

Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



AQA Level 1/2 Certificate in Chemistry
Specimen Paper

Chemistry

Paper 1

For this paper you must have:

- a ruler
- the Chemistry Data Sheet (enclosed).

You may use a calculator.

Time allowed

- 1 hr 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(a) should be answered in continuous prose.
In this question you will be marked on your ability to:
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.

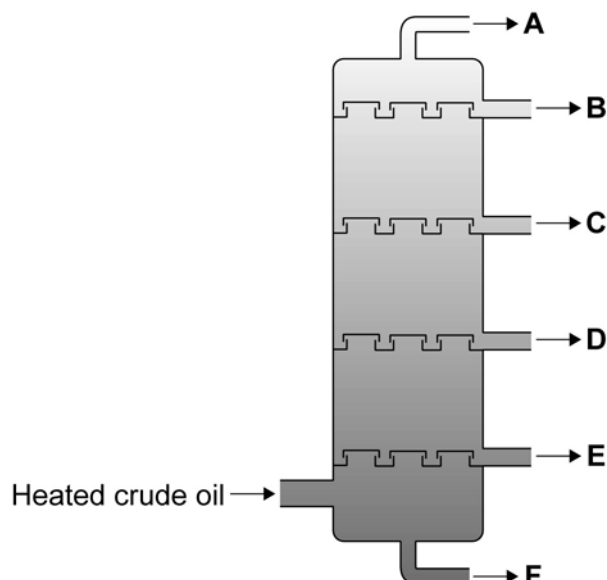
Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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8	
TOTAL	

Answer **all** questions in the spaces provided.

- 1** Crude oil is a mixture of hydrocarbons. The diagram shows a method of separating crude oil.



- 1 (a)** Complete the sentence.

This method of separation is called
(1 mark)

- 1 (b)** Most of the compounds in crude oil are *saturated hydrocarbons*.

Complete the sentences.

A *hydrocarbon* is a compound that contains and
..... only.

A hydrocarbon is *saturated* if it contains only bonds.
(2 marks)

- 1 (c) (i)** Give the letter from the diagram that represents the least flammable fraction.

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(1 mark)

- 1 (c) (ii)** Give the letter from the diagram that represents the most viscous fraction.

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(1 mark)

- 1 (d)** Use the diagram to explain how the crude oil is separated by this method.

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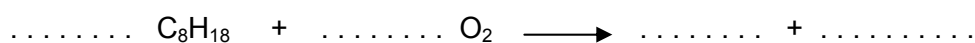
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(4 marks)

- 1 (e)** Many of the fractions of crude oil are used as fuels.

- 1 (e) (i)** Complete and balance the symbol equation for the complete combustion of the compound with the formula C_8H_{18} .



(2 marks)

- 1 (e) (ii)** Partial combustion of C_8H_{18} can produce particles of solid carbon.

What problem can be caused by these particles?

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(1 mark)

- 1 (f)** When fuels are used in car engines, oxygen and nitrogen from the air react together to form oxides of nitrogen.

- 1 (f) (i)** Why can oxygen and nitrogen react together in a car engine?

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(1 mark)

- 1 (f) (ii)** What environmental problem is caused by oxides of nitrogen?

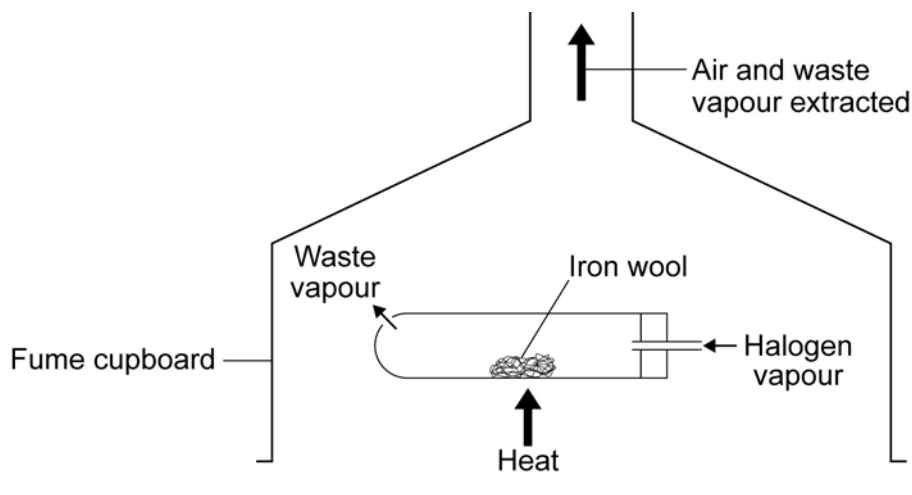
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(1 mark)

2 Chlorine, bromine and iodine are all halogens. They belong to Group 7 of the periodic table.

2 (a) A teacher demonstrated the reactivity of the halogens to some students.

Halogen vapour was passed over heated iron wool in a fume cupboard.



The teacher's observations are shown in the table below.

	Observations	
	During the reaction	After the reaction
Bromine	The iron wool glowed	A red-brown solid had been produced
Chlorine	The iron wool glowed brightly	A dark brown solid had been produced
Iodine	The iron wool did not glow	A black solid had been produced

2 (a) (i) What is the order of reactivity of these three halogens?

Order of reactivity: *most reactive halogen* 1.....

2

least reactive halogen 3

(1 mark)

2 (a) (ii) Explain how you used the teacher's observations to decide your order of reactivity.

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(2 marks)

2 (a) (iii) The students were asked to comment on the teacher's observations.

One student said that the observations were not valid because not all the halogens are vapours – chlorine is a gas, bromine is a liquid and iodine is a solid.

Are the student's comments justified?

Give reasons for your answer.

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(2 marks)

2 (b) Chlorine reacts with hot sodium hydroxide solution.

A sample of a compound formed in the reaction was found to contain 10.8 g of sodium atoms, 16.7 g of chlorine atoms and 22.5 g of oxygen atoms.

Calculate the empirical formula of the compound formed.

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(4 marks)

- 3 (a) Copper sulfate crystals can be made from copper oxide and dilute sulfuric acid.



- 3 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Give a method for making copper sulfate crystals from copper oxide and dilute sulfuric acid.

You should include:

- the names of the pieces of apparatus used
- the purpose of each step
- appropriate safety precautions.

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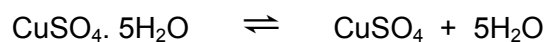
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(6 marks)

- 3 (b)** If crystals of hydrated copper(II) sulfate are dried by heating them strongly, they decompose to give a white solid.

The equation for this decomposition is:



- 3 (b) (i)** Give the name of the white solid formed.

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(1 mark)

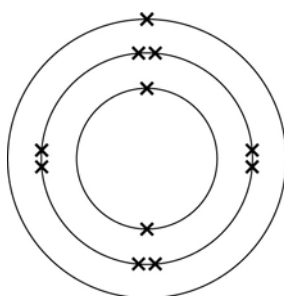
- 3 (b) (ii)** Dilute sulfuric acid was added to the white solid.
What colour would the white solid turn?
Explain your answer.

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(2 marks)

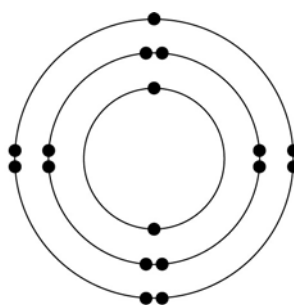
Turn over for the next question

4 Sodium chloride is an ionic compound. It is formed when sodium reacts with chlorine.

4 (a) The diagrams show the arrangement of the electrons in atoms of sodium and chlorine.



Sodium atom



Chlorine atom

4 (a) (i) Draw and label diagrams to show the arrangement of the electrons in the ions formed when sodium reacts with chlorine.

(2 marks)

4 (a) (ii) Give the symbols of the ions formed when sodium reacts with chlorine.

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(1 mark)

4 (b) Sodium chloride is a typical ionic compound.

4 (b) (i) Sodium chloride has a very high melting point.

Explain why.

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(3 marks)

4 (b) (ii) Explain why solid sodium chloride does not conduct electricity but when molten it does conduct electricity.

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(3 marks)

Turn over for the next question

5 (a) Ethanol is an alcohol. The structural formula of ethanol is $\text{CH}_3\text{CH}_2\text{OH}$.

5 (a) (i) Draw the displayed structure of ethanol, showing all the bonds.

(1 mark)

5 (a) (ii) Ethanol reacts with sodium to produce a gas.

What is the gas produced in this reaction?

(1 mark)

5 (b) (i) The structural formula of ethanoic acid is CH_3COOH .

Dilute solutions of ethanol can be converted into dilute solutions of ethanoic acid.

Use a word from the box to complete the sentence.

neutralised

oxidised

reduced

In this reaction the ethanol is

(1 mark)

5 (b) (ii) What is the common name for a dilute solution of ethanoic acid?

(1 mark)

5 (b) (iii) What is the functional group in ethanoic acid?

(1 mark)

5 (c) Ethanoic acid reacts with propanol to give propyl ethanoate, $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$

5 (c) (i) What type of organic compound is propyl ethanoate?

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(1 mark)

5 (c) (ii) Suggest a use for propyl ethanoate.

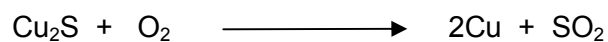
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(1 mark)

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Turn over for the next question

6 Copper is a widely used material.

One method of obtaining copper involves roasting copper(I) sulfide in air.



6 (a) (i) Sulfur dioxide released into the air can cause acid rain.

State **one** problem caused by acid rain.

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(1 mark)

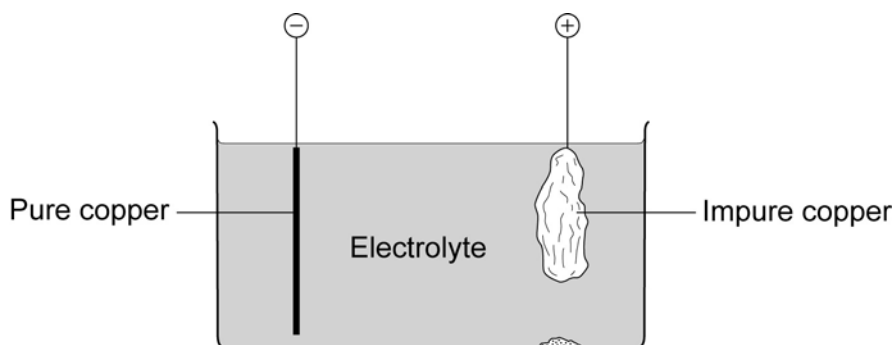
6 (a) (ii) The sulfur dioxide produced is soluble in water.

Write a chemical equation for the reaction of sulfur dioxide with water.

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(1 mark)

- 6 (b)** The copper produced by roasting copper(I) sulfide is impure. It can be purified using the apparatus shown in the diagram.



- 6 (b) (i)** Describe how copper is purified using the apparatus shown.

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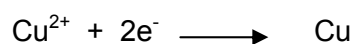
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(5 marks)

- 6 (b) (ii)** The ionic half equation for the reaction at the negative electrode is:



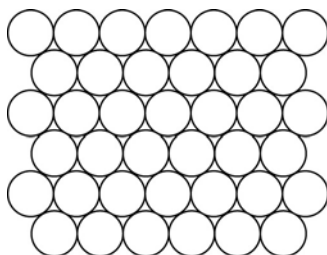
Write the ionic half equation for the reaction at the positive electrode.

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(2 marks)

Question 6 continues on the next page

- 6 (c)** The diagram shows the structure of a metal such as copper.



Use the diagram to help you explain why:

- 6 (c) (i)** copper is malleable

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(2 marks)

- 6 (c) (ii)** copper is an element.

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(1 mark)

- 6 (d)** Copper is often alloyed with other metals, such as tin. Alloys of copper are harder than pure copper.

Explain why alloys of copper are harder than pure copper.

You may draw a diagram to help explain your answer.

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(2 marks)

Turn over for the next question

7 (a) Ammonium sulfate is a fertiliser.

7 (a) (i) Complete the sentences.

Ammonium sulfate can be made by reacting ammonia with acid.

This reaction is a reaction.

(2 marks)

7 (a) (ii) Describe a chemical test you could carry out on a sample of fertiliser to show that it contained sulfate ions.

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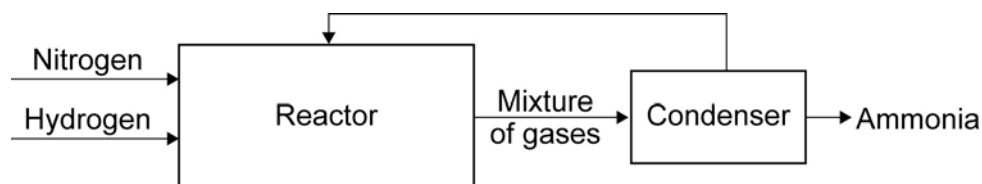
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(3 marks)

7 (b) Ammonia can be made by reacting nitrogen with hydrogen.



Describe how ammonia is removed from the mixture of gases that comes out of the reactor.

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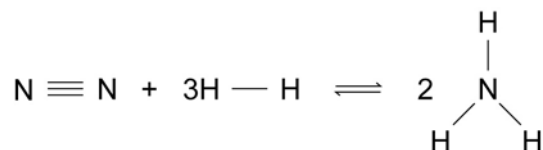
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(2 marks)

- 7 (c) The formation of ammonia from nitrogen and hydrogen can be represented by the equation.



The table shows the values of some average bond dissociation energies.

Bond	$\text{N} \equiv \text{N}$	$\text{H} - \text{H}$	$\text{N} - \text{H}$
Dissociation energy in kJ mol^{-1}	944	436	391

- 7 (c) (i) Use these values to calculate the enthalpy change (ΔH) for this reaction.

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Enthalpy change =

(3 marks)

- 7 (c) (ii) Draw an energy level diagram for this reaction.
Include on your diagram labels to show:

- the overall energy change (ΔH)
- the activation energy
- the reagents and products.

(3 marks)

Question 7 continues on the next page

- 7 (d)** Nitrogen molecules, N_2 , contain a triple bond between the nitrogen atoms. Draw a dot and cross bonding diagram to show the bonding in a nitrogen molecule.

(2 marks)

15

8 Calcium nitrate decomposes when heated.



8 (a) The solid product, CaO, is soluble in water and reacts to form a solution of Ca(OH)₂

8 (a) (i) Give the name of Ca(OH)₂

.....
(1 mark)

8 (a) (ii) Complete the sentences.

When universal indicator is added to the solution formed it turns blue.

This shows that Ca(OH)₂ is

The formula of the ion that causes the universal indicator to turn blue
is

(2 marks)

8 (a) (iii) Draw a ring around the most likely pH value of the solution.

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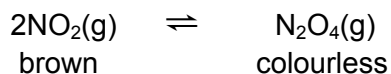
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(1 mark)

Question 8 continues on the next page

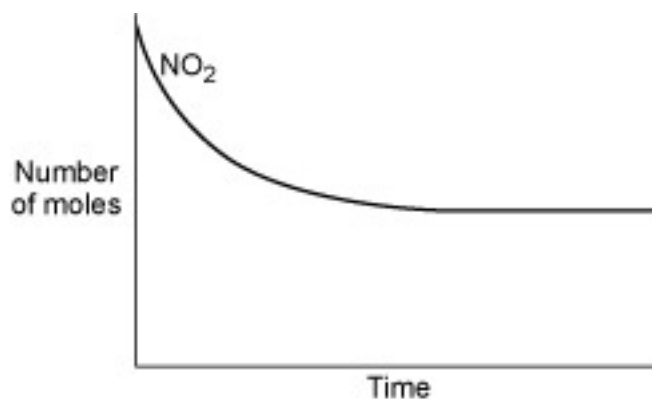
- 8 (b)** The nitrogen dioxide, NO_2 , gas produced is brown. It can react to form colourless dinitrogen tetroxide.



The reaction is reversible and a position of equilibrium can be reached.

A sample of nitrogen dioxide was placed in a glass flask. The flask was sealed and left until equilibrium had been reached. At equilibrium there was more nitrogen dioxide in the flask than there was dinitrogen tetroxide.

- 8 (b) (i)** The graph shows how the number of moles of nitrogen dioxide in the flask changed over a period of time.

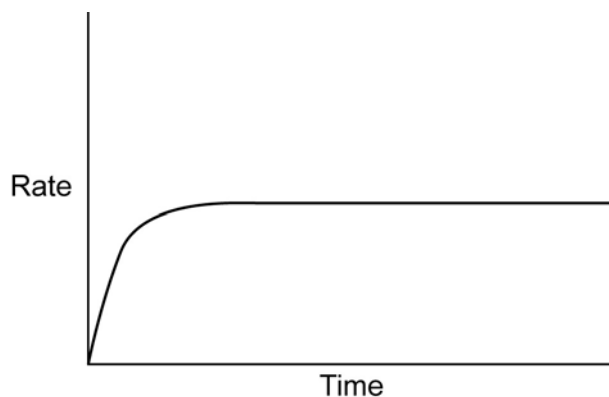


Add a line to the graph to show how the amount of dinitrogen tetroxide in the flask changes over the same period of time.

Mark on the graph the time at which the mixture reaches equilibrium.

(3 marks)

8 (b) (ii) The graph shows how the rate of the backward reaction changes during the reaction.



Explain why the backward reaction gets faster at the start of the reaction.

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(2 marks)

8 (b) (iii) The mixture of gases in the flask was cooled in ice. The colour became paler.

Explain what the change of colour tells us about the reaction of nitrogen dioxide to form dinitrogen tetroxide.

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(4 marks)

END OF QUESTIONS

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