4.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships.

Example 1

How many ATOMS of fluorine are present in 3.30 moles of BF_3?

$N = 6.023 \times 10^{23}\ mol^{-1}$

$$3.30\ mol\ BF_3 \left| \frac{3\ F}{1\ BF_3} \right. = 9.90\ mol\ F$$

BF_3 : 1B + 3F

$$9.90\ mol\ F \left| \frac{6.023 \times 10^{23}\ atoms}{1\ mol} \right. = 5.96 \times 10^{24}\ atoms\ F$$

$$6.023 \times 10^{23}\ mol^{-1} = \frac{6.023 \times 10^{23}}{1\ mol}$$

4.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships.

Example 2

How many MOLES of fluorine are present in 3.09×10^{22} molecules of BF_3?

$N = 6.023 \times 10^{23}\ mol^{-1}$

$$3.09 \times 10^{22}\ \text{molecules } BF_3 \left| \frac{1\ \text{mol}}{6.023 \times 10^{23}\ \text{molecules}} \right. = 0.0513\ \text{mol } BF_3$$

$$0.0513\ \text{mol } BF_3 \left| \frac{3\ F}{1\ BF_3} \right. = 0.154\ \text{mol } F$$

5.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships.

Example 3

How many **MOLES** of water are present in 5.41 grams of this compound ?

O: 16.0
H: 1.01

 a) 0.1 b) 0.2 c) 0.3 ✓ d) 0.4 e) Help

$5.41\,g\ H_2O \rightarrow ?\ mol\ H_2O$

H_2O: $2(H) + O$

$2(1.01) + 16.0 = 18.02\,g.mol^{-1}$ .... $\frac{18.02\,g}{1\,mol}$

$$5.41\,g\ H_2O \left| \frac{1\,mol}{18.02\,g} \right. = 0.03\ mol\ H_2O$$

5.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships.

Example 4

How many Grams of ethanol (CH_3CH_2OH) are present in 0.61 moles of this compound ?

C : 12.01
H : 1.01
O : 16.00

 a) 46 b) 96 c) 28 ✓ d) Help

CH_3CH_2OH : $2(C) + 6(H) + O$

$2(12.01) + 6(1.01) + 16.00 = 46.08\ g.mol^{-1}$ ... $\frac{46.08\ g}{1\ mol}$

$$0.61\ mol\ CH_3CH_2OH \left| \frac{46.08\ g}{1\ mol} \right. = 28.1\ g\ CH_3CH_2OH$$

4.4 How Do We Balance Chemical Equations?

Example 1

Balance the following chemical equation:

$$\underline{2}\ Fe_2O_3(s) + \underline{3}\ C(s) = \underline{\cancel{2}\ 4}\ Fe(s) + \underline{3}\ CO_2(g)$$

Reactants					✓
Fe	2	2	4	4	4
O	3	3	6	6	6
C	1	1	1	1	3

Products					✓
Fe	1	2	2	4	4
O	2	2	6	6	6
C	1	1	3	3	3

$2\ Fe_2O_3(s) + 3\ C(s) = 4\ Fe(s) + 3\ CO_2(g)$

4.4 How Do We Balance Chemical Equations?

Example 2

Balance the following chemical equation:

$$\_\_C_2H_6(g) + \underline{7/2}\,O_2(g) = \underline{2}\,CO_2(g) + \underline{3}\,H_2O(l)$$

Reactants				✓	
C	2	2	2	2	
H	6	6	6	6	
O	2	2	2	7	

Products				✓	
C	1	2	2	2	
H	2	2	6	6	
O	3	5	7	7	

$C_2H_6(g) + \frac{7}{2}O_2(g) = 2\,CO_2(g) + 3\,H_2O(l)$ technically ✗

$\times 2$

$2\,C_2H_6(g) + 7\,O_2(g) = 4\,CO_2(g) + 6\,H_2O(l)$ ✓

4.4 How Do We Balance Chemical Equations?

Example 3

a) 1
b) 2
c) 3
d) 4
e) 5

Balance the following chemical equation:

$$\_\_AgNO_3(aq) + \_\_K_2CrO_4(aq) = \text{?}\_\_Ag_2CrO_4(s) + \_\_KNO_3(aq)$$

? What is taking you so long ??

4.4 How Do We Balance Chemical Equations?

Example 3

a) 1 ✓
b) 2
c) 3
d) 4
e) 5

Balance the following chemical equation:

$$\underline{2}\ AgNO_3(aq) + \underline{\ \ }\ K_2CrO_4(aq) = \underline{?}\ Ag_2CrO_4(s) + \underline{2}\ KNO_3(aq)$$

Reactants			✓		
Ag	1	2	2		
NO_3	1	2	2		
K	2	2	2		
CrO_4	1	1	1		

Products			✓		
Ag	2	2	2		
NO_3	1	1	2		
K	1	1	2		
CrO_4	1	1	1		

$$2\ AgNO_3(aq) + K_2CrO_4(aq) = Ag_2CrO_4(s) + 2\ KNO_3(aq)$$

Polyatomic ions tend to remain intact ... when they do treat them as a single entity.