<u>Aim:</u> How is the empirical formula related to the molecular formula?

1) To obtain the EF from the MF, just simplify the ratio of atoms.

Molecular Formula		**Empirical Formula**
actual # atoms		simplest ratio
N_2O_4	**DIVIDE**	NO_2
$C_6H_{12}O_6$	**======>**	CH_2O
*H_2O		H_2O

* The MF and the EF are the same for H_2O because this ratio can't be simplified any further.

2) Going in reverse direction, just multiply by a whole number, "n".

	MULTIPLY	
?????	**<======**	CH

C_2H_2, C_3H_3, C_4H_4, etc…
There are many possibilities.

EF x n = MF

In other words, **the molecular formula is a multiple of the empirical formula**. And, the same applies for the masses.

For example,

CH = 12 + 1 = 13 CH x 2 = C_2H_2 = 2(12) + 2(1) = 26

So, to narrow it down to one of many molecular formulas they have to give you a molecular mass.

For example,

<u>Given</u>: empirical formula = CH and molecular mass = 78

<u>Find</u>: molecular formula

1st) CH
12+1=13

2nd) 78/13=6

3rd) CH x 6 = $\mathbf{C_6H_6}$

Go to handout.

RCHEM 2 / Chille

EF <==> MF

1st) 12 + 2 = 14

1) The empirical formula of a compound is **CH_2** and its molecular mass is **70**. What is the molecular formula of the compound?

2nd) $\frac{70}{14} \rightarrow 5$

1) **C_2H_4** 2) **C_3H_4** 3) **C_4H_{10}** 4) **C_5H_{10}**

$5(CH_2) = C_5H_{10}$

2) What is the molecular formula of a compound that has a molecular mass of **92** and an empirical formula of **NO_2**? 1) **NO_2** 2) **N_2O_4** 3) **N_3O_6** 4) **N_4O_8**

1st) 14 + 32 = 46 2nd) 92/46 = 2 3rd) $2(NO_2) = N_2O_4$

3) The empirical formula of a compound is **C_2H_3** and its molecular mass is **54**. What is the molecular formula of the compound? 1st) 24 + 3 = 27 2nd) 54/27 = 2 3rd) $2(C_2H_3) = C_4H_6$

1) **C_2H_4** 2) **C_4H_6** 3) **C_4H_8** 4) **C_6H_{10}**

12 + 1 = 13

4) The empirical formula of a compound is **CH**. Its molecular mass could be

1) **21** 2) **40** 3) **51** 4) **78**

6 × 13 = 78

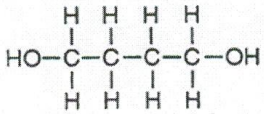
5) Which pair of compounds has the same empirical formula?

1) **CH_3OH** and **C_2H_5OH** 3) **C_2H_6** and **C_3H_8**

2) **C_2H_2** and **C_6H_6** 4) **CH_3CHO** and **CH_3COOH**

CH

6) Given the structural formula:



$\rightarrow C_4H_{10}O_2$

What is the empirical formula of this compound?

1) **$C_8H_{20}O_4$** 2) **$C_4H_{10}O_2$** 3) **CH_3O** 4) **C_2H_5O**

7) The molecular formula of a compound is represented by **X_3Y_6**. What is the empirical formula of this compound?

1) **X_2Y** 2) **XY_2** 3) **XY_3** 4) **X_3Y**

$X_{\frac{3}{3}}Y_{\frac{6}{3}} \rightarrow XY_2$