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Assignment 1

Soln 1:- ∵ Amount of coal consumed per day

$= 10^9$ tons $= 10^4 \times 10^3 \times 10^3$

$= 10^{10}$ gm.

Now, the reaction that produces SO_2 is

$$S + O_2 \rightarrow SO_2$$

∴ for 32 gm S $\longrightarrow$ 64 gm SO_2 is produced

∴ mass ratio $= 64/32 = 2$

∴ Amount of sulphur consumed per day

$= 2\%$ of 10^{10} gm $= 2 \times 10^8$ gm

∴ amount of SO_2 produced per day

$= 2 \times 2 \times 10^8$ gm $= 4 \times 10^8$ gm

∴ Concentration of $SO_2 = \dfrac{4 \times 10^8 \text{ gm}}{10^{11} \text{ m}^3}$

$= 4 \times 10^{-3}$ gm/m^3

$= 4000$ µg/m^3.

∵ NAAQS standard is 365 µg/m^3

let the optimal sulphur content be x %.

∴ concentration of $SO_2 \leq 365$ µg/m^3

$\Rightarrow 10^{10} \times \dfrac{x}{100} \times 2 \times 10^{-11} \leq 365 \times 10^{-6}$

$\Rightarrow \quad x \leq \frac{365}{2} \times 10^{-3}$

$\Rightarrow \quad x \leq 0.18\ \%.$

∴ The sulphur content in coal should be less than 0.18%.

Soln 2:- ∵ number of gasoline-powered cars = 10^9

∴ volume of gasoline produced from a car per year

$$= \frac{16000\ \text{km} \times 7.8\ \text{L}}{100\ \text{km}}$$

$$= 7.8 \times 160\ \text{lit}$$

$$= 1248\ \text{litres}$$

Now, CO_2 produced from combustion of gasoline per year

$$= \frac{1248 \times 2.3}{1\ \text{lit}}\ \text{lit} \cdot \text{Kg} = 2870.4\ \text{Kg}.$$

Also, there is 25% overheading

∴ total annual CO_2 emission ~~from~~ per automobiles

$$= 2870.4 \times (1.25)\ \text{Kg}$$

$$= 3588\ \text{Kg}$$

$$= 3.588\ \text{tonnes}.$$

∴ total emitted by automobile industry

$$= 3.588 \times 10^9\ \text{tonnes}$$

$$= 3.588\ \text{Gt}.$$

{10^9 since no. of gasoline powered cars}.

{∵ 1 ton = 10^9 Gt}