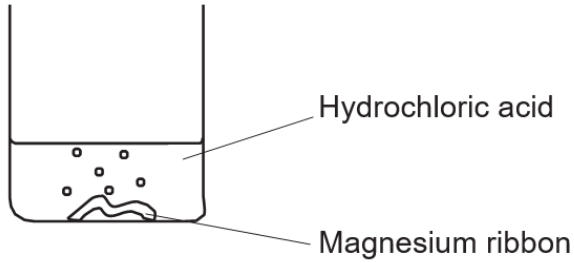
GCSE Chemistry A (Gateway Science)

J248/04 Chemistry A C4-C6 and C7 (Higher Tier)

Question Set 7

1 A student investigates the reaction between magnesium and dilute hydrochloric acid, HC*l*.

The student adds magnesium ribbon to hydrochloric acid in a beaker, as shown in the diagram.



(a) Write the **balanced symbol** equation for this reaction. **[2]**

$2HCl + Mg \rightarrow H_2 + MgCl_2$

(b)* The student measures the time it takes for all the magnesium to react. This is the reaction time.

The student does five experiments. This is the student's prediction:

"The smaller the volume of acid and the greater the concentration of acid, the faster the reaction rate."

Look at the student's results.

Experiment	Mass of magnesium used (g)	Volume of acid used (cm^3)	Concentration of acid (mol/dm^3)	Reaction time (s)
1	0.05	25	1.0	30
2	0.05	50	1.0	30
3	0.05	50	2.0	15
4	0.10	25	1.0	30
5	0.10	50	2.0	15

Describe and explain whether the student's results support his prediction.

Include ideas about the reacting particle model in your answer. **[6]**

by comparing experiment 1 & 2, we can see volumne has no effect on rate of reaction, when concentration is the same, as the reaction time for both is 30 seconds. This is because, per unit volume, there are the same number of particles, so the frequency of successful collisions is the same.

By comparing experiment 2 & 3, we see the greater the concentration, the faster the rate of reaction.
In experiment 3, there are twice the number of particles per cm^3, so the reaction time is half compared with experiment 2.
To fully disprove the hypothesis, the student should have tested $25cm^3$ $2moldm^{-3}$ HCl and $50cm^3$ $1moldm^{-3}$ HCl with 5g of magnesium.

(c) The student repeats experiment **1**. This time he uses acid at a **higher** temperature.

1

Explain, using the reacting particle model, **what happens to the rate of reaction** and **predict the reaction time** for this reaction. **[3]**

the acid molecules have more kinetic energy, so move faster. This results in more frequent, successful collisions per unit time and a faster rate of reaction.
predicted reaction time: 20s.

(d) Another student investigates the reaction between marble chips and hydrochloric acid.

She times how long it takes for all the marble chips to react.

Look at her results.

Experiment	Size of marble chips	Reaction time (s)	Mean rate of reaction (g/s)
1	large	240	8.33×10^{-4}
2	large	120	
3	large	100	2.00×10^{-3}
4	small	50	4.00×10^{-3}

Look at the student's results for experiment **2**.

Calculate the **mean rate of reaction** in experiment **2**.

Give your answer to **3** significant figures and in **standard form**.

$\frac{\text{mass}}{240\text{s}} = 8.33 \times 10^{-4}\ \text{g/s}$

$\text{mass} = 0.19992\ \text{g}$

$\frac{0.19992\text{g}}{120\text{s}} = 1.67 \times 10^{-3}$

Mean rate of reaction = 1.67×10^{-3} g/s **[3]**

Total Marks for Question Set 7: 14

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