Q1 (20 July 2021 Shift 1)

An inorganic Compound 'X' on treatment with concentrated H_2SO_4 produces brown fumes and gives dark brown ring with $FeSO_4$ in presence of concentrated H_2SO_4. Also Compound 'X' gives precipitate ' Y′, when its solution in dilute HCl is treated with H_2 S gas. The precipitate ' Y′ on treatment with concentrated HNO_3 followed by excess of NH_4OH further gives deep blue coloured solution, Compound ' X′ is:

(1) $Co(NO_3)_2$

(2) $Pb(NO_2)_2$

(3) $Cu(NO_3)_2$

(4) $Pb(NO_3)_2$

Q2 (22 July 2021 Shift 1)

Methylation of 10 g of benzene gave 9.2 g of toluene. Calculate the percentage yield of toluene (Nearest integer)

Q3 (25 July 2021 Shift 1)

Consider the complete combustion of butane, the amount of butane utilized to produce 72.0 g of water is x 10^{-1} g. (in nearest integer)

Q4 (25 July 2021 Shift 2)

The number of significant figures in 0.00340 is

Q5 (27 July 2021 Shift 1)

The density of NaOH solution is 1.2 g cm^{-3}. The molality of this solution is m.

(Round off to the Nearest Integer) [Use : Atomic masses: Na : 23.0u O : 16.0u

H : 1.0u

Density of H_2O : 1.0 g cm^{-3}]

Q6 (27 July 2021 Shift 2)

$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

The above reaction is carried out in a vessel starting with partial pressure $P_{SO_2} = 250$ m bar $P_{O_2} = 750$ m bar and $P_{SO_3} = 0$ bar. When the reaction is complete, the total pressure in the reaction vessel is m bar. (Round off of the nearest integer).

Answer Key

Q1 (3) **Q2** (78) **Q3** (464) **Q4** (3)

Q5 (5) **Q6** (375)

Q1

$$\underset{\text{(Anion)}}{\underset{X}{NO_3^-}} + H_2SO_4 \underset{\text{(Conc.)}}{} \rightarrow \underset{\text{Brown fumes}}{NO_2\uparrow} + H_2O$$

$$FeSO_4 + H_2SO_4 + NO_3^-$$

$$\text{Sol}^n \quad \text{conc.} \quad X$$

$$\downarrow$$

$$\left[Fe(H_2O)_5(NO)\right] SO_4$$

$$\text{(Dark brown ring) } Cu^{2+} + (\text{dilHCl} + H_2S)$$

$$\underset{\text{(cation)}}{X} \quad \text{(Group-II reagent)}$$

$$\downarrow$$

$$CuS\downarrow$$

(Black ppt)

(Y)

$$\underset{(Y)}{CuS} \xrightarrow[HNO_3]{\text{Conc}^a} \overset{\text{Soluble}}{Cu(NO_3)_2} + NO_2 + S + H_2O$$

$$\downarrow \text{Excess } NH_4OH \text{ Sol}^n.$$

$$[Cu(NH_3)_4]^{2+}$$

Deep blue colour solution.

$$\therefore X \rightarrow Cu(NO_3)_2$$

Q2

$$C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$$

$$\frac{10}{78}\left(\frac{10}{78} \times 92\right) \text{ gm} \Rightarrow$$

$$\frac{A_y}{T_y} = \%\text{ yield } = \frac{9.2}{920} \times 78 \times 100 \Rightarrow 78\%$$

Q3

$$C_4H_{10} + \frac{13}{2}O_2 \longrightarrow 4CO_2 + 5H_2O$$

$$\text{Moles of } H_2O = \frac{72}{18} = 4$$

$$\text{Moles of } C_4H_{10} \text{ used} = \frac{1}{5} \times 4$$

Weight of C_4H_{10} used $= \frac{4}{5} \times 58$

$= 46.4$gm

Q4

Number of significant figures $= 3$

Q5

Consider 1ℓ solution

mass of solution $= (1.2 \times 1000)$g

$= 1200$gm

Neglecting volume of NaOH Mass of water $= 1000$gm

$\Rightarrow$ Mass of NaOH $= (1200 - 1000)$gm

$= 200$gm

$\Rightarrow$ Moles of NaOH $= \frac{200\text{ g}}{50\text{ g/mol}} = 5$ mol

$\Rightarrow$ molality $= \frac{5\text{ mol}}{1\text{ kg}} = 5$ m

Q6

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

Initial	250 m bar	750 m bar	O
(L. R.)			
Final	-250 m bar	-125 m bar	250 m bar 0625mbar250mbar

$\therefore$ Final total pressure $= 625 + 250 = 875$ m bar