PART-A: PHYSICS

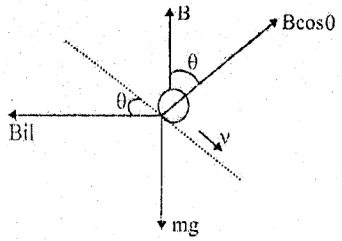
1. (4) $T = \frac{mv^2}{r}$

or $16 = \frac{16v^2}{144} \Rightarrow v = 12$ m/s.

2. (3) $BI\ell\cos\theta = mg\sin\theta$

Here induced emf across slider is $(B\cos\theta)\ell v$

$\therefore$ induced current $I = \frac{B\ell v\cos\theta}{R}$



From equation (i)

$B\ell\cos\theta\frac{B\ell v\cos\theta}{R} = mg\sin\theta$

$\therefore v = \frac{mgR\sin\theta}{B^2\ell^2\cos^2\theta}$

3. (2) $s_1 = \frac{1}{2}gt^2$ and $s_2 = \frac{1}{2}g(t-1)^2$

$\therefore s_1 - s_2 = 10 = \frac{1}{2}g[t^2 - (t-1)^2]$

$\therefore t = 1.5\ s.$

4. (2) Applying Ampere's circuital law,

$B \cdot 2\pi r = \frac{\mu_0 I\pi r^2}{\pi a^2}$ for $r < a$

and $B \cdot 2\pi R = \mu_0 I$ for $R > a$

Taking the ratio

$\frac{r}{R} = \frac{r^2}{a^2}$

$\therefore a = \sqrt{Rr}$

5. (4) For motion to be SHM acceleration of the particle must be opposite of restoring force and proportional to negative of displacement. So, $F = ma = m(-2x)$

i.e., $F = -2mx$, so $F \propto -x$

Hence, $a_x = -2x$

We should be clear that x has to be linear.

6. (2) $x = \frac{1}{2}at^2$

or $t = \sqrt{\frac{2x}{a}} = \sqrt{\frac{2x}{(Ee/m)}}$

$\therefore \frac{t_2}{t_1} = \sqrt{\frac{m_p}{m_e}}$

7. (3) $\vec{F} = q(\vec{v} \times \vec{B})$

$= 1.6 \times 10^{-19}[4 \times 10^5(\sin 30°\hat{i} + \cos 30°\hat{k}) \times 4\hat{k}]$

$= -12.8 \times 10^{-14}\ \hat{j}N$

8. (2) $x = at$

$y = bt^2$

$y = b\frac{x^2}{a^2}$ parabola

9. (4)

10. (3) $H = \frac{u^2\sin 45°}{2g} = \frac{u^2}{4g}$

$R = \frac{u^2}{g} = 4H.$

11. (2)

12. (2) Power delivered,

$P = \frac{U}{t} = \frac{\frac{1}{2}CV^2}{t} = \frac{\frac{1}{2} \times 40 \times 10^{-3} \times (3000)^2}{2 \times 10^{-3}}$

$= 90 \times 10^3\ W.$

13. (3) Due to change in temperature, magnetic moment of magnet decreases, and so time period of oscillations will increase.

As $T \propto \frac{1}{\sqrt{M}}$

14. (4) $\frac{1}{2}kx^2 = mgh$

or $h = \frac{kx^2}{2mg}$

15. (2) $E = \left(\frac{e}{R + R_h + r}\right) \times \frac{R}{L} \times \ell$

$= \left(\frac{10}{5+4+1}\right) \times \frac{5}{5} \times 3 = 3V.$

16. (4) $W = K_f - K_i$

$$\text{or} \int_3^4 (-6x)dx = \frac{1}{2} \times 2(v_f^2 - 8^2)$$

$$\text{or} \left| \frac{-6x^2}{2} \right|_3^4 = v_f^2 - 64$$

$$\text{or} -3|4^2 - 3^2| = v_f^2 - 64$$

$\therefore v_f = 6.6$ m/s

17. (1) The acceleration of the belt at any time

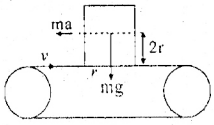
$$a = \frac{dv}{dt} = \frac{d}{dt} 2.4\, t^2$$

$$= 4.9\, t$$

So $mg \times r = ma \times 2r$

or $g = 4.9\, t \times 2$

$\therefore \quad t = 1$ s



18. (1) $e = \frac{NBA}{t}$

$$\text{or } 0.1 = \frac{100 \times 200 \times 10^{-4} \times 100 \times 10^{-4}}{t}$$

$\therefore t = 0.2\ s$

19. (3)

20. (3) Electric potential decreases in the direction of electric field. The direction of electric field is always perpendicular to one equipotential surface maintained at high electrostatic potential to other equipotential surface maintained at low electrostatic potential.

The positively charged partical experiences electrostatic force along the diretion of electric field, hence moves in the direction of electric field. Thus, positive work is done by the electric field on the charge.

We know

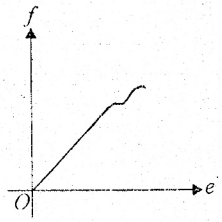
$W_{electrical} = -\Delta U = -q\Delta V = q(V_{initial} - V_{final})$

Hence electrostatic potential energy of the positive charge decreases.

21. (2) $E = \frac{\text{stress}}{\text{strain}} = \frac{FL}{\Delta L A}$

$$\text{or, } \frac{\text{stress}}{\text{strain}} \propto \frac{1}{\Delta L}$$

The ratio $\left(\frac{\text{stress}}{\text{strain}}\right)$ decreases. (see figure)



22. (4) $\frac{2T}{r} = \frac{2 \times 0.07}{0.14 \times 10^{-3}} = 10^3$ N/m^2

Pressure applied, $= P_a + \frac{2T}{r}$

$= 10^5 + 10^3 = 101 \times 10^3$ N/m^2

23. (4) $\tan \frac{\pi}{3} = \frac{X_L}{R} = \frac{X_L}{10}$

$$\text{or } 10\sqrt{3} = X_L \Rightarrow L = \frac{X_L}{\omega} = \frac{10\sqrt{3}}{2\pi \times 50}$$

$$\therefore \quad = \frac{\sqrt{3}}{10\pi} H.$$

24. (3) $I = 0 + 0 + mr^2 = m\left(\frac{\sqrt{3}\ell}{2}\right)^2$

$$= \frac{3}{4} m\ell^2$$

25. (4) Intensity $\propto$ (amplitude)^2

26. (2) Decrease in pressure energy is equal to increase in kinetic energy of water, so

$$\frac{1}{2} \rho v^2 = (P_1 - P_2)$$

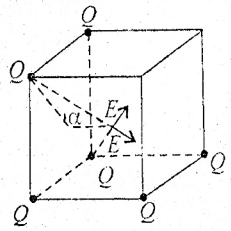
$$\text{or } \frac{1}{2} \times 1000 \times v^2 = (3.5 - 3) \times 10^5$$

$\therefore v = 10$ m/s

27. (3) Here $r = \frac{\sqrt{3}x}{2}$ $\cos \alpha = \sqrt{\frac{2}{3}}$

The net field is due to the two charges. The field of each charge

$$E = \frac{kQ}{r^2}$$



Resultant field, $E_R = 2E \cos \alpha$

$$= 2 \frac{kQ}{\left(\frac{\sqrt{3}x}{2}\right)^2} \cos \alpha$$

$$= \frac{8\sqrt{2}}{3\sqrt{3}} \left(\frac{kQ}{x^2}\right)$$

28. (3) $\Delta\vec{P} = -2mv\sin 60°$

$$F = \frac{\Delta P}{\Delta t} = \frac{2mv \times \sqrt{3}/2}{2\times 10^{-3}}$$

$$= \frac{2\times 0.1\times 5\times\sqrt{3}/2}{2\times 10^{-3}} = 250\sqrt{3}\ \text{N}.$$

29. (2) When lenses are in contact

$$\frac{1}{f_1}+\frac{1}{f_2} = \frac{1}{60} \quad \ldots(\text{i})$$

When lenses are at separation,

$$\frac{1}{f_1}+\frac{1}{f_2}-\frac{10}{f_1 f_2} = \frac{1}{30} \quad \ldots(\text{ii})$$

On solving above equations, we get

$f_1 = 20$ cm, $f_2 = -30$ cm.

30. (4) $T = \sqrt{\ell}$ and $\frac{\Delta\ell}{\ell} = \alpha.\Delta T$

$$\frac{\Delta T}{T}\times 100 = \left(\frac{\alpha\Delta T}{2}\right)\times 100$$

$$= \frac{2\times 10^{-6}\times 10\times 100}{2} = 10^{-3}.$$

31. (4) From conservation of energy,

$$E = E_1 + E_2$$

Average K.E. per molecule of a perfect gas $= \frac{3}{2}KT$

$$(n_1+n_2)\frac{3}{2}kT = n_1\times\frac{3}{2}kT_1 + n_2\times\frac{3}{2}kT_2$$

$$\therefore \quad T = \left[\frac{n_1T_1+n_2T_2}{n_1+n_2}\right]$$

32. (3) Using, $P_1V_1 = P_2V_2$

$(100\times 10^3 + 1000\text{g}\times 20)\times 3 = (100\times 10^3)\times V_2$

$\therefore\ V_2 = 8.88\ \text{mm}^3$

33. (3) The deviation produced by prism

$\delta = (\mu - 1)A = (1.50-1)\times 4 = 2°$.

To counter balance this deviation, the minor should be rotated by 1°.

34. (4) If T be the outside temperature, then

$$\frac{V^2}{R} = KA\left[\frac{T'-T}{\Delta x}\right]$$

$$\text{or}\ \frac{200^2}{20} = 0.2\times 4.2\times 1\left[\frac{20-T}{0.2\times 10^{-2}}\right]$$

$\therefore\ T = 15.2°\text{C}$.

35. (4)

36. (2) $\frac{N}{N_0} = \left(\frac{1}{2}\right)^n = \left(\frac{1}{2}\right)^{1/3} = \frac{1}{1.26}$

Also $\frac{N}{N_0} = \frac{1}{1.26} \Rightarrow \frac{Nu}{N_{Pb}+N_0} = \frac{1}{2.26}$

$\Rightarrow N_{Pb} = 0.26N_0 \Rightarrow \frac{N_{Pb}}{N_0} = 0.26$.

37. (1) Black spot on heating absorbs radiations from surroundings and so emits them in the dark room while the polished shining part reflects radiation and absorbs nothing and so does not radiate.

38. (2) In electron volt, $E(eV) = \frac{hc}{e\lambda} = \frac{12375}{\lambda\left(\text{Å}\right)} = \frac{12400}{\lambda\left(\text{Å}\right)}$

According to the problem,
Energy of a photon, E = 1 MeV or 10^6 eV
Now, hc = 1240 eV nm

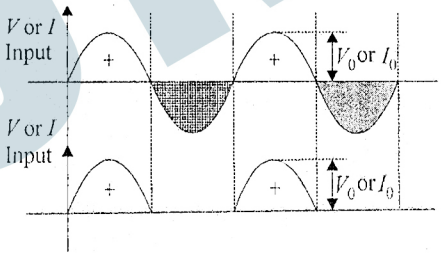
Now, $E = \frac{hc}{\lambda}$

$$\Rightarrow \lambda = \frac{hc}{E} = \frac{1240}{10^6}\ \text{nm}$$
$$= 1.24\times 10^{-3}\ \text{nm}$$

39. (3) The total power of bulbs in parallel = 400 W

Now $\frac{1}{P} = \frac{1}{400}+\frac{1}{400}$, and so P = 200 W

40. (3)



(i) During positive half cycle,
Diode → forward biased
Output signal → obtained

(ii) During negative half cycle,
Diode → reverse biased
Output signal → not obtained

(iii) Output voltage is obtained across the load resistance R_L. It is not constant but pulsating (mixture of *ac* and *dc*) in nature.

(iv) Average output in one cycle

(v) r.m.s. output: $I_{rms} = \frac{I_0}{2}, V_{rms} = \frac{V_0}{2}$

When the diode is forward biased during positive half cycle of input AC voltage, the resistance of p-n junction is low. The current in the circuit is maximum. In this situation, a maximum potential difference will appear across resistance connected in a series of circuit. This result into zero output voltage across p-n junction.

And when the diode is reverse biased during negative half cycle of AC voltage, the p-n junction is reverse biased. The resistance of p-n junction becomes high which will be more than resistance in series. That is why, there will be voltage across p-n junction with negative cycle in output, hence option (3) is correct.

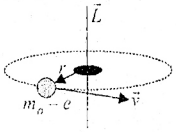
41. (1) The even number of harmonics possible in open pipe.

42. (3) Bohr's radius of orbit (for Hydrogen and H_2-like atoms):

For an electron around a stationary nucleus, the electrostatics force of attraction provides the necessary centripetal force.

$$i.e., \frac{1}{4\pi\varepsilon_0}\frac{(Ze)e}{r^2}=\frac{mv^2}{r} \quad ...(i)$$

$$\text{Also } mvr=\frac{nh}{2\pi} \quad ...(ii)$$



From equation (i) and (ii), radius of n^{th} orbit

$$r_n=\frac{n^2h^2}{4\pi^2kZme^2}=\frac{n^2h^2\varepsilon_0}{\pi mZe^2}=0.53\frac{n^2}{Z}\text{ Å} \quad \left(k=\frac{1}{4\pi\varepsilon_0}\right)$$

$$\Rightarrow r_n\propto\frac{n^2}{Z}\text{ or } r_n\propto\frac{1}{Z}$$

$r_n=a_0\frac{n^2}{Z}$, where a_0 = the Bohr radius = 53 pm

The atomic number (Z) of lithium is 3.

As $r_n=a_0=\frac{n^2}{Z}$,

Therefore, the radius of Li^{++} ion in its ground state, on the basis of Bohr's model, will be about $\frac{1}{3}$ times to that of Bohr radius.

Therefore, the radius of lithium ion is near $r=\frac{53}{3}=18$ pm.

43. (4) Acceleration due to gravity $g=\frac{GM}{R^2}$

$$\frac{g_p}{g_e}=\frac{M_p}{M_e}\left(\frac{R_e}{R_p}\right)^2=3\left(\frac{1}{3}\right)^2=\frac{1}{3}$$

$$\text{Also } T\propto\frac{1}{\sqrt{g}}\Rightarrow\frac{T_p}{T_e}=\sqrt{\frac{g_e}{g_p}}=\sqrt{3}$$

$$\Rightarrow T_p=2\sqrt{3}s$$

44. (2) For long coil, $L=\mu_0 n^2 Al$

$L'=\mu_0(2n)^2 A(2l)$

$=8L$.

45. (4) There are two views

Ist: If displacement amplitude remains same then

$$I\propto f^2$$

$$\Rightarrow\frac{I_1}{I_2}=\frac{f_1^2}{f_2^2}=\frac{1}{9}$$

$$\frac{I_{1200H_2}}{I_{400H_2}}=\frac{9}{1}$$

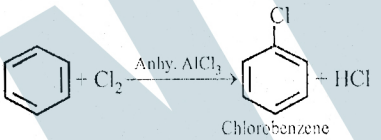
IInd: If pressure amplitude remains same then $\frac{I_{1200H_2}}{I_{400H_2}}$

$=\frac{1}{1}$

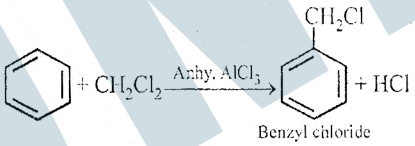
PART - B : CHEMISTRY

46. (2) For a weak acid value of pK_a will be very high but in case of strong acid value of pK_a will be very low.

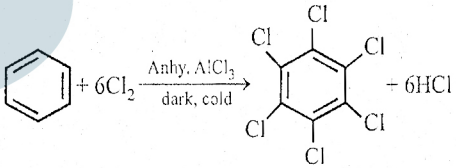
47. (2)



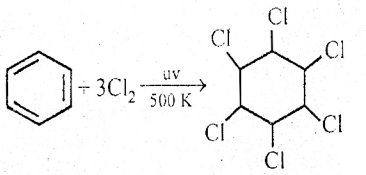
Chlorobenzene



Benzyl chloride



Hexachlorobenzene
(C_6Cl_6)



Benzene hexachloride.
(BHC)

48. (4) From the given data, it is clear that the atomic no. Z, of the species is 8 (no. of protons). Since the no. of electrons are two more than the no. of protons, hence, it is a binegative species. Thus, the species is $^{16}_{8}O^{2-}$.

49. (4) For the reaction

$$XeF_6(g)+H_2O(g)\rightleftharpoons XeOF_4(g)+2HF(g)$$

$$K_1=\frac{[XeOF_4][HF]^2}{[XeF_6][H_2O]} \quad ....(i)$$

and for the reaction

$XeO_4(g) + XeF_6(g) \rightleftharpoons XeOF_4(g) + XeO_3F_2(g)$

$K_2 = \frac{[XeOF_4][XeO_3F_2]}{[XeO_4][XeF_6]}$ ....(ii)

For reaction :

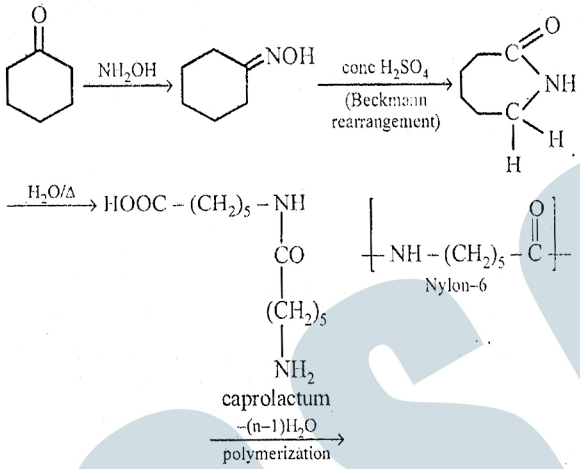
$XeO_4(g) + 2HF(g) \rightarrow XeO_3F_2(g) + H_2O(g)$

$K = \frac{[XeO_3F_2][H_2O]}{[XeO_4][HF]^2}$

$\therefore$ From eq. no. (i) and (ii)

$K = K_2 / K_1$

50. (4) Nylon–6 can be manufactured from



51. (2) $W = -PV = -nRT$

$W = -\frac{50}{55.85} \times 8.314 \times 298$

$W = -2218.05\ J = -2.218\ kJ$

52. (1) If CFSE (Δ_0) < P (Energy required for pairing), the electrons do not pair up and fourth electron goes to e_g of higher energy. Hence, high spin complex is formed. Pairing of electrons does not take place in case of weak field ligands.

53. (3) $P = \frac{w}{mv}RT$ since w and T are constant thus $P \propto \frac{1}{m}$

$P_2 > P_1 > P_3$

54. (1) Hydrogen bonding is possible only in compounds having hydrogen attached with F, O or N.

$C_2H_5 - OH$ (H-bonding possible) $\quad CH_3 - O - CH_3$ (H-bonding not possible)

$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$ (H-bonding not possible) $\quad CH_3 - \overset{\overset{O}{\|}}{C} - H$ (H-bonding not possible)

55. (4) $Q = \frac{[NH_3]^2}{[N_2][H_2]^3}$; $\Delta n_g = 2 - 4 = -2$

At equilibrium Q is equal to K_c but for the progress of reaction towards left side, $Q > K_c$.

56. (4) $Na_2HPO_4 \rightarrow Na_2PO_4^- + H^+$

It can give H^+ ion in solution.

57. (1) $\because 31 \times 4 = 124$ g P is present in 220 g P_4S_3

$\therefore$ 1.24 g P is present in $= \frac{220}{124} \times 1.24 = 2.2$ g

58. (1) $NaHCO_3$ and NaOH cannot exist together. $NaHCO_3$ being acid salt will react with alkali to from normal salt.

59. (2) Let wavelength of particle be x.

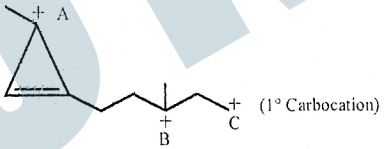
So, velocity $= \frac{x}{100}$

$\lambda = \frac{h}{mv}$; $x = \frac{h \times 100}{m \times x}$

$x^2 = 100\frac{h}{m}$ or $x = 10\sqrt{\frac{h}{m}}$

60. (1) Lone pair of electrons are highly delocalised and hence less available for protonation.

61. (1) Basic nature of OH group $\propto$ stability of C^+ ion produced after ejection of H_2O



62. (4) Total no. of electrons in $O_2^{2-} = 16 + 2 = 18$

Distribution of electrons in molecular orbital

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

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

Antibonding electrons = 8 (4 pairs)

63. (4) Acid rain contains $H_2SO_4 > HNO_3 > HCl$.

64. (2) $3GaCl(aq) \rightarrow 2Ga + GaCl_3$

65. (4) The bond angle will be exactly 109°28' when the central atom is sp^3 hybridised and all bonds have same atom.

CCl_4 has all identical bonds (C – Cl) and central carbon is sp^3 hybridised. So, it has bond angle exactly 109°28'.

66. (1) Hydrogen has + 1 oxidation state in compounds with more electronegative elements *e.g.* HF. It has –1 oxidation state in compounds with more electropositive compounds like NaH.

67. (2) $P_1 = P$; $T_1 = 273$ K

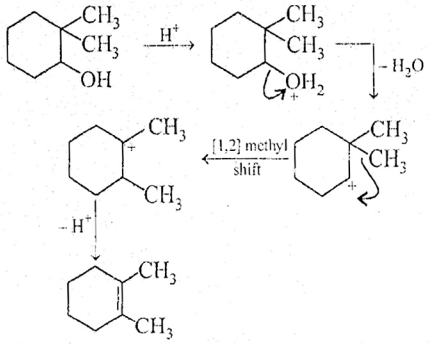
$P_2 = \frac{3}{2}P$; $T_2 = T_1 + \frac{T_1}{3} = \frac{4}{3} \times 273$ K

$V_2 = \frac{P_1V_1T_2}{P_2T_1}$

$$V_2 = \frac{2P}{3P} \times \frac{4}{3} \times \frac{273}{273} \times 100\,cc = \frac{800}{9} cc = 88.88cc$$

$$\approx 88.9\,cc$$

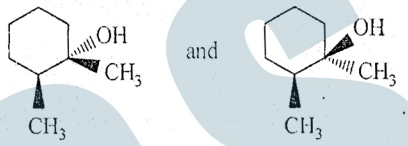
68. (4)



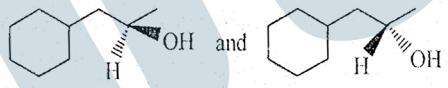
69. (2) Higher is the gold number, lower will be the protective power.

70. (1) Mercury does not give H_2 on reacting with water because its ionisation energy is very high.

71. (2) In (4) S_N2 occurs, in (1) substrate is optically inactive and in (3) diastereomers will be obtained like

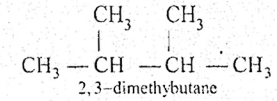


In (2) S_N1 occurs and enantiomeric pair will be produced.

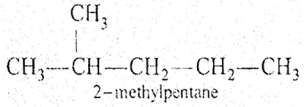


72. (3) Peptization involves conversion of freshly prepared precipitate into colloidal particles using a suitable electrolyte.

73. (4) 2, 3–dimethylbutane will be give two monochlorinated compound whereas 2-methylpentane will give five monochloro drivatives.



2,3–dimethybutane

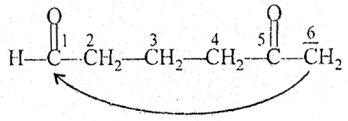


2–methylpentane

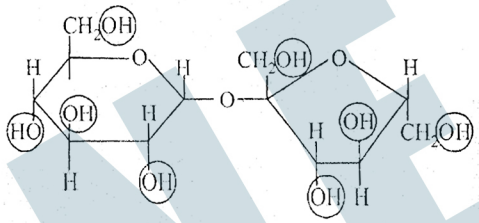
74. (3) $(CH_3)_2 - C = CH \xrightarrow[\text{Hydrogenation}]{\text{Catalytic}} (CH_3)_2 - CH - CH_2$ (CH3 on CH; CH3 on CH2)

No, chiral carbon in the product so there is no optical isomer.

75. (1)



76. (2) As it has eight OH groups, therefore, it will require 8 moles of AcCl.



77. (2) Pyrolusite – MnO_2
Malachite – $CuCO_3.Cu(OH)_2$
Diaspore – $Al_2O_3.H_2O$
Cassiterite – SnO_2

78. (1) $\log K_c = \frac{nE^\circ_{cell}}{0.0591}$

For the given reaction, $n = 1$

$$\log K_c = \frac{1 \times 0.36}{0.0591} = 6.09$$

$K_c = \text{antilog } 6.09 = 1.2 \times 10^6$

79. (4) Solid CO_2 is used as refrigerant.

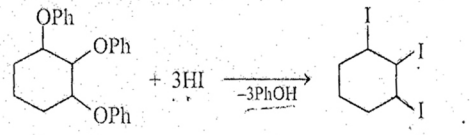
80. (1) Automobiles and thermal power plants cause air pollution. Radioactive power plants are the source of radioactive pollution and thermal pollution.

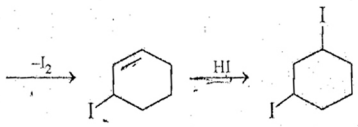
81. (1) In alkaline earth metals ionic size increases down the group. The lattice energy remains constant because sulphate ion is so large, so the small change in cationic sizes do not make any difference. On moving down the group the degree of hydration of metal ions decreases very much leading to decrease in solubility

$\therefore$ $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

82. (3) No. of *hcp* particles in 0.5 mole $= 0.5 \times 6.023 \times 10^{23}$
$= 3.011 \times 10^{23}$
No. of Octahedral void (n) $= 3.011 \times 10^{23}$
No. of Tetrahedral void ($2n$) $= 2 \times 3.011 \times 10^{23}$
$= 6.023 \times 10^{23}$
$\therefore$ Total no. of voids $= 3.011 \times 10^{23} + 6.022 \times 10^{23}$
$= 9.033 \times 10^{23}$

83. (1)





84. (4) Silicosis & pneumoconiosis are caused by inhalation of dust containing silica, silicon dioxide and coal especially by workers engaged in mining, pottery, ceramic industry, sand blasting, building and construction industries.

85. (3) $E_{metal} = \frac{\text{Weight of metal} \times 96500}{\text{Number of coulomb}} = \frac{22 \times 96500}{2 \times 5 \times 60 \times 60}$

$= 58.9$

Oxidation number of the metal $= \frac{177}{58.9} = +3$

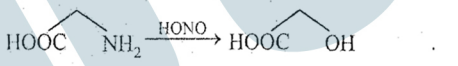
86. (1) In the given complex $[E(en)_2(C_2O_4)]^+ NO_2^-$; ethylene diamine is a bidentate ligand and $(C_2O_4^{2-})$ oxalate ion is also a bidentate ligand. Therefore co-ordination number of the complex is 6 i.e., it is an octahedral complex.

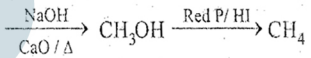
Oxidation number of E in the given complex is

$x + 2 \times 0 + 1 \times (-2) = +1$

$\therefore x = 3$

87. (4)





88. (4) The complementary colour of the absorbed colour is transmitted.

89. (1) Reaction (ii) is feasible because for this E_{cell} = +ve i.e. (+0.76V) and from $\Delta G = -nFE$, ΔG = –ve

90. (3) For a first order reaction

$$k = \frac{2.303}{t} \log \frac{a}{(a-x)}$$

$$t = \frac{2.303}{k} \log \frac{100}{(100-90)} = \frac{2.303 \times t_{1/2}}{0.693} \times \log \frac{100}{10}$$

$$= 3.3 \times t_{1/2} \times \log 10 = 3.3\ t_{1/2}$$

PART - C : BIOLOGY

91. (4) Development of an offspring from reproductive units such as buds or fragments in asexual reproduction, is called blastogenesis. Blastogenesis have the same target to develop a new individual by the process of cell division and differentiation.

92. (2) Crassinucellate ovule refers to the ovule in which nucellus is massive and two or more layers of the cells are present between megaspore mother cell and epidermal cells during megagametophyte development.

93. (2) **94.** (2) **95.** (2)

96. (2) Oocyte is liberated from ovary under the influence of LH, after completing meiosis I and before liberating second polar bodies.

97. (3) If fertilisation does not occur, the secondary oocyte undergoes autolysis and progesterone (secreted by persistent corpus luteum) inhibits the release of LH from pituitary. Reduction of LH level causes regression of corpus luteum by autolysis and thus fall in the progesterone level in the blood. Due to the deficiency of progesterone, uterine lining sloughs off causing bleeding. This whole phase is called bleeding phase.

98. (3) IMR (Infant Mortality Rate) and MMR (Maternal Mortality Rate) both are responsible for affecting the growth directly. Here, IMR has been increased so, it will result in decline in growth rate. Therefore, in the given situation, if IMR has been increased and MMR has been decreased in a population, it will not cause any significant change in growth rate.

99. (1) Post parturition intense lactation occurs, so there is suppression of gonadotropins which inhibits ovulation and thus the women lack menstrual cycle during this period.

100. (4) AIDS, genital herpes and hepatitis-B are sexually transmitted diseases which are not completely curable.

101. (1) Since the woman's father was colourblind, she would be a carrier of the colour blindness allele. When she marries a colourblind man, their progeny could be:

Parent: X^cX × X^cY

Carrier Woman ↓ Colour blind Man

Progeny: X^cX^c X^cY XX^c XY

Colour blind son Carrier daughter

102. (2) Mitochondrion is an organelle present in the cytoplasm. A zygote receives its cytoplasm from the female parent gamete. Hence in the given question, the F_2 progenies do not receive the mitochondrial genome from the male parent and mutation is not passed to progeny.

103. (4) 50% of ova will have (n + 1) chromosome which would on fertilisation, yield abnormal zygotes (n + 1) + (n) = 2n + 1.

104. (1) Males express all information on that portion of their X chromosome that is not homologous to their Y chromosome.

105. (2)

106. (2) A cross between heterozygous long-winged flies and (homozygous) vestigial winged flies represents an example of test cross, in which the exact Mendelian ratio of 1:1 is obtained. *i.e.*, 96 long-winged flies and 96 vestigial winged flies.

107. (2)

108. (4) Minisatellites are inherently unstable and susceptible to mutation at a higher rate than other sequences of DNA. Thus, due to difference in number, location and size of minisatellites on chromosomes, each individual has a unique DNA fingerprint.

109. (4) Even though DNA replication typically occurs millions of times during the life of a multicellular organism, it is remarkably error-free. Those errors that do occur are usually corrected with a high degree of reliability.

110. (2) Operons are segments of genetic material which function as regulated unit or units that can be switched on and switched off. An operon consists of one to several structural genes. (Three in *lac* operon).

These genes which produce mRNAs for forming polypeptides / proteins / enzymes are *lac z* (produces enzyme β galactosidase for splitting lactose into glucose and galactose), *lac y* (produces enzyme galactoside permease, required for entry of lactose) and *lac a* (produces enzyme thiogalactoside transacetylase).

The three structural genes of the operon produce a single polycistronic mRNA.

111. (3)

112. (4) In a transcription unit, the activity of RNA polymerase at a given promoter is regulated by interaction with accessory proteins, which affect its ability to recognise start sites. These regulatory proteins can act both positively (activators) and negatively (repressors).

113. (3) **114. (3)**

115. (4) Scales on their hind limbs and eggs with calcareous shell, indicate in birds about their reptilian ancestry.

116. (1)

117. (3) Molecular evolution is a change in the sequence composition of cellular molecules to explain biological changes at the molecular and cellular level using principle of evolutionary biology and population genetics.

118. (2) **119. (2)** **120. (3)**

121. (4) AIDS (Acquired Immuno Deficiency Syndrome) is caused by HIV, a retrovirus. The virus destroys the helper T-lymphocytes thus reducing their numbers.

122. (3) *Pongamia pinnata* is one of the few nitrogen fixing trees (NFTs) to produce seeds containing 30-40% oil. It is often planted as an ornamental and shade tree but now-a-days it is considered as alternative source for bio-diesel. This species is commonly called pongam, karanj, or a derivation of these names. *Pongamia, Jatropa, Euphorbia* are petrocrops. However, in the Indian countryside, *Pongamia* (Karanj) is being utilised as a source of biodiesel.

123. (4) Roquefort cheese is produced with the help of *Penicillium roqueforti*.

124. (4) **125. (3)** **126. (2)**

127. (3) Expression vectors may contain drug resistance markers, telomeres, and must contain DNA origins but none of these features distinguish them from other vectors. Expression vectors are unique because they contain regulatory sequences that allow the cloned gene to be expressed in the host cell.

128. (3) Treating cells with ampicillin does not make them more permeable to DNA. DNA coated with lipids (not carbohydrates) is used to introduce it into host cells, and microinjection is a method used to place recombinant DNA (not protein) into host cells.

129. (4)

130. (1) *Bacillus thuringiensis* is not used as a bio-fertiliser but it is used as biopesticide and to create transgenic plants.

131. (2) Gene therapy is a collection of methods that allows correction of gene defect that has been diagnosed in a child/embryo. Correction of a genetic defect involves delivery of a normal gene into the individual or embryo to take over the function of and compensate for the non-functional gene.

132. (1) Maintaining homeostasis, especially thermoregulation is energetically expensive for many organisms. During the course of evolution, the costs and benefits of maintaining a constant internal environment were taken into consideration and thus some species preferred to be conformers.

133. (3)

134. (4) Although immunology is sometimes a useful tool in assessing the amount of genetic variation that exists in a population, its importance is less than the other fields listed.

135. (3) 136. (2)

137. (2) Catalytic converters have costly metals like platinum, palladium and rhodium as catalysts. Exhaust gases first pass through catalytic converters to reduce the emission of poisonous gases. Automobiles fitted with catalytic converter should not use leaded petrol because lead inactivates the catalyst of the converter.

138. (3) The Montreal Protocol is an international agreement, which was signed in 1987 and became effective in 1989.

139. (2) The world summit on sustainable development 2002, took place in South Africa from 26 August to 4 September, 2002.

140. (2) Micelle formation is necessary for the absorption of dietary lipids such as cholesterol. Bile salts, iron and B vitamins are absorbed by membrane bound active transport system.

141. (4)

142. (4) Broca's area is the motor speech area and Wernicke's area plays role in understanding speech and speaking in coherent sentences.

143. (3) The space between the cornea and the lens is called the aqueous chamber and contains a thin watery fluid called the aqueous humor. When all the cones are stimulated equally, a sensation of white light is produced. The anterior transparent portion of sclera is called cornea.

144. (4) With the increase in intracranial pressure, the cerebral blood flow is reduced. This increased pressure also stimulates the vasomotor centre and increases systemic blood pressure.

145. (2)

146. (4) The filtrate is isotonic to blood plasma (in proximal convoluted tubule) and the filtrate becomes hypertonic to blood plasma (in descending limb of loop of Henle). The filtrate is hypotonic to blood plasma (in ascending limb of loop of Henle). ADH makes the filtrate isotonic to blood plasma.

147. (3) Urine volume and its concentration is regulated through the same process that regulate blood volume. Urine volume is regulated by ADH, aldosterone and ANF. Water is reabsorbed in DCT under the influence of ADH (secreted by posterior lobe of pituitary gland). This makes the filtrate isotonic to blood plasma and aldosterone is associated with the excretion of K^+ and H^+ ions, some Cl^- ions are also reabsorbed.

148. (3)

149. (3) Ligments are specialised connective tissues which connect bones together, hence if they are cut or broken the bone will become unfixed.

150. (1) Carbon monoxide combines with Hb far more readily than O_2 (CO has about 200 times greater affinity for Hb as compared to O_2), forming a relatively stable compound carboxyhaemoglobin. This causes low supply of O_2 to the body cells leading to headache, nausea, dizziness, paralysis and even death.

151. (2) Due to direct chemical control on respiratory centres, CO_2 stimulates respiratory centres in CNS.

152. (2) The melanocyte-stimulating hormones, known collectively as MSH, are secreted from intermediate lobe of pituitary gland. It is important for protecting the skin from UV rays, development of pigmentation and control of appetite.

153. (3) Calcium plays an important role in blood clotting. Parathormone, a hormone released by parathyroid glands, increases calcium level in the blood. Therefore, deficiency of this hormone will decrease Ca^{2+} level in the blood, thus leading to delay in blood clotting and increases in bleeding time.

154. (3)

155. (4) The adhesive pad of fungi penetrates the host with the help of mechanical pressure and enzymes. It pushes against the cell wall of the host and then releases cellulase to digest cellulose of the host cell wall so that the hypha is able to penetrate the host cell wall.

156. (3) Bilateral symmetry is found in few invertebrates and all vertebrates.

157. (2) 158. (1) 159. (4)

160. (1) The role of double fertilisation in angiosperms is to produce endosperm.

161. (3) Animals which maintain high and constant body temperature are called warm blooded animals. They are also called homeothermic animals. Birds are the first vertebrate to have warm blood. They are homeothermous.

162. (2) The family leguminosae (Fabaceae) comprises of 3 sub families–papilionoideae (Faboideae), caesalpinioideae and mimosoideae. These are distinguished mainly on the basis of inflorescence and floral characters mostly corolla and androecium (whose male reproductive units are called stamens).

163. (3) 164. (4)

165. (3) K_m (Michaelis-Menten constant) is defined as substrate concentration at which under optimum conditions the rate of an enzyme catalysed reaction reaches half the maximum rate. K_m is inversely proportional to affinity of enzyme for its substrate.

166. (1) **167. (3)** **168. (2)**

169. (1) Enzymes may be broadly classified into two types depending on their chemical composition-simple enzymes and conjugated enzymes.

Simple enzymes are made up of proteins and any additional substance or group is absent, e.g., pepsin, trypsin etc.

Conjugated enzymes (or holoenzymes) are formed of two parts - a protein part called apoenzyme and a non-protein part named as cofactor. The complete conjugated enzyme consisting of an apoenzyme and a cofactor is called holoenzyme. Holoenzyme is the functional unit of enzyme.

170. (4) **171. (4)** **172. (3)**

173. (4) Colchicine is an alkaloid. It is used to treat acute attacks of gout. It arrests the spindle action during mitosis as a result of which the divided chromosomes during metaphase stage fail to move the opposite poles. Thus the cell becomes polyploid. Colchicine is used to induce polyploidy in plants.

174. (1) **175. (1)** **176. (1)**

177. (4) ATP formation occurs both at B and E, where glyceraldehyde-3-phosphate is converted into pyruvate; and at E, where the six-carbon compound, citrate, releases water and CO_2 in the Krebs cycle.

178. (4) **179. (3)**

180. (1) Bolting of cabbage can be induced artificially by the application of gibberellin under conditions that would normally maintain the rosette form.