

EMPIRICAL FORMULA MASS

1 Iodine forms an oxide which has the composition by mass: I, 76.0%; O, 24.0%.

(i) Use this information to determine the empirical formula of this oxide of iodine.

empirical formula [3]

MARKING SCHEME:

I_2O_5 M1 76.0 / 127 AND 24.0 / 16.0 M2 0.59 AND 1.5 OR 1 AND 2.5 M3 I_2O_5	3
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2 (a) (i) Calculate the number of moles of copper(II) oxide added to the hydrochloric acid.

moles of copper(II) oxide = mol [2]

(ii) Calculate the number of moles of hydrochloric acid used.

moles of hydrochloric acid = mol [1]

(iii) Calculate the mass of copper(II) oxide that did **not** react.

mass of copper(II) oxide that did **not** react = g [2]

(b) Crystals of hydrated copper(II) chloride were obtained from the solution at the end of the reaction.

The crystals had the following composition by mass: Cl, 41.52%; Cu, 37.43%; H, 2.34%; O, 18.71%.

Calculate the empirical formula of the crystals.

empirical formula = [2]

MARKING SCHEME:

(a) (i)	0.075 If full credit is not awarded, allow 1 mark for M_r of CuO = 80	2
(ii)	0.05	1
(iii)	4 (g) M1 moles copper(II) oxide that reacted = $(0.05 / 2) = 0.025$ mol M2 mass copper(II) oxide = $((0.075 - 0.025) \times 80) = 4$ g	2
(b)	$C_2CuH_4O_2$ M1 41.52 / 35.5; 37.43 / 64; 2.34 / 1; 18.71 / 16 OR 1.17 : 0.58 : 2.34 : 1.17 M2 appropriate scaling to give whole number ratios	2

- 3** Sulfur dioxide reacts with aqueous sodium sulfite to produce a compound with the following composition by mass: 29.1% Na, 40.5% S and 30.4% O.

Calculate the empirical formula of this compound.

empirical formula = [3]

MARKING SCHEME:

	29.1 / 23 40.5 / 32 30.4 / 16 or 1.2(65) 1.2(65) 1.9 (1) 1:1:1.5 (1) $\text{Na}_2\text{S}_2\text{O}_3$ (1)	3
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4 (a) State **one** medical use of radioactive isotopes.

..... [1]

(b) What is meant by the term *relative atomic mass*?

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.....
..... [2]

(c) Suggest why the relative atomic mass of chlorine is **not** a whole number.

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.....
..... [2]

MARKING SCHEME:

(a)	radiotherapy OR treatment of cancer	1
(b)	<u>average</u> mass of (naturally occurring) <u>atom(s)</u> (of an element) (compared to an atom of ^{12}C)	2
(c)	chlorine must have more than one isotope the masses of these isotopes / (any given) mass numbers are averaged	2

- 5** Phosphorus forms another compound with hydrogen with the following composition by mass:
P, 93.94%; H, 6.06%.

(i) Calculate the empirical formula of the compound.

empirical formula = [2]

(ii) The compound has a relative molecular mass of 66.

Deduce the molecular formula of the compound.

molecular formula = [1]

MARKING SCHEME:

(i)	93.94 / 31 and 6.06 / 1 OR 3.03 and 6.06 OR 1 : 2 ratio (1) PH ₂ (1)	2
(ii)	P ₂ H ₄	1