Q # 41, 46, 45, 47, 49 pg. 275-276 Read mass spec pg 281

41. empirical mass $= 12.011 + 2(1.008) + 15.999$

M_{CH_2O} $= 30.026$ g/mol

molecular multiplier $= \frac{180.18 \text{ g/mol}}{30.026 \text{ g/mol}}$

$= 6$

molecular formula $C_6H_{12}O_6$

46. $M_{C_4H_5N_2O} = 4(12.011) + 5(1.008) + 2(14.007) + 15.999$

$= 97.097$ g/mol

$\times 2 = 194$ g/mol

∴ the formula is $C_8H_{10}N_4O_2$

45 84.98% Hg 15.02% Cl $M = 472$ g/mol

Assume 100g sample

$m_{Hg} = 84.98$ g $\quad m_{Cl} = 15.02$ g

$n_{Hg} = \frac{84.98 \text{ g}}{200.59 \text{ g/mol}}$ $\quad n_{Cl} = \frac{15.02 \text{ g}}{35.453 \text{ g/mol}}$

$= 0.4237$ mol $\quad = 0.4237$ mol

Hg	:	Cl
$\frac{0.4237}{0.4237}$	:	$\frac{0.4237}{0.4237}$
1	:	1

empirical formula HgCl

$M_{ClHg} = 200.59 + 35.453$

$= 236.043$ g/mol

molecular multiplier $= \frac{472}{236.043}$

$= 2$

∴ molecular formula

Hg_2Cl_2

47. 42.6% O 32% C 18.7% N 6.7% H

Assume 100g sample

$m_O = 42.6\,g$

$n_O = \frac{42.6\,g}{15.999\,g/mol} = 2.663\,mol$

$m_C = 32\,g$

$n_C = \frac{32\,g}{12.011\,g/mol} = 2.664\,mol$

$m_N = 18.7\,g$

$n_N = \frac{18.7\,g}{14.007\,g/mol} = 1.335\,mol$

$m_H = 6.7\,g$

$n_H = \frac{6.7\,g}{1.008\,g/mol} = 6.647\,mol$

O : C : N : H

$\frac{2.663}{1.335} : \frac{2.664}{1.335} : \frac{1.335}{1.335} : \frac{6.647}{1.335}$

2 : 2 : 1 : 5

∴ empirical formula $O_2C_2NH_5$

empirical mass = $2(15.999) + 2(12.011) + 14.007 + 5(1.008)$

$M_{O_2C_2NH_5} = 75.067$

molecular multiplier = $\frac{75.0\,g/mol}{75.067\,g/mol} = 1$

∴ the empirical formula is $O_2C_2NH_5$

49. C 48.63% O 21.59% N 18.90% H 10.88%

Assume 100g sample

$m_C = 48.63\,g$

$n_C = \frac{48.63\,g}{12.011\,g/mol} = 4.049\,mol$

$m_O = 21.59\,g$

$n_O = \frac{21.59\,g}{15.999\,g/mol} = 1.349\,mol$

$m_N = 18.90\,g$

$n_N = \frac{18.90\,g}{14.007\,g/mol} = 1.349\,mol$

$m_H = 10.88\,g$

$n_H = \frac{10.88\,g}{1.008\,g/mol} = 10.79\,mol$

C : O : N : H

$\frac{4.049}{1.349} : \frac{1.349}{1.349} : \frac{1.349}{1.349} : \frac{10.79}{1.349}$

3 : 1 : 1 : 8

∴ empirical formula C_3ONH_8

$M_{C_3ONH_8} = 74.103\,g/mol$

m.m = 148.20 ÷ 74.103 = 2