

FOR OFFICIAL USE

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KU PS

Total Marks

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**0500/402**

NATIONAL  
QUALIFICATIONS  
2002

THURSDAY, 16 MAY  
2.50 PM – 4.20 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

- All questions should be attempted.
- Necessary data will be found in the Data Booklet provided for Chemistry at Standard Grade and Intermediate 2.
- 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.
- 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.
- Additional space for answers and rough work will be found at the end of the book.
- 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.
- 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.

1. The grid shows the names of some common ionic compounds.

A	B	C
ammonium chloride	calcium carbonate	potassium chloride
D	E	F
calcium sulphate	magnesium sulphate	sodium carbonate

- (a) Identify the **two** compounds which could be used as fertilisers.

A	B	C
D	E	F

- (b) Identify the **two** compounds which are bases.

A	B	C
D	E	F

[Turn over

2.

Substance	Conducts as		Melting point/°C
	a solid	a liquid	
A	no	yes	801
B	no	no	113
C	yes	yes	63
D	no	no	1700
E	yes	yes	98
F	no	no	44

(a) Identify the substance which could be sodium chloride.

A
B
C
D
E
F

(b) Identify the **two** substances which exist as molecules.

A
B
C
D
E
F

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3. The symbols for some elements are shown below.

A	Li	B	O	C	Mg
D	Si	E	F	F	K

- (a) Identify the **two** elements which form an ionic compound with a formula of the type  $XY_2$ , where X is a metal.

A	B	C
D	E	F

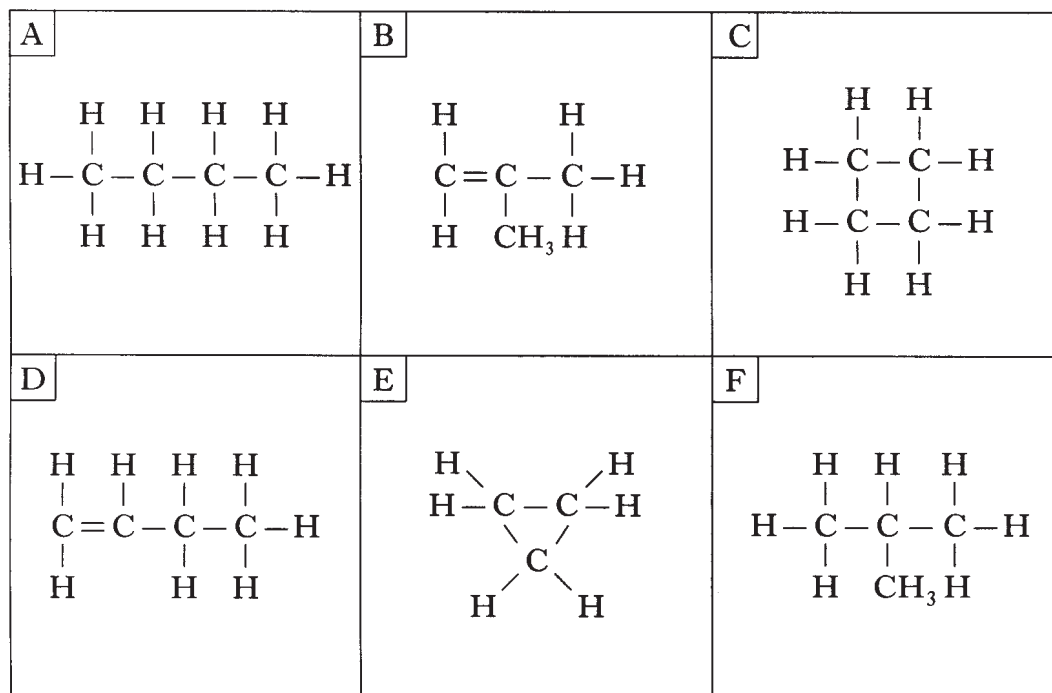
- (b) Identify the **two** elements which would react together to form molecules with the same shape as a methane molecule.

A	B	C
D	E	F

[Turn over

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4. Hydrocarbons contain hydrogen and carbon only.



(a) Identify the **two** hydrocarbons which would quickly decolourise bromine solution.

A	B	C
D	E	F

(b) Identify the isomer of the hydrocarbon in box D which belongs to a different homologous series.

A	B	C
D	E	F

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5.

Particle	Number of		
	protons	neutrons	electrons
A	12	13	12
B	8	10	10
C	12	12	10
D	10	12	10
E	8	10	8

(a) Identify the particle which is a positive ion.

A
B
C
D
E

(b) Identify the **two** particles which are isotopes.

A
B
C
D
E

[Turn over

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6. An atom of carbon can be represented by the symbol  ${}_{6}^{14}\text{C}$ .  
Identify the correct statement(s) about this carbon atom.

A	It has 14 protons.
B	It has 8 neutrons.
C	It has more protons than neutrons.
D	It has an equal number of protons and neutrons.
E	It has an equal number of protons and electrons.
F	It has an equal number of neutrons and electrons.

A
B
C
D
E
F

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7.

A	$C_4H_{10} + O_2$	B	$CaCO_3 + HCl$
C	$Zn + H_2SO_4$	D	$Li + H_2O$
E	$CuO + C$	F	$Cu + ZnSO_4$

- (a) Which box contains a pair of chemicals that will **not** react with each other?

A	B
C	D
E	F

- (b) Which box(es) contain(s) a pair of chemicals that react to form water?

A	B
C	D
E	F

[Turn over







Marks

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**PART 2**

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

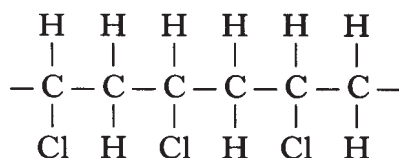
10. Ethene is a starting material in the manufacture of the polymer poly(vinylchloride), PVC.

(a) Name the process used to make ethene from hydrocarbons obtained from crude oil.

\_\_\_\_\_

1

(b) Part of a PVC molecule is shown below.



(i) Draw the structure of the repeating unit in a PVC molecule.

1

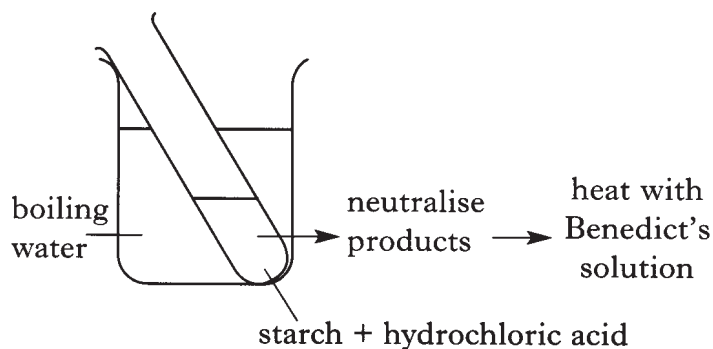
(ii) Name a toxic gas produced when PVC burns.

\_\_\_\_\_

1

(3)

11. (a) Ailsa carried out the experiment shown below.



**Result:**  
Benedict's solution  
turns red/orange

- (i) What type of chemical reaction takes place when starch is heated with hydrochloric acid?
- \_\_\_\_\_
- (ii) Ailsa said that the starch had turned into glucose.  
Name another sugar which turns Benedict's solution red/orange.
- \_\_\_\_\_
- (iii) Ailsa repeated her experiment using amylase solution instead of hydrochloric acid.  
Suggest a reason why the Benedict's solution did not turn red/orange.
- \_\_\_\_\_
- (b) Write the molecular formula for glucose.
- \_\_\_\_\_

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1

1

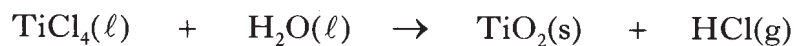
1

(4)

[Turn over

12. Titanium compounds have many uses.

- (a) (i) Warships can produce a smokescreen by reacting titanium(IV) chloride with water:



Balance this equation.

- (ii) Titanium(IV) chloride is a liquid at room temperature.  
What type of bonding does this suggest is present in titanium(IV) chloride?

- (b) Titanium(IV) oxide ( $\text{TiO}_2$ ) is used as a white pigment in paint.  
Calculate the percentage by mass of titanium in  $\text{TiO}_2$ .  
(Relative atomic mass of titanium = 48)  
**Show your working clearly.**

Marks

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1		
1		
2		
(4)		

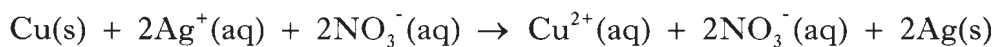
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13. Copper displaces silver from silver(I) nitrate solution.



- (a) Rewrite the equation omitting the spectator ions.

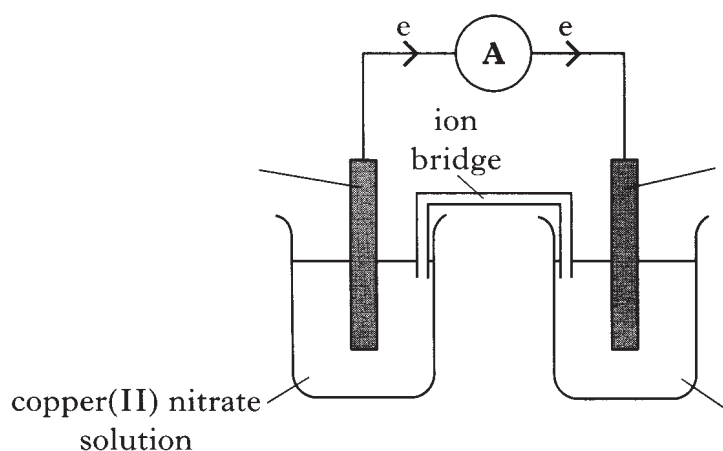
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- (b) Write the ion-electron equation for the oxidation step in the displacement reaction.

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

1

- (c) The reaction can also be carried out in a cell.



- (i) Complete the three labels on the diagram.

1

- (ii) The purpose of the ion bridge is to complete the circuit.

Suggest why sodium carbonate solution should not be used in the ion bridge.

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

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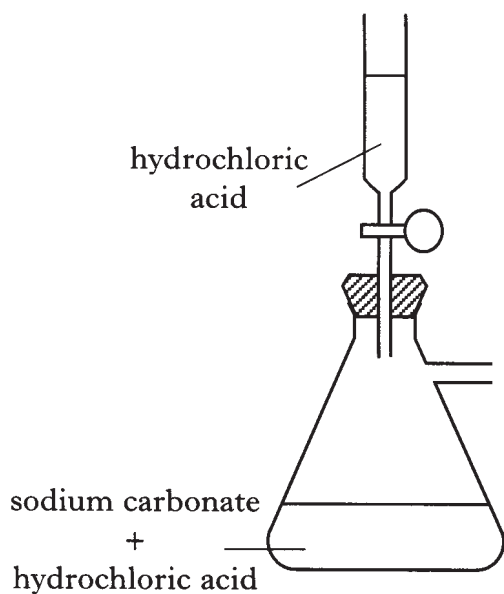
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(4)

Marks

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14. Sodium carbonate reacts with hydrochloric acid to form carbon dioxide. Brian measured the volume of carbon dioxide given off over a period of time and recorded his results.



- (a) Complete and label the diagram to show how Brian measured the volume of carbon dioxide.
- (b) Brian's results are shown below.

2

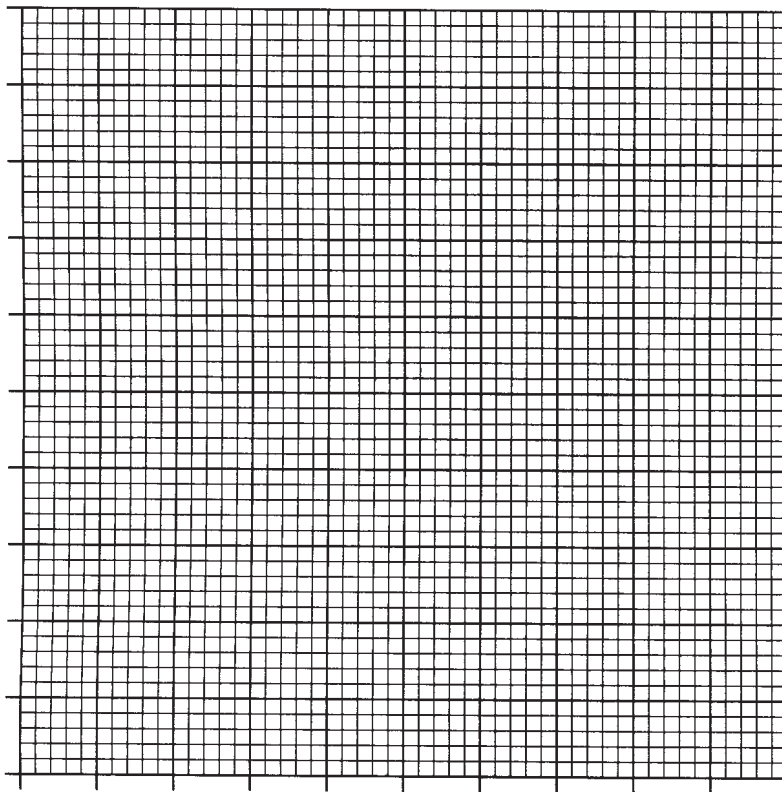
<b>Time/s</b>	0	10	30	40	50	60	70
<b>Volume of carbon dioxide/cm<sup>3</sup></b>	0	12	29	34	36	37	37

## 14. (b) (continued)

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 26.)



Marks

	KU	PS
2		
1		
1		
(6)		

- (c) Suggest a value for the volume of carbon dioxide collected during the first 20 seconds.

\_\_\_\_\_ cm<sup>3</sup>

- (d) Write the ionic formula for sodium carbonate.

\_\_\_\_\_

[Turn over



15. Some metals are found uncombined in the Earth's crust but others have to be extracted from their ores.

(a) Place the following metals in the correct space in the table.

lead, magnesium, mercury

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

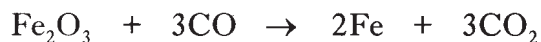
Metal	Method of Extraction
	using heat alone
	using heat and carbon
	electrolysis of molten compound

(b) Iron is extracted by reacting iron(III) oxide with carbon monoxide.

(i) Name the type of industrial plant where iron is extracted.

\_\_\_\_\_

(ii) The overall reaction taking place during the extraction of iron is given by the equation:



Calculate the mass of iron, in tonnes, which is produced from 1600 tonnes of iron(III) oxide.

**Show your working clearly.**

Answer: \_\_\_\_\_ tonnes

Marks

KU	PS
1	
1	
2	
(4)	

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16. Fermentation is used to produce alcohol from sugars like glucose.

(a) Name the gas produced during the fermentation of glucose.

\_\_\_\_\_

1

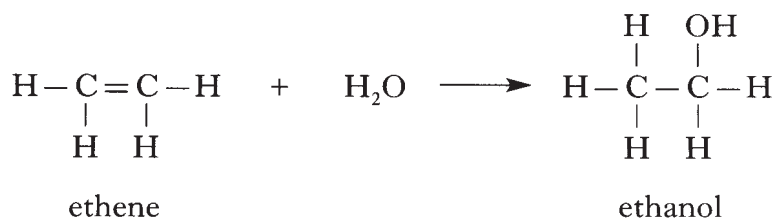
(b) Why does fermentation stop when the alcohol concentration reaches approximately 15%?

\_\_\_\_\_

\_\_\_\_\_

1

(c) In industry, ethanol (alcohol) can be produced from ethene as shown below.

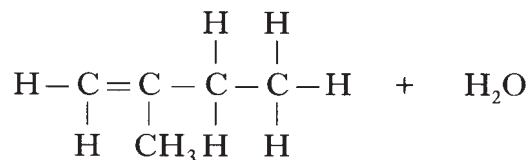


(i) Name the type of chemical reaction taking place.

\_\_\_\_\_

1

(ii) Draw a structural formula for the product of the following reaction:



1

(4)

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17. Alcohols can be oxidised by hot copper(II) oxide.  
The product is either an aldehyde or a ketone.

Alcohol	Structural formula	Type of product	Structural formula
ethanol	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{OH} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	an aldehyde	$\begin{array}{c} \text{H} \quad \text{O} \\   \quad // \\ \text{H}-\text{C}-\text{C} \\   \quad \backslash \\ \text{H} \quad \text{H} \end{array}$
propan-1-ol	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$	an aldehyde	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{O} \\   \quad   \quad // \\ \text{H}-\text{C}-\text{C}-\text{C} \\   \quad   \quad \backslash \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$
propan-2-ol	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{OH} \quad \text{H} \end{array}$	a ketone	$\begin{array}{c} \text{H} \quad \quad \text{H} \\   \quad \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad    \quad   \\ \text{H} \quad \text{O} \quad \text{H} \end{array}$
butan-2-ol	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \quad   \\ \text{H} \quad \text{OH} \quad \text{H} \quad \text{H} \end{array}$	a ketone	$\begin{array}{c} \text{H} \quad \quad \text{H} \quad \text{H} \\   \quad \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad    \quad   \quad   \\ \text{H} \quad \text{O} \quad \text{H} \quad \text{H} \end{array}$

- (a) (i) Aldehydes and ketones have the same general formula.  
Suggest a general formula for these compounds.

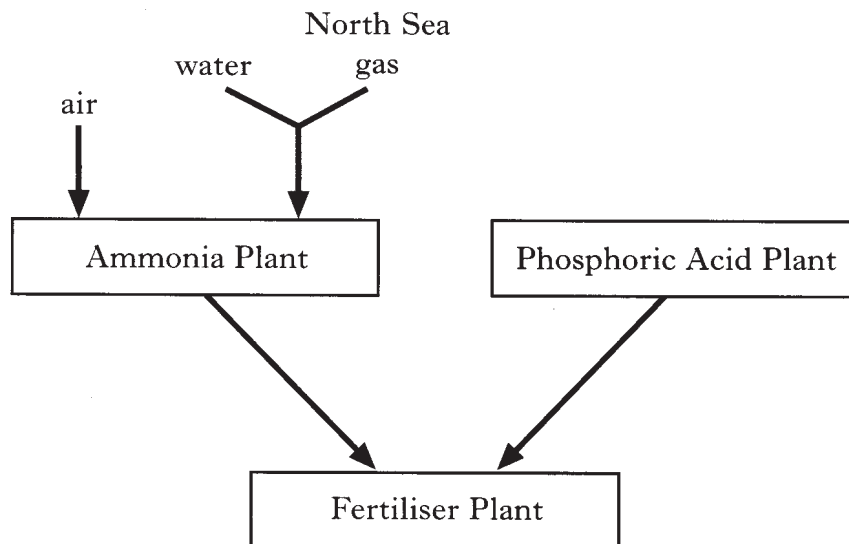
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- (ii) Write a general statement linking the type of product to the structure of the alcohol used.

1

18. The flow chart shows some processes which take place in an industrial chemical complex.

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- (a) Air and water are used as raw materials because they contain the elements needed to make ammonia.

Suggest **one** other reason why they are used as raw materials.

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- (b) Which reactant for the ammonia plant must be produced in the reaction between North Sea gas and water?

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1

- (c) Name the salt formed in the fertiliser plant.

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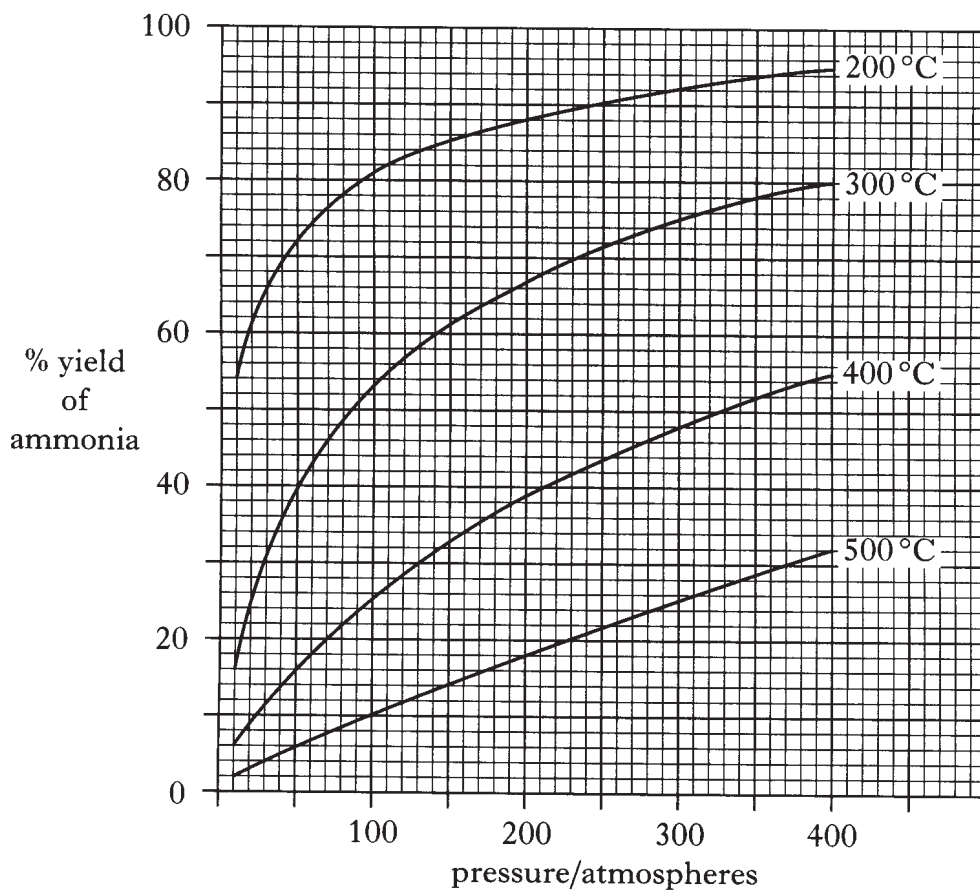
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Marks

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## 18. (continued)

- (d) The graph shows the different percentage yields of ammonia which can be obtained under different conditions in the ammonia plant.



- (i) What is the relationship between the percentage yield of ammonia and the temperature at constant pressure?

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- (ii) Explain why all of the nitrogen and hydrogen are not converted to ammonia.

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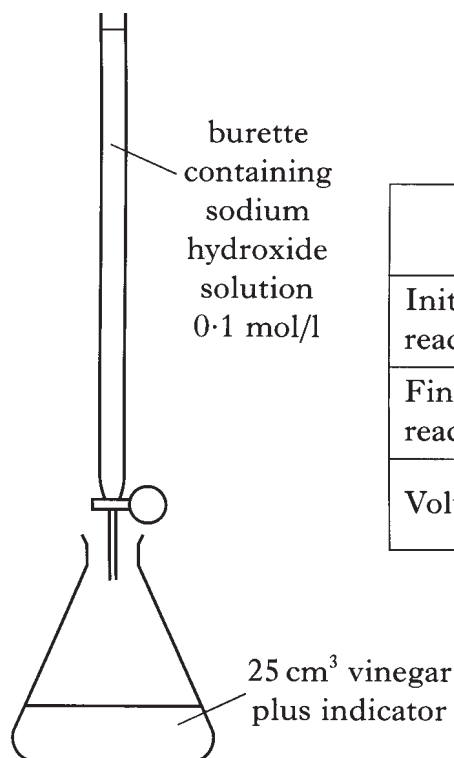
(5)

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19. Vinegar is a dilute solution of ethanoic acid in water.

Karen carried out a titration to find out the concentration of ethanoic acid in some vinegar.



	<b>Rough titre</b>	<b>1st titre</b>	<b>2nd titre</b>
Initial burette reading/cm <sup>3</sup>	1.0	21.7	11.7
Final burette reading/cm <sup>3</sup>	21.7	41.7	31.9
Volume used/cm <sup>3</sup>	20.7	20.0	20.2

- (a) Karen used data from the table to calculate an average volume of sodium hydroxide solution.

She used this average volume to calculate the number of moles of sodium hydroxide needed to neutralise the acid in 25 cm<sup>3</sup> of the vinegar.

- (i) What average volume of sodium hydroxide should she have used?

\_\_\_\_\_ cm<sup>3</sup>

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## 19. (a) (continued)

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1		
(3)		

- (ii) Calculate the number of moles of sodium hydroxide in this average volume.

**Show your working clearly.**

- (b) 1 mole of ethanoic acid reacts with 1 mole of sodium hydroxide.  
Calculate the concentration, in mol/l, of ethanoic acid in the vinegar.

**Show your working clearly**

[END OF QUESTION PAPER]