Oxford Cambridge and RSA

GCSE Chemistry B (Twenty First Century Science)

J258/03 Breadth in chemistry (Higher Tier)

Question Set 24

1 ‘Tumsoothe’ is a medicine that cures indigestion.

Tumsoothe is a solution of ‘sodium bicarbonate’, $NaHCO_3$.

Layla puts some Tumsoothe in a beaker and places it on a balance.

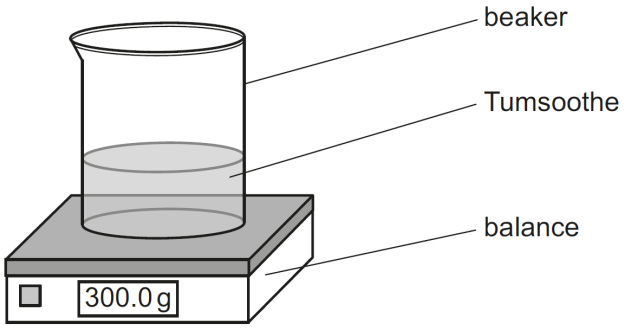


Fig 1.1

She adds dilute hydrochloric acid to the contents of the beaker. CO_2 is given off.

(a) Layla records the mass of the beaker and its contents every 10 seconds up to 60 seconds.

This is a graph of her results:

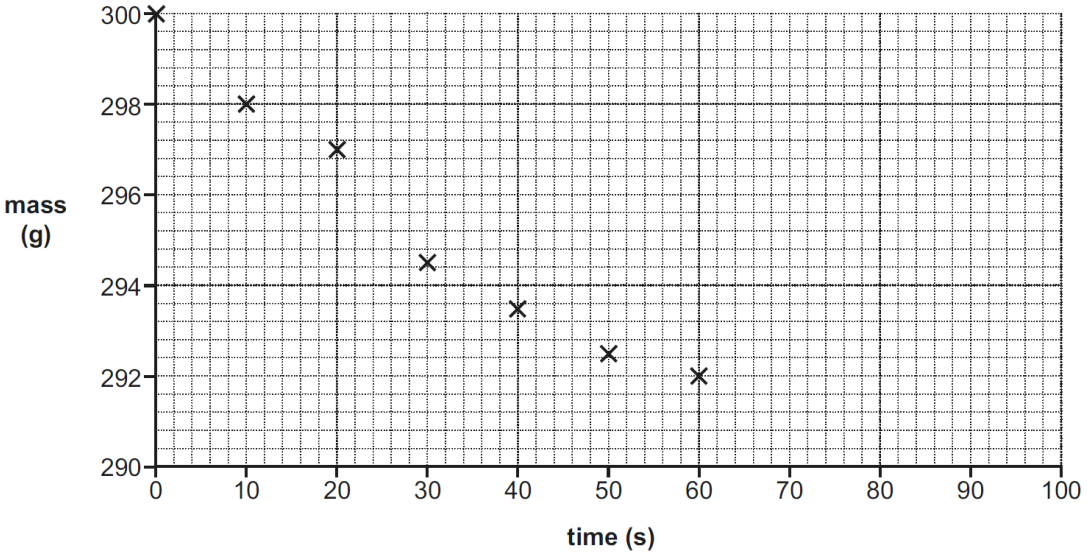


Fig 1.2

(i) Draw a curve of best fit on the graph in **Fig 1.2**. **[1]**

(ii) Use **Fig. 1.2** to calculate the **initial** rate of reaction.

Initial rate of reaction = ... g / s **[2]**

(iii) Describe how the rate of reaction changes with time. **[1]**

(iv) Use **Fig. 1.2** to estimate the **total** mass loss in the reaction after 100 seconds has passed.

Explain how you obtained your answer.

Total mass loss = ... g **[2]**

(b) Layla does her experiment a second time. She uses an excess of acid and a different volume of Tumsoothe.

8 g of CO_2 is given off.

(i) Calculate the number of moles of CO_2 given off.

$$\text{Use the formula: number of moles} = \frac{\text{mass of substance}}{\text{relative formula mass}}$$

Give your answer to **2** significant figures.

Number of moles of CO_2 = ... mol **[2]**

(ii) This is an equation for the reaction:

$NaHCO_3(aq) + HCl\,(aq) \rightarrow CO_2(g) + NaCl\,(aq) + H_2O(l)$

Calculate the **mass** of $NaHCO_3$ that reacts.

$$\text{Use the formula: number of moles} = \frac{\text{mass of substance}}{\text{relative formula mass}}$$

Give your answer to **2** significant figures.

Use your answer to **(b)(i)** to help you.

Mass of $NaHCO_3$ = ... g **[2]**

(c) Layla wants to measure the concentration of $NaHCO_3$ in Tumsoothe.

She titrates her Tumsoothe solution with hydrochloric acid.

(i) Layla measures out 25.0 cm^3 of Tumsoothe.

What piece of apparatus should Layla use to measure out this volume?

[1]

(ii) Layla repeats her titration three times. Her results are shown.

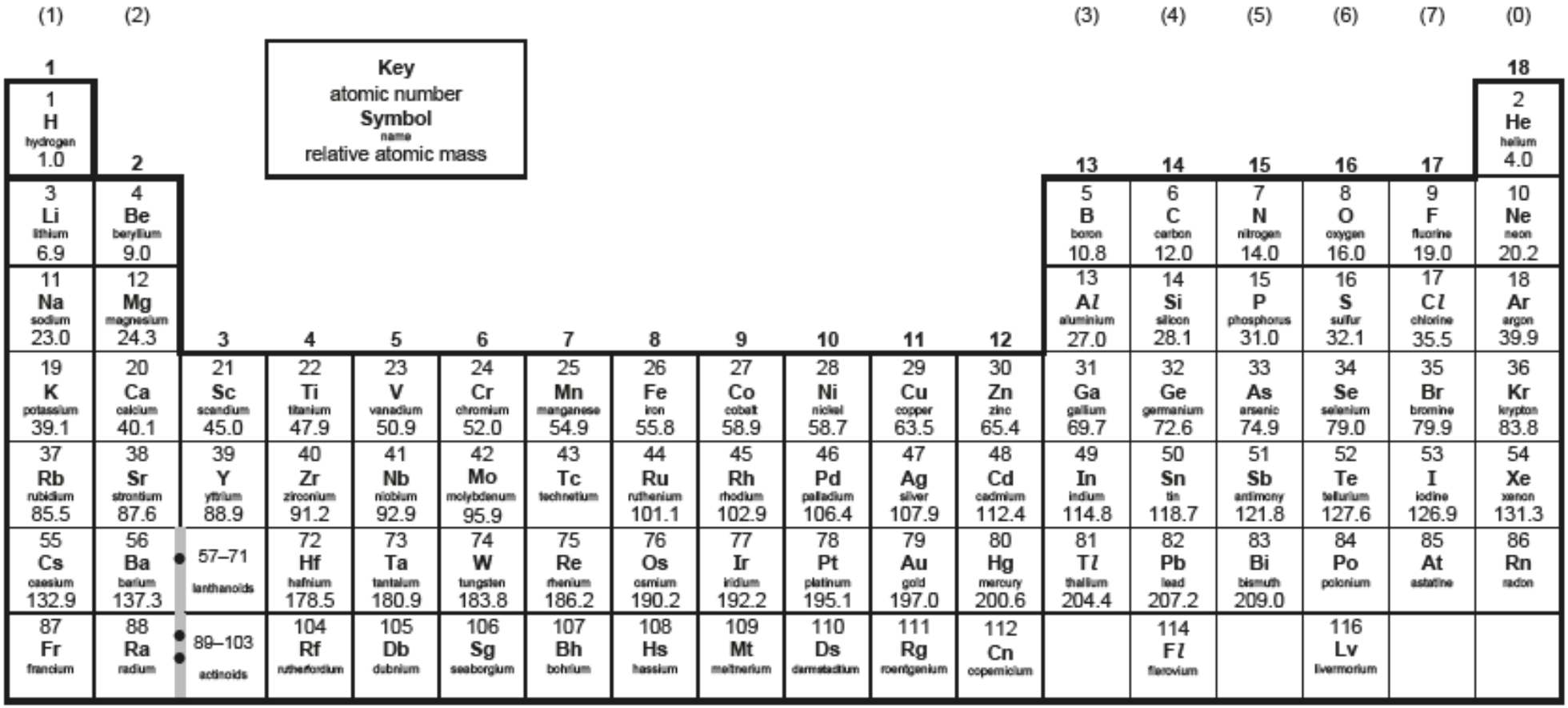
Repeat	**1**	**2**	**3**
Volume of acid added to neutralise $NaHCO_3$ (cm^3)	20.10	20.20	20.60

What can Layla do to improve the quality of her results? **[1]**

Total Marks for Question Set 24: 12

Resource Materials

The Periodic Table of the Elements



(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1																	18
1 H hydrogen 1.0	2											13	14	15	16	17	2 He helium 4.0
3 Li lithium 6.9	4 Be beryllium 9.0											5 B boron 10.8	6 C carbon 12.0	7 N nitrogen 14.0	8 O oxygen 16.0	9 F fluorine 19.0	10 Ne neon 20.2
11 Na sodium 23.0	12 Mg magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	18 Ar argon 39.9
19 K potassium 39.1	20 Ca calcium 40.1	21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7	29 Cu copper 63.5	30 Zn zinc 65.4	31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8
37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3
55 Cs caesium 132.9	56 Ba barium 137.3	57–71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	84 Po polonium	85 At astatine	86 Rn radon
87 Fr francium	88 Ra radium	89–103 actinoids	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium		114 Fl flerovium		116 Lv livermorium		

Key
atomic number
Symbol
name
relative atomic mass