

# MARK SCHEME

# GCSE

## CHEMISTRY

## AQA - COMBINED SCIENCE

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C6 - TEST 3

RATE OF REACTION

Intermediate

## Mark schemes

1.

(a) (i) sulfuric

*accept H<sub>2</sub>SO<sub>4</sub>*

*accept sulphuric*

*allow phonetic spellings*

1

(ii)  $\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$

*1 mark for reactants*

*1 mark for products*

*ignore state symbols*

*max 1 mark for incorrect balancing*

2

(b) any **two** from:

- particles gain energy **or** particles have more energy

*allow have more activation energy*

- particles move faster

*allow they collide faster / quicker*

*ignore move / vibrate more*

- collide more often

*allow more collisions*

- collide more energetically

- more of the collisions are successful

**or** more particles have the activation energy

**NB** *more successful collisions alone = 1 mark*

*if particles are identified as electrons = max 1 mark*

2

[5]

2.

(a) 6

*accept 5.8 – 6*

1

- (b) hydrochloric acid used up / reacted / combined / **or** fewer particles  
(of hydrochloric acid) **or** fewer hydrogen ions owtte

*accept reactants used up*  
*accept less calcium carbonate **or***  
*smaller surface area of calcium carbonate*  
*accept lower concentration / less crowded*  
*do **not** accept atoms / molecules*  
*ignore references to energy*  
*do **not** accept references to atoms or molecules*

1

fewer collisions owtte

*independent mark*

1

- (c) steeper curve initially

*independent marks*

1

levels out at same volume

- *must indicate levelling out*
- *if line goes higher than 66 do **not** award this mark*
- *diagonal line only = 0 marks*
- *if steeper initially and then crosses the line and finishes correctly, then loses one*

1

[5]

3.

- (a) increase concentration of acid;  
increase surface area of solid  
**or** grind up the solid;  
add a catalyst

*any two for 1 mark each*

2

- (b) 1;  
it is the one that makes the gas fastest (steeper curve etc)  
(second part is dependant on first)

*for 1 mark each*

2

- (c) (i) faster after one minute, slower after 2 minutes

*for 1 mark*

1

- (ii) the reactants get used up;  
so concentration decreases/less chance of collision  
*for 1 mark each*

2

[7]

4.

- (a) because sulfur / S forms

1

which is insoluble / a solid / a precipitate

1

- (b) (i) 32

*correct answer with or without working gains 2 marks*

*accept evidence of 31 + 33 / 2 for 1 mark*

*allow 35 for 1 mark*

2

- (ii) reaction rate increases

*if incorrect reference to energy = max 2*

1

because of more particles (per unit volume)

*allow because particles are closer together*

1

and because there is an increase in frequency of collisions

*accept because particles are more likely to collide **or** higher chance of collision*

*ignore more (successful) collisions*

1

[7]

5.

- (a) (i) corners

*accept an arrow to any corner*

1

- (ii) more (surface) exposed

*accept can be attacked from more directions **or** more space around it*

1

- (b) (i) 1 any **two** pairs from  
 more concentrated  
*answers may be in either order*  
*do not accept more acid*  
*do not accept more powerful **or***  
*stronger (but stronger is neutral)*  
*a reference to sulphuric acid is neutral* 1
- more particles to hit the solid  
*accept more collisions per second*  
*do not accept more collisions* 1
- 2 hotter solution **or** increasing temperature  
 (faster) particles hit more often  
**or** harder  
*accept particles have more energy*  
**or** are more powerful **or**  
*more successful collisions* 1
- 3 stirring  
 more surface area exposed **or**  
 particles available  
*accept more collisions per second*  
*do not accept more collisions* 1
- (ii) cut it up **or** increase the surface area  
*accept grind it up **or** powder it*  
**or** flatten it do not accept make it smaller  
**or** use a smaller piece 1
- more particles are exposed **or** available **or** can react  
*accept heat it and there are more*  
*successful collisions for both marks* 1

[8]

6.

- (a) sensible line of best fit which goes through or close to all the points **except**  
 the anomalous point  
*allow wobbly / short double lines*  
*± ½ square* 1
- (b) loss of gas / loss of CO<sub>2</sub>  
*idea of gas produced / formed* 1

- (c) 7 1
- (d) (i) steeper line from around the same starting point  
and left of the points 1  
*allow crosses if they are fully correct for 1 mark*
- levelling off at 99 1  
*accept short level line at 99*  
*± ½ square*
- (ii) any **three** from: 3
- particles / molecules / atoms/ ions have more energy  
*allow given / gain / get energy*
  - move faster  
*ignore move about more*  
*ignore vibrate more / faster*
  - collide more often  
  
**or** more chance of collisions  
  
**or** bump into each other more  
*ignore collide quicker / faster*
  - collide with more force / energy  
  
**or** more particles have the activation energy  
  
**or** more collisions result in reaction  
  
**or** more collisions are successful

7.

- (a)  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$  1
- (b) (i) 12.5 1
- (ii) steeper curve same volume of gas evolved 2  
*do not credit two intersects of straight lines*  
*accept a sharp bend*

(iii) any **two** from:

stir it

*accept mix it better*

heat it

*accept warm it*

use a more finely divided catalyst

*accept use a better catalyst or more finely divided zinc*

*do not credit use acid of a higher*

2

(c) (i) any **one** from

zinc is more reactive than copper

*accept zinc is above copper in the reactivity series*

zinc displaces copper

*accept it is higher than copper in the reactivity series*

1

(ii) zinc + copper sulphate → copper + zinc sulphate

*ignore the presence of acid or water*

*accept a balanced equation*

1

[8]

8.

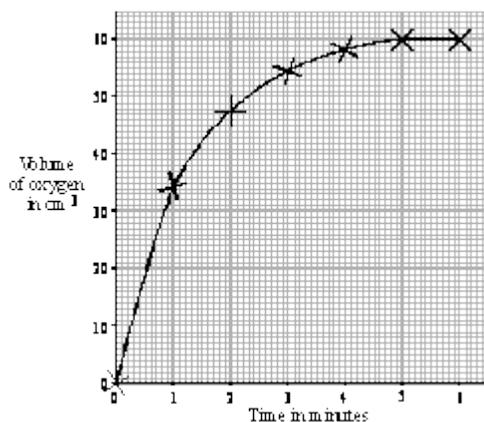
(a) (i) H<sub>2</sub>O must be formula

1

(ii) catalyst

1

(b) (i)



correct plotting

2

**1 mark deducted per error to a maximum of 2**

**do not** accept a complete dot-to-dot line

**do not** accept a bar chart if the (0,0) point is missing and line to one minute missing then maximum mark is **2**

best fit single line

*if curve correct but no obvious points award 3marks*

1

(ii) 4.5 – 5

*no units required*

1

(iii) all hydrogen peroxide had reacted

*accept all hydrogen peroxide had decomposed **or** been used up*

*accept no hydrogen peroxide (particles) left*

1

(c) (i) remains lower than previous line

*do not* accept bar chart

1

line levels off lower than 60cm<sup>3</sup>

*correct points but no line drawn then maximum 1 mark*

1

(ii) decrease of (hydrogen peroxide) concentration

*accept concentration is less*

*accept fewer collisions (of particles)*

*do not* accept weaker solutions **or** dilute solutions

1

**[10]**

9.

(a) **Level 3 (5–6 marks):**

A coherent method is described with relevant detail, which demonstrates a broad understanding of the relevant scientific techniques and procedures. The steps in the method are logically ordered with the dependent and control variables correctly identified. The method would lead to the production of valid results.

**Level 2 (3–4 marks):**

The bulk of a method is described with mostly relevant detail, which demonstrates a reasonable understanding of the relevant scientific techniques and procedures. The method may not be in a completely logical sequence and may be missing some detail.

**Level 1 (1–2 marks):**

Simple statements are made which demonstrate some understanding of some of the relevant scientific techniques and procedures. The response may lack a logical structure and would not lead to the production of valid results.

**0 marks:**

No relevant content

**Indicative content**

- remove bung and add magnesium
- start stopclock / timer
- measure volume of gas at fixed time intervals
- repeat with different concentrations of acid
- control volume of acid
- control initial temperature of acid
- control amount / mass / length / particle size of magnesium

6

(b) 6.5 cm<sup>3</sup>

1

(c) all points plotted correctly

*allow 1 mark for 4 points plotted correctly*

2

best fit straight line drawn

1

(d) when the concentration of acid increased the rate of reaction increased or vice versa

*answer must use the terms 'rate of reaction' linked to 'concentration'*

1

[11]