

GCSE COMBINED SCIENCE: CHEMISTRY Name:

Practice Paper 2 Foundation

Maximum marks: 69

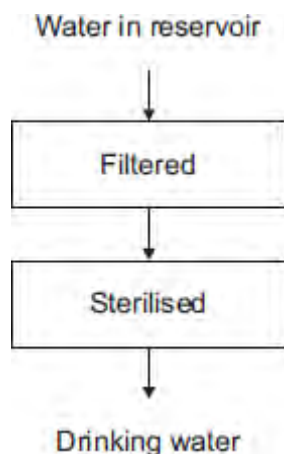
These questions are from past papers covering topics and skills based on the advance information to help you prepare for the exams this summer.

Answer all questions in the spaces provided.

You will need the Periodic Table

1 This question is about drinking water.

(a) The flow diagram below shows how water is made suitable for drinking.



(i) What is removed when the water is filtered?

Tick (✓) **one** box.

Gases

Liquids

Solids

(1)

(ii) What is used to sterilise the water?

Tick (✓) **one** box.

Carbon

Chlorine

Sodium chloride

(1)

(iii) Why is the water sterilised?

(1)

(b) Water can be purified by distillation.

Drinking water is **not** usually purified by distillation because distillation is expensive.

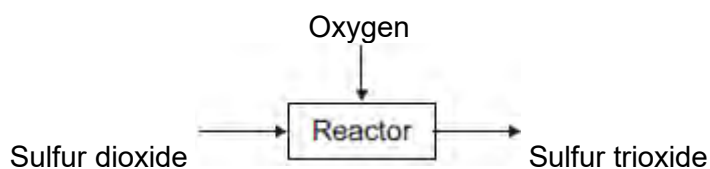
Complete the sentence.

Distillation is expensive because it requires a lot of

(1)

4

2 (a) The figure below represents the reaction of sulfur dioxide with oxygen.



(i) Complete the word equation for the reaction of sulfur dioxide with oxygen.

sulfur dioxide + _____ → _____

(1)

(ii) Draw a ring around the correct answer to complete the sentence.

Sulfur dioxide (SO₂) is

a compound.

an element.

a mixture.

(1)

(b) The reactants are gases.

When the pressure of the gases is increased, the reaction gets faster.

Complete the sentence.

When the pressure of the gases is increased,

the frequency of the collisions _____

(1)

(c) The particles need energy to react.

Complete the sentence.

The minimum amount of energy that particles need to react is called

the _____ energy.

(1)

(d) Give **one** way of increasing the rate of the reaction, other than changing the pressure or using a catalyst.

(1)

5

3 Crude oil is a fossil fuel.

(a) To make crude oil more useful it is separated into fractions.

Use the correct word from the box to complete each sentence.

boiling	compound	decomposition	distillation
filtration	mixture	molecule	

(i) Crude oil is a _____ of different substances.

(1)

(ii) The substances in crude oil have different

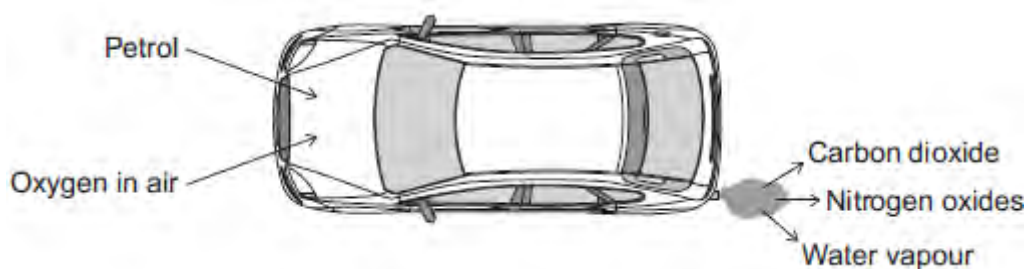
_____ points.

(1)

(b) Petrol is one of the fractions produced from crude oil.

Car engines use a mixture of petrol and air.

The diagram shows some of the gases produced.



(i) What type of reaction happens to petrol in a car engine?

Tick (✓) **one** box.

combustion

decomposition

neutralisation

(1)

(ii) Petrol contains octane (C_8H_{18}).

Complete the word equation for the reaction of octane with oxygen.

octane + _____ → _____ + _____

(2)

(iii) Cars use sulfur-free petrol as a fuel.

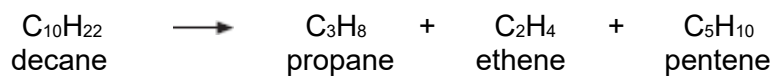
Explain why sulfur should be removed from petrol.

(2)

(c) Some fractions from crude oil contain large hydrocarbon molecules.

These molecules can be cracked to produce smaller, more useful molecules.

An equation for cracking decane is:



(i) Why is propane useful?

Tick (✓) **one** box.

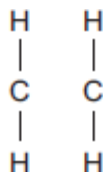
Propane is a polymer.

Propane is an alloy.

Propane is a fuel.

(1)

(ii) Draw bonds to complete the displayed structure of ethene.



(1)

(iii) What is the colour change when bromine water reacts with ethene?

Tick (✓) **one** box.

Orange to colourless

Orange to green

Orange to red

(1)

10

4 Hand warmers use chemical reactions.



(a) The table shows temperature changes for chemical reactions **A**, **B** and **C**.

Reaction	Starting temperature in °C	Final temperature in °C	Change in temperature in °C
A	18	25	+ 7
B	17	_____	+ 5
C	18	27	+ 9

What is the final temperature for reaction **B**? Write your answer in the table.

(1)

(b) (i) What name is given to reactions that heat the surroundings?

(1)

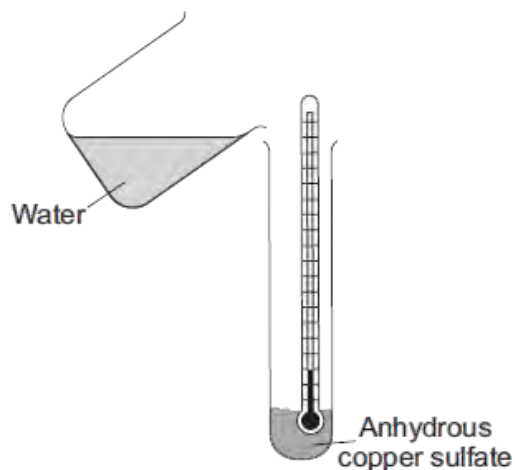
(ii) Which reaction, **A**, **B** or **C**, would be best to use in a hand warmer?

Reaction

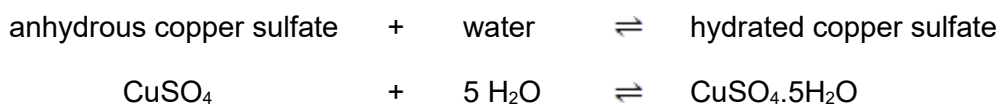
Give a reason why you chose this reaction.

(2)

- (c) A student added water to some anhydrous copper sulfate.



The equation for the reaction is shown.



The student measured the temperature before and after the reaction.

- (i) The measurements showed that this reaction can be used for a hand warmer.

Draw a ring around the correct answer to complete the sentence.

When water is added to anhydrous copper sulfate the temperature

of the mixture

- | |
|-----------------|
| increases. |
| decreases. |
| stays the same. |

(1)

- (ii) Anhydrous copper sulfate is white.

What colour is seen after water is added to the anhydrous copper sulfate?

(1)

- (iii) What does the symbol \rightleftharpoons mean in a reaction equation?

(1)

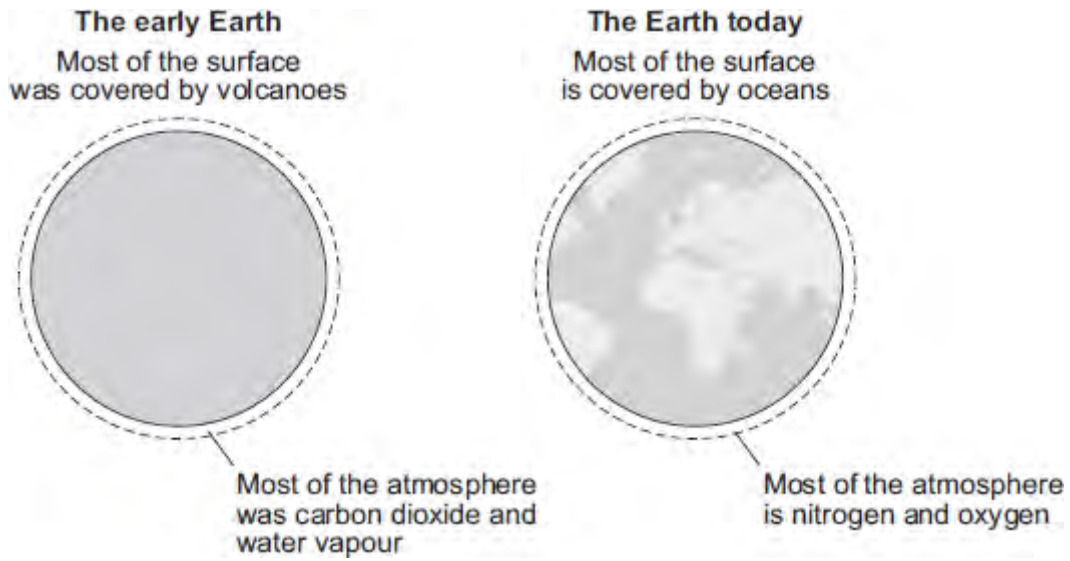
- (iv) The student heated a tube containing hydrated copper sulfate.

Name the solid substance produced.

(1)

5 This question is about the Earth and its atmosphere.

This Earth and its atmosphere today are not like the early Earth and its atmosphere.



Describe and explain how the surface of the early Earth and its atmosphere have changed to form the surface of the Earth and its atmosphere today.

(6)

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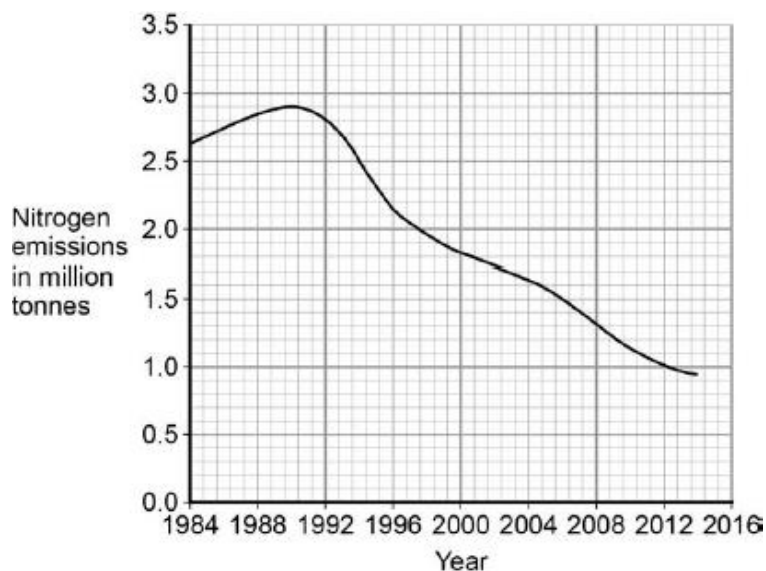
6 This question is about pollutants in the atmosphere.

(a) Oxides of nitrogen are produced when fuels are burnt.

Write a balanced symbol equation for the production of nitrogen dioxide (NO₂) from nitrogen and oxygen.

(2)

(b) The graph below gives information about emissions of oxides of nitrogen in the UK.



Calculate the percentage decrease in emissions of oxides of nitrogen from 1990 to 2014.

Give your answer to three significant figures.

Percentage decrease = _____ %

(3)

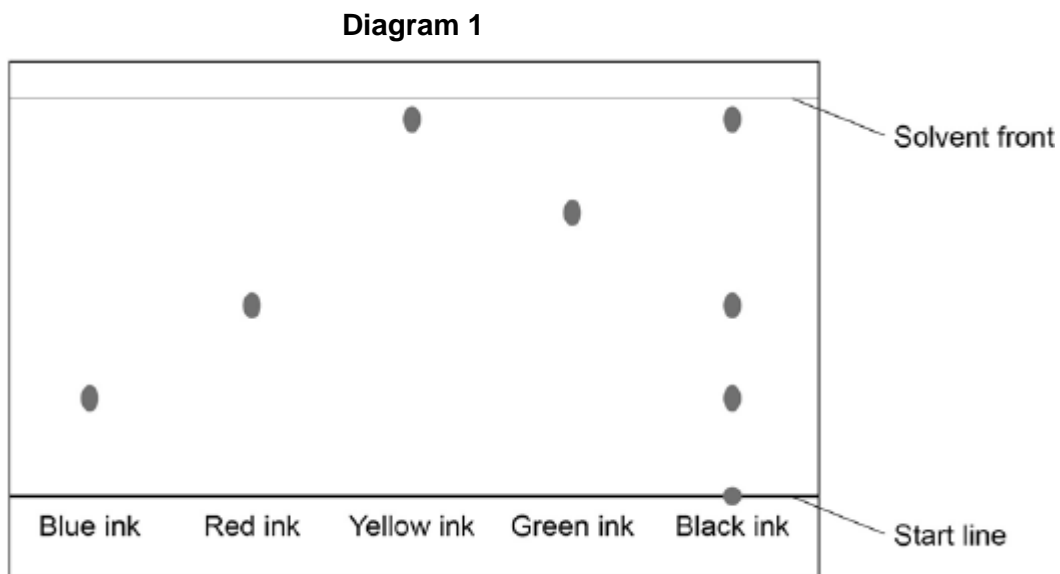
(c) Carbon monoxide is a pollutant that can be produced when diesel burns in a car engine. Explain how.

(2)

7

7 Chromatography can be used to separate components of a mixture.

(a) **Diagram 1** shows a paper chromatogram of five different inks.



Explain how paper chromatography separates substances.

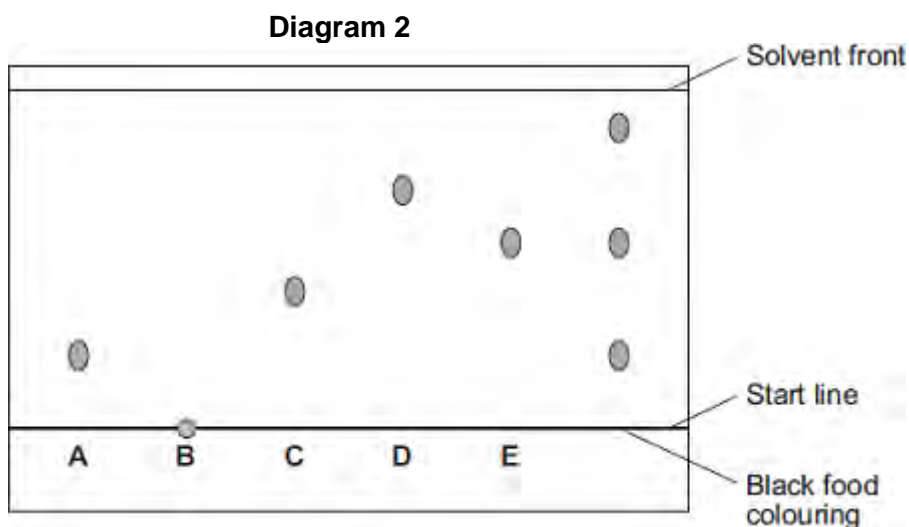
(3)

(b) The start line should be drawn in pencil **not** in ink. Suggest why.

(1)

(c) A student used paper chromatography to analyse a black food colouring.

The chromatogram in **Diagram 2** shows the student's results.



(i) What do the results tell you about the composition of the black food colouring?

(2)

(ii) Use a ruler and **Diagram 2** to complete **Table 1**.

Table 1

	Distance in mm
Distance from start line to solvent front	_____
Distance moved by food colour C	_____

(2)

(iii) Use your answers in part (c) (ii) to calculate the R_f value for food colour **C**.

R_f value = _____

(1)

- (d) **Table 2** gives the results of chromatography experiments that were carried out on some known food colours, using the same solvent as the student.

Table 2

Name of food colour	Distance from start line to solvent front in mm	Distance moved by food colour in mm	R _f value
Ponceau 4R	62	59	0.95
Carmoisine	74	45	0.61
Fast red	67	27	0.40
Erythrosine	58	17	0.29

Which of the food colours in **Table 2** could be food colour **C** from the chromatogram?

Give the reason for your answer.

(2)

11

8 Hydrogen gas is produced by the reaction of methane and steam.

- (a) A catalyst is used in the reaction.

Draw a ring around the correct answer to complete the sentence.

A catalyst

increases the rate of reaction.
increases the temperature.
increases the yield of a reaction.

(1)

(b) The equation for the reaction of methane and steam is:

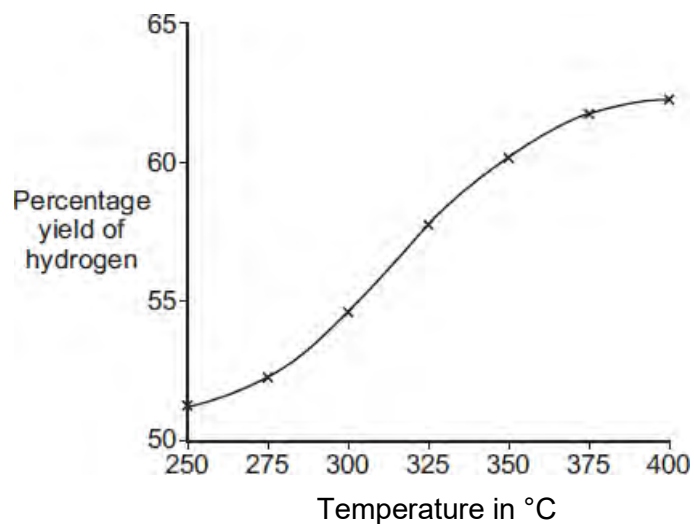


(i) Lowering the pressure reduces the rate of reaction.

Explain why, in terms of particles.

(2)

(ii) The graph shows the yield of hydrogen at different temperatures.



The forward reaction is endothermic.

How does the graph show that the forward reaction is endothermic?

(1)

- (c) Car engines are being developed that use hydrogen gas as a fuel instead of petrol. The table compares the two fuels.

	Hydrogen	Petrol
Energy	5700 kJ per litre	34 000 kJ per litre
State	Gas	Liquid
Equation for combustion	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$	$2\text{C}_8\text{H}_{18} + 25\text{O}_2 \rightarrow 16\text{CO}_2 + 18\text{H}_2\text{O}$
How the fuel is obtained	Most hydrogen is produced from coal, oil or natural gas. Hydrogen can be produced by the electrolysis of water or the solar decomposition of water.	Fractional distillation of crude oil.

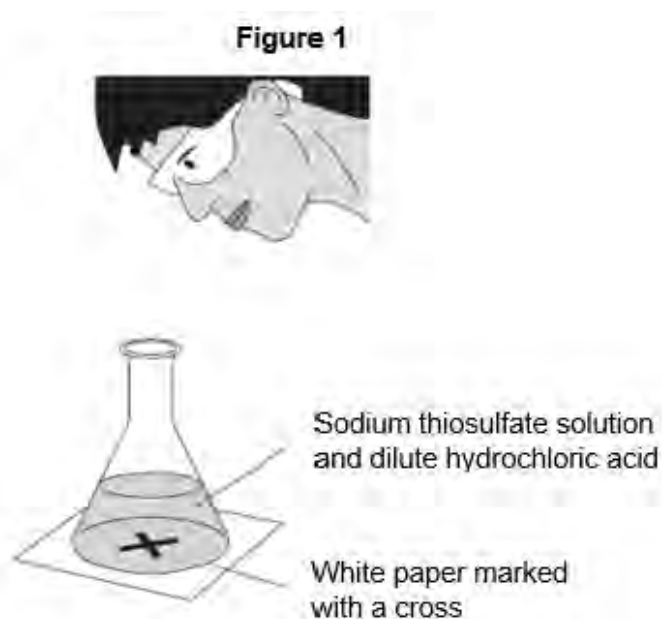
Use the information in the table and your knowledge of fuels to evaluate the use of hydrogen instead of petrol as a fuel.

You should describe the advantages and disadvantages of using hydrogen instead of petrol.

(6)

<hr/> 10

- 9 A student investigated the rate of reaction between sodium thiosulfate solution and dilute hydrochloric acid, as shown in **Figure 1**.

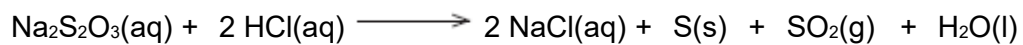


The reaction produced a precipitate, which made the mixture turn cloudy.

The student timed how long it took until she could no longer see the cross.

She calculated the rate of the reaction.

- (a) The equation for the reaction is:

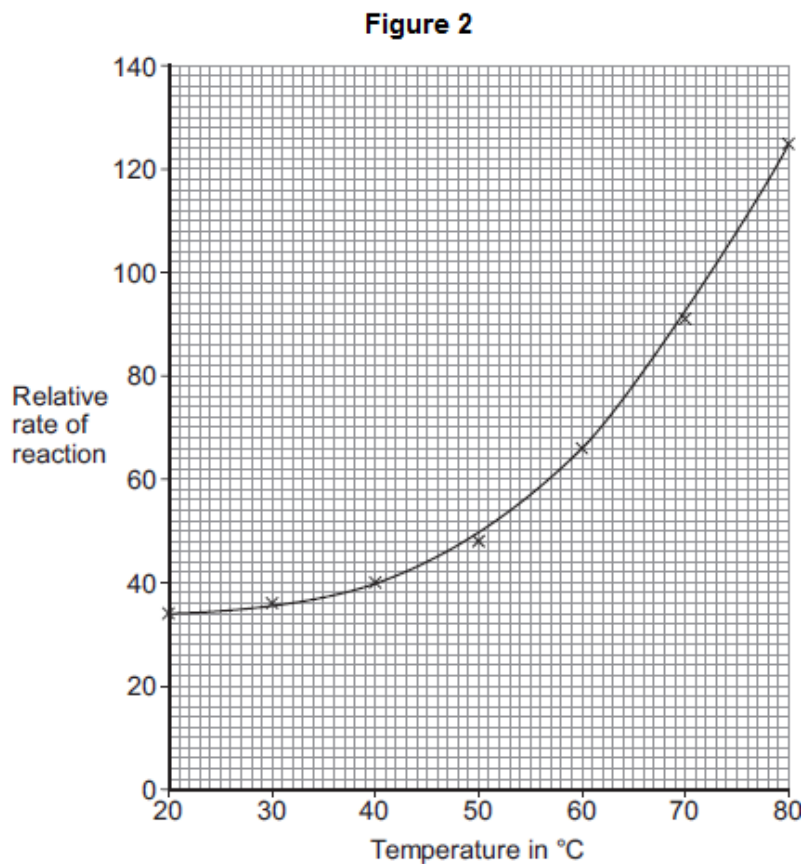


Name the product that made the mixture go cloudy.

(1)

- (b) The student investigated the effect of changing the temperature of the sodium thiosulfate solution on the rate of reaction.

She plotted her results on a graph, as shown in **Figure 2**.



Describe the trends shown in the student's results.

(2)

- (c) The student then investigated the effect of changing the concentration of sodium thiosulfate solution on the rate of the reaction.

- (i) Suggest **two** variables the student would need to control to make sure that her results were valid.

1. _____

2. _____

(2)

(ii) From this investigation the student correctly concluded:

As the concentration of sodium thiosulfate solution doubles, the rate of reaction doubles.'

Explain the student's conclusion in terms of particles.

(3)

8

GCSE COMBINED SCIENCE: CHEMISTRY MARK SCHEME

Practice Paper 2 Foundation

Maximum marks: 69

View detailed guidance on the conclusions you can draw from your students' performance in these papers on the MERiT welcome page. Understand how your students compare with others and target revision effectively by entering marks into MERiT.

1	(a)	(i)	Solids	1
		(ii)	Chlorine	1
		(iii)	kill microbes / bacteria <i>allow to make the water safe to drink</i> <i>ignore disinfect</i> <i>ignore remove / get rid of microbes</i>	1
	(b)		energy <i>allow heat</i>	1
				[4 marks]
2	(a)	(i)	oxygen, sulfur trioxide <i>both needed for mark</i>	1
		(ii)	compound	1
	(b)		increases <i>accept (goes) higher / (goes) up / (is) faster / (are) more frequent</i>	1
	(c)		activation	1
	(d)		increase temperature	1
				[5 marks]

3	(a)	(i)	mixture (of different substances)	1
		(ii)	boiling (points)	1
	(b)	(i)	combustion	1
		(ii)	(reactant)	1
			Oxygen	
			<i>allow correct formulae</i>	
			(products)	
			<i>products in any order</i>	
			carbon dioxide	
		<i>allow carbon or carbon monoxide</i>		
		and		
		water	1	
		<i>allow water vapour or steam or hydrogen oxide</i>		
	(iii)	(burning sulfur) produces sulfur dioxide / SO ₂	1	
		<i>allow it / sulfur reacts with oxygen ignore sulfur oxide</i>		
		causes acid rain	1	
(c)	(i)	propane is a fuel	1	
	(ii)	double bond drawn between carbon atoms	1	
		<i>do not allow any other bonds or symbols</i>		
	(iii)	orange to colourless	1	
			[10 marks]	
4	(a)	22	1	
	(b)	(i)	exothermic	1
		(ii)	C	1
			gives out most heat energy	1
		<i>accept has largest temperature change / increase</i>		
		<i>allow has highest (final) temperature or hottest</i>		
	(c)	(i)	increases	1
		(ii)	blue	1
			<i>ignore pale / dark etc</i>	
		(iii)	reversible (reaction)	1
	<i>allow goes both ways or two / either way</i>			
(iv)	<u>anhydrous</u> copper sulfate	1		
		[8 marks]		

5

Level 3: Descriptions of how at least two changes occurred	5 – 6 marks
Level 2: Description of how one change occurred	3 – 4 marks
Level 1: Statements based on diagrams	1 – 2 marks
No relevant content	0 marks

Indicative content**Main changes**

- oxygen increased because plants / algae developed and used carbon dioxide for photosynthesis / growth producing oxygen; carbon dioxide decreased because of this
- carbon dioxide decreased because oceans formed and dissolved / absorbed carbon dioxide; carbon dioxide became locked up in sedimentary / carbonate rocks and / or fossil fuels
- oceans formed because the Earth / water vapour cooled and water vapour in the atmosphere condensed
- continents formed because the Earth cooled forming a supercontinent / Pangaea which formed the separate continents
- volcanoes reduced because the Earth cooled forming a crust.

Other changes

- nitrogen has formed because ammonia in the Earth's early atmosphere reacted with oxygen / denitrifying bacteria.

[6 marks]

- 6 (a) $N_2 + 2O_2 \longrightarrow 2NO_2$ 1
correct formulae for reactants
correct balancing 1
- (b) 2.90 – 0.95 1
correct values read from graph
 $1.95 \div 2.96 (\times 100)$ 1
allow ecf from readings from graph
 $= 67.2(\%)$ 1
allow 66.9 shown without working for the 3 calculation marks
incorrect number of sig. figs max 2 marks
- (c) carbon / diesel / it reacts / burns in oxygen / air 1
 limited supply (of oxygen / air) 1
accept incomplete combustion
 $2C + O_2 \rightarrow 2CO$ **or**
 $C + CO_2 \rightarrow 2CO$ **gains 2 marks**

[7 marks]

7	(a) mobile phase / solvent moves through paper	1
	and carries substances different distances	1
	which depend on their attraction for paper and solvent <i>allow which depend on solubility in solvent and attraction to paper</i>	1
	(b) ink dissolves in the solvent <i>allow ink 'runs' / spreads or pencil does not 'run' / spread</i> <i>allow ink would affect the result / mixes with colours</i>	
	or	
	carbon / graphite does not dissolve in the solvent <i>accept pencil for carbon / graphite</i>	1
(c)	(i) contains A and E	1
	and one other (unknown substance) <i>if no other marks awarded, an answer saying it is made up of three colours gains 1 mark</i>	1
	(ii) 43 or 44 <i>allow any value from 43 to 47</i>	1
	18 <i>allow any value from 16 to 20</i> <i>award 1 mark if numbers correct but in cm</i>	1
	(iii) 0.40 <i>allow ecf from (c)(ii)</i> <i>ignore units</i>	1
	(d) fast red <i>allow ecf from (c)(iii)</i>	1
	has same R_f value <i>allow none of them, as none has the same R_f value for 2 marks</i>	1
		[11 marks]
8	(a) increases the rate of reaction	1
	(b) (i) at lower pressure the molecules will be further apart so there will be fewer collisions <u>per unit time</u> <i>accept frequency of collisions lower</i>	1 1
	(ii) as the temperature increases, the yield of the reaction increases	1

(c)

Level 3: Candidate has given an evaluation that includes both advantages and disadvantages. Candidate has clearly linked points from the table with their own knowledge and uses appropriate scientific terminology.	5 – 6 marks
Level 2: Candidate has attempted an evaluation using points from the table and their own knowledge. Candidate has included advantages and disadvantages.	3 – 4 marks
Level 1: Candidate has written about some basic points from the table but has not added any extra knowledge. Candidate may have included advantages or disadvantages.	1 – 2 marks
No relevant content	0 marks

Indicative content

Advantages of using hydrogen:

- its combustion only produces water
- combustion of hydrogen does not produce carbon dioxide or does not contribute to climate change
- petrol requires much more oxygen to burn so partial combustion is possible producing carbon monoxide
- combustion of hydrogen does not produce any particulates or does not contribute to global dimming
- petrol comes from a non-renewable source or there are renewable ways of producing hydrogen, eg electrolysis of water.

Disadvantages of using hydrogen:

- hydrogen has to be stored at high pressure or risk of explosion or larger volume needed for storage.
- much less energy produced from the combustion of hydrogen or need to refuel more often
- most methods of producing hydrogen need fossil fuels.

[10 marks]

- 9 (a) sulfur / sulphur / S / S(s) 1
- (b) as the temperature increases, the rate of reaction increases 1
allow two correct values for rate quoted (from graph) at different temperatures
- the rate of increase increases **or** there is an exponential relationship 1
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

- (c) (i) any **two** from: 2
- 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
- (ii) (because as the concentration increases) the number of particles per unit volume increases **or** particles are closer together. 1
idea of more particles in a given space is required for the first mark.
ignore references to area.
- (therefore) the frequency of (successful) collisions increases 1
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.
- so the number of particles (per unit volume) doubles 1
or (the frequency of) collisions doubles.
students can score 2 marks for a qualitative explanation;
the third mark is for a quantitative explanation.

[8 marks]