

FOR OFFICIAL USE

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C

KU PS

Total  
Marks

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**0500/402**

NATIONAL  
QUALIFICATIONS  
2008

THURSDAY, 1 MAY  
10.50 AM – 12.20 PM

**CHEMISTRY**  
**STANDARD GRADE**  
Credit Level

**Fill in these boxes and read what is printed below.**

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

- 1 All questions should be attempted.
- 2 Necessary data will be found in the Data Booklet provided for Chemistry at Standard Grade and Intermediate 2.
- 3 The questions may be answered in any order but all answers are to be written in this answer book, and must be written clearly and legibly in ink.
- 4 Rough work, if any should be necessary, as well as the fair copy, is to be written in this book.  
Rough work should be scored through when the fair copy has been written.
- 5 Additional space for answers and rough work will be found at the end of the book.
- 6 The size of the space provided for an answer should not be taken as an indication of how much to write. It is not necessary to use all the space.
- 7 Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.



## PART 1

In Questions 1 to 9 of this part of the paper, an answer is given by circling the appropriate letter (or letters) in the answer grid provided.

In some questions, two letters are required for full marks.

If more than the correct number of answers is given, marks will be deducted.

A total of 20 marks is available in this part of the paper.

### SAMPLE QUESTION

A	CH <sub>4</sub>	B	H <sub>2</sub>	C	CO <sub>2</sub>
D	CO	E	C <sub>2</sub> H <sub>5</sub> OH	F	C

(a) Identify the hydrocarbon.

Ⓐ	B	C
D	E	F

The one correct answer to part (a) is A. This should be circled.

(b) Identify the **two** elements.

A	Ⓑ	C
D	E	Ⓕ

As indicated in this question, there are **two** correct answers to part (b). These are B and F. Both answers are circled.

If, after you have recorded your answer, you decide that you have made an error and wish to make a change, you should cancel the original answer and circle the answer you now consider to be correct. Thus, in part (a), if you want to change an answer A to an answer D, your answer sheet would look like this:

<del>Ⓐ</del>	B	C
Ⓓ	E	F

If you want to change back to an answer which has already been scored out, you should enter a tick (✓) in the box of the answer of your choice, thus:

✓ <del>Ⓐ</del>	B	C
<del>Ⓓ</del>	E	F

Marks

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1. The formulae of some gases are shown in the grid.

A	H <sub>2</sub>	B	N <sub>2</sub>	C	CO
D	O <sub>2</sub>	E	CO <sub>2</sub>	F	NO <sub>2</sub>

- (a) Identify the toxic gas produced during the burning of plastics.

A	B	C
D	E	F

1

- (b) Identify the gas which makes up approximately 80% of air.

A	B	C
D	E	F

1

- (c) Identify the gas used up during respiration.

A	B	C
D	E	F

1

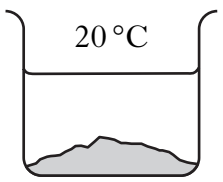
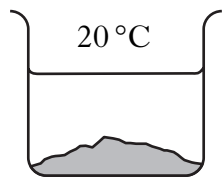
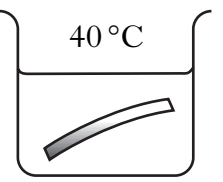
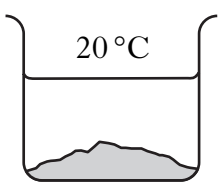
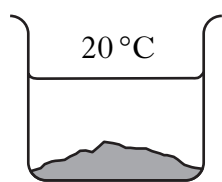
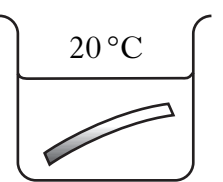
(3)

[Turn over

Marks

KU PS

2. A student carried out several experiments with metals and acids.

<p>A</p>  <p>20 °C</p> <p>magnesium powder 1 mol/l hydrochloric acid</p>	<p>B</p>  <p>20 °C</p> <p>copper powder 1 mol/l hydrochloric acid</p>	<p>C</p>  <p>40 °C</p> <p>magnesium ribbon 1 mol/l hydrochloric acid</p>
<p>D</p>  <p>20 °C</p> <p>magnesium powder 1 mol/l sulphuric acid</p>	<p>E</p>  <p>20 °C</p> <p>iron powder 2 mol/l hydrochloric acid</p>	<p>F</p>  <p>20 °C</p> <p>magnesium ribbon 1 mol/l hydrochloric acid</p>

(a) Identify the **two** experiments which could be compared to show the effect of particle size on reaction rate.

A	B	C
D	E	F

1

(b) Identify the experiment in which **no** reaction would take place.

A	B	C
D	E	F

1

(2)

Marks

KU PS

3. The grid shows the structural formulae of some hydrocarbons.

<p>A</p> <pre>       H   H             H — C — C — H                   H   H           </pre>	<p>B</p> <pre>       H   H        \ /         C        / \       H   C — H          / \         C   C — H          \ /         H   H           </pre>	<p>C</p> <pre>       H   H                   C = C                   H   H           </pre>
<p>D</p> <pre>       CH<sub>3</sub> H                    C = C                    H   H           </pre>	<p>E</p> <pre>       H   CH<sub>3</sub> H                  H — C — C — C — H                        H   CH<sub>3</sub> H           </pre>	<p>F</p> <pre>       H   H             H — C — C — H             H — C — C — H                   H   H           </pre>

(a) Identify the **two** hydrocarbons which can polymerise.

A	B	C
D	E	F

1

(b) Identify the **two** hydrocarbons with the general formula  $C_nH_{2n}$  which do **not** decolourise bromine solution quickly.

A	B	C
D	E	F

1

(2)

[Turn over

Marks

KU PS

4. The grid shows the names of some oxides.

A	silicon dioxide	B	carbon dioxide	C	sodium oxide
D	iron oxide	E	sulphur dioxide	F	copper oxide

- (a) Identify the **two** oxides which contain transition metals.

You may wish to use the data booklet to help you.

A	B	C
D	E	F

1

- (b) Identify the oxide which reacts with water in the atmosphere to produce acid rain.

A	B	C
D	E	F

1

- (c) Identify the oxide which, when added to water, produces a solution with a greater concentration of hydroxide ions ( $\text{OH}^-$ ) than hydrogen ions ( $\text{H}^+$ ).

A	B	C
D	E	F

1

(3)

Marks

KU PS

5. There are different types of chemical reactions.

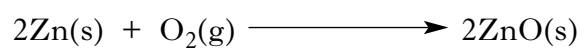
A	redox
B	precipitation
C	combustion
D	neutralisation
E	displacement

- (a) Identify the type of chemical reaction taking place when dilute hydrochloric acid reacts with a carbonate.

A
B
C
D
E

1

- (b) Identify the **two** types of chemical reaction represented by the following equation.



A
B
C
D
E

2

(3)

[Turn over





Marks

KU PS

7. The grid contains the names of some carbohydrates.

A	fructose
B	glucose
C	maltose
D	sucrose
E	starch

(a) Galactose is a monosaccharide found in dairy products.

Identify the **two** isomers of galactose.

A
B
C
D
E

1

(b) Identify the carbohydrate which is a condensation polymer.

A
B
C
D
E

1

(2)

[Turn over

Marks

KU PS

8. A student made some statements about acids.

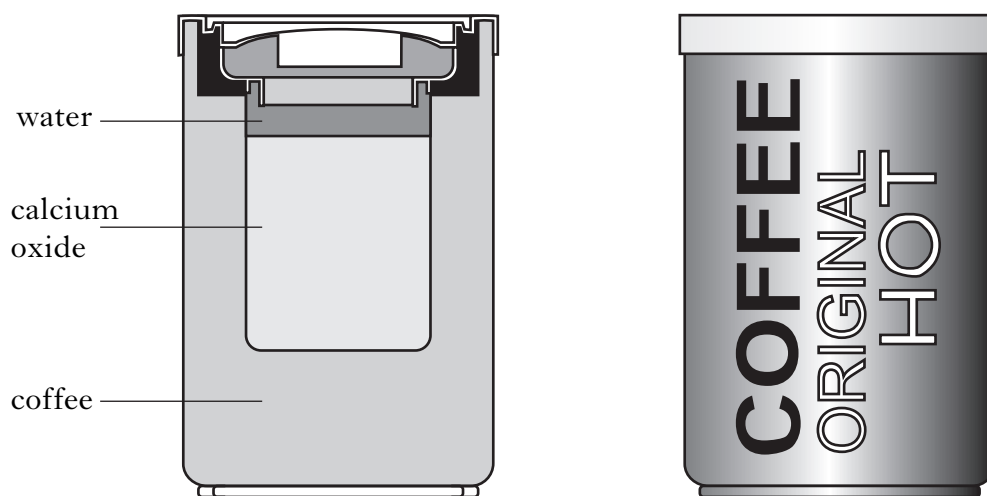
A	Acid rain will have no effect on iron structures.
B	A base is a substance which can neutralise an alkali.
C	Treatment of acid indigestion is an example of neutralisation.
D	In a neutralisation reaction the pH of the acid will fall towards 7.
E	When dilute nitric acid reacts with potassium hydroxide solution, the salt potassium nitrate is produced.

Identify the **two** correct statements.

A
B
C
D
E

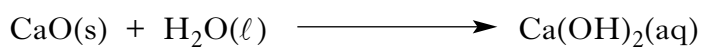
(2)

9. Coffee manufacturers have produced a self-heating can of coffee.



In the centre of the can calcium oxide reacts with water, releasing heat energy.

The equation for the reaction is:



A	Calcium oxide is insoluble.
B	The reaction is exothermic.
C	The reaction produces an acidic solution.
D	The temperature of the coffee goes down.
E	0.1 moles of calcium oxide reacts with water producing 0.1 moles of calcium hydroxide.

Identify the **two** correct statements.

A
B
C
D
E

(2)

**PART 2**

**A total of 40 marks is available in this part of the paper.**

10. Hydrogen reacts with other elements to form molecules such as hydrogen fluoride and hydrogen chloride.

(a) Name the family to which fluorine and chlorine belong.

\_\_\_\_\_

1

(b) The atoms in these molecules are held together by a covalent bond.

Circle the correct words to complete the sentence.

A covalent bond forms when two  $\left\{ \begin{array}{l} \text{positive} \\ \text{negative} \\ \text{neutral} \end{array} \right\}$  nuclei are held together by

their common attraction for a shared pair of  $\left\{ \begin{array}{l} \text{protons} \\ \text{neutrons} \\ \text{electrons} \end{array} \right\}$ .

1

(c) The table gives information about some molecules.

Molecule H-X	Size of X/pm	Energy to break bond kJ/mol
H-F	71	569
H-Cl	99	428
H-Br	114	362
H-I	133	295

Describe how the size of element **X** affects the energy needed to break the bond in the molecule.

\_\_\_\_\_

\_\_\_\_\_

1

(3)

Marks

KU PS

11. Crude oil can be transported to a refinery through a steel pipeline.

(a) If the pipeline is not protected the iron will rust.

Name the **ion** formed from water and oxygen, when they accept electrons during rusting.

\_\_\_\_\_

1

(b) Some parts of the pipeline are under the sea.

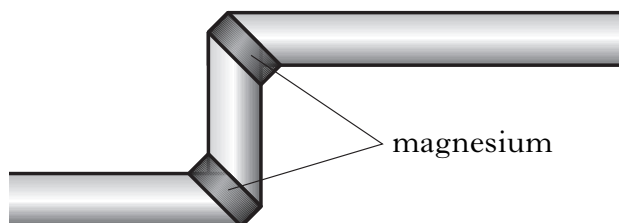
What effect would seawater have on the rate of rusting?

\_\_\_\_\_

\_\_\_\_\_

1

(c) Magnesium can be attached to the steel pipeline to prevent rusting.



What name is given to the **type** of protection provided by the magnesium?

\_\_\_\_\_

1

(3)

[Turn over

Marks

KU	PS
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12. Airbags in cars are designed to prevent injuries in car crashes. They contain sodium azide ( $\text{NaN}_3$ ) which produces nitrogen gas on impact. The nitrogen inflates the airbag very quickly.

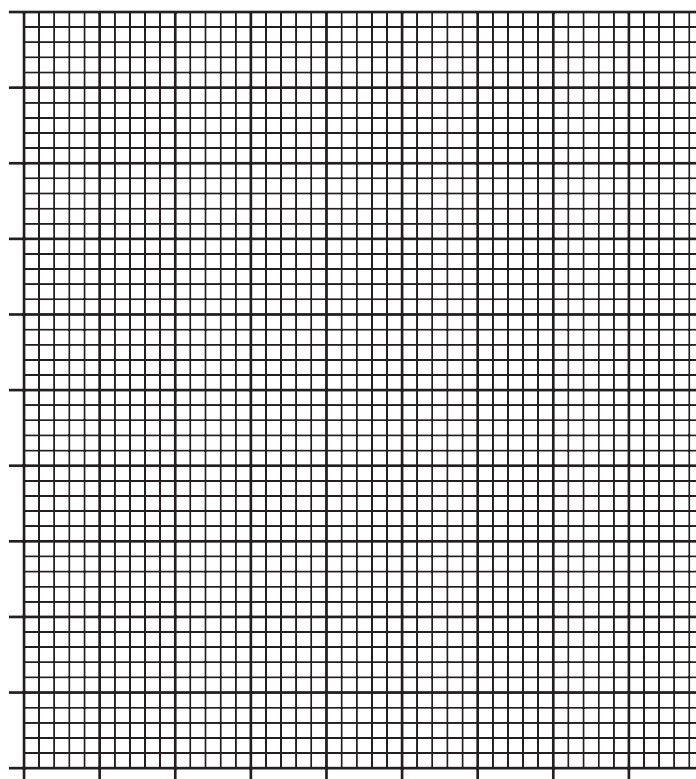
(a) The table gives information on the volume of nitrogen gas produced.

Time/microseconds	Volume of nitrogen gas produced/litres
0	0
5	46
10	64
15	74
20	82
25	88
30	88

(i) Draw a line graph of the results.

*Use appropriate scales to fill most of the graph paper.*

(Additional graph paper, if required, will be found on page 28.)



(ii) Using your graph, predict the time taken to produce 70 litres of nitrogen gas.

\_\_\_\_\_ microseconds

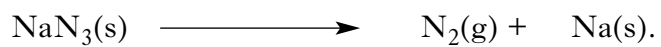
2

1

<i>Marks</i>	KU	PS
<b>1</b>		
<b>1</b>		
<b>(5)</b>		

**12. (continued)**

(b) The equation for the production of nitrogen gas is:



Balance the equation above.

(c) Nitrogen is a non-toxic gas.

Suggest another property of nitrogen which makes it a suitable gas for use in airbags.

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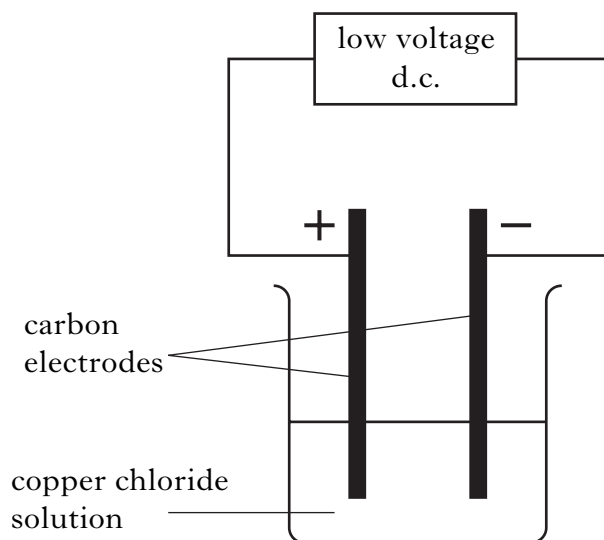
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**[Turn over**

Marks

KU PS

13. Copper chloride solution can be broken up into its elements by passing electricity through it.



- (a) Carbon is unreactive and insoluble in water.

Give another reason why it is suitable for use as an electrode.

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1

- (b) Chlorine gas is released at the positive electrode.

Write an ion-electron equation for the formation of chlorine.

You may wish to use the data booklet to help you.

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1

- (c) Why do ionic compounds, like copper chloride, conduct electricity when in solution?

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1

(3)



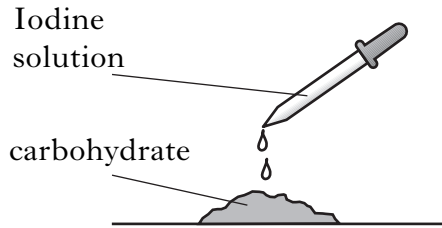
**14.** A fizzy drink "Fizz Alive" contains a carbohydrate.

(a) Name all the elements found in a carbohydrate.

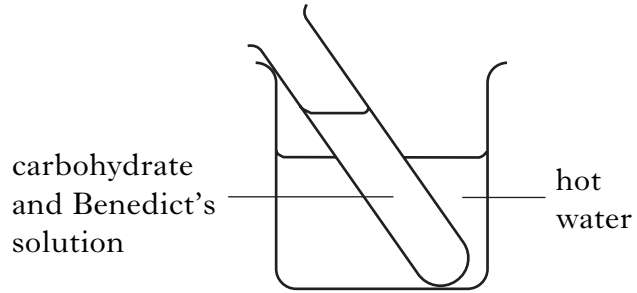
\_\_\_\_\_

(b) A student carried out an investigation to find out which carbohydrate was present in "Fizz Alive".

**Test 1**



**Test 2**



The results are shown in the table.

Test	Result
Iodine solution	stays brown
Benedict's solution	stays blue

Name the carbohydrate present in "Fizz Alive".

\_\_\_\_\_

(c) A 330 cm<sup>3</sup> can of "Fizz Alive" has a carbohydrate concentration of 0.01 mol/l.

Calculate the number of moles of carbohydrate in the can of "Fizz Alive".

\_\_\_\_\_ mol

**(3)**

**[Turn over**

Marks

KU	PS

1

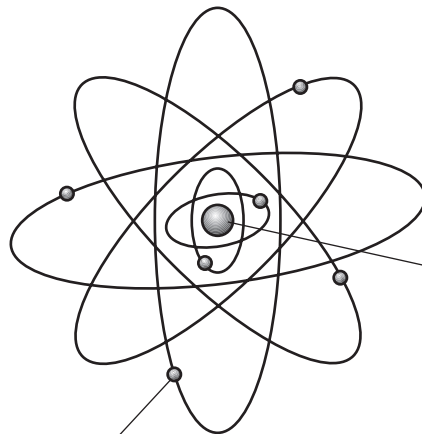
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1

Marks

KU	PS
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15. The diagram represents the structure of an atom.



THE NUCLEUS	
Name of Particle	Relative mass
PROTON	(i)
NEUTRON	1

OUTSIDE THE NUCLEUS	
Name of Particle	Relative mass
(ii)	0

(a) Fill in the missing information for:

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

1

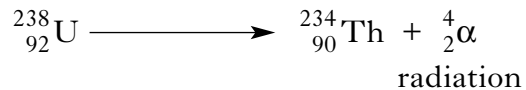
Marks

KU PS

## 15. (continued)

(b) The element uranium has unstable atoms.

These atoms give out radiation and a new element is formed.

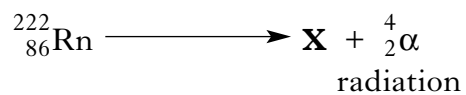


(i) Complete the table to show the number of each type of particle in  ${}_{90}^{234}\text{Th}$ .

Particle	Number
proton	
neutron	

1

(ii) Radon is another element which gives out radiation.



State the **atomic number** of element **X**.

\_\_\_\_\_

1

(3)

[Turn over

Marks

KU	PS
----	----

16. Anglesite is an ore containing lead(II) sulphate,  $\text{PbSO}_4$ .

(a) Calculate the percentage by mass of lead in anglesite.

\_\_\_\_\_ %

2

(b) Most metals are found combined in the Earth's crust and have to be extracted from their ores.

Place the following metals in the correct space in the table.

**lead**                      **aluminium**

You may wish to use the data booklet to help you.

Metal	Method of extraction
	electrolysis of molten compound
	using heat and carbon

1

(c) Metal **X** can be extracted from its ore by heat alone.

What does this indicate about the reactivity of **X** compared to both lead and aluminium?

\_\_\_\_\_

\_\_\_\_\_

1

(d) When a metal is extracted from its ore, metal ions are changed to metal atoms.

Name this **type** of chemical reaction.

\_\_\_\_\_

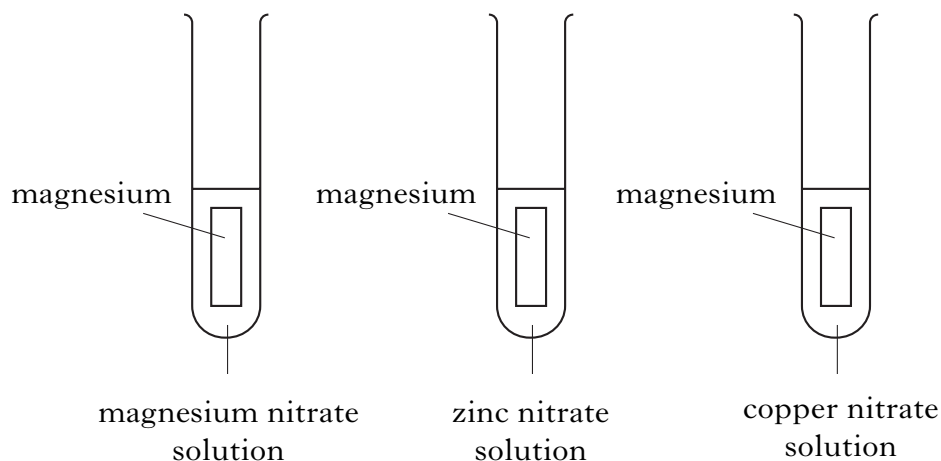
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(5)

Marks

KU PS

17. A student added strips of magnesium to solutions of other metals.



The results are shown in the table.

Solution Metal	magnesium nitrate	zinc nitrate	copper nitrate
magnesium	(i)	(ii)	reaction occurred

(a) In the table, fill in the missing information at (i) and (ii) to show whether or not a chemical reaction has occurred.

You may wish to use the data booklet to help you.

(b) The equation for the reaction between magnesium and copper nitrate is:



(i) Circle the spectator ion in the above equation.

(ii) What technique could be used to remove copper from the mixture?

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1

(3)

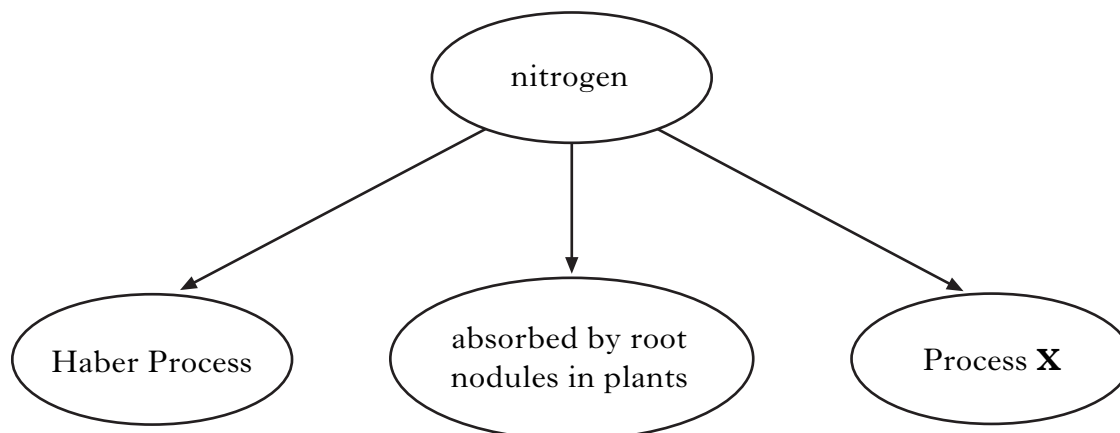
[Turn over

Marks

KU PS

18. Nitrogen is essential for healthy plant growth.

Nitrogen from the atmosphere can be fixed in a number of ways.



(a) **X** is a natural process which takes place in the atmosphere, producing nitrogen dioxide gas.

What provides the energy for this process?

\_\_\_\_\_

1

(b) What is present in the root nodules of some plants which convert nitrogen from the atmosphere into nitrogen compounds?

\_\_\_\_\_

\_\_\_\_\_

1

(c) The Haber Process is the industrial method of converting nitrogen into a nitrogen compound.

Name the nitrogen compound produced.

\_\_\_\_\_

1

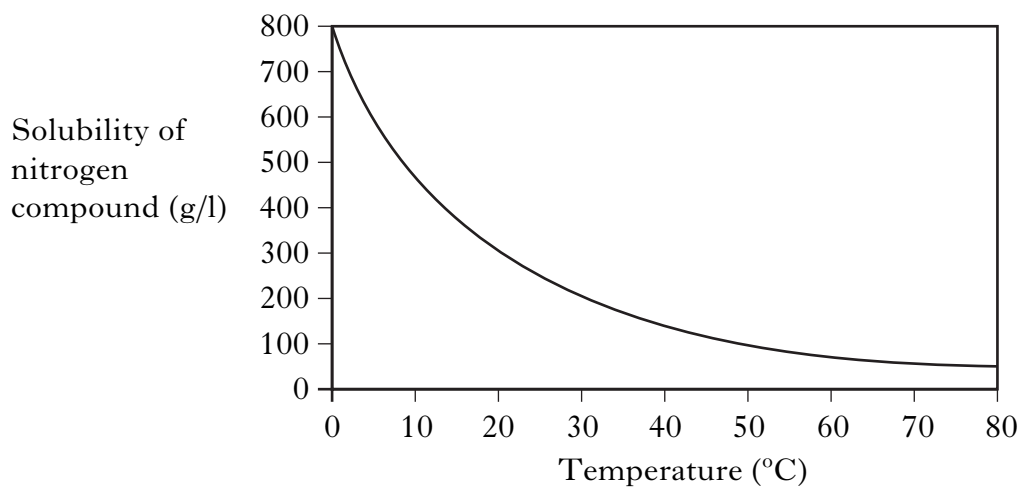
Marks

KU PS

**18. (continued)**

(d) The nitrogen compound produced in the Haber Process dissolves in water.

The graph shows the solubility of the nitrogen compound at different temperatures.



Write a general statement describing the effect of temperature on the solubility of the nitrogen compound.

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1  
(4)**[Turn over**

19. The octane number indicates how efficiently a fuel burns.

Alkane	Molecular Formula	Full Structural Formula	Octane Number
2-methylbutane	$C_5H_{12}$	<pre>       H             H-C-H           H  H   H            H-C-C-C-C-H              H  H H H           </pre>	93
2-methylpentane	$C_6H_{14}$	<pre>       H             H-C-H           H  H H   H              H-C-C-C-C-C-H                H  H H H H           </pre>	71
2-methylhexane	$C_7H_{16}$		47
2-methylheptane	$C_8H_{18}$	<pre>       H             H-C-H           H  H H H H   H                H-C-C-C-C-C-C-C-H                    H  H H H H H H           </pre>	
2-methyloctane	$C_9H_{20}$	<pre>       H             H-C-H           H  H H H H H   H                  H-C-C-C-C-C-C-C-C-H                      H  H H H H H H H           </pre>	2

(a) Draw the **full** structural formula for 2-methylhexane.



*Marks*

KU PS

**19. (continued)**

- (b) 2-methylpentane and hexane have the same molecular formula ( $C_6H_{14}$ ), but different structural formulae.

What term is used to describe this pair of alkanes?

\_\_\_\_\_

**1**

- (c) Using information in the table, predict the octane number for 2-methylheptane.

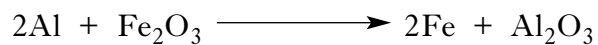
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**1****(3)****[Turn over**

*Marks*

KU PS

20. Molten iron is used to join steel railway lines together.  
Molten iron is produced when aluminium reacts with iron oxide.  
The equation for the reaction is:



- (a) Calculate the mass of iron produced from 40 grams of iron oxide.

\_\_\_\_\_ g

2

- (b) The formula for iron oxide is  $\text{Fe}_2\text{O}_3$ .

What is the charge on this iron ion?

\_\_\_\_\_

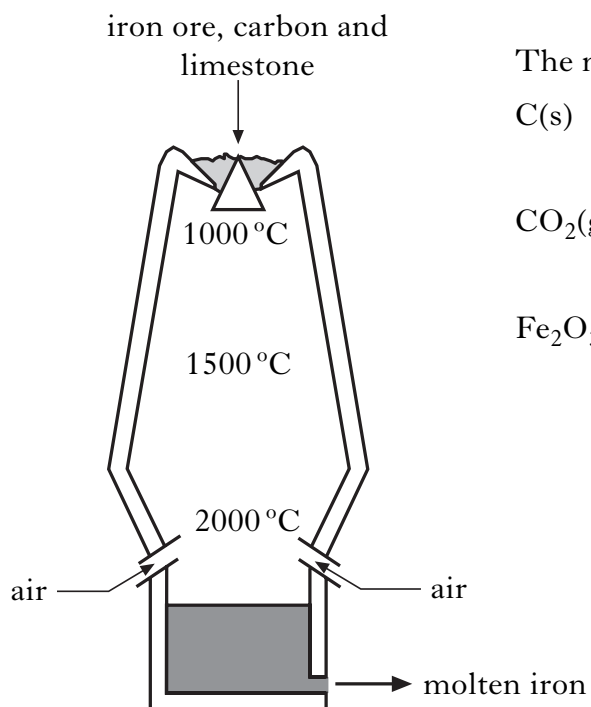
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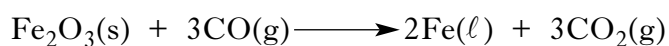
KU PS

## 20. (continued)

(c) Iron can also be produced from iron ore,  $\text{Fe}_2\text{O}_3$ , in a blast furnace.



The main reactions taking place are:



- (i) When air is blown into the furnace the temperature rises.  
Suggest another reason why **air** is blown into the furnace.

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1

- (ii) Explain why the temperature at the bottom of the blast furnace should **not** drop below  $1535\text{ }^\circ\text{C}$ .

You may wish to use the data booklet to help you.

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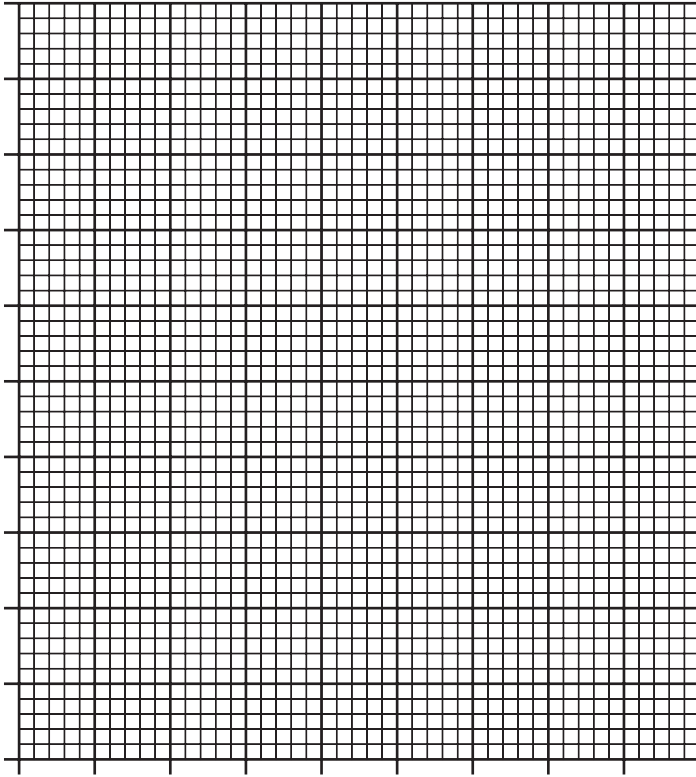
(5)

[END OF QUESTION PAPER]

**ADDITIONAL SPACE FOR ANSWERS**

KU	PS
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ADDITIONAL GRAPH PAPER FOR QUESTION 12(a)(i)



**ADDITIONAL SPACE FOR ANSWERS**

KU	PS

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**[BLANK PAGE]**