

C8- Rates of Reaction Practice Paper 1

Name:

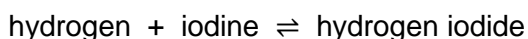
Score:

Q1.

This question is about reactions between gases.

When hydrogen gas is heated with iodine gas, hydrogen iodide gas is produced.

The equation for this reversible reaction is:



This reversible reaction reaches equilibrium in a sealed container.

(a) How does the equation show that the reaction is reversible?

(1)

(b) Which **two** statements are correct when the reaction reaches equilibrium?

Tick (✓) **two** boxes.

The forward reaction and reverse reaction are both exothermic.

The gases have escaped from the container.

The hydrogen no longer reacts with iodine.

The mass of each substance does not change.

The rates of the forward reaction and reverse reaction are equal.

(2)

(c) The initial mixture of hydrogen and iodine in the sealed container is purple.

Hydrogen iodide is colourless.

How will the colour of the mixture in the sealed container have changed when equilibrium is reached?

Tick (✓) **one** box.

The mixture will have become a deeper purple.

The mixture will have become a paler purple.

The mixture will have become colourless.

(1)

- (d) The rate of reaction between gases is affected by changing the pressure.

Complete the sentences.

When the pressure of the reacting gases is increased,

the rate of reaction _____.

This is because at higher pressures the distance

between the particles _____.

This means that the frequency of collisions _____.

(3)

- (e) Give **one** other way of changing the rate of reaction between gases.

You should **not** refer to pressure in your answer.

(1)

(Total 8 marks)

Q2.

A student investigates the effect of concentration on the rate of reaction.

The student reacts sodium thiosulfate solution with dilute hydrochloric acid.

This produces a cloudy mixture.

(a) The cloudiness is produced by the formation of solid sulfur.

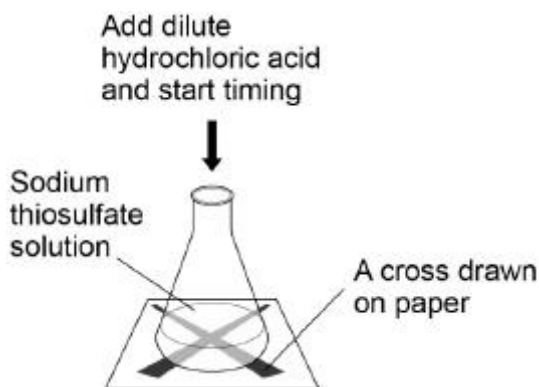
How should sulfur be written in the chemical equation for this reaction?

Tick (✓) **one** box.

S(aq) S(g) S(l) S(s)

(1)

The diagram shows some of the apparatus the student uses.



This is the method used.

1. Measure 40 cm³ sodium thiosulfate solution into a conical flask.
2. Stand the flask on a piece of paper with a cross drawn on it.
3. Add 10 cm³ of dilute hydrochloric acid to the flask.
4. Time how long it takes the cross to become no longer visible.
5. Repeat steps 1–4 twice more.
6. Repeat steps 1–5 with sodium thiosulfate solutions of different concentrations.

(1)

(b) Which apparatus could be used to measure 10 cm³ of dilute hydrochloric acid?

Tick (✓) **one** box.

Beaker

Boiling tube

Measuring cylinder

Test tube 

(1)

(c) Draw **one** line from each type of variable to the description of the variable.

Type of variable	Description of the variable
Dependent variable	Concentration of sodium thiosulfate solution
	Size of conical flask
Independent variable	Size of cross drawn on paper
	Time for cross to become no longer visible
	Volume of hydrochloric acid

(2)

(d) The student draws a new cross for each experiment.

Suggest why this might give inaccurate results.

(1)

(e) The table shows the student's results for sodium thiosulfate solution with a concentration of 12 g / dm^3

Time for cross to become no longer visible in s			
Trial 1	Trial 2	Trial 3	Mean
43	78	41	X

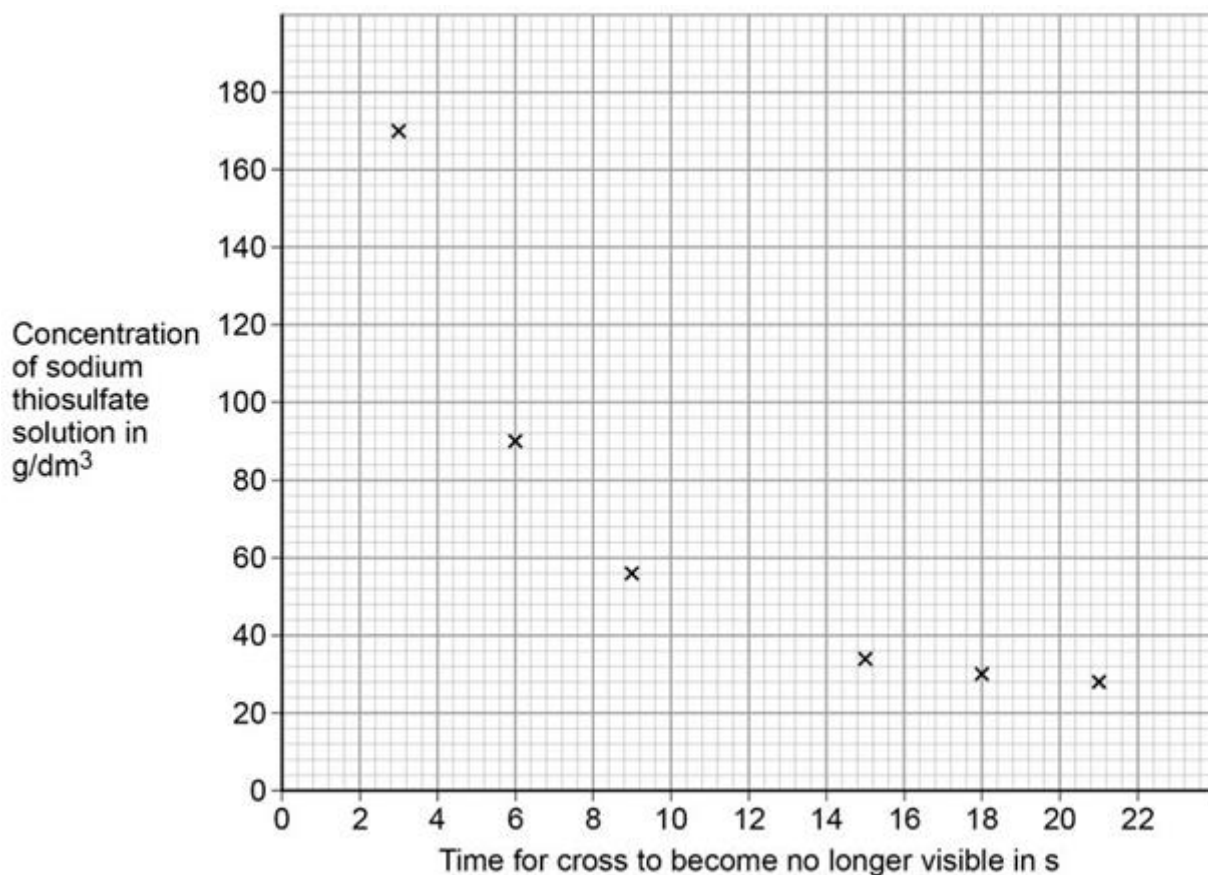
Calculate value **X** in the table.

Do **not** use any anomalous results in your calculation.

X = _____ s

(2)

(f) The graph shows some of the student's results.



Draw a smooth curve of best fit on the graph above.

(1)

(g) Another student does the same investigation.

Both students have a similar pattern in their results.

Which word describes investigations performed by different students, which give a similar pattern of results?

Tick (✓) **one** box.

Accurate

Precise

Reproducible

Valid

(1)

(h) The more concentrated the sodium thiosulfate solution, the less time is taken for the cross to become no longer visible.

Give **two** reasons why.

Tick (✓) **two** boxes.

Particles are more spread out

Particles collide more frequently

Particles have more energy

Particles move more quickly

There are more particles in a fixed volume

(2)
(Total 11 marks)

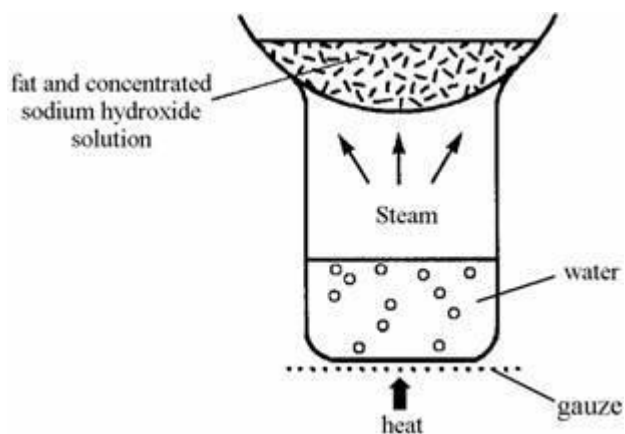
Higher Tier Questions

Q3.

Soap can be made by reacting fats with sodium hydroxide solution.



The diagram shows a laboratory experiment to make soap.



From the information in the diagram, give **two** factors which increase the rate of this reaction.

In each case explain, in terms of particles, why the rate of reaction increases.

Factor 1 _____

Reason _____

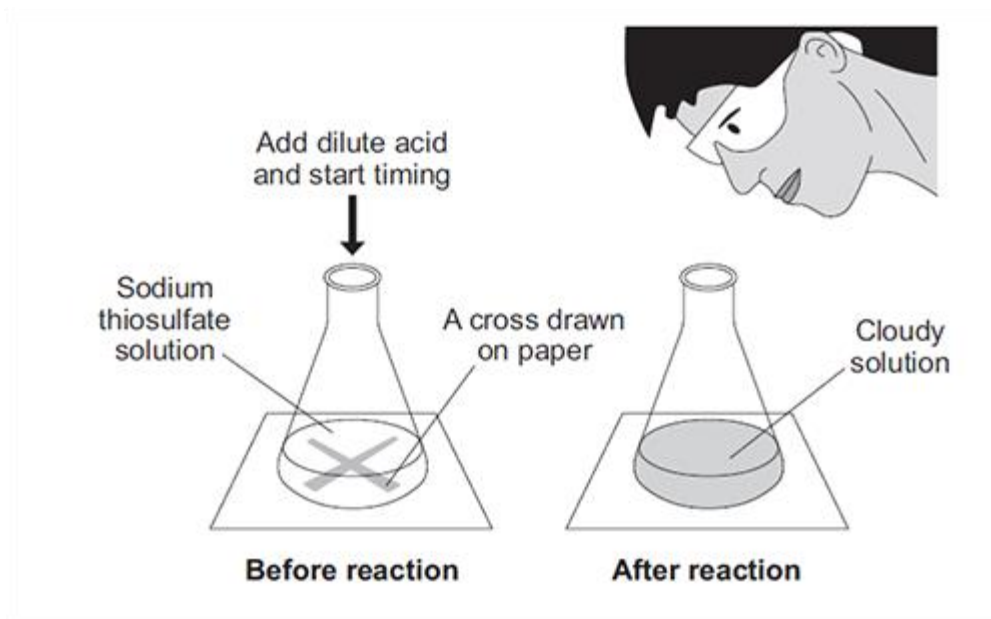
Factor 2 _____

Reason _____

(Total 7 marks)

Q4.

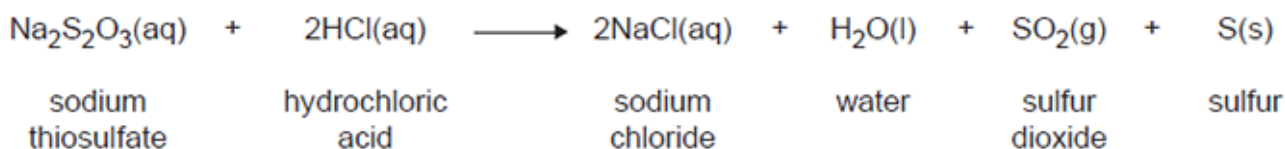
A student investigated the effect of temperature on the rate of a reaction. The picture below shows an experiment.



The student:

- put sodium thiosulfate solution into a conical flask
- heated the sodium thiosulfate solution to the required temperature
- put the flask on a cross drawn on a piece of paper
- added dilute hydrochloric acid and started a stopclock
- stopped the stopclock when the cross could no longer be seen
- repeated the experiment at different temperatures.

The equation for the reaction is:



(a) Explain why the solution goes cloudy.

(2)

(b) Give **two** variables the student must control to make the investigation a fair test.

1. _____

2. _____ (2)

- (c) State the effect that increasing the temperature of the sodium thiosulfate solution has on the rate of the reaction.
Explain this effect in terms of particles and collisions.

(4)

- (d) Suggest how the student should change the method to investigate the rate of reaction at 5°C.

(1)

(Total 9 marks)

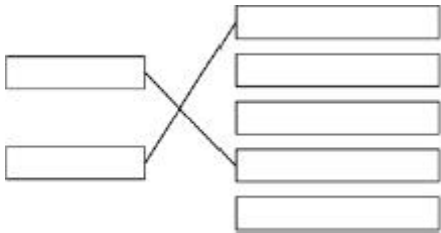
Mark schemes

Q1.

- (a) (equation contains the symbol) \rightleftharpoons
allow description of arrow / symbol 1
- (b) the mass of each substance does not change 1
the rates of the forward reaction and reverse reaction are equal 1
- (c) the mixture will have become a paler purple 1
- (d) increases
must be in this order 1
decreases 1
increases 1
- (e) change the temperature
or
add a catalyst
ignore references to pressure 1

[8]

Q2.

- (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
allow cross may not be the same size / shape 1
- (e) $\frac{43 + 41}{2}$
an answer of 42 (s) scores 2 marks 1
- = 42 (s)
an answer of 54 (s) scores 1 mark 1
- (f) smooth curve through all points
must touch all crosses
*do **not** allow straight lines between points*
ignore attempt to plot X 1
- (g) reproducible 1
- (h) particles collide more frequently 1
- there are more particles in a fixed volume 1
- [11]

Higher Tier Mark Scheme

Q3.

Factor 1

heating the solution / heat / increasing temperature / candidates can gain one mark here for the idea of the water evaporating faster with increased heat (so heating the reactants faster).

particles (of fat and sodium hydroxide) move faster (not vibration / not just move more) / more kinetic energy

collide more often / more collisions

have more energy when they collide / more successful collisions

Factor 2

concentrated (solution of alkali)

more (sodium hydroxide) particles (in a given volume) particles closer/ more crowded etc.

more collisions / greater chance of successful collisions
each for 1 mark

Possible alternative answer

size of fat pieces / small pieces of fat

have larger surface area

more collisions / greater chance of collisions

[7]

Q4.

(a) because sulfur / S (forms)

1

(which) is solid / insoluble / a precipitate / a suspension

1

(b) any **two** from:

- volume of sodium thiosulfate

ignore amount of sodium thiosulfate

- volume of (hydrochloric) acid

ignore amount of (hydrochloric) acid

- concentration of sodium thiosulfate

- concentration of (hydrochloric) acid

*if no other mark, allow 1 mark for same cross **or** same flask*

***or** unspecified volume **or** unspecified concentration*

ignore same person

*do **not** accept references to temperature*

2

(c) rate increases

1

because particles move faster

accept particles have more energy

1

so frequency of collisions increases

*accept particles are more likely to collide **or** more chance of collisions*

ignore more collisions

1

more particles / collisions have energy greater than (or equal to) the activation energy

1

(d) cool

*accept refrigerate **or** method to decrease temperature*

or

decrease the temperature (of the solutions)

1

[9]