

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2004



**CHEMISTRY (MODULAR) SPECIFICATION A 3423/F
FOUNDATION TIER**

Monday 14 June 2004 9.00 am to 10.30 am

F

In addition to this paper you will require:

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

You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		13	
2		14	
3		15	
4		16	
5		17	
6		18	
7		19	
8			
9			
10			
11			
12			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 90.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

PATTERNS OF CHEMICAL CHANGE

1 Hazard symbols are put on containers to show how dangerous some substances can be.

(a) Draw a straight line from each symbol to its description.

**Toxic**

These substances can cause death. They may have their effects when swallowed or breathed in, or when absorbed through the skin.

**Oxidising**

These substances provide oxygen which allows other materials to burn more fiercely.

**Corrosive**

These substances attack and destroy living tissues including the eyes and skin.

**Highly flammable**

These substances easily catch fire.

(3 marks)

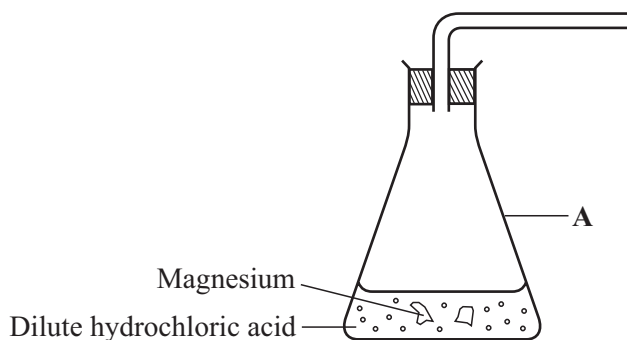
(b) In the box below, draw the hazard symbol for a substance that is an *irritant*.



(1 mark)

- 2 A student did an experiment to find out how fast some magnesium reacted with dilute hydrochloric acid to give off hydrogen gas.

(a) Part of the apparatus the student used is shown in the diagram below.



- (i) What is the name of the piece of apparatus labelled **A**?

.....
(1 mark)

- (ii) Complete the diagram to show the piece of apparatus used to collect and measure the volume of hydrogen produced.
(1 mark)

- (iii) What other piece of apparatus would the student need to measure the rate at which the hydrogen is produced?

.....
(1 mark)

- (b) Which **one** of the following would make the gas come off faster?
Put a ring around your answer.

**adding water to
the acid**

**cooling the
flask**

**cutting the magnesium
into smaller pieces**

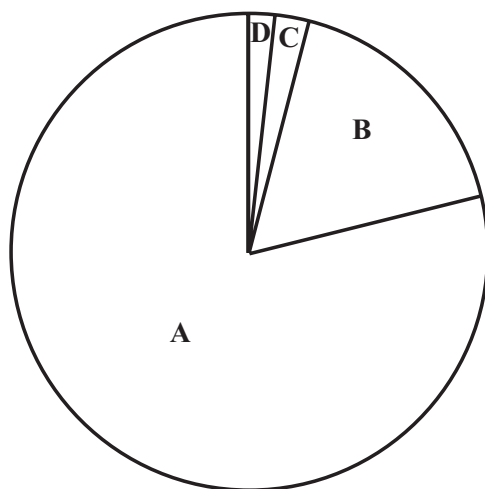
(1 mark)

○
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4

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 3 (a) The pie chart shows the proportions of gases in the air.
Which letter (A, B, C or D) shows the proportion of nitrogen in the air?



.....
(1 mark)

- (b) The Haber process is used to manufacture ammonia, NH_3 .

The word equation for this reaction is:



- (i) What is gas X?

.....
(1 mark)

- (ii) What does the symbol \rightleftharpoons tell us about the reaction?

.....
.....
(1 mark)

- (c) Ammonia is used to make the fertilizer ammonium nitrate.

The formula of ammonium nitrate is NH_4NO_3 .

How many different elements are there in ammonium nitrate?

.....
(1 mark)

STRUCTURES AND BONDING

4 A chlorine atom in the periodic table is shown as ${}^{37}_{17}\text{Cl}$.

(a) How many neutrons are there in this atom of chlorine?

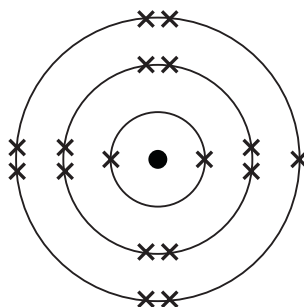
.....
(1 mark)

(b) There are two isotopes of chlorine. One is ${}^{37}_{17}\text{Cl}$.

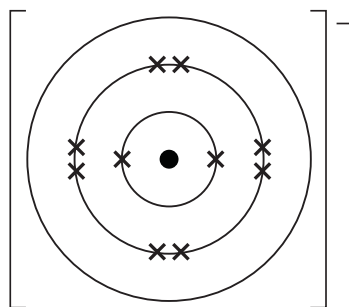
How would another *isotope* of chlorine differ from this?

.....
.....
(1 mark)

(c) The electronic structure of a chlorine atom can be shown as:



(i) Complete the diagram below to show the electronic structure of a chloride ion, Cl^- .



(1 mark)

(ii) Which noble gas has the same electronic structure as a chloride ion, Cl^- ?

.....
(1 mark)

5 Complete the sentences below by choosing the correct words from the box.

divided	giant	metallic
molecular	oppositely	positively
shared	similarly	transferred

Ionic compounds form structures held together by strong forces between charged ions. In compounds with covalent bonding the electrons are between the atoms. Covalent compounds with low melting points have structures.

(4 marks)

4

6 The elements in Group 7 of the periodic table are called the halogens.

(a) Complete the table below.

Halogen	Colour	Physical state
Fluorine	yellow	gas
Chlorine		gas
Bromine	red-brown	
Iodine	grey	solid

(2 marks)

(b) A piece of damp litmus paper is put into a jar of chlorine.

What happens to the litmus paper?

.....
.....

(1 mark)

(c) Complete the word equation below.

potassium + iodine →

(1 mark)

4

7 Use the information from the Data Sheet to help you to answer these questions.

- (a) How many electrons are there in the outer shell (energy level) of a calcium atom?

.....
(1 mark)

- (b) Calcium reacts with chlorine to form calcium chloride.

- (i) Give the formula of calcium chloride.

.....
(1 mark)

- (ii) Calcium chloride has ionic bonds.

What happens to the outer electrons in the atoms of calcium and chlorine when they react together?

.....
.....
.....
.....
(2 marks)

4

TURN OVER FOR THE NEXT QUESTION

Turn over ►

CHEMISTRY IN ACTION

8 Titanium can be produced by reacting titanium chloride with sodium.

- (a) (i) Complete the following word equation for this reaction.

Titanium chloride + sodium \rightarrow titanium +
(1 mark)

- (ii) This is a displacement reaction.

Give a reason why sodium can displace titanium from titanium chloride.

.....
.....
(1 mark)

- (iii) In industry the reaction is carried out in an atmosphere of argon.

What reaction might take place if air was present?

.....
.....
.....
.....
(2 marks)

- (b) Give **one** use for titanium.

.....
(1 mark)

9 A solution contains aluminium ions and sulphate ions.

(a) Sodium hydroxide solution is used to test for aluminium ions.

What would you see when:

(i) a few drops of sodium hydroxide solution are added to the solution?

.....
.....
(1 mark)

(ii) an excess of sodium hydroxide solution is added to the solution?

.....
.....
(1 mark)

(b) What solution would you use to show that sulphate ions are present in a solution?

.....
.....
(1 mark)

(c) Both aluminium and sulphate ions could be detected using instrumental methods.

Give **one** advantage of using an instrumental method.

.....
.....
(1 mark)

4

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 10** (a) Which ion is responsible for acidic properties?

.....
(1 mark)

- (b) Explain what is meant by the terms *strong* and *weak* when they are used to describe acids.

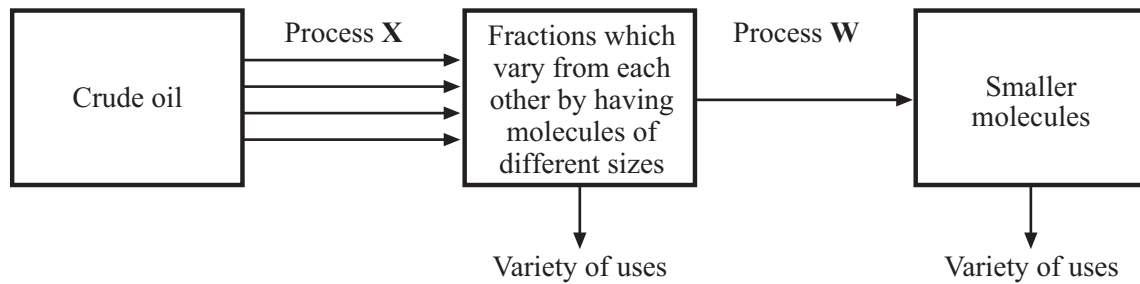
.....
.....
.....
.....
(2 marks)

- (c) You have been given solutions of a strong acid and a weak acid with the same concentration.
Describe a test you could do to identify the strong acid. You should include the result of the test.

.....
.....
.....
.....
(1 mark)

○
—
4

12 The flow chart shows crude oil being converted into more useful products.



(a) What are the names of the **two** processes?

(i) Process **X**.....

(ii) Process **W**

(2 marks)

(b) Name **one** of the fractions from Process **X** and give a use for it.

Name of fraction.....

Use.....

(2 marks)

(c) Give **one** use for the “smaller molecules” from Process **W**.

.....

(1 mark)

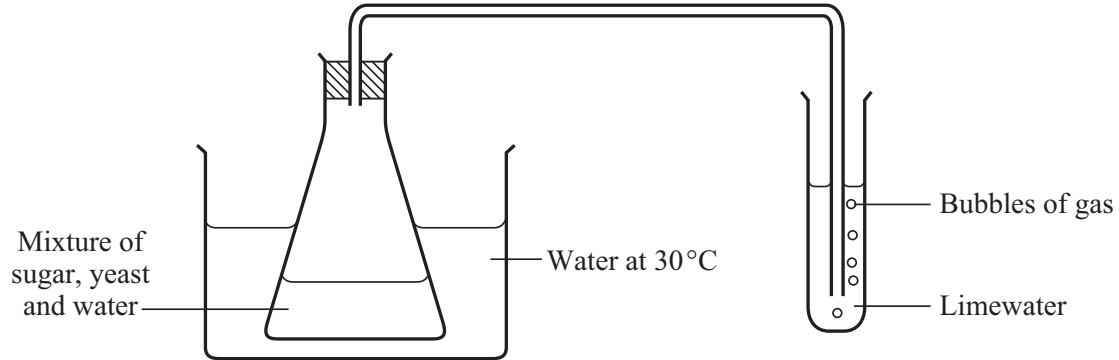
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TURN OVER FOR THE NEXT QUESTION

Turn over ►

PATTERNS OF CHEMICAL CHANGE

- 13 The diagram is of an experiment used to show the process of yeast breaking down sugar.



- (a) What is the name of the process when yeast breaks down sugar?

.....
(1 mark)

- (b) Name the gas produced in the experiment.

.....
(1 mark)

- (c) If the experiment is repeated using water at 60°C no gas bubbles are produced.

Explain why increasing the temperature has this effect on the process.

.....
.....
.....
.....
(2 marks)

(d) The sugar used in this experiment is glucose, $C_6H_{12}O_6$.

- (i) Calculate the relative formula mass of glucose.
Relative atomic masses: H = 1; C = 12; O = 16

.....
.....
(1 mark)

- (ii) Calculate the percentage of carbon in a molecule of glucose.

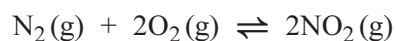
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(2 marks)

7

TURN OVER FOR THE NEXT QUESTION

Turn over ►

14 Nitrogen reacts with oxygen to form nitrogen dioxide.



(a) State and explain the effect of increasing the pressure on the rate of this reaction.

.....
.....
.....
.....

(2 marks)

(b) The reaction is *exothermic*.

What does *exothermic* mean?

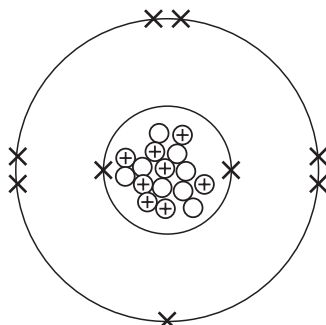
.....
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(1 mark)

3

STRUCTURES AND BONDING

- 15 (a) A student draws the structure of an atom in this way:



- (i) What mistake has the student made in the drawing?

.....

 (1 mark)

- (ii) To which Group of the periodic table could this atom belong?
 Explain your answer.

.....

 (2 marks)

- (b) Name the **least** reactive element in Group 1 of the periodic table.

.....
 (1 mark)

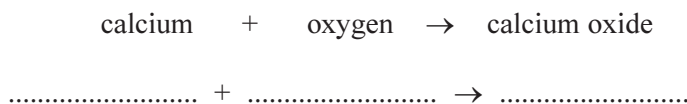
- (c) (i) Write the word equation for the reaction of sodium with water.

sodium + water → +
 (1 mark)

- (ii) Suggest a value for the pH of the solution at the end of the reaction.

.....
 (1 mark)

- (d) Write the balanced symbol equation for the reaction.



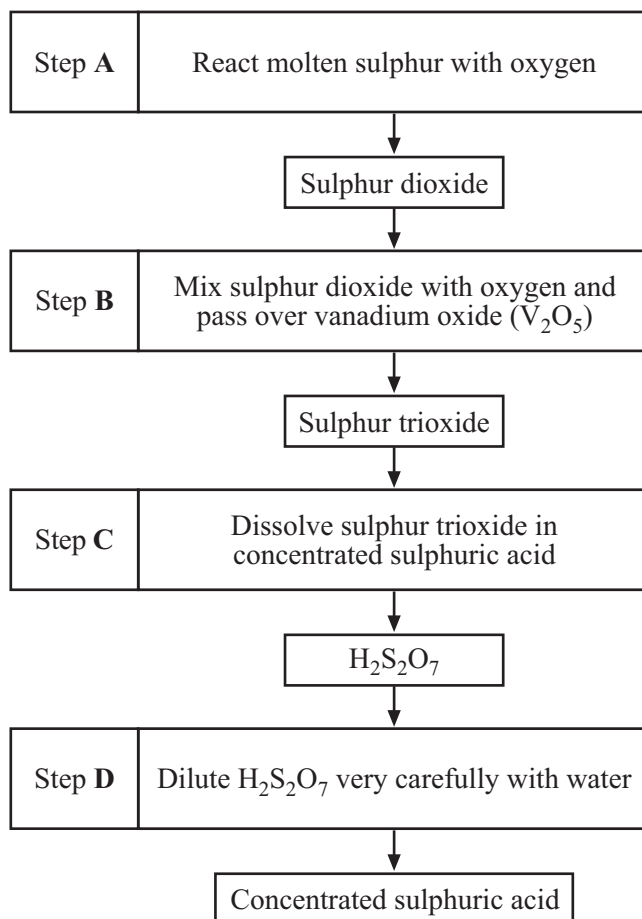
(2 marks)

8

Turn over ►

CHEMISTRY IN ACTION

- 16 (a) The flow chart shows how concentrated sulphuric acid is manufactured in industry from sulphur.

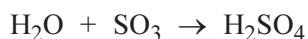


- (i) What type of chemical reaction takes place in Step A?
.....
(1 mark)
- (ii) What environmental problem would be produced by releasing any unreacted gases into the environment?
.....
(1 mark)
- (iii) What is the purpose of using vanadium oxide, V₂O₅, in Step B?
.....
(1 mark)

- (iv) What is the name of the substance $\text{H}_2\text{S}_2\text{O}_7$ made in Step C?

.....
(1 mark)

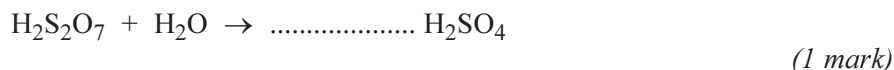
- (v) Instead of Step C and Step D the sulphur trioxide could be converted directly into sulphuric acid by adding water in a single step.



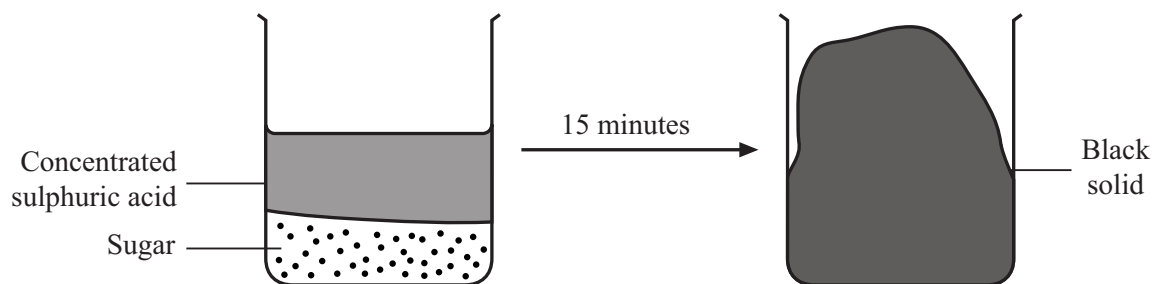
What are the problems caused by this single step reaction?

.....
.....
.....
.....
(2 marks)

- (vi) Balance the chemical equation for Step D.



- (b) The diagram shows the effect of adding concentrated sulphuric acid to sugar.



Which property of sulphuric acid does this experiment show?

.....
(1 mark)

18 The transition elements, e.g. iron and copper, and the elements of Group 1 are metals and so they have some properties that are similar. However, they also have properties that are very different from each other.

(a) Give **one** physical property that will be similar for the two groups of metals.

.....
(1 mark)

(b) Complete the table using the words *high* or *low* to show the differences between these metals.

Property	Group 1	Transition elements
Density		
Reactivity with oxygen		

(2 marks)

(c) A piece of copper left exposed to the atmosphere for a long time changes colour due to the formation of a layer of a copper compound called verdigris.

What is the colour of verdigris?

.....
(1 mark)

(d) Transition elements are extracted from their ores by reduction using carbon.

Explain why this method **cannot** be used for Group 1 metals.

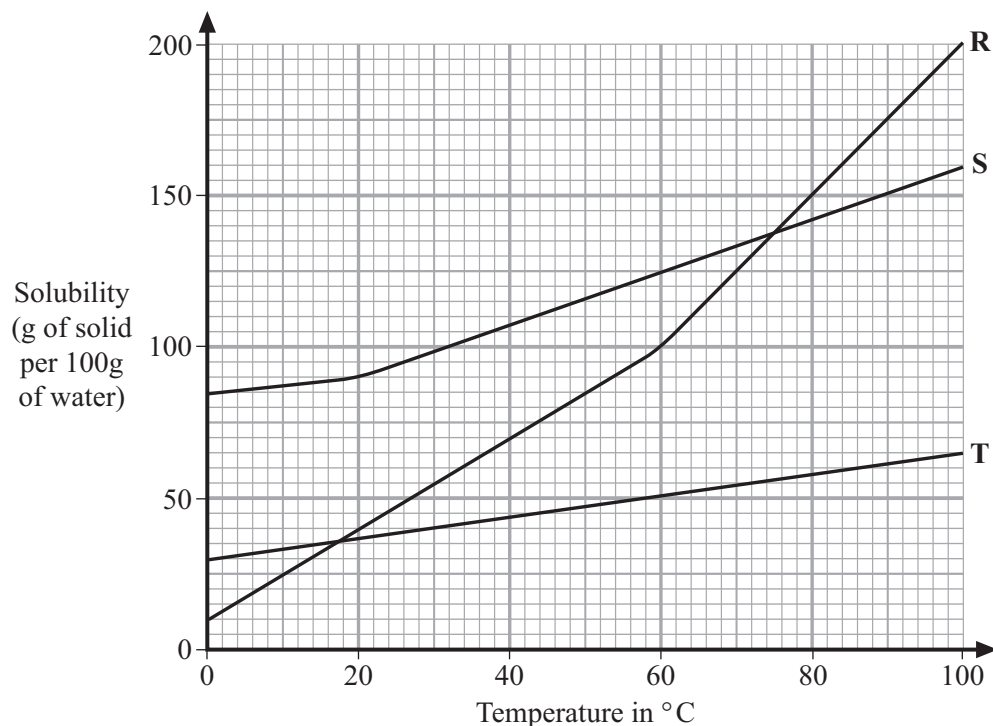
.....
.....
(1 mark)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

19 The graph shows the solubility curves for three ionic solids **R**, **S** and **T**.



(a) (i) How many grams of solid **T** could be dissolved in 100 g of water at 60°C?

.....g
(1 mark)

(ii) At what temperature would 200 g of water dissolve 200 g of solid **S**?

.....°C
(1 mark)

(b) A saturated solution of solid **R** was made at 80°C using 100 g of water.

(i) Explain the term *saturated solution*.

.....

 (1 mark)

(ii) The saturated solution of **R** was cooled from 80°C to 20°C.

Calculate the mass of **R** that would separate out of the solution.

.....

 (1 mark)

END OF QUESTIONS

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THERE ARE NO QUESTIONS PRINTED ON THIS PAGE