\frac{L}{f_o}\left(1+\frac{D}{f_e}\right)$$

40. **(c)**

41. **(b)** : From, $f=\frac{1}{2l}\sqrt{\frac{T}{\mu}}$, $f^2=\frac{T}{4l^2\mu}$

$$\text{or, } \mu=\frac{T}{4l^2f^2}=\frac{[MLT^{-2}]}{L^2T^{-2}}=\frac{M}{L}$$

$$=\frac{\text{Mass}}{\text{length}}=\text{linear mass density.}$$

42. **(c)** : As time of flight,

$$T=\frac{2u\sin\theta}{g} \quad \therefore \quad T'=\frac{2(nu)\sin\theta}{g}=nT$$

But range

$$R=\frac{u^2\sin 2\theta}{g} \quad \therefore \quad R'=\frac{n^2u^2\sin 2\theta}{g}=n^2R.$$

43. **(c)** : A needle placed carefully on the surface of water may float due to surface tension as upward force due to surface tension balances the weight of the needle. But these upward force due to surface tension are very small as compared to weight of ball. Also the weight of liquid displaced by the ball immersed in liquid is less than the weight of the ball, hence ball sinks into the liquid.

44. **(a)** : Green flower emit all folour except green and the emitted colours are dominated by red colour. So flower appear black.

45. **(c)** : Assertion is correct but reason is false because inductance reactance $X_L = 2\pi fL$. So, higher frequency greater inductance reactance.

46. **(b)**

47. **(b)** : Hardness penetrating power of X-ray depends upon accelerating voltage applied across X-ray tube. Characteristic X-ray relate to the material of target. X-ray can't pass through matter of heavier element like bones (which contain phosphorus and calcium) but can pass through matter of lighter element as flesh (which contain oxygen, hydrogen and carbon)

48. **(d)** : Emission transitions can take place between any higher energy level and any energy level below it while absorption transitions start from the lowest energy level only and may end at any higher energy level. Hence number of absorptions transitions between two given energy level. Hence number of absorptions transitions between two given energy levels is always less than the number of emission transitions between the same two levels.

49. **(a)** : $\frac{1}{f}=({}^a\mu_g-1)\left[\frac{1}{R_1}-\frac{1}{R_2}\right]$

$$=\left(\frac{\mu_g}{\mu_w}-1\right)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

$$\frac{1}{f}=\left(\frac{\mu_g-\mu_w}{\mu_w}\right)\cdot\left[\frac{1}{R_1}-\frac{1}{R_2}\right]$$

$$=\left(\frac{1.5-1.33}{1.33}\right)\cdot\left[\frac{1}{20}+\frac{1}{20}\right]$$

$$\frac{1}{f}=\frac{0.13\times 2}{20} \Rightarrow f=\frac{20}{0.26}$$

$\therefore$ $f = 76.92$ cm.

50. **(b)**

51. **(d)** : It is quite clear that magnetic poles always exists in pairs. Since, one can imagine magnetic field configuration with three poles. When north poles or south poles of two mangets are glued together. They provide a three pole field configuration. It is also know that a bar magnet does not exert a torque on itself due to own its field.

52. **(b)** : When the displacement of a particle executing SHM is y, then its

$$K.E.=\frac{1}{2}m\omega^2(a^2-y^2) \text{ and}$$

$$P.E.=\frac{1}{2}m\omega^2y^2.$$

For $K.E. = P.E.$ or $2y^2 = a^2$ or, $y = a/\sqrt{2}$. Since total energy remains constant through out the motion, which is $E = K.E. + P.E.$ So, when $P.E.$ is maximum then $K.E.$ is zero and vice versa.

53. **(c)** : Electric shock is due to the electric current flowing through a living body. When the bird perches on a single high power line, no current passes through its body because its body is at equipotential surface i.e., there is no potential difference. While when man touches the same line, standing bare foot on ground the electrical circuit is completed through the ground. The hands of man are at high potential and his feets are at low potential. Hence large amount of current flows through the body of the man and person therefore gets a fatal shock.

54. **(b)** : Stopping potential is a measure of maximum kinetic energy of emitted photoelectron ($eV_0 = K_{max}$) and K_{max} depends upon the frequency of incident light but is independent of intensity.

55. **(a)**

56. **(a)** : Magnetic moment, $M = nIA$

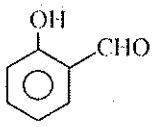
57. **(a)** : $V = E - I(R + r)$

58. **(a)**

59. **(d)** : The force on a charged particle moving in a uniform magnetic field always acts in direction perpendicular to the direction of motion of the charge. As work done by magnetic field on the charge is zero. [$W = FS\cos\theta$], so the energy of the charged particle does not change.

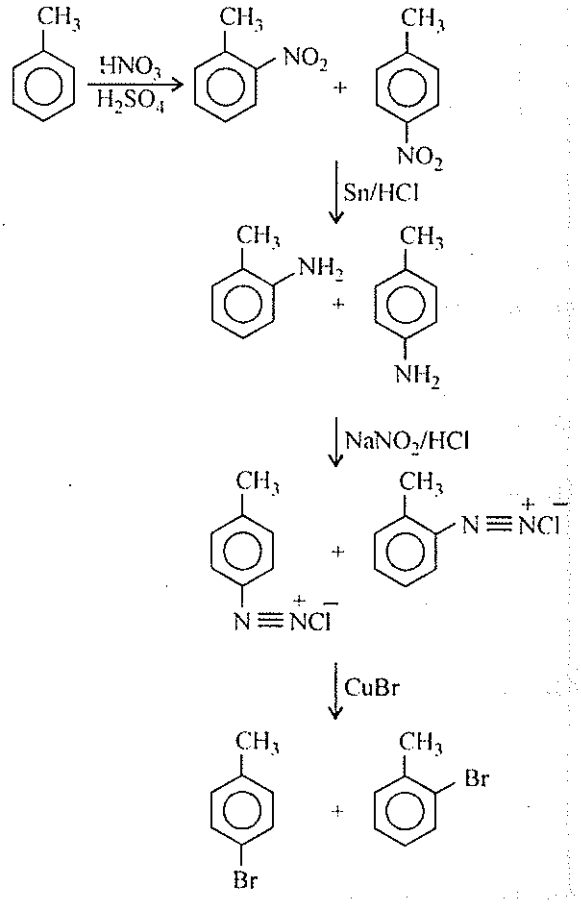
60. **(a)**

CHEMISTRY

61. **(b)** : X is  ; which undergoes Cannizzaro's reaction to give Z.

62. **(b)** : Slowest step of mechanism decides the rate expression. Thus rate = $K[NO_2][F_2]$.

63. **(d)** :
I $Na_2O + H_2O \rightarrow 2NaOH$
II $Na_2S + H_2O \rightarrow 2NaOH + H_2S$
III $Na_2Se + H_2O \rightarrow 2NaOH + H_2Se$
IV $Na_2Te + H_2O \rightarrow 2NaOH + H_2Te$
I will have the highest pH. Among H_2S, H_2Se, H_2Te acidity goes on increasing on going down the group as bond length increases on increasing size of central atom. So, $pH_4 < pH_3 < pH_2$
Overall order is $pH_1 > pH_2 > pH_3 > pH_4$

64. **(b)** :


65. **(d)** :

	$2AB_{2(g)}$	$\rightleftharpoons 2AB_{(g)}$	$+ B_{2(g)}$
Initial	2	0	0
Equilibrium	$2(1-x)$	$2x$	x

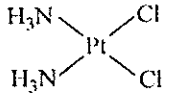
Moles at equilibrium $= 2(1-x) + 2x + x$
$= 2 - 2x + 2x + x = x + 2.$

$$K_p = \frac{[P_{AB}]^2[P_{B_2}]}{[P_{AB_2}]} = \frac{\left(\frac{2x}{x+2}\times p\right)^2\left(\frac{x}{2+x}\times p\right)}{\left[\frac{2(1-x)}{x+2}\times p\right]^2}$$

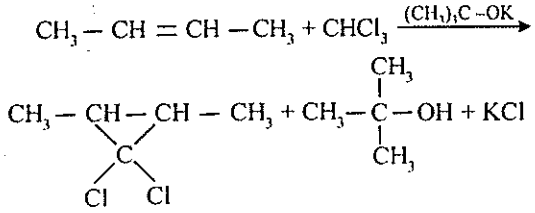
$$= \frac{\frac{4x^3}{x+2}\times p}{4(1-x)^2} = \frac{4x^2\times p}{2}\times\frac{1}{4}$$

$$x = \left(\frac{2K_p}{p}\right)^{1/3} \qquad (\text{as } 1-x \approx 1,\ 2+x \approx 2)$$

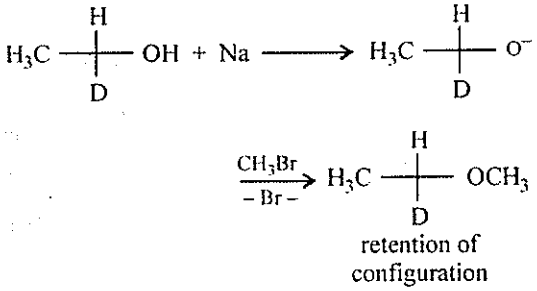
66. **(a) :** Cisplatin is effective in curing cancer



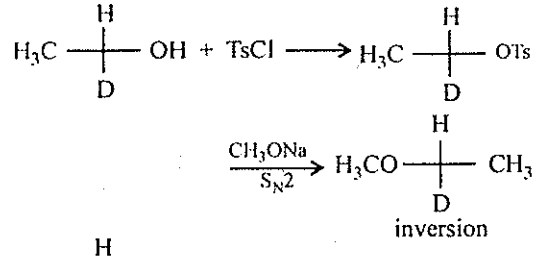
67. **(b) :** It is a method of preparation of cycloalkanes.



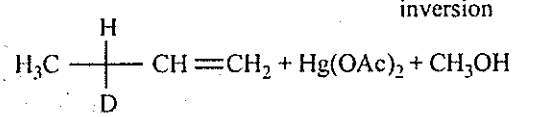
68. **(b)**



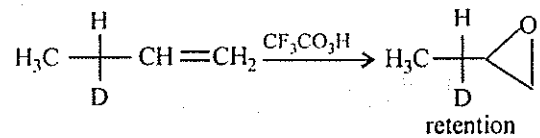
retention of configuration



inversion

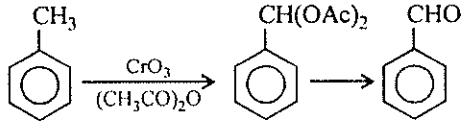


retention



retention

69. **(a) :**



70. **(b) :** Weight of Ag required = $V \times d$

$= 80 \times 5 \times 10^{-3} \times 1.05 = 0.42$

$\because \quad W = \dfrac{Eit}{96500}$

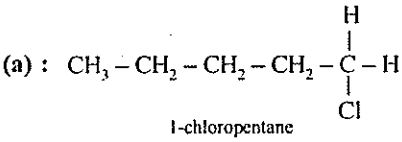
$\therefore \quad 0.42 = \dfrac{108 \times 3 \times t}{96500} \Rightarrow t = 125 \text{ sec.}$

71. **(a) :** The empirical relation,

viz., $\dfrac{x}{m} = kc^{1/n}$, put forward by Freundlich is known as Freundlich's adsorption isotherm. Taking log on both sides

$$\log\left(\frac{x}{m}\right) = \log k + \frac{1}{n}\log c$$

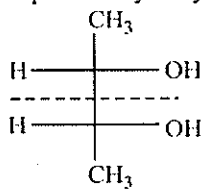
72. **(a) :**



1-chloropentane

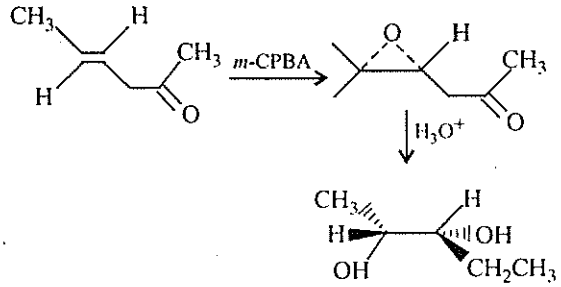
$\Rightarrow$ absence of asymmetric carbon atom.

73. **(c) :** As it has plane of symetry



74. **(d)**

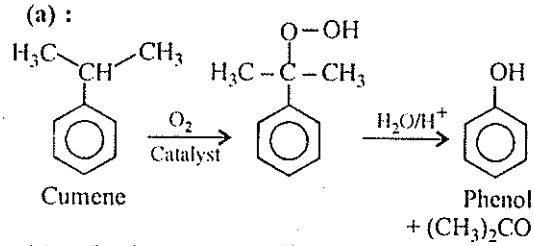
75. **(b) :**



76. **(d) :** This defect arises when a compound has excess metal ion. If a negative ion is absent from its lattice site leaving a hole occupied by electron. The holes occupied by electrons are called F- centres. Greater the number of F-centres greater is the intensity of colour.

77. **(b) :** Trinitrotoluene (TNT) with ammonium nitrate is extensively employed as blasting explosive.

78. **(a) :**



79. **(c) :** On long storage in contact with air and moisture, oils and fats develop unpleasant smell. This process is known as ranicidification. It is due to

(a) Enzymatic hydrolysis - producing bad smelling lower fatty acids.

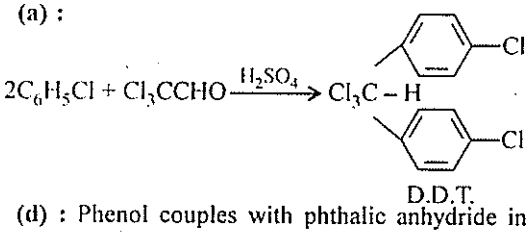
(b) Oxidation of unsaturated acids - producing aldehydes and ketones.

80. **(a) :** It is an example of pseudo unimolecular reaction where molecularity ≥ 2 but order of reaction is one.

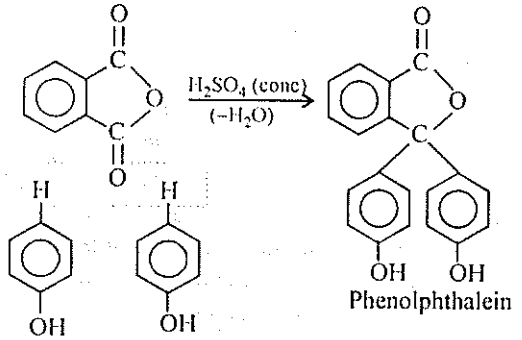
Rate = k[Sugar] [H_2O]

In the reaction, water is present in excess and its concentration is taken to be constant, thus the reaction becomes independent of [H_2O] and is pseudo first order.

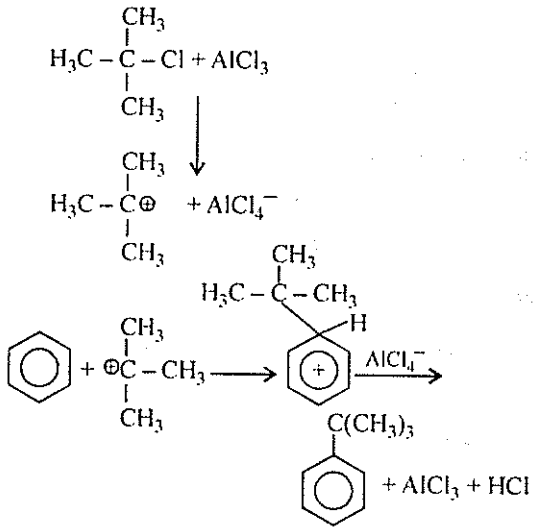
81. **(a) :**



82. **(d) :** Phenol couples with phthalic anhydride in presence of conc. H_2SO_4 to form phenolphthalein which is used as an indicator :



83. **(d) :**



84. **(c) :** H_2SO_4 is strong acid having pH < 7. $NaNO_2$ on hydrolysis gives alkaline solution of pH > 7. NaCl is neutral and H_2S is weak acid.

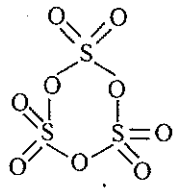
85. **(a) :** The enzyme must contain at least one atom of Se.

$\because$ 0.5 g of Se is present in 100 g of enzyme

$\therefore$ 78.4 g of Se will be present in $= \frac{100 \times 78.4}{0.5}$

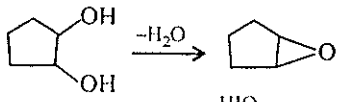
$= 1.576 \times 10^3$ g of enzymes

86. **(d) :**



Cyclic. trimer

87. **(a) :**



$\xrightarrow{-HIO_4}$ $OH(CH_2)_3CHO$

To cuase oxidative cleavage of bonds carrying groups prone to undergo oxidation. One mole of reagent is required to cleave one bond.

88. **(a) :** In H_2O, electronegativity difference is highest. So, dipole moment is highest in this. CH_4 is a symmetrical tetrahedral structure and its dipole moment is zero.

99. **(c) :** $u = \sqrt{\frac{3RT}{M}}$

If $T = 2T$ and $M = M/2$, then $u_1 = \sqrt{\frac{3R \times 2T}{M/2}}$

$\therefore \quad \frac{u_1}{u} = \sqrt{4} = 2.$

90. **(c)** : Pt (H_2) P_1 atm. | Pt(H_2) P_2 atm.
For spontaneous reaction, E_{cell} should be positive so $P_1 > P_2$

$$E_{cell} = \frac{0.059}{2} \log \frac{P_1}{P_2}$$

Also, if $P_1 > P_2$ oxidation occurs at L.H.S. electrode and reduction occurs at R.H.S. electrode.

91. **(b)** : Molecule is simply amine in nature.

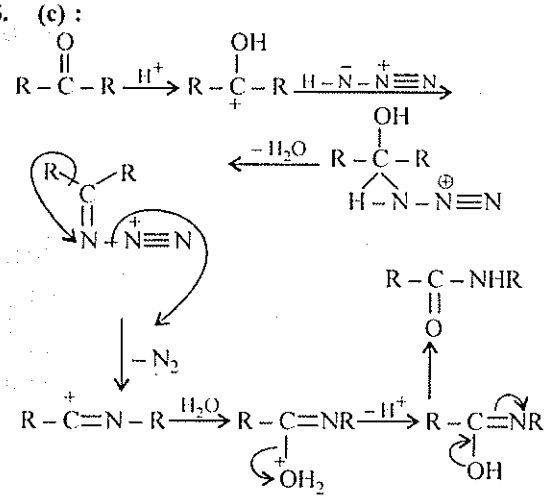
92. **(b)** : $E^\circ_{cell} = 0.76 - 0.41 = 0.35$ V.

93. **(d)** : Solution which contains large number of ions compared to another solution of same concentration at the same temperature has more conductance and is said to be stronger electrolyte. The one which has relatively small number of ions is called weak electrolyte. If concentration of respective electrolyte was increased, the equivalent conductance decreased in each case, but rapid decrease in equivalent conductance is seen in weak electrolyte.

94. **(b)**: $\text{Density} = \frac{nM}{N_A \times a^3}$

$$= \frac{4 \times 58.5}{6.023 \times 10^{23} \times (5.64 \times 10^{-8})^3} = 2.17 \text{ g/cm}^3.$$

95. **(c)** :

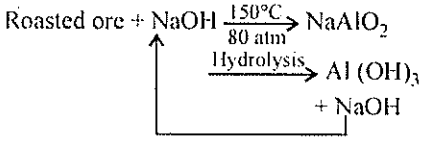


96. **(c)** : Secondary amines form nitrosoamines which are yellow oily liquids insoluble in water.

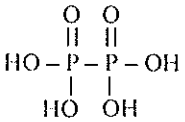
$$R_2NH + HONO \rightarrow R_2NNO + H_2O$$

Dialkyl nitrosoamine

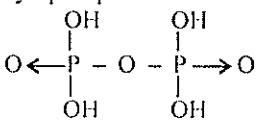
97. **(a)** : Baeyer's process = Bauxite ore is roasted as to convert FeO into Fe_2O_3



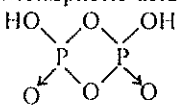
98. **(a)** : Hypophosphoric acid is



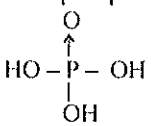
Pyrophosphoric acid



Metasphoric acid



Orthophosphoric acid



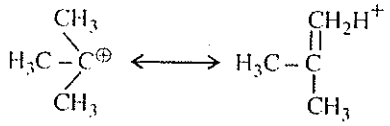
99. **(a)** : $(HNO_3 + H_2SO_4)$ will generate $\overset{+}{NO_2}$ (nitronium ion) which will give nitrobenzene, as $-NO_2$ is deactivating and *meta* directing so, product formed will be 3-nitrochlorobenzene.

100. **(c)** : It follows Huckel's rule of $(4n + 2)\pi$ electrons. If we keep $n = 0$
the total number of π electrons will be 2.

So,  follows the aromaticity rule whereas options (a), (b), (d) have 4π electrons.

101. **(b)** : HSO_3^- is a bulky nucleophile, hence, cannot attack on sterically hindered ketones.

102. **(a)** : Greater the number of H-atoms present on the carbon atoms α to unsaturation the more resonating forms are possible due to hyperconjugation and thus greater is the stability of carbonium ion.



(9-equivalent forms)

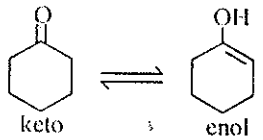
103. (d) : H_2 and Cl_2 react chemically. Hence Dalton's law is not applicable. Dalton's law states that "at a given temperature, the total pressure exerted by two or more non-reacting gases occupying a definite volume is equal to the sum of the partial pressures of the component gases."

104. (a) : $E = -\frac{2\pi^2 k^2 m_e^4}{n^2 h^2}$

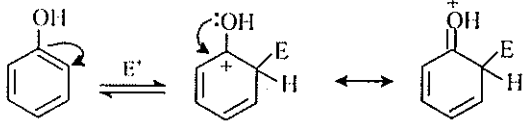
where n = principal quantum number which has only integral value, it follows that total energy is quantized.

105. (a) : Solid + heat $\rightleftharpoons$ liquid. So on heating forward reaction is favoured and amount of solid will decrease.

106. (a) : Cyclohexanone exists in two readily interconvertible different structures leading to dynamic equilibrium known as tautomerism.



107. (c) : – OH group shows + M effect and is an activating group, moreover the arenium ion of phenolic substitution is more stable.



108. (b) : The factor $T\Delta S$ increases with increase in temperature.

109. (a) :

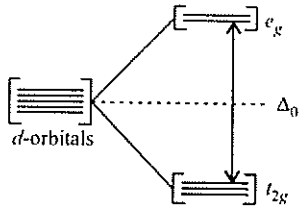
110. (b) : The reaction involved is

$CaOCl_2 + H_2SO_4 \rightarrow CaSO_4 + H_2O + Cl_2$

The available chlorine may be defined as the % of chlorine liberated when one mole of bleaching powder (127 g) is treated with excess of dilute H_2SO_4.

111. (b) : Due to presence of strong C-F bonds teflon has high thermal stability and chemical intertness. As, it softens on heating and can be remoulded. So, it is a thermoplastic.

112. (c) :



d-orbital splitting in an octahedral crystal field

$\therefore$ In high spin situation, $\Delta_0 < P$, in d^5 configuration, 4th and 5th electron are added to e_g rather than t_{2g}. So configuration of d^5 ion will be $t_{2g}^3\, e_g^2$.

113. (d) : Non-oxidising acids (HCl and dil. H_2SO_4) do not have any effect on copper. However they dissolve the metal in presence of air. As it is a non-spontaneous process so, ΔG can not be –ve.

114. (d) : Molarity equation is written as $M_1V_1 = M_2V_2$ thus if the V_2 changes M_2 also changes.

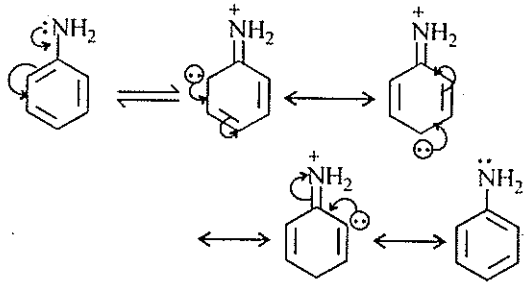
$$\text{Molarity} = \frac{\text{moles of solute}}{\text{volume of solution in litre}}$$

115. (c) : Aniline is weaker base than ammonium chlordie. In NH_4Cl or aliphatic amines, then non-bonding electron pair of N is localised and is fully available for coordination with a proton.

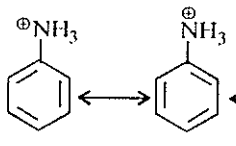
$C_6H_5NH_3^{\oplus} \longrightarrow C_6H_5NH_2 + H^+$

(stronger acid) (weaker-conjugate base)

On the other hand, in aniline and other aromatic amines, the non-bonding electron pair is delocalised into benzene ring by resonance.



But anilinium ion is less resonance stabilised than aniline



no other resonating structure possible.

116. (a)

117. (a) : Saytzeff's rule : The alkene formed in greatest amount is the one that corresponds to removal of the hydrogen from the β-carbon having the fewest hydrogen substituent.

In case of 2° and 3° alc. Saytzeff's rule is followed

$$H_3C-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[(1:1)]{H_2SO_4} H_3C\,CH=CH-CH_3 + H_2O$$

118. (c) : $SeCl_4$ possesses see-saw geometry, which can be regarded as a distorted trigonal bipyramidal structure, having one lone pair of electrons in the basal position of the trigonal bipyramid. See-saw geometry of $SeCl_4$ molecules arises due to the sp^3d hybridisation of the central atom. The distortion in shape is due to the presence of one lone pair of electrons.

119. (a) : Liq. NH_3 has high heat of vaporisation (327 cal/g). So, it takes up lots of heat and helps in cooling. So, it is used in ice-plants.

120. (a) : Due to the presence of lone pair of electrons on oxygen atom, ethers behave as base and form stable oxonium salts with mineral acids.

$$C_2H_5-\ddot{O}-C_2H_5 + HCl \rightarrow C_2H_5-\overset{\oplus}{\underset{H}{O}}-C_2H_5\ \overset{\ominus}{Cl}$$

Diethyl oxonium chloride

BIOLOGY

121. (b) : The environmental factors which can check the growth of population size constitute the environmental resistance. These include predators, food, water, nesting sites, similar competitors, etc. All living things tend to reproduce until the point at which their environment becomes a limiting factor. No population, human or otherwise, can grow indefinitely; eventually, some biotic or abiotic variable will begin to limit population growth.

122 (c) : The activated spermatozoan on reaching the egg plasma membrane, undergoes a number of changes in its acrosomal region. All these changes are collectively described under acrosome reaction. Acrosome reaction is calcium-dependent involving massive uptake of calcium and sodium with an efflux of hydrogen generating high pH and osmotic pressure, producing negative surface charge, and partial or total release of the acrosomal enzymes. Calcium influx may activate phospholipase resulting in accumulation of unsaturated fatty acids and fusiogenic lysophospholipids contributing to acrosome reaction.

123. (a) : Keystone species are those species which has significant and disproportionately large influence on the community structure and characteristics. It has often considerably low abundance and biomass as compared to dominant species. Removal of such species causes serious disruption in structure and function of community.

124. (b) : *Serratia marcescens* is considered a harmful human pathogen which has been known to cause urinary tract infections, wound infections, and pneumonia. *Serratia* bacteria also have many antibiotic resistance properties which may become important if the incidence of *Serratia* infections dramatically increases.

125. (c) : Clotting of collected blood can be prevented by -

– coating test tubes with silicon (which produce non wettable surface similar in its smoothness to endothelial lining of blood vessels).

– adding chelating agents (includes trisodium citrate, sodium oxalate and sodium EDTA) which remove calcium which is important for blood coagulation, and prevent blood clotting.

– adding Heparin, most powerful anticoagulant which acts indirectly by activating plasma antithrombin III. Heparin is effective both *in vivo* and *in vitro*. Whereas the option a, b and d are effective *in vitro*.

Heparinized blood is not suitable for blood counts (as it alters the shape of RBC's and WBC's which affects blood testing), Fragility testing and complement fixation tests. Hence (c) is the correct answer.

126. (c) : Cancer is caused by cells dividing repeatedly out of control. They cease to respond to the normal signals around them and form unspecialised masses of cells called tumours. Lung cancer usually starts in the epithelium of the bronchioles, so-called bronchial carcinoma. It then usually spreads throughout the lungs. It is caused almost exclusively by smoking. Tobacco smoke contains chemicals responsible for lung cancer. The most important of

these are polycyclic hydrocarbons which are converted in the body to carcinogens.
Besides, carbon monoxide combines with haemoglobin and reduces oxygen transport by about 15% in smokers and nicotine increases blood pressure, heart rate and constriction of blood vessels.

127. **(d)** : A major problem in the treatment of bacterial mediated diseases is that many bacteria have been found to show resistance to antibiotics. The emergence of antibiotic-resistant bacteria is closely linked to the extent that antibiotics are used in humans and items of human diet. Resistant strains may appear rapidly or slowly, according to the amount or type of antibiotic used. Bacteria occur in such large numbers that there is a high chance of a mutant individual eventually appearing in the population. As soon as it does, use of the antibiotic to which it is resistant will give it a selective advantage over non-resistant types and it will multiply and eventually become the dominant type. Antibiotics may also be destroyed by enzymes inside the cells being targetted. A well-known and important example is the group of enzymes known as penicillinases which hydrolyses and destroys penicillins and cephalosporins.

128. **(d)** : Diptheria, leprosy and plague are the bacterial diseases of humans. Diptheria is a serious air-borne contagious disease. It is caused by *Cornybacterium diptheriae* which is a Gram-positive bacterium. It is inhaled through droplets and reaches to respiratory tract and infects it. Leprosy or Hansen's disease is a contact disease, caused by bacterium *Mycobacterium leprae*. It degenerates the tissues and deforms the body organs. Plague is a disease caused by bacterium *Yersinia pestis* or *Pasteurella pestis*.

129. **(b)** : Binding of antibodies to the antigens produces a large insoluble complex known as agglutination. It is a specific reaction, *i.e.*, a particular antigen will only clump in the presence of its specific antibody. Each antibody has two antigen binding sites. It combines with two antigens, causing them to agglutinate.

130. **(a)** : The predator develops a preference to other diets and can give unforeseen negative results that could outweigh all benefits. For example, when the mongoose was introduced in Hawaii in order to control the rat population, it preyed on the endemic birds of Hawaii, especially their eggs, more often than it ate the rats. As most of the birds feed on insect and keep insect population low. The mangoose who destroy birds acts as secondary pest.

131. **(c)** : Dicumarol is an anticoagulant found in spoilts sweet clover causes hemorrhage and other symptoms of bleeding disorder by disrupting vitamin K metabolism and preventing the activation of prothrombin and certain other clotting factors by the liver.

132. **(b)** : The propagation through vegetative multiplication is used to maintain the genetic traits of a given plant. It gives rise to genetically uniform population or clone. In case of plants propagated through seeds, variations creep in due to chance segregation of genes during meiosis and their chance combination during fertilization.

133. **(d)** : Bacteria attacking the dead animals represent the end of the food chain and are decomposers. These are the organisms that obtain energy from chemical breakdown of organisms. They secrete enzymes onto dead matter and then absorb the breakdown products. Bacteria are specialised to breakdown organic materials that are difficult for other organisms to digest. They also fulfil a vital role in the ecosystem, returning the constituents of organic matter to the environment in inorganic forms so that they can again be assimilated by producers.

134. **(d)** : Symbiosis means "living together". It is a beneficial coaction between two (or more) different species in which one or both the species are benefited and neither species is harmed. Symbiotic relationships are manifested through commensalism, protocooperation and mutualism and are widespread in nature. Commensalism is an association or relationship between two different organisms in which one is always benefited while the other is neither benefited nor harmed. This relationship may be permanent or temporary and the benefit derived from the other organism may consist of protection, transportation,

living space and food. Protocooperation is a relationship between two species, which is favourable but not obligatory to both. Mutualism is a relationship between two or more individuals of different species in which all are benefited by one another.

135. **(c)** : At sexual maturity, the undifferentiated primordial germ cells divide several times by mitosis to produce a large number of spermatogonia. Each spermatogonium actively grows to a larger primary spermatocyte. Each primary spermatocyte undergoes two successive divisions, called maturation divisions. The first maturation division is reductional or meiotic. Hence, the primary spermatocyte divides into two haploid daughter cells called secondary spermatocytes. Both secondary spermatocytes now undergo second maturation division which is an ordinary mitotic division to form, four haploid spermatids. Thus each secondary spermatocyte gives rise to two spermatids that undergo transformation to form two sperms. Overall, both secondary spermatocytes give rise to four sperms.

136. **(b)** : Growth regulators are organic substances, other than nutrients, which in low concentration regulate growth, differentiation and development by promoting or inhibiting the same. Phytohormones are growth regulators produced naturally in plants and translocated to another region for regulating one or more physiological reactions when present in low concentration. Phytohormone can have a promoting or inhibiting effect on a process.

137. **(b)** : Grey crescent is the area just opposite to the site of entry of sperm into ovum. It marks the future dorsal side of the embryo.

138. **(d)** : During the post-pollination development, germination of pollen grain takes place. The pollen grain absorbs water and nutrients on the stigma from the stigmatic secretion through its germ pores. The tube or vegetative cell enlarges and comes out of the pollen grain through one of the germ pores or germinal furrows to form a pollen tube. Generative cell does not produces pollen tube instead it passes into the pollen tube and divides into 2 male gametes. Thus even after killing the generative cell with a laser beam, the pollen grain produces normal pollen tube because the vegetative cell has not been damaged.

139. **(d)** : Simple or unconditional reflexes are present in an individual right from birth. They are specific, predictable, purposeful and have survival value, *e.g.* breast feeding and swallowing in newly born babies and blinking of eyes are examples of unconditioned reflexes. (a), (b) and (c) are the examples of conditional reflexes and are not present at birth but develop later in life through learning habit.

140. **(d)** : Unlike *Cycas* and *Pinus*, *Gnetum* shows the occurrence of vessel elements and the absence of archegonia. Archegonia are altogether absent in the female gametophyte and vessels occur in the xylem along with the tracheids in the secondary wood. Thus *Gnetum* shows affinities with angiosperms. Besides it resembles angiosperms in several other aspects like presence of tetrasporic embryo sac, free nuclear divisions in the embryo sac, two cotyledonous embryo etc.

141. **(a)** : Vagus nerve arises from the side of medulla oblongata. It innervates the larynx, trachea, oesophagus, stomach, lungs, heart and intestines. It is a mixed nerve. It controls the visceral sensations and visceral movements, *i.e.*, heart beat, respiratory movements, peristalsis, sound production, etc. Movement of the tongue is controlled by hypoglossal nerve as it innervates the muscles of the tongue.

142. **(a)** : Lubb (first sound, systolic sound) is the first heart sound which is low pitched, not very loud, of long duration (about 0.15 seconds) and is produced partly due to closure of atrio-ventricular valves (tricuspid and bicuspid) and partly by the contraction of the muscles in the ventricles.

143. **(a)** : Part of fertilizers added to crop fields are passed down to water bodies during rains through surface run-off. Presence of extra nutrients brings about dense growth of plant and animal life. The phenomenon is called eutrophication. Eutrophication leads to organic loading, depletion of oxygen, death of animals and fouling of water.

144. **(d)** : The egg cell is one of the haploid cell of egg apparatus present in the micropylar end of embryo sac in seeded plants. It is also called oosphere and represents the single female gamete of the embryo sac. Antipodal cells are the haploid cells, usually three in number, present in embryo sac at the opposite end of micropyle. Their function is unknown and at fertilization, they may disintegrate or multiply and enlarge.

145. **(b)** : Affinity of carbon monoxide for haemoglobin is 200 times more than oxygen. At 0.5 partial pressure, CO combines with 50% of haemoglobin. It produces a relatively stable compound called carboxy-haemoglobin. This causes low supply of oxygen to the body which is characterised by headache, dizziness, nausea, etc.

146. **(a)** : A patient of diabetes mellitus is unable to produce or fail to utilize insulin hormone. Thus, he is unable to store glucose in the form of glycogen. Hence, he started to excrete glucose in the urine. A patient is kept in carbohydrate free diet yet he excretes glocose in urine becuase high level of glucose not only depends on dietary carbohydrates but also on glycogenolysis (degradation of glycogen in liver) and gluconeogenesis (breakdown of fats into glucose in adipose tissues and coversion of muscle lactate into glucose *via* cori cycle).

147. **(d)** : Life cycle of *F.hepatica* is complete and completed in two hosts. Primary host, in which the adult fluke lives, is sheep. While the intermediate host, in which numerous larval stages are passed, is a snail (*Lymnaea*, *Planorbis*, etc.). This type of life cycle, involving two different kinds of hosts, is termed digenetic.

Miracidium larva is the larval stage involved in life cycle. When suitable conditions become available, the encapsulated embryo, in 4-15 days, differentiates into a miracidium larva. It hatches out and swims in water. Metacercaria develops into adult fluke only inside its definitive host or sheep. The latter gets infection by grazing on leaves and grass blades to which the cysts are attached. Metacercaria survives action of host's gastric juice as its cyst is insoluble in it. Cyst wall finally dissolves in proximal part of intestine and liberates the larva.

148. **(d)** : Enzymes are protein that, in small amounts, speed up the rate of a biological reactions and help in regulating metabolism.

Hormones are also metabolic regulator and help in stimulation or inhibition of one or more physiological processes.

Vitamines are accessory food factors which are required in small quantity for controlling metabolism and body functioning.

149. **(b)**

150. **(a)** : The process by which N_2 is reduced to NH_4^+ is called nitrogen fixation. Nitrogenase enzyme catalyzes this reduction. It is only carried out by prokaryotic microorganisms. Principal N_2-fixers include certain free living cyanobacteria in symbiotic associations with fungi in lichens or with ferns, mosses, and liverworts, and by bacteria or other microbes associated symbiotically with roots, especially those of legumes. About 15 percent of the nearly 20,000 species in the fabaceae (Leguminosae) family have been examined for N_2 fixation, and approximately 90 percent of these have root nodules in which fixation occurs. So without active nitrogenase enzyme there will be no N_2 fixation in legumes.

151. **(c)** : Hallucination means apparent perception of external objects or sounds not actually present. It is caused by psychedelic drugs or hallicinogens. The hallucinogens act mainly on CNS (central nervous system) and greatly alter one's thoughts, feelings and perceptions. Hashish is the example of hallucinogen.

152. **(b)** : In CAM plants stomata open at night. In these plants night acidification occurs. *i.e.*, malic acid is synthesised during night due to incomplete oxidation of carbohydrates.

In night, $2C_6H_{12}O_6 + 3O_2 \rightarrow \underset{\text{(malic acid)}}{3C_4H_6O_5} + 3H_2O$

$\downarrow$

leads to opening of stomata

At night malic acid formed in guard cells dissociates into H^+ and malate ions. K^+ ion exchange from subsidiary cells with H^+ ions. Thus due to accumulation of K^+ ions osmotic pressure of guard cells increases, endosmosis occurs and

guard cells become turgid due to which stomata opens. The malic acid at day time breaks into CO_2 and pyruvic acid thus increasing the concentration of CO_2 in mesophyll cells. This is utilised in Calvin cycle to form sugar which is finally converted into starch.

153. **(b) :** In the apices of some roots, (e.g., *Zea mays*, maize), there is a central region of cells which normally does not divide. This central inactive region was called quiescent centre by F.A.L. Clowes (1959, 1961). The cells of this region have lesser amounts of RNA and DNA so they have small nuclei. These cells also have a lower rate of protein synthesis. Mitochondria and endoplasmic reticulum are less developed. The cells of the quiescent centre are usually inactive. However, if already existing meristematic cells are injured or become inactive due to any other reason, the cells of quiescent centre become active.

154. **(d) :** *Thermococcus*, *Methanococcus* and *Methanobacterium* exemplify archaebacteria that lack any histones resembling those found in eukaryotes but whose DNA is negatively supercoiled. Archaebacteria do not have a nucleus, the genetic material floats freely in the cytoplasm. They consist of ribosomal RNA. DNA contains a single, circular molecule, which is compact and tightly wound. No protein is associated with DNA. The archaebacterial cell may contain plasmids, which are small, circular pieces of DNA and have a highly negatively supercoiled DNA.

155. **(a) :** Stele is a column containing vascular tissues which is surrounded by pericycle and separated from ground tissue by endodermis.
Siphonostele is medullated protostele or protostele with a central non-vascular pith. Leaf gaps are absent. Siphonostele is of two types :
In Ectophloic siphonostele, central pith is surrounded successively by xylem, phloem, pericycle and endodermis. In amphiphloic siphonostele there is a central pith and xylem is surrounded on either side by phloem, pericycle and endodermis. It is found in *Osmunda* and *Equisetum*.

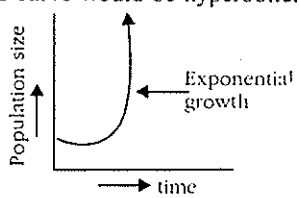
156. **(c) :** Chlorenchyma or assimilatory parenchyma are parenchymatous cells that possess abundant chloroplasts in them. They are capable of photosynthesis. A spore capsule of moss can perform photosynthesis because of the presence of chlorenchyma cells in them.

157. **(b) :** The physical distance between two genes determines both the strength of the linkage and the frequency of the crossing over between two genes. The strength of the linkage increases with the closeness of the two genes. On the other hand the frequency of crossing over increases with the increase in the physical distance between the two genes.

158. **(d) :** The plants, in which a functional foreign gene has been incorporated by any biotechnological methods that generally is not present in plant, are called transgenic plants. When plant cell are transformed by any of the transformation methods it is necessary to isolate the transformed cells/tissue. There are certain selectable marker genes present in vectors that facilitate the selection process. In transformed cells the selectable marker genes or are introduced through vector. There is a number of marker genes which are commonly described as reporter genes screenable genes. Some of the reporter genes which are most commonly used in plant transformation are : cat, gus, lux, nptII., etc.

159. **(c) :** Since a typical green plant is diploid, therefore it has two sets of chromosomes. So the number of genome will be two, because genome is the entire set of gene carried by a gamete or present in the haploid cell of a particular organism.

160. **(b) :** Under continuous supply of food and space in the laboratory conditions the bacterial population grows exponentially and shows a J-shaped curve, thus the curve would be hyperbolic.



Such populations ultimately crash when the population size grows beyond carrying capacity.

161. **(a) :** In all the septate fungi except basidiomycetes (dolipore septum), the septa are seldom complete. They are perforated and contain plasmodesmata

or small central pores. Septal pores allow protoplasmic continuity between adjacent cells. This is useful for quick translocation of nutrients to all part of the body, mobilisation of reserve materials from older parts to younger parts and from vegetative hyphae to reproductive hyphae.

162. **(a)** : The haploid spores on germination gives rise to alga-like filamentous branched portion called primary protonema. This protonema develops buds, from which leafy gametophyte arises. Sometimes this primary protonema breaks up into small fragments accidentally and these fragments give rise to leafy gametophores.

163. **(c)** : Cephalization is the concentration of nervous tissues and sense organs in or towards the anterior end forming a distinct head. It provides greater prominence and domination of the head over the rest of the body. It does not improve the appearance of the animal.

164. **(c)** : Koel is a nest parasite and does not build a nest of its own. It simply lays its eggs in a crow's nest so that the eggs and young ones, are looked after by the foster parents.

165. **(c)** : Competitive inhibition is the inhibition of enzyme activity by the presence of a chemical that competes with the substrate for binding to the active site of the enzyme. The inhibitor chemical is called substrate analogue or competitive inhibitor. It resembles the substrate in structure and gets bound up to the active site of the enzyme without getting transformed by the latter.

166. **(c)** : Haemophilia, also called bleeder's disease is a X-linked recessive disorder. The person which contains the recessive gene for haemophilia lacks a normal clotting substance (thromboplastin) in blood. So minor injuries cause continuous bleeding and ultimate death of the person due to hemorrhages. Haemophilia is of two types : type A characterized by lack of anti-haemophilic globulin (factor VIII) and type B characterized by a defect in plasma thromboplastic component (factor IX).
Prothrombin is an inactive plasma protein and is produced by liver. It helps in blood clotting. It is not produced by platelets.

167. **(a)** : The hybridoma cells are shifted to a medium deficient in nutrient which cannot be synthesized by myeloma cells so that myeloma cells could be removed or hybridoma cells could be purified. The unfused myeloma cells *die* while hybridoma cells survive. The hybridoma cells are allowed to multiply separately.

168. **(c)** : Any seed which contains endosperm or perisperm at maturity is called albuminous or endospermic seed *i.e.*, food reserve of the seed is stored in endosperm or perisperm, *e.g.* rubber, coconut, castor bean, maize and other cereals. Seed that does not have endosperm at maturity and in which cotyledons absorb food reserve from endosperm during development and act as storage organs is called exalbuminous or non-endospermic seed, *e.g.*, mustard, groundnut, bean, pea etc.

169. **(b)** : Trachea and large bronchi are lined by pseudostratified ciliated columnar epithelium bearing glandular cells (mucous gland). The secretion of mucous glands keeps the walls of trachea and large bronchi moist and traps dust particles which enter with the air. The vibratile cilia of the epithelium then carry the mucous containing dust particles upto the larynx where they can be spitted out.

170. **(a)** : Light has got no direct effect on the rate of transpiration but indirectly it affects the rate in two ways firstly by controlling the stomatal opening and secondly by affecting the temperature. With the increase in the light intensity the rate of transpiration increases because the stomata get opened and the temperature increases. The rate of transpiration increases markedly in light and decreases in dark. There is a close relationship between the opening of stomata and presence of light.

171. **(b)** : Oxygen accumulation causes substantial inhibition of photosynthesis. Both oxygen evolution and CO_2 assimilation were reduced in the presence of atmospheric oxygen. Oxygen causes a direct and indeed competitive inhibition of Ribulose diphosphate carboxylase. As a result glycolate synthesis is enhanced and leads to begin photorespiration. Carbon dioxide being one of the raw materials for photosynthesis, its

concentration affects the rate of photosynthesis markedly. Because of its very low concentration in atmosphere (0.03 per cent only) it acts as a limiting factor in natural photosynthesis.

172. (c) : Oxysomes or $F_0 - F_1$ particles are present on the inner mitochondrial membrane. The F_1 head-piece of oxysome functions as ATP-synthetase which synthesises ATP from ADP and ip (inorganic phosphate) using energy from proton gradient or ATP synthetase becomes active in ATP formation only when there is a proton gradient having high concentration of protons on F_0 side (base) as compared to F_1 side (head piece) of $F_0 - F_1$ particles or oxysomes.

173. (c) : Inner ends of cone cells lie upon an elongated, spindle shaped rod, the rhabdome. Rhabdome is secreted and surrounded by a group of seven elongated retinal cells. Rhabdome and retinal cells together form the receptor region of eye.

174. (d) : Pituitary gland or hypophysis is situated in a depression, the sella turcica of sphenoid bone of the skull. It is directly attached to the hypothalamus by a stalk, the infundibulum. Hypophysial portal veins carry blood containing neurohormones (releasing factors) from the hypothalamus to the anterior pituitary.

175. (c) : Rabies (hydrophobia) is an acute viral disease of the central nervous system that affects all warm-blooded animals and is usually transmitted to humans by a bite from an infected dog. Symptoms appear after an incubation period ranging from 10 days to over a year and include malaise, fever, difficulty in breathing, salivation, periods of intense excitement, and painful muscle spasms of the throat induced by swallowing. In the later stages of the disease the mere sight of water induces convulsions and paralysis, death occurs within 4-5 days.

176. (a) : The most common form of asexual reproduction in plants is called vegetative propagation. It is the formation of new plants from vegetative units (propagules) such as buds, tubers, rhizomes, roots, stem, leaf etc. Besides the natural methods of vegetative propagation, there are a number of techniques for artificial vegetative propagation of economically and aesthetically important plants. Potatoes are produced by tubers and not by seeds. Stem tubers are found in potato and artichoke. They have buds in the region of nodes or eyes for vegetative multiplication. Root cuttings are used in propagation of lemon, apple, orange, blackberry etc.

177. (c) : In nuclear endosperm, first and further divisions of primary endosperm nucleus are not followed by cytokinesis or wall formation and thus these free nuclear divisions lead to formation of a large number of free nuclei in embryo sac. At maturity, centripetal wall formation may occur to make the tissue partly cellular. Endosperm of coconut is unique in sense that it is both nuclear and cellular. Here the primary endosperm nucleus undergoes a number of free nuclear divisions. When the fruit is about 50 mm long the embryo sac remains filled with a watery fluid or milk containing free nuclei and fine cytoplasmic particles. At a later stage when the fruit becomes about 100 mm in length the liquid shows in addition to free nuclei, several cells each enclosing variable number of nuclei. Thus coconut has multicellular endosperm (called coconut meat) in the outer part and free nuclear as well as vacuolate endosperm (called coconut milk) in the centre.

178. (d) : The female secondary sexual characters are developed by estrogens. Estrogens are steroid hormones secreted by growing ovarian follicles. It includes estradiol, estriol and estrone. This hormone is responsible for the development of female secondary sexual and accessory characters. In humans it is also formed in the adrenal cortex, testis and foetoplacental unit.
Gonadotrophic hormones (LH and FSH) are secreted by the anterior lobe of pituitary gland. LH is responsible for ovulation and transforms graafian follicle into corpus luteum and FSH stimulates spermatogenesis and maturation of graafian follicle and secretion of estrogen in ovaries.

179. (d) : Net primary productivity is the available biomass for the consumption to heterotrophs (herbivores and decomposers). The rate of biomass

production is called productivity. It has two aspects, gross primary productivity and net primary productivity. The rate of total production of organic matter during photosynthesis is known as gross primary productivity. Its considerable amount is utilised by plants in respiration. The organic matter synthesised by plants (GPP) minus the rate of respiration and other loss represents the net primary productivity.

180. **(b)** : Mercury is an important toxic pollutant. It is changed to water soluble dimethyl mercury which undergoes biomagnification, *i.e.*, accumulates in the body of organisms inhabiting in the water. Eating poisoned animals causes deformity known as minamata disease which is characterized by diarrhoea, impairment of various senses, numbness of lips, blurring of vision, mental dearrangement and death.

GENERAL KNOWLEDGE

181. (a)	**182. (b)**	**183. (c)**	**184. (b)**	**185. (c)**
186. (c)	**187. (d)**	**188. (c)**	**189. (a)**	**190. (c)**
191. (d)	**192. (a)**	**193. (b)**	**194. (a)**	**195. (d)**
196. (a)	**197. (a)**	**198. (d)**	**199. (c)**	**200. (c)**

☺☺☺

Chapterwise Index - '09

Physics • Chemistry • Biology

Use the index for topicwise analysis of this year's AIIMS paper and refer to these questions when you are practising MCQs chapterwise.

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