1. A sample of an organic compound with a mass of 1.634 g was completely burned in oxygen and found to produce 2.396 g of carbon dioxide and 0.981g of water.

   (a) Calculate the empirical formula of the organic compound.
   (b) The molecular mass of the compound is 60. What is the molecular formula of the compound?

2. When 2.173g of an organic compound is burned in oxygen 6.103g of carbon dioxide and 1.248g of water were formed.

   Calculate the empirical formula of the compound.

3. Ferrocene is an organometallic compound which contain only the elements carbon, hydrogen, and iron. When 1.672g of ferrocene was burned in oxygen, 3.962g of carbon dioxide and 0.810g of water is formed.
   Calculate the empirical formula of ferrocene.

Advanced Higher Chemistry   Organic Chemistry

Elemental Analysis   Ex 3.15

1. (a) mass of carbon $= 2396 \times \dfrac{12}{44} = 0.6534$

   mass of Hydrogen $= 0.981 \times \dfrac{2}{18} = 0.109$

Since mass of carbon + mass of hydrogen is less than 1.634 oxygen must be present in the compound

   mass oxygen $= 1.634 - (0.6534 + 0.109)$

   $= 0.8716$

Empirical formula calculation

	C	H	O
mass	0.6534	0.109	0.8716
moles	$\dfrac{0.6534}{12}$	$\dfrac{0.109}{1}$	$\dfrac{0.8716}{16}$
$=$	0.05445	0.109	0.054475
ratio	$\dfrac{0.05445}{0.05445}$	$\dfrac{0.109}{0.05445}$	$\dfrac{0.054475}{0.054445}$
$=$	1	2.0018	1.00055

Empirical formula $= C H_2 O$

1(b) Since mass of CH_2O = 30

and molecular mass = 60

molecular formula = 2 × empirical formula

$$= C_2H_4O_2$$

2. mass of carbon = $\frac{12}{44} × 6.103 = 1.664$

mass of hydrogen $\frac{2}{18} × 1.248 = 0.1387$

mass of oxygen $= 2.173 - (1.664 + 0.1387)$

$$= 0.3703$$

	C	H	O
mass	1.664	0.1387	0.3703
moles	$\frac{1.664}{12}$	$\frac{0.1387}{1}$	$\frac{0.3703}{16}$
=	0.1387	0.1387	0.02314
ratio	$\frac{0.1387}{0.02314}$	$\frac{0.1387}{0.02314}$	$\frac{0.02314}{0.02314}$
	5.99	5.99	1

Empirical
Formula $= C_6H_6O$

3. same as in-text question