Problem #1 : If a bucket holds 2 kg of NaOH, how many kmoles of NaOH does it contain?

Solution Basis : 2 kg of NaOH

S. NO.	Component	Molecular formula (-)	Molecular Weight (kg/kmol)	Weight (kg)	Moles (kmol)
01	Sodium Hydroxide	NaOH	40	2	0.05

Note: Moles of NaOH = Weight of NaOH/ Molecular Weight of NaOH = 2/40 = 0.05 kmol

Problem #2 : How many kilogram of NaOH is there in 7.50 gmol of NaOH?

Solution Basis : 7.50 g of NaOH

S. NO.	Component	Molecular formula (-)	Molecular Weight (g/gmol)	Weight (kg)	Moles (gmol)
01	Sodium Hydroxide	NaOH	40	0.3	7.50

Note: Weight of NaOH = Gram moles of NaOH x Molecular Weight of NaOH = 7.50 x 40 = 300 grams.
300 grams NaOH = 0.3 kilograms of NaOH.

Problem #3 : What is the molecular weight of a super conductor which has the following elements ?

Barium, Yttrium, Copper, Oxygen.

Solution

Element	Number of Atoms	Atomic Weights	Mass (g)
Ba	2	137.347	2 x 137.24 = 274.480
Y	16	63.546	16 x 63.546 = 1016.700
Cu	24	16.00	24 x 16.00 = 384.000
O	1	88.905	1 x 88.905 = 88.905
		Total	**1764.085 g/gmol**

Problem #4 : A mixture of gases has the following composition by mass

O_2 = 16.0 %
CO = 4.0 %
CO_2 = 17.0 %
N_2 = 63.0 %

What is the molar composition of the gas mixture?

Solution

S. No.	Components	Molecular Formula (-)	Molecular Weight (kg/kmol)	Mass (kg)	Moles (kmol)	Mole fraction (-)
1	Oxygen	O_2	32	16.00	0.500	0.150
2	Carbon monoxide	CO	28	04.00	0.143	0.044
3	Carbon dioxide	CO_2	44	17.00	0.386	0.120
4	Nitrogen	N_2	28	63.00	2.250	0.690
	Total			**100.0**	**3.279**	**1.000**

Problem #5 : Average molecular weight of air

Solution : Basis 100 moles of air

S. No.	Components	Molecular Formula (-)	Molecular Weight (kg/kmol)	Moles (kmol)	Mass (kgl)	Weight Percentage (%)
1	Oxygen	O_2	32.0	21.0	672.00	23.17
2	Nitrogen	N_2	28.2	79.0	2228.00	76.83
Total				**100.0**	**2900.00**	**100.00**

The average molecular weight of the mixture is given as

$$\text{Average molecular weight} = \frac{\sum_{i=1}^{n} M_i}{\sum_{i=1}^{n} x_i}$$

Where M_i = mass or weight of i components in the mixture

x_i = moles of of i components in the mixture

Therefore the average molecular weight of the air = 2900 kg / 100 kmol = 29 kg/kmol

Problem #6 : You have 100 kilogram of gas of the following composition

CH_4 = 30%

H_2 = 10%

N_2 = 60%

What is the average molecular weight of the air ?

Solution : 100 kilogram of gas mixture

S. No.	Components	Molecular Formula (-)	Molecular Weight (kg/kmol)	Mass (kg)	Moles (kmol)	Weight Percentage (-)
1	Methane	CH_4	16	30.00	1.875	30
2	Hydrogen	H_2	2	10.00	5.000	10
3	Nitrogen	N_2	28	60.00	2.143	60
	Total			**100.0**	**9.018**	**100**

The average molecular weight of the mixture is given as

$$\text{Average molecular weight} = \frac{\sum_{i=1}^{n} M_i}{\sum_{i=1}^{n} x_i}$$

Where M_i = mass or weight of i components in the mixture

x_i = moles of i components in the mixture

Therefore the average molecular weight of the gas = 100 kg /9.018 kmol = 29 kg/kmol = 11.089 kg/kmol

Problem #7 : An industrial drain cleaner contains 5.0 kf of water and 5 kg of NaOH. What are the mass (or weight) fraction and mole fraction of each component in the drain cleaner.

Solution : 10 kg of solution (5 kg of water and 5 kg of NaoH)

S. No.	Components	Molecular Formula (-)	Molecular Weight (kg/kmol)	Mass (kg)	Mass fraction	Mole (kmol)	Mole fraction (-)
1	Water	H_2O	32	5.00	0.500	0.278	0.69
2	Sodium hydroxide	NaOH	40	5.00	0.500	0.125	0.31
	Total			**10.00**	**1.000**	**0.403**	**1.00**

Problem#8 : A liquefied mixture of n-butane, n-pentane and n-hexane has the following composition:

n-butane :50%
n-pentane : 30%
n-hexane : 20%

For this mixture calculate:
(a) The weight fraction of each component
(b) Mole fraction of each component
(c) Mole percent of each component
(d) The average molecular weight of the mixture

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Solution : 100 kilogram of liquefied mixture

S. No.	Components	Molecular Formula (-)	Molecular Weight (kg/kmol)	Mass (kg)	Mass fraction	Mole (kmol)	Mole fraction (-)
1	n-butane	C_4H_{10}	58	50	0.50	0.86	0.57
2	n-pentane	C_5H_{12}	72	30	0.30	0.42	0.28
3	n-hexane	C_6H_{14}	86	20	0.20	0.23	0.15
	Total			**100**	**1.00**	**1.51**	**1.00**