

# GCSE Double Award Science Chemistry

## Sample Results and Observations

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## C.1 Investigate the reactions of acids, including temperature changes that occur

### Experiment 1

Reaction	Observations
Hydrochloric acid + magnesium	bubbles/fizzing grey solid/magnesium disappears solution remains colourless heat released
Hydrochloric acid + zinc	bubbles/fizzing solution remains colourless heat released slower reaction than for Mg and HCl
Hydrochloric acid + copper	No reaction
Testing the gas with a lit splint	Droplets of water on side of test-tube pop sound

### Answers to questions

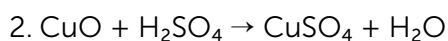
1. Hydrogen – a squeaky pop was produced when the gas burned.
2. zinc + hydrochloric acid → zinc chloride + hydrogen.
3.  $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(aq)}$
4.  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
5. Copper.

## Experiment 2

Test	Observation
1	red pH 1 – 2
6	black copper oxide reacts with colourless acid blue solution forms
8	orange/yellow pH 4 – 5

### Answers to questions

1. Some of the acid had been neutralised.



## Experiment 3

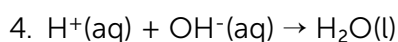
Initial temperature of acid /°C	Initial temperature of sodium hydroxide solution /°C	Average initial temperature /°C	Highest temperature reached /°C	Temperature change /°C
20	20	20	27	7

### Answers to questions

1. To keep heat in/insulate.

2. To support cup.

3. Temperature increased so exothermic.



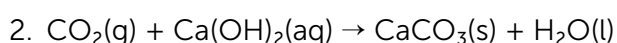
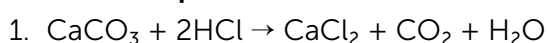
## Experiment 4

### Observations

Bubbles of gas produced/fizzing/effervescence.

Limewater changes from colourless to milky.

### Answers to questions



## C.2 Identifying the ions in an ionic compound using flame tests

**Table of Results**

Compound	Flame colour	Cation present
Calcium chloride	(brick) red	Ca <sup>2+</sup>
Copper(II) chloride	blue-green	Cu <sup>2+</sup>
Lithium chloride	crimson	Li <sup>+</sup>
Potassium chloride	lilac	K <sup>+</sup>
Sodium chloride	orange/yellow	Na <sup>+</sup>
X	lilac	K <sup>+</sup>
Y	orange/yellow	Na <sup>+</sup>

## C.3 Investigate the reactivity of metals

### Results

Table 1

	Copper	Magnesium	Iron	Zinc
Copper(II) sulfate		✓	✓	✓
Magnesium sulfate	x		x	x
Iron(II) sulfate	x	✓		✓
Zinc sulfate	x	✓	x	

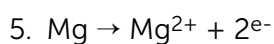
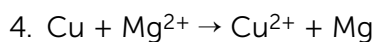
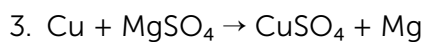
Table 2: Observations

	Copper	Magnesium	Iron	Zinc
Copper(II) sulfate		Blue solution changes to colourless. Red-brown solid forms. Heat released.	Blue solution fades. Some red-brown solid forms. Some heat released.	Blue solution fades. Some red-brown solid forms. Some heat released.
Magnesium sulfate	No reaction		No reaction	No reaction
Iron(II) sulfate	No reaction	Magnesium darkens as layer deposited on it. Heat released.		Green solution fades. Zinc darkens as layer deposited on it. Heat released.
Zinc sulfate	No reaction	Magnesium darkens as layer deposited on it. Heat released.		

**Answers to questions**

1. Magnesium. zinc. iron. copper.

2. Magnesium is more reactive than copper and pushes it out of solution.



Magnesium has lost 2 electrons.

6. Measure the initial temperature of each metal ion solution.

Add magnesium to each and record the highest temperature reached.

Work out the temperature change.

The greater the difference in temperature, the greater the difference in reactivity.

If there is no temperature change, there is no reaction.



## C.4 Investigate how changing a variable changes the rate of reaction

Volume of hydrochloric acid /cm <sup>3</sup>	Volume of deionised water /cm <sup>3</sup>	Concentration of hydrochloric acid /mol/dm <sup>3</sup>	Time taken for magnesium to disappear /s	Repeat time taken for magnesium to disappear /s	Average time /s	Rate /s <sup>-1</sup>
25	0	2.0	28	29		
10	5	1.6	35	37		
15	10	1.2	58	60		
10	15	0.8	98	102		
5	20	0.4	196	204		

### Answers to questions

1. Increasing the concentration of acid increases the rate/decreases the time.
2. Graph drawn using results with best fit line.

Trend: As concentration of acid increases, rate increases.

## C.5 Determine the mass of water present in hydrated crystals

### Results table

	Mass /g
Mass of evaporating basin	82.45
Mass of evaporating basin and contents before heating	83.98
Mass of evaporating basin and contents after heating for 2 minutes	83.50
Mass of evaporating basin and contents after heating for 4 minutes	83.39
Mass of evaporating basin and contents after heating for 6 minutes	83.29
Mass of evaporating basin and contents after heating for 8 minutes	83.29

### Observations

Green solid change to white.

### Answers to questions

1. Water of crystallisation is lost during heating as the mass decreases.

2. (a)  $83.98 - 82.45 = 1.53$  g  
(b)  $83.29 - 82.45 = 0.84$  g  
(c)  $83.98 - 83.29 = 0.69$  g  
(d) 152

(e)  $\frac{0.84}{152} = 0.00553$

(f)  $\frac{0.69}{18} = 0.0383$

(g)  $\frac{0.0383}{0.00553} = 7$

3. (a) Some iron(II) sulfate decomposed.  
(b) Not all water of crystallisation removed.

## C.6 Investigate the preparation, properties, tests and reactions of the gases hydrogen, oxygen and carbon dioxide

### Carbon dioxide

#### Test 1

Lit splint extinguishes.

#### Test 2

Limewater changes from colourless to milky.

#### Test 3

Universal indicator change to orange pH 3 – 4.

#### Answers to questions

- Not able, acidic, insoluble.
- The lit splint extinguished so it does not support combustion.  
It is acidic as the universal indicator indicated a pH of 3 – 4 which is weakly acidic.  
The milky colour produced is a white solid which is insoluble.
- hydrochloric acid                  calcium carbonate  
 $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$

### Hydrogen

Appearance of hydrochloric acid	Colourless liquid/solution
Appearance of zinc	Grey solid
Observations during the reaction	Bubbles, heat released, solution remains colourless
Observations with a lit split	Pop sound

#### Answers to questions

- zinc/magnesium and hydrochloric acid.  
 $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$  or  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
- $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

## Oxygen

Appearance of hydrogen peroxide solution	Colourless liquid/solution
Appearance of manganese(IV) oxide	Black solid/black powder
Observations during the reaction	Bubbles/fizzing
Observations with a glowing splint	Glowing splint relights

### Answers to questions

1. The hydrogen peroxide decomposes to produce oxygen.
2. Catalyst to speed up the reaction.
3. Hydrogen peroxide and manganese(IV) oxide catalyst.

