

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
GATEWAY SCIENCE  
CHEMISTRY B**

**B642/02**

Unit 2 Modules C4 C5 C6 (Higher Tier)

Candidates answer on the Question Paper  
A calculator may be used for this paper

**OCR Supplied Materials:**  
None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)

**Wednesday 16 June 2010  
Morning**

**Duration: 1 hour**



Candidate Forename		Candidate Surname	
--------------------	--	-------------------	--

Centre Number						Candidate Number				
---------------	--	--	--	--	--	------------------	--	--	--	--

**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- The Periodic Table is printed on the back page.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

**Section A – Module C4**

- 1 Sea-water contains many different ions.

Look at the table. It shows the composition of sea-water.

ion	formula	percentage by mass in sea-water
chloride	$Cl^-$	55.0
magnesium	$Mg^{2+}$	3.7
potassium	$K^+$	1.1
sodium	$Na^+$	30.6
sulfate	$SO_4^{2-}$	7.7

- (a) Evaporation of sea-water gives a mixture of salts.

One of these salts is potassium sulfate.

What is the formula for potassium sulfate?

..... [1]

- (b) Katharine wants to test for sulfate ions in sea-water.

She uses barium chloride solution.

Barium chloride solution reacts with sulfate ions.

What type of reaction happens?

Choose from:

**neutralisation**

**oxidation**

**precipitation**

**reduction**

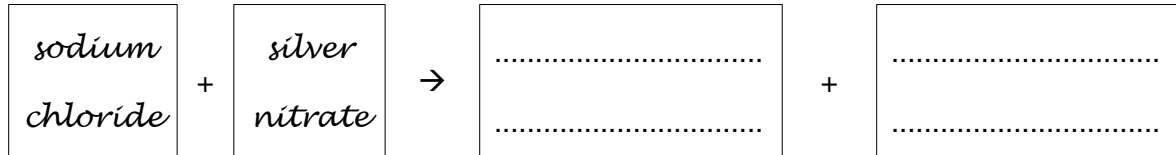
**reversible**

answer ..... [1]

(c) Sea-water contains sodium chloride.

Silver nitrate solution reacts with sodium chloride.

Complete the **word** equation for this reaction.



[1]

(d) Ryan wants to show that sea-water has a pH of 8.

He does some research on the internet. Ryan finds out he can use a pH meter.

Describe one **other** way Ryan can find out the pH of sea-water.

.....

.....

.....

..... [2]

[Total: 5]

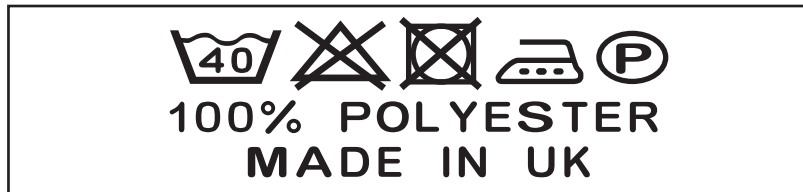
2 This question is about washing clothes.

Kieran wants to wash his dirty shirt.

Kieran's shirt has several food stains.

He decides to use a biological washing powder that contains enzymes.

He looks at the wash label on his shirt.



(a) Write down two advantages of using a **low** temperature rather than a high temperature wash.

1 .....

.....

2 .....

..... [2]

(b) The washing powder contains a detergent.

Molecules of the detergent have a hydrophobic tail and a hydrophilic head.

(i) What is meant by the word **hydrophilic**?

..... [1]

(ii) What is meant by the word **hydrophobic**?

..... [1]

[Total: 4]

3 Medicines and pharmaceutical drugs are speciality chemicals.

(a) Digitalis is a medicine used to treat heart disease.

Digitalis can be extracted from the foxglove plant.



Describe how chemicals such as digitalis can be extracted from plants.

.....

.....

.....

..... [2]

(b) Statins are speciality chemicals.

They are medicines used to reduce cholesterol levels.

It has taken over 15 years for some statins to be fully tested.

This is one of the reasons why it is expensive to make and develop a new medicine.

Write down **one** other reason why it is expensive to make and develop a new medicine.

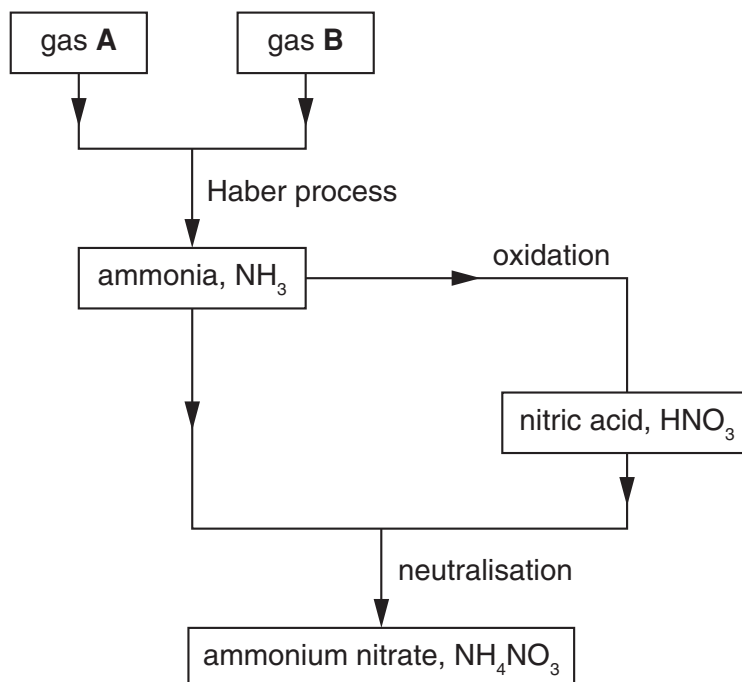
.....

..... [1]

[Total: 3]

4 Ammonium nitrate is a fertiliser used by farmers.

Look at the flow chart. It shows how ammonium nitrate can be made.



(a) Write down the **balanced symbol** equation for the reaction that takes place in the Haber Process.

..... [2]

(b) It is important that the Haber process has a

- high rate of reaction
- good percentage yield.

(i) Explain why a high pressure is used in the Haber process.

.....

..... [1]

(ii) Explain why a compromise temperature of 450°C is used in the Haber process.

.....

.....

..... [1]

- (c) A factory makes ammonium nitrate.

Jordan predicts the factory should make 50 tonnes of ammonium nitrate.

The factory actually makes 37.5 tonnes of ammonium nitrate.

What is the percentage yield?

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

percentage yield = .....% [2]

- (d) Calculate the relative formula mass,  $M_r$ , of ammonium nitrate,  $\text{NH}_4\text{NO}_3$ .

Use this  $M_r$  to calculate the percentage by mass of nitrogen in ammonium nitrate.

The relative atomic mass,  $A_r$ , of H is 1, of N is 14 and of O is 16.

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

percentage by mass = .....% [2]

[Total: 8]

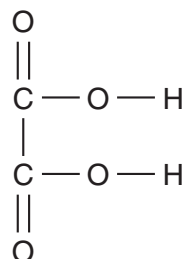
**PLEASE DO NOT WRITE ON THIS PAGE**



## Section B – Module C5

5 Research chemists have isolated a weak acid from the leaves of rhubarb.

Look at the displayed formula of the weak acid.



(a) What is the molecular formula of the weak acid?

..... [1]

(b) Chris dissolves some of the weak acid in water.

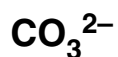
He tests the pH of the solution.

The pH value is 3.5.

The weak acid ionises in water.

Which one of the following ions is present in the solution?

Choose from



answer .....

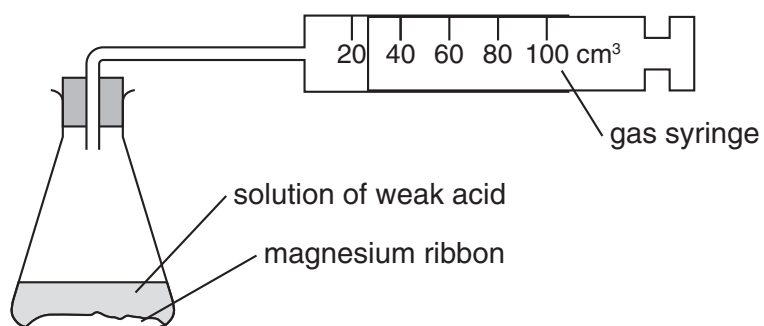
[1]

(c) Chris investigates the reaction of the weak acid with magnesium ribbon.

He adds a small amount of magnesium ribbon to 50 cm<sup>3</sup> of the weak acid solution.

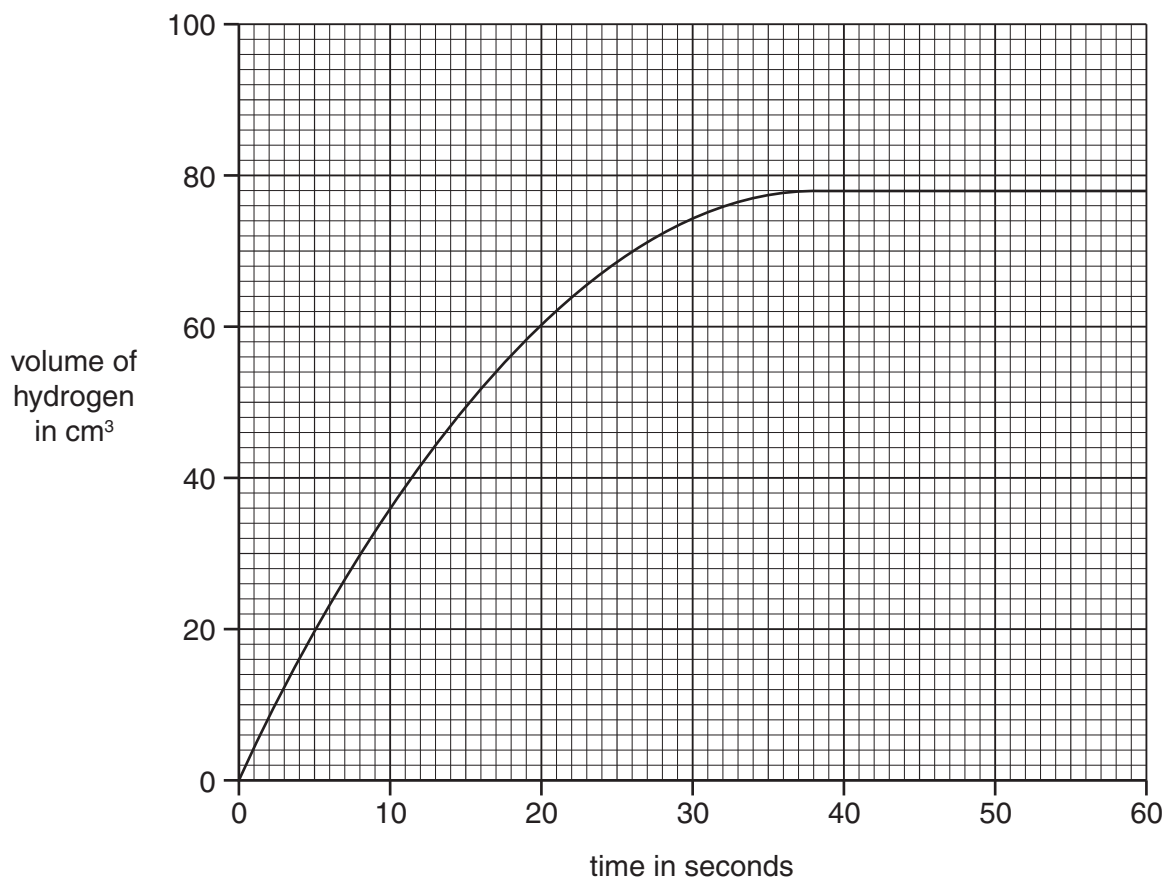
He measures the volume of hydrogen made every 10 seconds.

Look at the apparatus he uses.



At the end of the reaction there was still some magnesium ribbon in the flask.

Look at the graph of Chris' results.



(i) What is the volume of hydrogen made after 18 seconds?

..... cm<sup>3</sup> [1]

(ii) At what time did the reaction stop?

..... seconds [1]

(iii) Explain why the reaction stops.

.....  
..... [1]

(d) Chris does another experiment.

This time he collects 0.060 dm<sup>3</sup> of hydrogen at room temperature and pressure (rtp).

What is the number of moles of hydrogen collected?

One mole of hydrogen at rtp occupies a volume of 24 dm<sup>3</sup>.

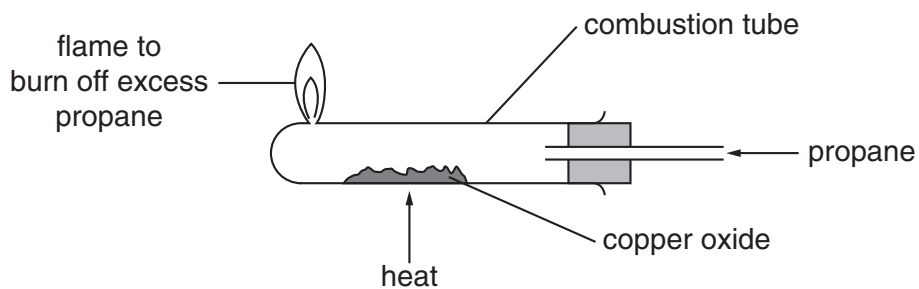
.....  
.....

number of moles = ..... [1]

[Total: 6]

6 Alyce wants to find the empirical formula of a sample of copper oxide.

Look at the apparatus she uses.



Alyce puts 2.88 g of copper oxide into the combustion tube.

Alyce passes propane gas over the heated copper oxide.

After 20 minutes all the copper oxide has been changed into copper.

She makes 2.56 g of copper.

(a) (i) What is the amount, in moles, of copper made?

The relative atomic mass,  $A_r$ , of Cu is 64.

.....

.....

amount of copper = ..... moles [1]

(ii) During the reaction all the oxygen in the 2.88 g of copper oxide is removed.

What is the amount, in moles, of oxygen removed?

The relative atomic mass,  $A_r$ , of O is 16.

.....

.....

.....

amount of oxygen = ..... moles [1]

(iii) Use your answers to parts (i) and (ii) to work out the empirical formula for copper oxide.

.....

.....

.....

empirical formula is ..... [1]

(b) Alyce repeats the experiment.

This time she uses **5.76 g** of copper oxide instead of **2.88 g**.

What mass of copper should Alyce make?

.....  
.....

mass of copper = .....g

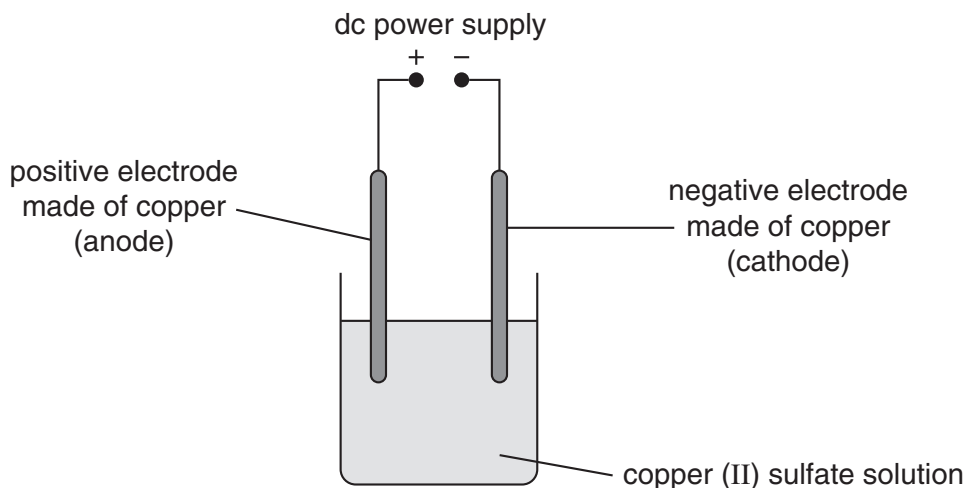
[1]

[Total: 4]

7 This question is about the electrolysis of copper(II) sulfate solution.

Look at the diagram.

It shows the apparatus Jess uses to electrolyse copper(II) sulfate solution.



(a) Jess finds the mass of the copper electrodes before and after doing the electrolysis.

What happens to the mass of each electrode during the electrolysis?

mass of negative electrode .....

.....

mass of positive electrode .....

..... [2]

(b) Jess replaces copper(II) sulfate solution with **solid** copper(II) sulfate.

This time no electrolysis takes place.

Explain why.

Use ideas about the particles found in copper(II) sulfate.

.....

.....

..... [2]

(c) The electrolysis of molten (liquid) potassium chloride makes potassium and chlorine.

At the negative electrode potassium ions,  $K^+$ , gain electrons to make potassium atoms.

Write down the **symbol** equation for the process that happens at the negative electrode.

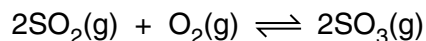
Use  $e^-$  for an electron.

..... [1]

[Total: 5]

- 8 The Contact Process manufactures sulfuric acid,  $\text{H}_2\text{SO}_4$ .

One of the reactions in the Contact Process changes sulfur dioxide into sulfur trioxide.



This is a reversible reaction.

- (a) Some reversible reactions reach a position of equilibrium.

Explain why.

Use ideas about rate of reaction.

.....

.....

.....

..... [2]

- (b) The position of equilibrium for this reaction lies on the right.

What does this tell you about the concentrations of sulfur dioxide and sulfur trioxide at equilibrium?

.....

..... [1]

- (c) What is the effect of a catalyst on the position of equilibrium?

.....

..... [1]

- (d) Sulfur trioxide reacts with water to make sulfuric acid.

Write the **balanced symbol** equation for this reaction.

..... [1]

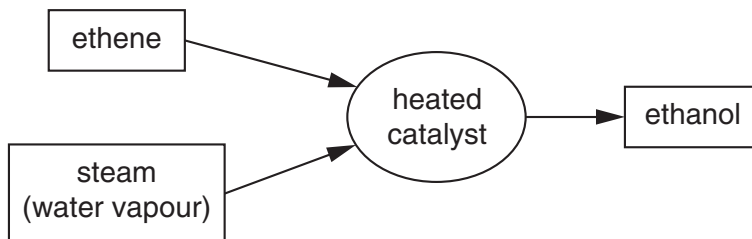
[Total: 5]



## Section C – Module C6

9 This question is about ethanol.

Look at the flow chart. It shows how ethanol is made from ethene.



(a) (i) Write down the **word** equation for making **ethanol** from ethene.

..... [1]

(ii) **Ethene** can be made from ethanol.

Write down **one** condition for this reaction.

.....  
 ..... [1]

(b) Ethanol can also be made from glucose solution and yeast.

This reaction is called fermentation.

Fermentation makes a solution of ethanol.

What is the name of the process used to obtain ethanol from this solution?

..... [1]

(c) The formula of ethanol is  $C_2H_5OH$ .

Ethanol is one of a series of alcohols with the general formula  $C_nH_{2n+1}OH$ .

Butanol has **4** carbon atoms. Write down the formula of butanol.

..... [1]

[Total: 4]

10 This question is about rusting.

(a) Colin is fixing the roof of his shed using galvanised iron nails.



Galvanised iron nails have been coated in zinc.

The zinc coating prevents the iron nail from rusting.

Explain **two** ways the zinc coating does this.

1 .....

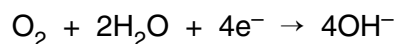
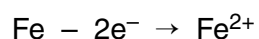
.....

2 .....

..... [2]

(b) Look at the equations.

These are two processes that happen during rusting.



Rusting is a redox reaction.

Explain why using information from **both** equations.

.....

..... [1]

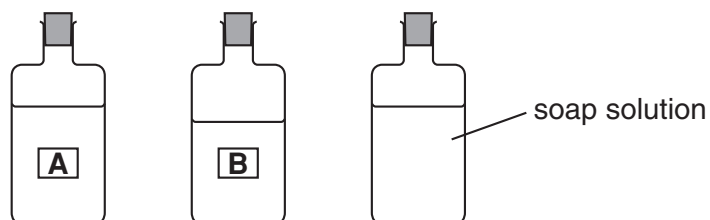
[Total: 3]

11 This question is about hardness in water.

(a) Bev and Jeff bring in two water samples, **A** and **B**.

They want to find out which has the most hardness.

They use soap solution in their experiment.



Write about how they do their experiment.

Your answer should include

- the apparatus they use
- the measurements they take
- how they tell which sample of water has the most hardness.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

(b) Washing soda solution contains carbonate ions,  $\text{CO}_3^{2-}$ .

Washing soda is used to soften water.

Hard water contains calcium ions,  $\text{Ca}^{2+}$ , in solution.

Explain how sodium carbonate softens water.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [2]

[Total: 5]

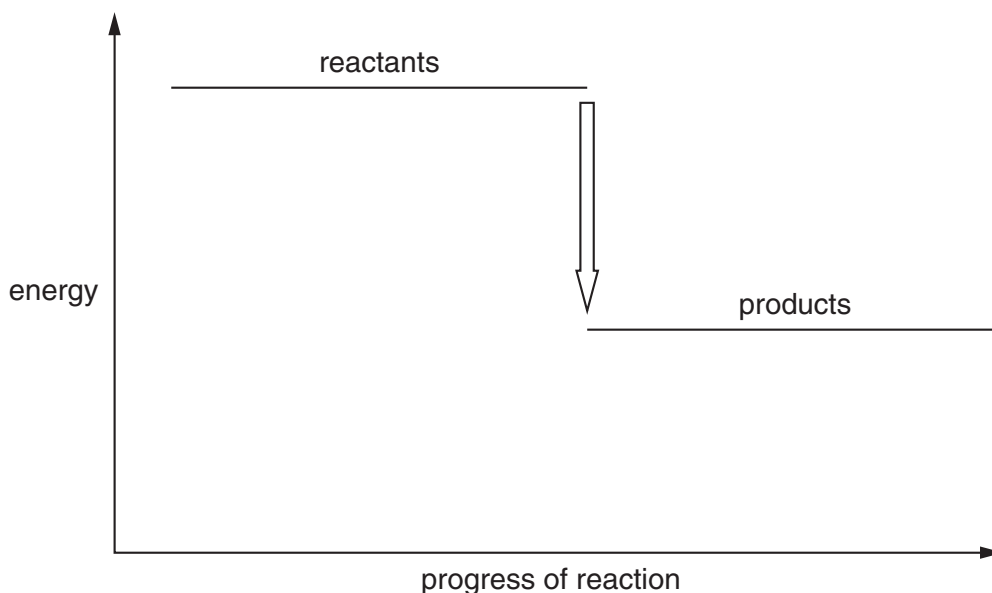
12 Fuel cells use hydrogen, H<sub>2</sub>, and oxygen, O<sub>2</sub>.

Fuel cells make water.

(a) Write a **balanced symbol** equation for the reaction between hydrogen and oxygen.

..... [2]

(b) Look at the energy level diagram for the reaction between hydrogen and oxygen.



Energy is given out in this reaction.

(i) How does the diagram show that energy is given out?

.....  
 ..... [1]

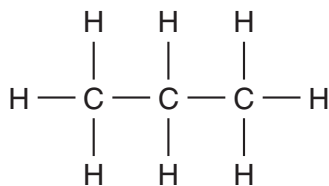
(ii) What is the name given to a reaction that gives out energy?

..... [1]

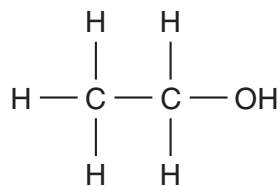
[Total: 4]

13 This question is about unsaturated compounds.

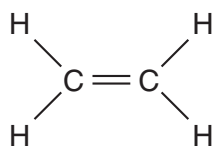
Look at the displayed formulas of some compounds of carbon.



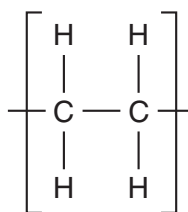
compound **A**



compound **B**



compound **C**



compound **D**

(a) Which one of the compounds is unsaturated?

Choose from **A**, **B**, **C**, or **D**.

answer .....

[1]

(b) Look at the list of chemicals.

**bromine water**

**phosphoric acid**

**sodium carbonate**

**sodium hydroxide**

One of these chemicals can be used to test for unsaturation.

Which one?

Choose from the list.

answer ..... [1]

(c) Unsaturated vegetable oils are often too runny to spread onto bread.

Unsaturated vegetable oils are hardened by changing them into saturated vegetable oils.



(i) Write down the name of gas X.

..... [1]

(ii) Write down a condition used in this reaction.

.....  
..... [1]

[Total: 4]

**END OF QUESTION PAPER**

**PLEASE DO NOT WRITE ON THIS PAGE**



**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

# The Periodic Table of the Elements

1	2	3	4	5	6	7	0										
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>P</b> phosphorus 15	16 <b>O</b> oxygen 8	17 <b>F</b> fluorine 9	18 <b>Ne</b> neon 10								
19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36		
37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	40 <b>Ca</b> calcium 20	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium [98]	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54	
55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77	78 <b>Pt</b> platinum 78	79 <b>Au</b> gold 79	80 <b>Hg</b> mercury 80	81 <b>Tl</b> thallium 81	82 <b>Pb</b> lead 82	83 <b>Bi</b> bismuth 83	84 <b>Po</b> polonium 84	85 <b>At</b> astatine 85	86 <b>Rn</b> radon 86
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

1	<b>H</b> hydrogen 1
---	---------------------------

relative atomic mass
atomic symbol
name
atomic (proton) number

Key

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.