Mark schemes

1.

(a) 83 (cm^3)

allow 83.0 / 83.00

1

(b) mass of magnesium powder

1

temperature of hydrochloric acid

1

(c) $\frac{(46 + 47 + 49)}{3}$

*allow 47.3(333) (cm^3) for **1** mark*

1

= 47 (cm^3) (2 sf)

*an answer of 43 (cm^3) scores **1** mark*

1

*an answer of 47 (cm^3) scores **2** marks*

(d) all points plotted correctly
(inc 0,0)

allow a tolerance of ±½ a square
*allow ecf from question **(c)***
ignore line
*allow **1** mark for four points plotted correctly*

2

(e) $\frac{80}{50}$

allow 80 ± 2

1

= 1.6 (cm^3/s)

allow 1.60 ± 0.04

1

*an answer of 1.6 (cm^3/s) scores **2** marks*

(f) rate is greatest at start

allow rate is faster at start

1

(then) rate decreases

allow (then) rate slows down

1

reaction stops

1

(g) there are more particle collisions each second 1

there are more particles in the same volume 1

(h) (gas is) not carbon dioxide 1

ignore does not react with limewater

(i) hydrogen 1

allow H_2

pop sound 1

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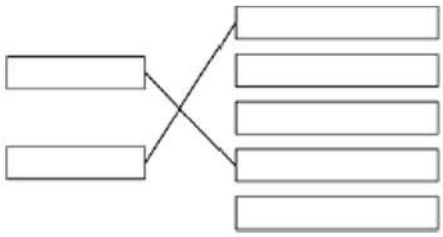
2. (a) S(s) 1

(b) measuring cylinder 1

(c)  1

*allow for **1** mark an answer of dependent variable --- concentration of sodium thiosulfate solution and independent variable --- time for cross to become no longer visible* 1

(d) cross might be darker or paler 1

allow cross may not be the same size / shape

(e) $\frac{43 + 41}{2}$ 1

*an answer of 42 (s) scores **2** marks*

= 42 (s) 1

*an answer of 54 (s) scores **1** mark*

(f) smooth curve through all points 1

must touch all

*do **not** allow s*

ignore attempt

(g) reproducible 1

(h) particles collide more frequently

1

there are more particles in a fixed volume

1

[11]

3. (a) cotton wool

1

(b) all points correct

± ½ *small square*

2

allow ***1*** *mark if 5 or 6 of the points are correct*

best fit line

must not deviate towards anomalous point

1

(c) (mass)
2.1 (g)

allow ecf from drawn best fit line

1

(time)
100 (s)

1

(d) a gas is produced

1

which escapes from the flask

1

(e) $\frac{9.85}{150} = 0.0656$

1

0.07 (g / s)

allow ecf answer correctly calculated to 2 decimal places

1

(f) collect the gas in a gas syringe

1

measured the volume of gas

allow carbon dioxide for gas

1

*allow for **1** mark*

collected gas

or

counted bubbles

(g) The particles have more energy

1

The particles move faster

1

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4. (a) sulfur / sulphur / S / S(s)

1

(b) as the temperature increases, the rate of reaction increases

allow two correct values for rate quoted (from graph) at different temperatures

1

the rate of increase increases **or** there is an exponential relationship

*accept the rate of reaction increases slowly (from 20 °C to 50 °C) then increases more rapidly for **2** marks*

answer MUST be based on rate / speed of reaction

1

(c) (i) any **two** from:

- temperature (of the reactants)
- concentration of hydrochloric acid
- volume of hydrochloric acid
- volume of sodium thiosulfate
- the (size / darkness / thickness of the) cross
- total volume of solution.

*if no other marks gained, allow **1** mark for:*

rate of stirring

OR

amount of hydrochloric acid / sodium thiosulfate

OR

volume of solution

2

(ii) (because as the concentration increases) the number of particles per unit volume increases **or** particles are closer together.

idea of more particles in a given space is required for the first mark.

ignore references to area.

1

(therefore) the frequency of (successful) collisions increases

allow increased chance / probability of collisions

number of collisions increases is insufficient here.

***must** mention per unit time or frequency.*

ignore speed of collisions.

if reference to space and time missing from M1 and M2 but they are otherwise correct, then award 1 mark.

1

so the number of particles (per unit volume) doubles **or** (the frequency of) collisions doubles.

*students can score **2** marks for a qualitative explanation; the third mark is for a quantitative explanation.*

1

[8]

5. (a) (i) the higher the temperature, the greater the rate

or

at 40 °C rate is faster than at 20 °C

accept the higher the temperature, the faster the reaction

1

(ii) 40 °C curve is steeper

accept the 40 °C line becomes horizontal sooner

accept at higher temperatures the reaction finishes sooner

accept reaction finishes sooner at 40 °C

accept at higher temperatures the gas is produced faster

or

correct comparison of data from the graph

1

(iii) 2

1

(b) (i) Concentration of acid
Mass of marble chips

2

(ii) increases rate

*incorrect reference to energy = max **1***

1

(because of) more frequent collisions (between particles)

accept particles are more likely to collide

ignore more collisions

ignore more successful collisions

1

(c) any **one** from:

- increases rate of reaction
- reduces energy required
- lower temperature can be used
- catalyst is not used up.

1

[8]