2. b)

Given

$n = 0.5$ mol He

$N_A = \frac{6.022 \times 10^{23} \text{ atoms He}}{\text{mol He}}$

Required

$N_{He} = ?$

Solution

$N = n \times N_A$

$N_{He} = 0.5 \text{ mol He} \times \frac{6.022 \times 10^{23} \text{ atoms He}}{\text{mol He}}$

$= 3,011 \times 10^{23}$

$N_{He} = 3 \times 10^{23}$ atoms He

∴ the number of helim atoms is 3×10^{23}

3. b)

Given

$N = 3.2 \times 10^{12}$ atoms H

$N_A = \dfrac{6.022 \times 10^{23} \text{ atoms H}}{\text{mol H}}$

Required

$n = ?$

Solution

$N = n \times N_A$

$n = \dfrac{N}{N_A}$

$= \dfrac{3.2 \times 10^{12} \text{ atoms H}}{6.022 \times 10^{23} \text{ atoms H/mol H}}$

$= 5.3138492 \times 10^{-12}$

$n = 5.3 \times 10^{-12}$ mol H

$\therefore$ there are 5.3×10^{-12} moles of H atoms

4. C)

Given

Atomic mass of Al = 26.982 U

Atomic mass of O = 15.999 U

Atomic mass of H = 1.008 U

molecular mass = molar mass

Required:

molar mass of $Al(OH)_3$ = ?

Solution

molar mass = atomic mass of Al + 3(atomic mass of O) + 3(atomic mass H)

= 26.982 U + 3(15.999) U + 3(1.008) U

molar mass = 78.003 g/mol

≐ 78.0 g/mol

∴ The molar mass of $Al(OH)_3$ is 78.0 g/mol

D)

Given

Atomic mass of Si = 28.086 U

Atomic mass of Cl = 35.453 U

molecacular mass = molar mass

Required:

molar mass of $SiCl_4$ = ?

Solution

molar mass = atomic mass of Si + 4(atomic mass of Cl)

= 28.086 U + 4(35.453) U

molar mass = 169.898 g/mol

≐ 169.9 g/mol

∴ The molar mass of $SiCl_4$ is 169.9 g/mol

6. a)

Given

$M_N = 14.007$ g/mol

$M_{O_2} = 2(15.999) = 31.998$ g/mo

$M_{NO_2} = M_N + M_{O_2} = 14.007 + 31.998 = 46.005$ g/mol

$n = 5$ mol NO_2

Required

$m_{NO_2} = ?$

Solution

$m = n \times M$

$m_{NO_2} = 5 \text{ mol } NO_2 \times 46.005$ g/mol

$= 230.025$ g

$\doteq 200$ g

$\therefore$ The mass of NO_2 is 200 grams

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6c)

Given

$N_{CO} = 7.5 \times 10^{25}$ molecules CO

$M_{CO} = M_C + M_O = 12.011 + 15.999 = 28.01$ g/mol

$N_A = \frac{6.022 \times 10^{23} \text{ molecules CO}}{\text{mol CO}}$

Required

$m_{CO} = ?$

Solution

$$m = \frac{N \times M}{N_A}$$

$$m_{CO} = \frac{N_{CO} \times M_{CO}}{N_A}$$

$$= \frac{7.5 \times 10^{25} \text{ molecules CO} \times 28.01 \text{ g/mol}}{6.022 \times 10^{23} \text{ molecule CO / mol CO}}$$

$$= 3488.458984$$

$$= 3500 \text{ grams}$$

∴ The mass of CO is 3500 g

b) n

Given

$M_{NaOH} = M_{Na} + M_O + M_H = 22.990 + 15.999 + 1.008 = 39.997 \text{ g/mol}$

$m_{NaOH} = 50 \text{ g}$

Required

$n = ?$

Solution

$m = n \times M$

$$n = \frac{m}{M}$$

$$n = \frac{50g}{39.997 \text{ g/mol}}$$

$= 1.2500094 \text{ mol}$

$= 1 \text{ mol NaOH}$

∴ There ~~is~~ 1 mole of NaOH

8. a)

Given

$n = 3.8 \text{ mol } CH_4$

$M_{CH_4} = M_C + M_{H_4} = 12.011 + 4(1.008) = 16.043 \text{ g/mol}$

$N_A = \frac{6.022 \times 10^{23} \, CH_4 \text{ fu}}{\text{mol } CH_4}$

$m = 3.8 \times 16.043 = 60.9634 \text{ g}$

Required

$N_C = ?$

Solution

$$N_C = \frac{m}{M} \times N_A \times \frac{C}{CH_4 \text{ fu}} \rightarrow \frac{m}{M} \times N_A \times \#\text{ of atoms}$$

$$= \frac{g}{\frac{g}{\text{mol } CH_4}} \times \frac{CH_4 \text{ fu}}{\text{mol } CH_4} \times \frac{C \text{ atoms}}{CH_4 \text{ fu}}$$

$$= \cancel{\text{mol } CH_4} \times \frac{\cancel{CH_4 \text{ fu}}}{\cancel{\text{mol } CH_4}} \times \frac{C \text{ atoms}}{\cancel{CH_4 \text{ fu}}}$$

8. b)

Given

$m = 100g$

$M_{C_2H_6} = M_{C_2} + M_{H_6} = 2(12.011) + 6(1.008) = 30.07\ g/mol\ C_2H_6$

$N_A = \frac{6.022 \times 10^{23}\ C_2H_6\ fu}{mol\ C_2H_6}$

\# of C in $C_2H_6 = 2$

Required

$N_c = ?$

$$N_c = \frac{m}{M} \times N_A \times \#\text{ of } C$$

$$= \frac{100\cancel{g}}{30.07\cancel{g/mol\ C_2H_6}} \times \frac{6.022 \times 10^{23}\ \cancel{C_2H_6\ fu}}{\cancel{mol\ C_2H_6}} \times \frac{2\ C\ atoms}{\cancel{C_2H_6\ fu}}$$

$$= \frac{100}{30.07}(6.022 \times 10^{23}) \times 2\ C\ atoms$$

$$\doteq 4.0053 \times 10^{24}\ C\ atom$$

$$\doteq 4 \times 10^{24}\ C\ atoms$$

$\therefore$ There are 4×10^{24} Carbon atoms in 100 g of ethane.