Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0245/02

SCIENCE
HIGHER TIER
CHEMISTRY 3

A.M. TUESDAY, 29 January 2013

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**7**	
3.	**4**	
4.	**9**	
5.	**7**	
6.	**9**	
7.	**6**	
8.	**4**	
Total	**50**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

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Answer **all** *questions.*

1. The fire triangle can be used to explain how fires start and how they can be put out. Use your knowledge of the fire triangle to describe and explain **two** methods which are used to put out large forest fires. [4]

.....

.....

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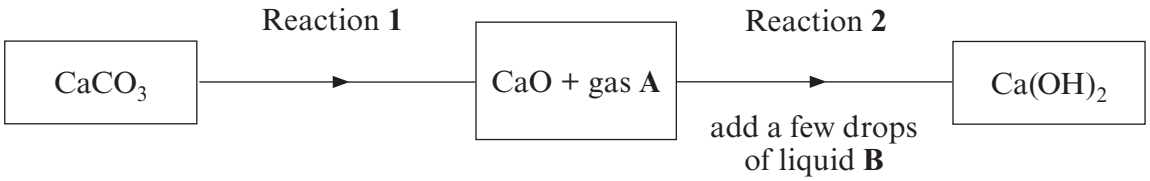
4

2. *(a)* The flow diagram below shows the reactions used to prepare slaked lime, $Ca(OH)_2$, from limestone, $CaCO_3$.



(i) I Briefly describe what needs to be done to limestone for reaction **1** to take place. [1]

.....

II Give the name for the type of reaction taking place. [1]

.....

(ii) Name gas **A**. [1]

.....

(iii) Name liquid **B**. [1]

.....

(b) Write a balanced **symbol** equation for the reaction which takes place when slaked lime, $Ca(OH)_2$, is neutralised by hydrochloric acid, HCl. [3]

..... + ... ⟶ ..... + ...

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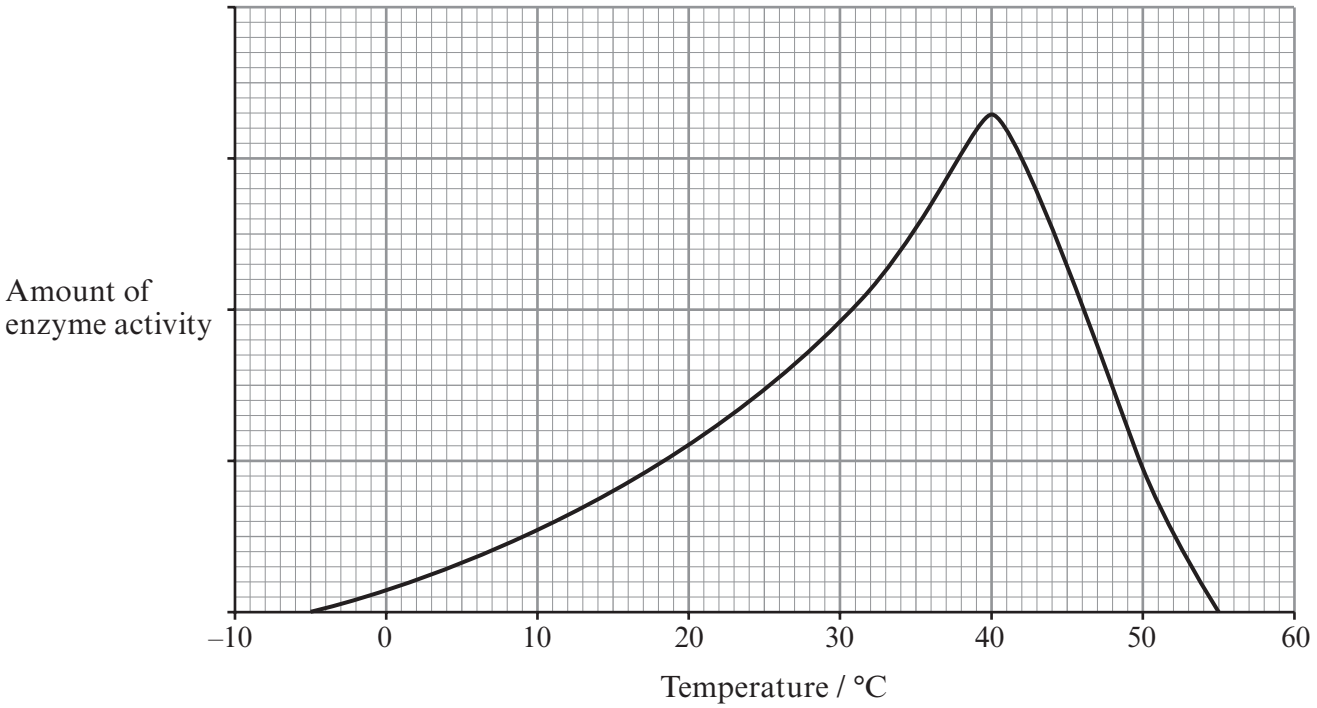
3. The temperature range in which enzyme activity occurs can be different for different enzymes. The graph below shows the amount of activity of an enzyme, **A**, over a temperature range.



(a) Use the graph to give the temperature range where the enzyme activity is **increasing**. [1]

..... °C to ..... °C

(b) Sketch carefully the graph of the amount of enzyme activity of a different enzyme, **B**, which is active between 5 °C and 50 °C and has the greatest activity at 30 °C. [2]

(c) Give a temperature value at which **both** enzymes would be destroyed. [1]

..... °C

4

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4. *(a)* The following table shows the colours of universal indicator at different pH values.

Colour	red	orange	yellow	green	blue	navy blue	purple
pH	0-2	3-4	5-6	7	8-9	10-12	13-14

Universal indicator solution was put into separate solutions of sulphuric acid and ethanoic acid.

Give the indicator colour you would expect in each acid and give the reason for your choices. [4]

Indicator colour in sulphuric acid .....

.....

Indicator colour in ethanoic acid .....

.....

(b) Two experiments were carried out to investigate the temperature rise when acids and alkalis react. 80 cm^3 of dilute hydrochloric acid was added, 10 cm^3 at a time, to 100 cm^3 of sodium hydroxide solution and the temperature recorded after each addition. The same process was repeated with 80 cm^3 of dilute ethanoic acid.

The table below shows the results.

Volume of acid added / cm^3	0	10	20	30	40	50	60	70	80
Temperature using hydrochloric acid / °C	21.0	22.8	24.2	25.4	26.4	27.0	26.7	26.2	25.6
Temperature using ethanoic acid / °C	21.0	22.6	23.8	24.8	25.6	26.0	25.9	25.5	25.0

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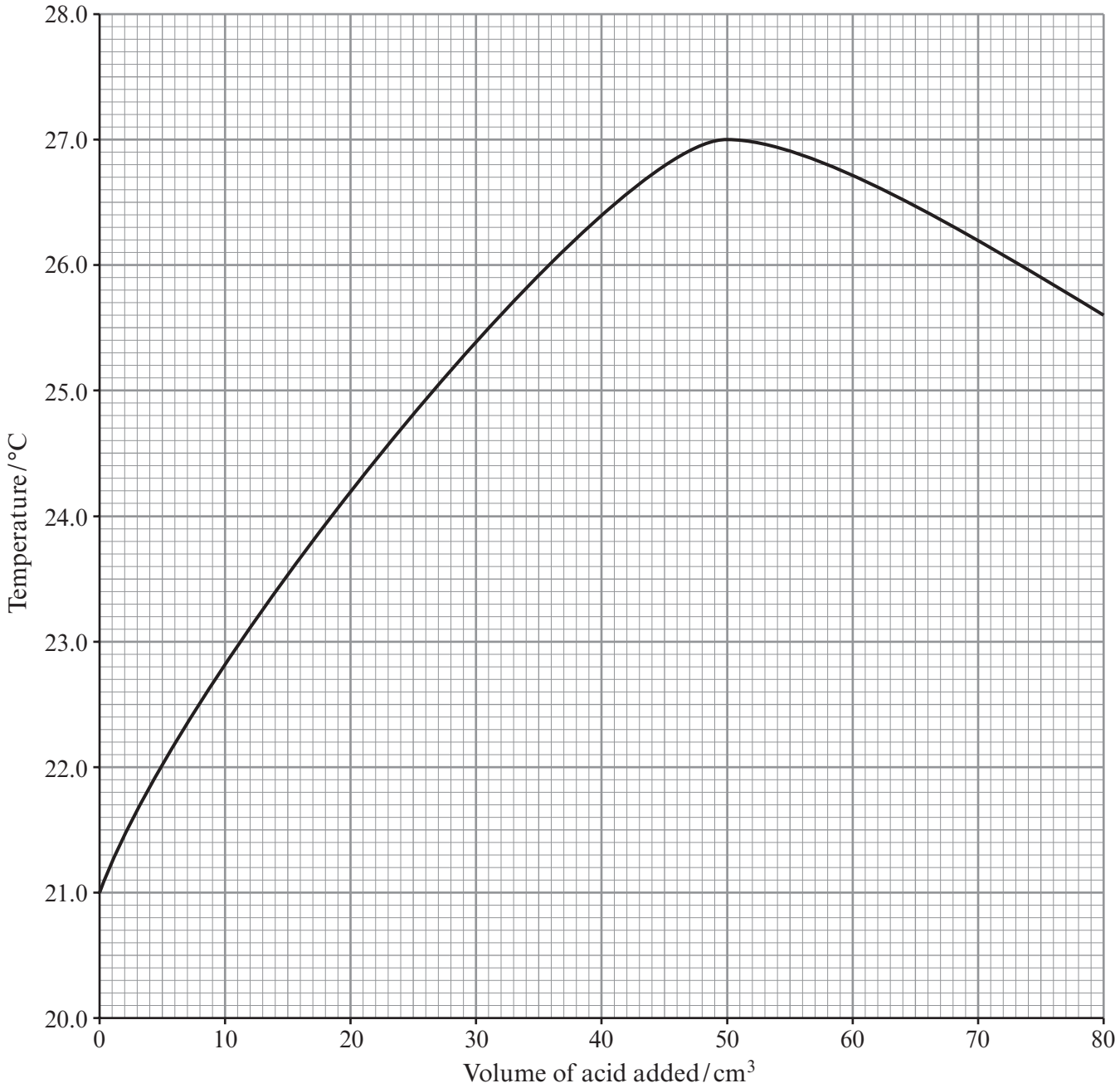
(i) Plot the results for ethanoic acid on the grid below and draw a curve of best fit. The curve for hydrochloric acid has already been plotted. [3]



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(ii) If a piece of universal indicator paper was placed in the flask when exactly 50 cm^3 of hydrochloric acid had been added, state the indicator colour you would expect to see. Give the reason for your choice. [2]

Colour .....

Reason .....

.....

9

Turn over.

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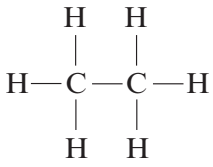
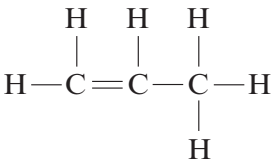
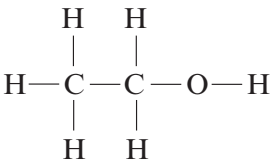
5. The structural formulae of five carbon compounds are shown below.



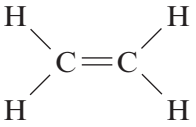
A



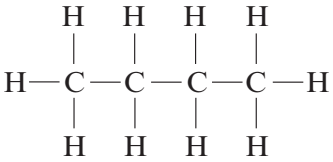
B



C



D



E

(a) Give the name of the homologous series to which the following pairs of carbon compounds belong.

(i) **A** and **E** ..... [1]

(ii) **B** and **D** ..... [1]

(b) Give the **letter** of the carbon compound which

(i) reacts with hydrogen to form compound **A**, ... [1]

(ii) when exposed to air forms ethanoic acid. ..... [1]

(c) The structural formula of carbon compound **E** is one of the two chain isomers of butane.

(i) Draw the other chain isomer of butane. [1]

(ii) Explain the meaning of the term *isomer*. [2]

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6. The main stages in the manufacture of sulphuric acid are given below.

Stage 1 Sulphur reacts with oxygen

Stage 2 Sulphur dioxide reacts with oxygen

Stage 3 Sulphur trioxide is absorbed into concentrated sulphuric acid and then diluted to various concentrations

(a) Give the chemical formula of sulphuric acid. [1]

.....

(b) During stage 2, gases are passed through a vanadium(V) oxide catalyst. The catalyst will **not** work below 400 °C and **breaks down** above 620 °C.

The table below shows the percentage yield of sulphur trioxide in stage 2 at different temperatures.

Temperature / °C	400	450	500	550	600
Percentage yield of sulphur trioxide / %	99	97	92	85	76

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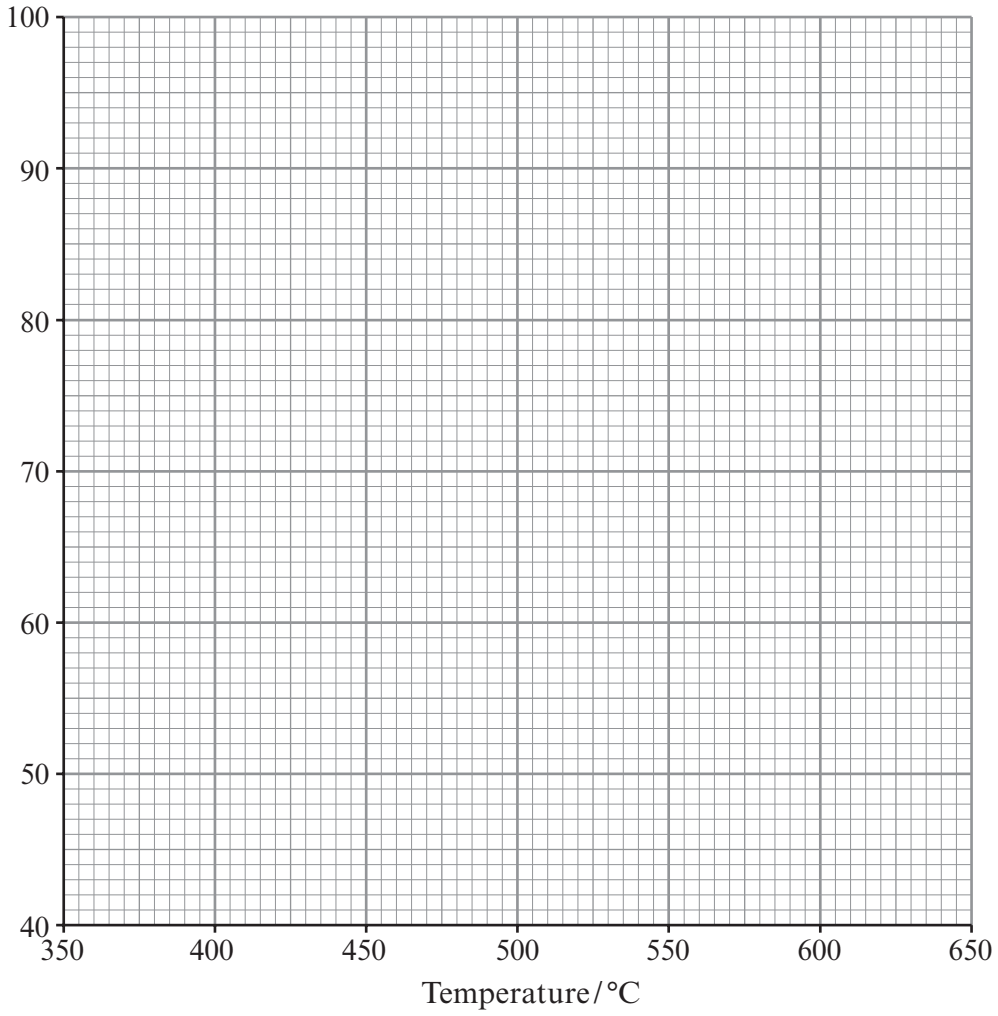
(i) Plot a graph of the percentage yield of sulphur trioxide at different temperatures on the grid below. [3]



(ii) Use the graph to

I state how changing the temperature affects the yield of sulphur trioxide, [1]

.....

II identify the highest temperature that can be used if a yield of at least 90% is required. [1]

..... °C

(iii) Write a balanced **symbol** equation for the reaction between sulphur dioxide and oxygen, O_2, in stage 2. [3]

..... + ... ⇌ .....

9

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7. Ethanol, C_2H_5OH, is a biofuel alternative to petrol and is widely used in cars in Brazil.

(a) Ethanol can be made from sugars by the process of fermentation. Briefly describe how ethanol can be separated from the fermentation mixture by distillation. [2]

.....

.....

.....

.....

(b) Give **one** advantage and **one** disadvantage of using ethanol rather than petrol to fuel cars. [2]

Advantage .....

Disadvantage .....

(c) (i) Give **one** *health* problem associated with alcohol abuse over a **long** period of time. [1]

.....

(ii) Give **one** *social* problem associated with the excessive intake of alcohol. [1]

.....

6

8. The diagram below shows the apparatus used to find the concentration of a sample of hydrochloric acid.

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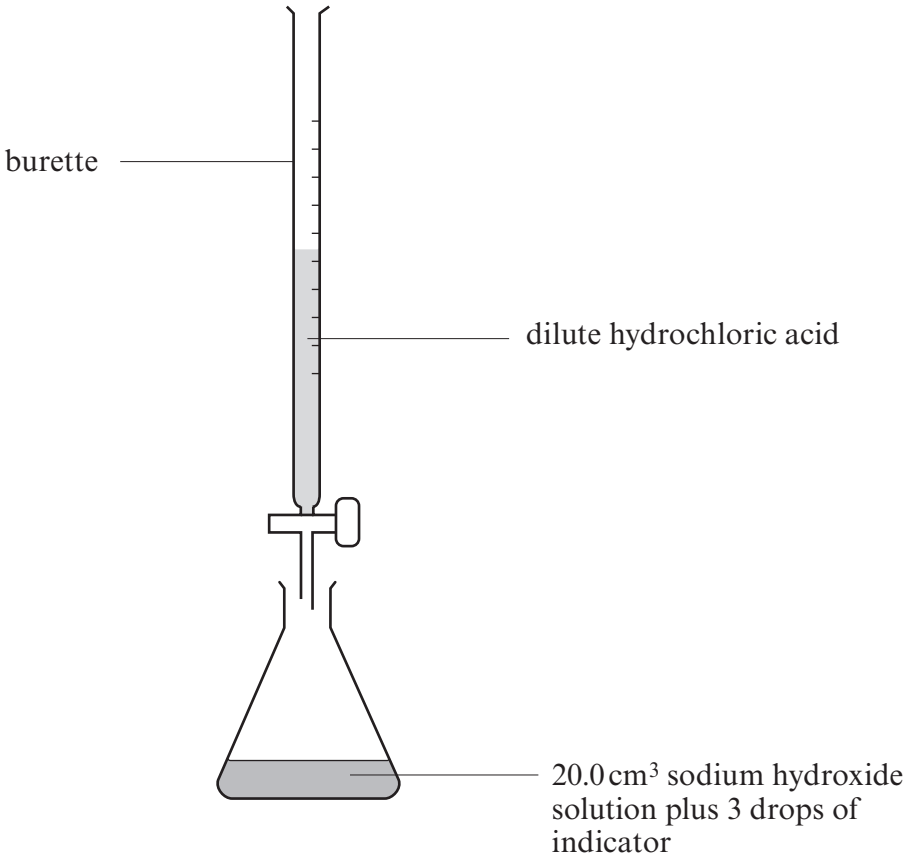

The titration was carried out three times and the volume of acid needed to change the indicator colour each time was recorded in the table below. A fresh 20.0 cm^3 of sodium hydroxide of concentration 0.2 mol dm^{-3} was used in each titration.

Volume of hydrochloric acid / cm^3		
Run 1	Run 2	Run 3
24.9	25.0	25.1

The balanced symbol equation for the reaction between hydrochloric acid and sodium hydroxide is shown below.

$$HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$$

Calculate the concentration of the hydrochloric acid in mol dm^{-3}. [4]

.....

.....

.....

.....

Concentration = ... mol dm^{-3}

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

Turn over.

PERIODIC TABLE OF ELEMENTS

1	2											3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulphur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key: