Physics

1. **(c)**
2. **(d)**
3. **(b)** First, let's consider the charge deposited on each sphere. Given that Lhe total charge is 4×10^{-6}C and it's equally divided betweer the two sphere, each sphere will have a charge:

$$q = \frac{4 \times 10^{-4}}{2} = 2 \times 10^{-6}, C$$

Next, the geometry of the setup needs to be considered. The strings create a 60° angle beetween them. This gives each side an angle of 30°, rmaking the vertical component:

$$\sin \theta = \frac{\tau}{0.1} = r = 0.1, m$$

To find the equilitrium condition, we analyze the forces acting on the spheres. The electrical repulsion between the charges can be balanced by the component of the gravitational force. Using the tangent of the angle:

$$\tan \theta = \frac{F_{eleririr}}{mg}$$

Substituting $\theta = 30^\circ$ and expressing the forces:

$$\tan 30^\circ = \frac{Kq^2}{r^2 mg}$$

Using the values provided:

$$\frac{1}{\sqrt{3}} = \frac{9 \times 10^y \times (2 \times 10^{-5})^2}{(0.1)^2 - m \cdot 10}$$

Solving form:

$$m = \frac{9 \times \sqrt{3} \times 4 \times 10^{-3} \times 10^2}{10}$$

Simplifying:

$$m = 0.6235, kg$$

Thus, each sphere has a mass of 0.6235 kg.

4. **(a)**

$$E=\frac{2\,K\lambda}{r}$$
$$\Rightarrow \lambda=\frac{E.r}{2\,K}$$
$$=\frac{3\times10^{8}\times2\times10^{-2}}{2\times9\times10^{9}}$$
$$=\frac{1}{3}\times10^{-3}$$
$$=\frac{1000\mu c}{3}$$
$$=333\frac{\mu c}{m}$$

5. **(b)** Given, $d=R_m$, radius $=R_m$

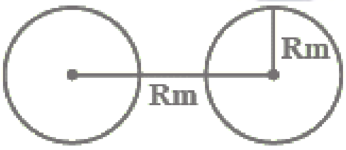
$$Q_1=10C, Q_2=5C$$
$$E=E_1-E_2$$
$$=\frac{1}{4\pi\varepsilon_0}\cdot\frac{5}{R^2}\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$$

Work done $W=qE\cdot d$

$$=q\cdot\frac{1}{4\pi\varepsilon_0}\cdot\frac{5}{R^2}\cdot\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)\cdot R$$

$$W=\frac{1}{4\pi\varepsilon_0}\cdot\frac{5}{R}\cdot q\cdot\left(1-\frac{1}{\sqrt{2}}\right)$$

So, $W=\frac{5q}{4\pi\varepsilon_0 R}\left[1-\frac{1}{\sqrt{2}}\right]J$



6. **(c)** We know that
The energy U which is stored in the capacitor

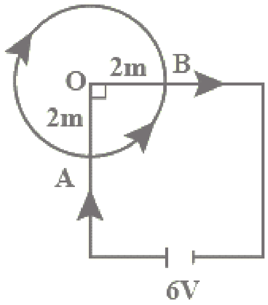
$$U=\frac{1Q^2}{2C}\left[\because C=4\pi\varepsilon_0\cdot R; K=\frac{1}{4\pi\varepsilon_0}\right]$$
$$U=\frac{1Q^2}{2R/K}\Rightarrow U=\frac{1KQ^2}{2R}$$

7. **(a)** The correct option is **B**8 A
Resistance of complete wire $=2\pi r\times\frac{1}{\pi}=2r=2\times2=4\Omega$
$\therefore$ Resistance of each $\frac{1}{4}$ part $=\frac{1}{4}\times4=1\Omega$
Hence, equivalent resistance

$$R_{AB}=\frac{3}{4}\times1=\frac{3}{4}$$

The current through the battery

$$= \frac{V}{R_{AB}} = \frac{6}{3/4} = \frac{6 \times 4}{3} = 8\text{ A}$$



8. **(b)**

9. **(b)** We know that

$$R_1 = \rho \frac{l_1}{A_1} = \rho \frac{l_1}{\pi r_1^2}$$

$$R_2 = \rho \frac{l_2}{\pi r_2^2}$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2} \times \left(\frac{r_2}{r_1}\right)^2$$

$$\frac{V/I_1}{V/I_2} = \frac{l_1}{l_2} \cdot \left(\frac{r_2}{r_1}\right)^2 \quad (\because \text{ wire connected in parallel })$$

$$\frac{I_2}{I_1} = \frac{3}{4} \times \left(\frac{2}{3}\right)^2$$

$$I_1 : I_2 = 9 \times 4 : 4 \times 3$$

$$= 3 : 1$$

10. **(b)** For the voltmeter, a high resistance is connected in series with the galvanometer and so, the resistance of voltmeter is very high compared to that of a galvanometer.

11. **(a)** We know that

Motion of charged particles in uniform magnetic field

$$F = qvB = \frac{mv}{r}$$

$$r = \frac{mv}{qB} \text{ and } K = \frac{1}{2}mv^2$$

$$\Rightarrow v^2 = \sqrt{2\,K/m}$$

$$\text{So, } T = \frac{\sqrt{2mK}}{qB}$$

$$\text{But } T = \frac{2\pi r}{v} = \frac{2\pi m}{qB}$$

$$\therefore T \propto \frac{m}{q}$$

$$T_\alpha = \frac{m_\alpha}{q_\alpha}, T_p = \frac{m_p}{q_p}$$

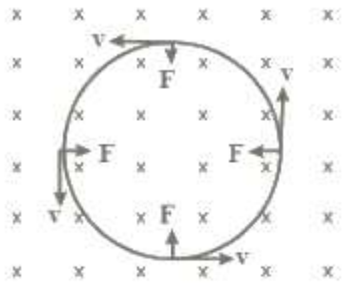
$$\frac{T_\alpha}{T_p} = \frac{m_\alpha}{q_\alpha} \times \frac{q_p}{m_p}$$

[Charge on α particle $= 3.2 \times 10^{-19}$C
Charge on proton $= 1.6 \times 10^{-19}$C
Mass of proton $= 1.7 \times 10^{-27}$ kg
Mass of $\alpha -$ particle $= 6.67 \times 10^{-27}$ kg]

$$= \frac{6.6 \times 10^{-27} \times 1.6 \times 10^{-19}}{2 \times 1.6 \times 10^{-19} \times 1.7 \times 10^{-17}}$$

$$= \frac{66}{34} = \frac{1.94}{1}$$

$$= \frac{2.00}{1} = 2:1$$



12. (d) Given, $N_1 = N_2 = 25$ turns

$R_1 = 50 \text{ cm} = 0.5 \text{ m}$
$R_2 = 200 \text{ cm} = 2 \text{ m}$
$i_1 = 0.1 \text{ A}, i_2 = 0.2 \text{ A}$

The magnitude of the magnetic field

$$\Delta B = B_1 - B_2$$
$$= \frac{\mu_0 N_1 i_1}{2R_1} - \frac{\mu_0 N_2 i_2}{2R_2}$$
$$= \frac{\mu_0 \times 25}{2}\left(\frac{i_1}{R_1} - \frac{i_2}{R_2}\right)$$
$$= \frac{\mu_0 \times 25}{2}\left(\frac{0.1}{0.5} - \frac{0.2}{2}\right)$$
$$= \frac{25}{2}\mu_0\left(\frac{1}{5} - \frac{1}{10}\right)$$
$$= \frac{25}{2}\mu_0\left(\frac{2-1}{10}\right)$$
$$= \frac{25}{2}\mu_0 \times \frac{1}{10} = \frac{25}{20}\mu_0 = \frac{5}{4}\mu_0$$

13. (c)
14. (b)
15. (d) Antistokes lines is Raman scattering are the lines of high frequency and low wavelength.
16. (b) The speed of light in vacuum (air) is represent by c

$$\therefore n = \frac{c}{v}\left(\begin{array}{c}\therefore c = 3 \times 10^8 \text{ m/s} \\ n = \frac{4}{3} \text{ (given)}\end{array}\right)$$
$$v = \frac{c}{n} = \frac{3 \times 10^8}{4/3}$$
$$= \frac{9 \times 10^8}{4} = 2.25 \times 10^8 \text{ m/s}$$
$$t = \frac{d}{v} = \frac{\text{(Distance)}}{\text{(Speed)}}$$
$$t = \frac{4.5 \text{ m}}{2.25 \times 10^{+8}} = \frac{4.50 \times 10^{-8}}{2.25}$$
$$= \frac{450}{225} \times 10^{-8} = 2 \times 10^{-8}$$
$$= 20 \times 10^{-9} \text{ s} = 20 \text{ ns}$$

17. (d)
18. (b) The correct option is $\mathbf{C}10^{-34}$
Given, $m = 100 \text{ g} = 0.1 \text{ kg}$

$$v = 36 \text{ km/h} = 36 \times \frac{5}{18} \text{ m/s} = 2 \times 5 = 10 \text{ m/s}$$
$$h = 6.626 \times 10^{-34} \text{Js}$$

We know that

$$\lambda = \frac{h}{mv}\left(\because p = \frac{h}{\lambda} \text{ and } p = mv\right)$$
$$= \frac{6.626 \times 10^{-34}}{0.1 \times 10}$$
$$\lambda = 6.626 \times 10^{-34} \text{ m}$$

So, the de-Broglie wavelength related to it is of the order 10^{-34} m

19. **(b)** We know that

de-Broglie wavelength $\lambda = \frac{h}{p}$

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

If K be the kinetic energy of the electron, then

$$K = \frac{1}{2}mvv^2$$
$$v = \sqrt{2\,K/m}$$

So, de-Broglie wavelength is

$$\lambda = \frac{h}{\sqrt{2mK}}$$
$$\lambda \propto \frac{1}{\sqrt{K}}$$
$$\therefore \lambda_1 = \frac{1}{\sqrt{K_1}} \ldots.\text{(i)}$$
$$\lambda_2 = \frac{1}{\sqrt{2\,K_1}} \ldots.\text{(ii)}$$
$$\frac{\lambda_2}{\lambda_1} = \frac{1/\sqrt{2\,K_1}}{1/\sqrt{K_1}}$$
$$\frac{\lambda_2}{\lambda_1} = \frac{1}{\sqrt{2}}$$

So, the new de-Broglie wavelength will be $\frac{1}{\sqrt{2}}$ times that of initial wavelength.

20. **(d)** The threshold wavelength of a material signifies that if the photons of energy corresponding to this wavelength or higher strike onto the material, they will undergo photo electric effect. As the energy of a photon is inversely proportional to wavelength ($E = \lambda hc$), the photonic wavelength should be less than equal to threshold wavelength.

21. **(b)** The force experienced by a moving charge in a magnetic field is given by $F = q(\vec{v} \times \vec{B})$

Here, $\vec{B}$ is the magnetic field or magnetic flux density or magnetic flux per unit area.

Thus, dimensions of magnetic flux $[\Phi] = [B] \times [\text{Area}] = \frac{[F][A]}{[q][v]}$

We know the dimensions of the following as-

$$[F] = [M^1\,L^1\,T^{-2}]$$
$$[A] = [L^2]$$
$$[q] = [A^1\,T^1]$$
$$[v] = [L^1\,T^{-1}]$$

Thus, $[\Phi] = \frac{[M^1\,L^1\,T^{-2}][L^2]}{[A^1\,T^1][L^1\,T^{-1}]} = [M^1\,L^2\,T^{-2}\,A^{-1}]$

22. **(d)** Given,

$N = 500$ turn
$A = 0.15\ m^2$
$B_1 = 0.2\ T$
$B_2 = 1.0\ T$
$\Delta t = 0.4\ s$

By Faraday's law of electromagnetic induction

$$
\begin{aligned}
e &= N \cdot \frac{\Delta B}{\Delta t} \cdot A \\
&= 500 \times \frac{(B_2 - B_1)}{\Delta t} \cdot A \\
&= 500 \times \frac{(1.0 - 0.2)}{0.4} \times 0.15 \\
&= \frac{500 \times 0.8 \times 0.15}{0.4} \\
&= 500 \times 2 \times 0.15 \\
&= 150.0\ V
\end{aligned}
$$

So, the induced emf produced in the coil will be 150 V.

23. **(c)** The output power in a step-up transformer is less than the input power as getting 100% efficiency is practically not possible in practice.

24. **(b)**

25. **(b)**

Given,

DC current, $I_{DC} = 8\ A\ldots\ldots(1)$
AC current, $I_{AC} = 6 \sin \omega t\ldots..(2)$

Total current, $I = I_{DC} + I_{AC}$

$I = 8 + 6 \sin \omega t$

Squaring on both sides,

$I^2 = (8 + 6 \sin \omega t)^2$

$I^2 = 64 + 36 \sin^2 \omega t + 96 \sin \omega t$

$$
\begin{aligned}
I^2 &= 64 + 36 \times \frac{1}{2} + 96 \times 0 \\
I^2 &= 64 + 18 = 82 \\
I_{rms} &= \sqrt{82} = 9.05\ A
\end{aligned}
$$

26. **(b)** We know that

1 Short radio waves

Wavelength range $= 1 \times 10^{-1}$ m to 1×10^4 m
Frequency range $= 3 \times 10^9$ Hz to 3×10^4 Hz
2. Microwaves

Wavelength range $= 1 \times 10^{-3}$ m to 3×10^{-1} m
Frequency range $= 3 \times 10^{11}$ Hz to 1×10^{9} Hz
3. Ultraviolet waves

Wavelength range $= 1 \times 10^{-8}$ m to 4×10^{-8} m
Frequency range $= 3 \times 10^{16}$ Hz to 8×10^{14} Hz
So, decreasing order is $\lambda_1, \lambda_2, \lambda_3$.

27. **(b)** Given: Unit of permeability of vacuum
Solution: $\mu_0 = 4\pi \times 10^{-7}$
Units are $\frac{\text{Tm}}{\text{A}}$ or $\frac{\text{Wb}}{\text{A-m}}$ or $\frac{\text{N}}{\text{A}^2}$

28. **(c)**

29. **(d)** Given,

$$I = \frac{I_0}{2} \dots (i)$$
$$I = I\cos^2\theta \left(\because I = \frac{I_0}{8}\right)$$
$$\therefore \frac{I_0}{8} = \frac{I_0}{2}\cos^2\theta$$

From the equation (i), we have

$$\frac{1}{4} = \cos^2\theta \Rightarrow \cos\theta = 1/2$$
$$\Rightarrow \cos\theta = \cos 60^\circ$$
$$\Rightarrow \theta = 60^\circ$$

30. **(b)**

31. **(d)** For first line of Lyman series,

$$n_1 = 1 \text{ and } n_2 = 3$$
$$\therefore \frac{1}{\lambda_1} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$$
$$= R\left(1 - \frac{1}{4}\right)$$
$$= \frac{3R}{4}$$

For first line of Paschen series

$$n_1 = 3 \text{ and } n_2 = 4$$
$$\therefore \frac{1}{\lambda_2} = R\left(\frac{1}{3^2} - \frac{1}{4^2}\right)$$
$$= R\left(\frac{1}{9} - \frac{1}{16}\right)$$
$$= \frac{7R}{144}$$
$$\therefore \frac{\lambda_1}{\lambda_2} = \frac{7R}{144} \times \frac{4}{3R}$$
$$= \frac{7}{108}.$$

32. **(a)**

33. (c)

$$\underset{\text{parent nucleus}}{{}_{Z}X^{A}} \longrightarrow \underset{\text{daughter nucleus}}{{}_{Z+1}X_{1}^{A}} + \underset{\text{bata particle}}{{}_{-1}\beta^{o}} + \underset{\text{anti neutrino}}{\overline{\nu}} + \underset{\text{energy released}}{Q}$$

$$\text{and } \underset{\text{parent nucleus}}{{}_{Z+1}X_{1}^{A}} \longrightarrow \underset{\text{daughter nucleus}}{{}_{Z-1}X_{1}^{A-4}} + \underset{\text{alpha particle}}{{}_{2}He^{4}} + \underset{\text{energy released}}{Q}$$

$$\text{and } \underset{\text{parent nucleus}}{{}_{Z-1}X_{2}^{A-4}} \longrightarrow \underset{\text{daughter nucleus}}{{}_{Z-3}X_{3}^{A-8}} + \underset{\text{alpha particle}}{{}_{2}He^{4}} + \underset{\text{energy released}}{Q}$$

So,

$${}_{Z}X^{A} \xrightarrow{\beta^-} {}_{Z+1}X_{1}^{A} \xrightarrow{\alpha} {}_{Z-1}X_{2}^{A-4} \xrightarrow{\alpha} {}_{Z-3}X_{3}^{A-8}$$

β^{-1}, α, α are successively emitted radioactive radiations.

34. (c) ${}_{8}O^{16} \longrightarrow {}_{8}O^{17} +_{0} n^{1}$

$\therefore$ energy to remove neutron
$=$ binding energy of ${}_{8}O^{17} -$ binding energy of ${}_{8}O^{16} = (17 \times 7.75) - (16 \times 7.79) =$ 4.23MeV.

35. (c) According to the question [Given, $T = 20$ days]

$$\frac{2}{3}N_0 = N_0 e^{-\lambda t_2} \;...\text{(i)}$$
$$\frac{1}{3}N_0 = N_0 e^{-\lambda t_1} \;...\text{(ii)}$$

Dividing equation (i) by equation (ii), we get

$$\frac{\frac{2}{3}N_0}{\frac{1}{3}N_0} = \frac{N_0 e^{-\lambda t_2}}{N_0 e^{-\lambda t_1}}$$
$$2 = e^{+\lambda(t_2 - t_1)}$$
$$\lambda(t_2 - t_1) = \log 2$$
$$t_2 - t_1 = \frac{1}{\lambda}\log 2 \left[\because T = \frac{\log 2}{\lambda}\right]$$
$$t_2 - t_1 = T \Rightarrow t_2 - t_1 = 20 \text{ day}$$

36. (a) In the L-C circuits
For the first condition

$$f_1 = \frac{1}{2\pi}\sqrt{\frac{1}{LC}} \;\ldots\ldots (1)$$

For the second condition, when C = doubling

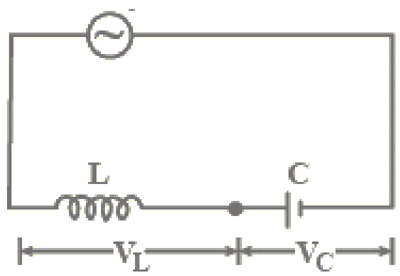
$f_2 = \frac{1}{2\pi}\sqrt{\frac{1}{2LC}}$ ....(2)

From the equation (i), we get

$$f_2 = \frac{1}{2\pi}\sqrt{\frac{1}{LC}} \times \frac{1}{\sqrt{2}} \Rightarrow f_2 = f_1 \times \frac{1}{\sqrt{2}}$$

So, the frequency of the output signal becomes $1/\sqrt{2}$ times by doubling the value of the capacitance in the L -C oscillator circuit.

$E = \varepsilon_0 \sin \omega t$



37. (b) The correct option is $\mathbf{A1}_{10}$ ^{6}

The magnitude of the barrier electric field for a zener diode

$E = V/d, ---(1)$

where $V = 3$ volt

$d = 300 \times 10^{-8}$ cm

Putting corresponding values in equation 1 we get:

$$E = 1 \times 10^6 \text{ V/cm}$$
$$E = 3300 \times 10 - 10$$

38. (c)

Given, $\beta = 200, \Delta I_B = 10\mu A$

$= 10 \times 10^{-6}$ A $= 10^{-5}$ A

$\beta = \left(\frac{\Delta I_C}{\Delta I_B}\right)$

$\Rightarrow \Delta I_C = \beta \Delta I_B$

$\Rightarrow \Delta I_C = 200 \times 10^{-5} = 2 \times 10^{-3}$ A

and $R_L = \frac{\Delta V_{CE}}{\Delta I_C} = \frac{(10-4)}{2 \times 10^{-3}} = \frac{6}{2 \times 10^{-3}}$

$= 3 \times 10^3 \Omega = 3k\Omega$

39. (c) The generally accepted standard range of audible frequencies is 20 Hz to 20,000 Hz, although the range of frequencies individuals hear is greatly influenced by environmental factor. Frequencies below **20Hz** are generally felt rather than heard, assuming the amplitude of the vibration is great enough. Frequencies above 20,000 Hz(20kHz) frequencies are the first to be affected by hearing loss due to age and prolonged exposure to very loud noises.

40. **(b)**

Chemistry

41. **(d)** Let the number of atoms of element Y in hcp unit cell be n.

$\therefore$ Number of tetrahedral voids $= 2n$

As $2/3^{rd}$ of the tetrahedral voids are occupied by atoms of element X,

Number of atoms of element $X = 2n \times 2/3 = 4n/3$

$\therefore$ Ratio of atoms of element X : atoms of element $Y = 4n/3 : n = 4 : 3$

The formula of the compound is X_4Y_3.

42. **(a)** Number of atoms in face centred cubic unit cell, $X_F = 8$ (cornered atoms) $\times \frac{1}{8} + 6$ (face centred atom) $\times \frac{1}{2} =$ $1 + 3 = 4$ atoms / unit cell

Number of atoms in body centred unit cell, $X_b = 8$ (cornered atoms) $\times \frac{1}{8} + 1$ (body centred atom) $= 1 + 1 = 2$

$X_F - X_b = 4 - 2 = 2$

43. **(a)** 10%w/w means 10 g NaOH dissolves in 100 g solution or 10 g NaOH is present in $(100 - 10 = 90\text{ g})$ of water.

$\therefore$ Weight of NaOH $= 10$ g

Mol. wt. of NaOH $= 23 + 16 + 1 = 40\text{gmol}^{-1}$

Moles of NaOH $= \frac{10}{40} = \frac{1}{4} = 0.25$

Weight of solvent (water) $= 90$ g

$\therefore$ Molality (m) $= \frac{\text{Moles of NaOH} \times 1000}{\text{Wt.of water(ing)}}$

$$= \frac{0.25 \times 1000}{90} = 2.778$$

44. **(c)** gas A given graph

45. **(b)** Total volume, $V = 10$ mL10

Volume of one drop $= \frac{10}{1000}$ mL

($\because$ This volume has been divided into 1000 drops)

$$MV = 1000MV$$

(for solution) (for drops)

$$0.1 \times 10 = 1000 \times M' \times \frac{10}{1000}$$

$$M' = 0.1$$

Alternative Concentration is intensive. the property, i.e., remains the same if a solution is divided into n equal parts.

46. **(c)**

47. **(c)** Metallic or electronic conductivity is due to the presence of free electrons or/and holes (positive charge). It depends upon:

(i) Number of valence electrons present in the metal

(ii) Structure and nature (characteristic) of metal

(iii) Density of metal

(iv) Temperature

With increase in temperature, electronic conductivity decreases because the arrangement of electrons gets disturbed. Metallic conductivity does not affect the structure of the metal.

48. (d)

49. (d) The correct option is **D** Ni

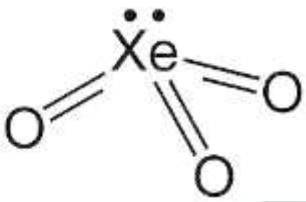
Nickel (Ni) Is purified by Mond carbonyl process. In this process, impure nickel is heated with carbon monoxide, so that it gets converted into nickel carbonyl, a volatile compound. This compound on heating at higher temperature gets dissociate to give pure Ni metal.

$$\underset{\text{Impure}}{\mathrm{Ni}} + 4\mathrm{CO} \xrightarrow{330-350\mathrm{K}} \mathrm{Ni(CO)_4} \xrightarrow{450-470\mathrm{K}} \underset{\text{Pure}}{\mathrm{Ni}} + 4\mathrm{CO}$$

50. (a) N_2O_3 is a blue solid but other oxides are colourless. Among the others only N_2O (nitrous oxide, also called laughing gas) Is neutral to litmus.

51. (b) In XeO_3, Xe, the central atom contains 3 base pair and 1 lone pair.

Because of the presence of one lone pair, its geometrical shape is trigonal pyramidal.



52. (a) Hydrofluoric acid reacts with silica (SiO_2) present in the glass (an important constituent of glass) to form soluble hydrofluorosilicic acid. That's why it is not stored in glass bottles.

$$\underset{\text{From glass}}{\mathrm{SiO_2}} + 4\mathrm{HF} \rightarrow \mathrm{SiF_4} + 2\mathrm{H_2O}$$

$$\mathrm{SiF_4} + 2\mathrm{HF} \rightarrow \underset{\text{Hydrofluorosilicic acid}}{\mathrm{H_2SiF_6}}$$

53. (a) The correct option is **a** $CH_3F > CH_3Cl > CH_3Br > CH_3I$

As the size of halogen atom increases, the $C-X$ bond length increases and hence, the $C-X$ bond strength decreases.

Since, the order of size of halogen atom is

$F < Cl < Br < I$

Thus, the order of C - X bond strength is

$C-F > C-Cl > C-Br > C-I$

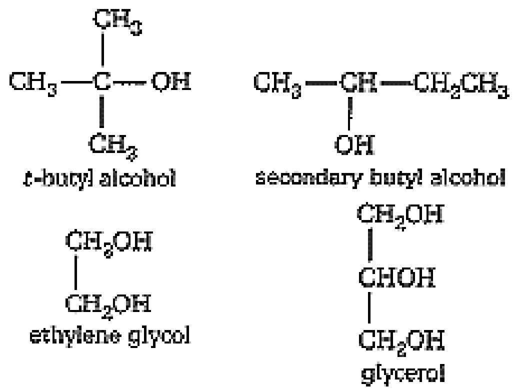
54. (c)

55. (c) S_N2 stands for bimolecular nucleophilic substitution reactions. This reaction takes place in a single step with the formation of intermediate transition state as follows:

$$\underset{\text{Substrate}}{R-X} + \underset{\text{Nucteophile}}{OH^-} \rightarrow \underset{\text{Transition state}}{HO \quad R \quad X} \ldots \rightarrow HO-R+X^-$$

Since, both the substrate and the nucleophile take part in the rate-determining step, i.e., rate depends on the concentration of both, so the order of such reactions is 2 . Here, the substrate does not undergo heterolytic fission.

56. (d) More the number of hydroxyl groups in a compound more is the tendency to form hydrogen bonds with water and hence, more will be the solubility. Thus, among the given, glycerol, because of the presence of more number of hydroxyl groups, readily dissolves in water.



57. (a) Dehydration of alcohol

It involves cleavage of C – O bond.
(b) Oxidation of alcohol 3° alcohols generally do not undergo oxidation however in the presence of $KMnO_4$, cleavage of C - C bond takes place to give two acids in which C-O bond remains uncleaved.
(c) Reduction

$$CH_3CH_2OH \xrightarrow{LiAlH_4} CH_3CH_3$$

It involves cleavage of C – OH bond.
(d) Reaction with phosphorus tribromide

$$CH_3CH_2OH \xrightarrow{PBr_3} CH_3CH_2Br$$

It also involves cleavage of C – OH bond.

Thus, oxidation reactions of alcohol do not involve cleavage of C -O bond among the given reactions.

58. (d) Reduction product(s) of the given compounds are as follows

(a) $\underset{\text{Propanal}}{CH_3CH_3CHO} \xrightarrow[2H]{LiAlH_4} \underset{\substack{\text{Propanol} \\ (1^\circ\ \text{alcohol})}}{CH_3CH_2CH_2OH}$

(b) $\underset{\text{Propanoic acid}}{CH_3CH_3COOH} \xrightarrow[4H]{LiAlH_4} \underset{\substack{\text{Propanol} \\ (1^\circ\ \text{alcohol})}}{CH_3CH_2CH_2OH}$

(c) $\underset{\text{Methyl propanoate}}{CH_3CH_3COOH_3} \xrightarrow{LiAlH_4} \underset{\substack{\text{Propanol} \\ (1^\circ\ \text{alcohol})}}{CH_3CH_2CH_2OH} + \underset{\substack{\text{Methanol} \\ (1^\circ\ \text{alcohol})}}{CH_3OH}$

(c) $\underset{\text{Propan-2-one}}{CH_3 - \underset{\underset{O}{||}}{C} - CH_3} \xrightarrow{LiAlH_4} \underset{\substack{\text{Propan-2-ol} \\ (2^\circ\ \text{alcohol})}}{CH_3 - \underset{\underset{OH}{|}}{CH} - CH_3}$

Thus, propan-2-one is the compound which on reduction does not produce 1° alcohol.

59. (b) Integrated rate law for a first order reaction is

$$k = \frac{2.30}{t} \log \frac{a}{a - x}$$

For half-life, $t = t_{1/2}, x = \frac{a}{2}$
On substituting the values,

$$k = \frac{2.303}{t_{1/2}} \log \frac{a}{a - \frac{a}{2}}$$
$$k = \frac{2.303 \log 2}{t_{1/2}} = \frac{0.693}{t_{1/2}}$$
$$\text{or } t_{1/2} = \frac{0.693}{k}$$

Thus, half-life period $\left(t_{1/2}\right)$ of a first order reaction does not depend upon the concentration.

60. (b)
61. (b) Given, rate constant for first order reaction:

$$k = 2.303 \times 10^{-2}\ s^{-1}$$

Let, initial concentration be a.

Then, final concentration $(a - x) = \frac{1}{10}$ of an $\frac{a}{10}$

Integrated rate law expression for first order reaction is:

$$k = \frac{2.303}{t} \log \frac{a}{(a - x)}$$
$$\text{or } t = \frac{2.3 \circ 3}{k} \log \frac{a}{(a - x)}$$

On substituting values, we get:

$$t = \frac{2.303}{2.303 \times 10^{-2}} \log \frac{a}{\frac{a}{10}}$$
$$= 10^2 \log 10$$
$$= 10^2 = 100\ s$$

62. (a) Physical adsorption Is an instantaneous process in which van der Waals' forces exist between the adsorbate and adsorbent. Thus, an activation energy of such adsorption is low and it results in the formation of multimolecular layer (more than one molecule thick). Physisorption occurs at low temperature and decreases with rising in temperature.
63. (b)
64. (a) The ground state electronic configuration of the given elements is:

$Hg_{80} = [Xe]4f^{14}, 5\,d^{10}, 6\,s^2$
$Au_{79} = [Xe]4f^{14}, 5\,d^{10}, 6\,s^1$
$Cd_{48} = [Kr]4\,d^{10}, 5\,s^2$
$Zn_{30} = [Ar]3\,d^{10}, 4\,s^2$

The electronic configuration of only Au contains Incompletely filled orbital, i.e., partially filled orbital. That's why it is a transition element as per the ground state electronic configuration.

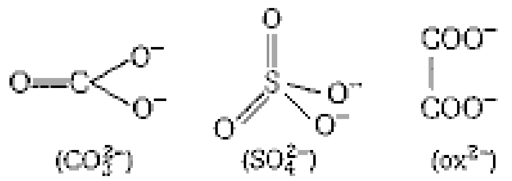
65. (a)

66. (b) Pyrophoric Misch metal, which is an alloy of Ce, La and some other rare earth elements, Is extremely employed in making gas lighters and cigarette lighters. It is also a powerful reductant.

67. (d)

68. (b)

69. (a) Monodentate ligand like oxide (O^{2-}), chloride (Cl^-), etc. contains only one coordination site. Other given ligands, CO_3^{2-}, SO_4^{2-} and OX^{2-} have two coordination sites as shown below



70. (b) Presence of an electron-withdrawing group, (-I showing group) like -CI facilitates the removal of a proton from a carboxylic acid by dispersing the negative charge of the carboxylate ion formed.

Thus, increases the acidity of the carboxylic acids. More the number of -I showing (electron-withdrawing) groups, more will be the acidity of carboxylic acid.

Thus, the order of acidic strength is

$Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH > CH_3COOH$

71. (c) Fehling solution B is an alkaline solution of sodium potassium tartarate or Rochelle's salt.

72. (c)

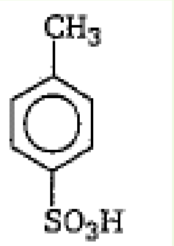
73. (a) The correct option is a Tripropyl amine + benzene sulphonyl chloride Tertiary or 3° amines like tripropyl amine, because of the absence of hydrogen attached directly with N atom, do not react with benzene sulphonyl chloride (Hinsberg's reagent).

Hence,

$\underset{\text{amine}}{\text{Tripropyl}} + \underset{\text{sulphonylchloride}}{\text{benzene}} \rightarrow \text{No reaction}$

$(C_3H_7)_3N + C_6H_5SO_2Cl \rightarrow \text{No reaction}$

74. (a) p-toluene sulphonyl chloride 1°, 2° and 3° amines were generally separated by using Hinsberg's reagent (benzene sulphonyl chloride). But now a days p-toluene sulphonyl chloride is widely used for this purpose.



75. **(b)** Cyanocobalamine is vitamin B_{12}. It is manufactured by bacteria and can only be found naturally in animal products. Its main sources are liver of ox, fish, crab, milk, cheese, etc. Thus, it is not obtained from plants.
76. **(b)** When sucrose Is heated to 483 K , it loses water and forms a brown amorphous substance having nutty flavours, called the .caramel. This process is called caremelization. Caremelization is a non-enzymatic oxidation reaction.
77. **(a)** Neutral Amino acids: Glycine, Alanine, leucine, Isoleucine, valine, phenylalanine, Proline, methionine, serine, threonine, tyrosine, cysteine, glutamine, asparagine, tryptophan.

Acidic amino acids: Aspartic acid, glutamic acid

Basic amino acids: Lysine, histidine, Arginine

78. **(d)**
79. **(a)**
80. **(a)** Salts of sorbic acid are used as preservative in cheese, baked food, pickles and meat.

Biology

81. **(c)**
82. **(c)**
83. **(d)**
84. **(b, d)**
85. **(c)**
86. **(d)**
87. **(c)**
88. **(a)**
89. **(d)**
90. **(b)**
91. **(b)**
92. **(a)**
93. **(d)**
94. **(c)**
95. **(c)**
96. **(a)**
97. **(c)**
98. **(a)**
99. **(a)**
100. **(d)**
101. **(a)**
102. **(c)**
103. **(d)**
104. **(b)**
105. **(b)**
106. **(c)**

107. (a)
108. (b)
109. (a)
110. (b)
111. (b)
112. (d)
113. (a)
114. (d)
115. (d)
116. (b)
117. (c)
118. (a)
119. (b)
120. (c)