Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4493/01

CHEMISTRY

CHEMISTRY 3
FOUNDATION TIER

A.M. THURSDAY, 15 May 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**6**	
4.	**4**	
5.	**10**	
6.	**6**	
7.	**10**	
8.	**8**	
9.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you will need 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.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **9**.

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.

Examiner only

Answer **all** *questions.*

1. The fire triangle is shown below.

(a) Describe what the fire triangle shows. [1]

.....

.....

(b) Use your understanding of the fire triangle to state how each of the following fire-fighting methods work. [3]

Placing a heatproof mat over a beaker that contains burning ethanol

.....

Using water to put out a bonfire

.....

Cutting down trees to provide a fire break in a forest

.....

(c) A cook notices that a frying pan containing oil has caught fire. He decides to get a fire extinguisher to put the fire out. Choose from the following box the type of fire extinguisher that should **not** be used. [1]

carbon dioxide	**foam**	**powder**	**water**

Type of fire extinguisher **not** *to be used* .....

5

Examiner only

2. Ethanol can be used as a fuel. It can be made by the fermentation of sugars using yeast.

The following graph shows the rate of fermentation using different sugars at 25 °C.

(a) Identify the best sugar for producing ethanol and give a reason for your choice. [1]

Best sugar .....

Reason .....

.....

(b) The following table contains some statements relating to the use of ethanol as a fuel.

It is a renewable resource
Large areas of land required to grow the crops
Produces less soot than petrol when burnt
Engines require modifications to run on ethanol
Produces less heat per litre than petrol
Produces only carbon dioxide and water when burnt

(i) In your opinion, should ethanol be used as a fuel? Give reasons to support your answer. [3]

Opinion (Yes/No) .....

Reasons .....

.....

.....

.....

(ii) Complete the **word** equation for the complete combustion of ethanol. [1]

ethanol + oxygen ⟶ ..... + ...

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3. *(a)* Draw a line from each gas below to the observation made in identifying it. [3]

Gas	Observation
	relights a glowing splint
carbon dioxide	turns flame red
ammonia	turns limewater milky
oxygen	pops with a burning splint
	turns damp red litmus blue

(b) The following box contains observations made when testing for some common metal ions.

lilac flame	**yellow flame**	**green flame**
blue precipitate	**brown precipitate**	**green precipitate**
	white precipitate	

Choose from the box the result you would expect for the following tests. [3]

A flame test is carried out on a sample of sodium chloride

.....

A flame test is carried out on a sample of copper(II) sulfate

.....

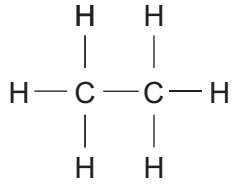
Sodium hydroxide solution is added to a solution of iron(III) chloride

.....

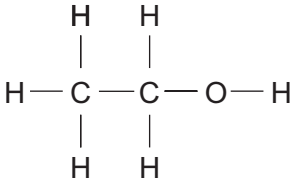
6

Examiner only

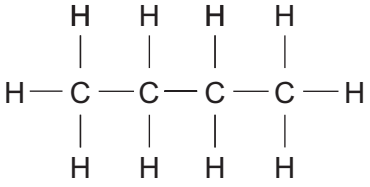
4. *(a)* The structural formulae of some organic compounds are shown below.



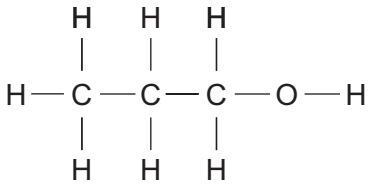
A



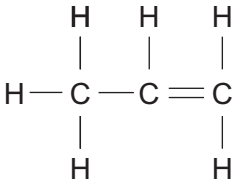
B



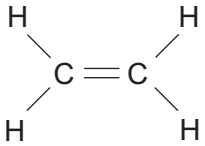
C



D



E



F

(i) Give the letters, **A**-**F**, of **two** alkanes and **two** alcohols. [2]

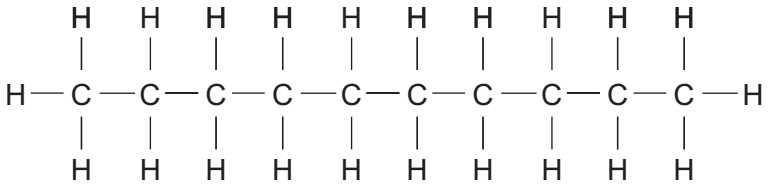
Alkanes ..... and .....

Alcohols ..... and .....

(ii) State which compound, **A**-**F**, has the molecular formula C_3H_6. [1]

.....

(b) Give the molecular formula of decane. [1]



.....

4

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5. *(a)* Sulfuric acid is produced by the contact process. The main stages in the process are shown below.

Stage 1: Burning sulfur in air to produce gas **A**

Stage 2: Passing gas **A** over a catalyst at 450 °C to produce gas **B**

Stage 3: Dissolving gas **B** in concentrated sulfuric acid to produce oleum

Stage 4: Diluting oleum to produce sulfuric acid

(i) Give the names of gases **A** and **B**. [2]

Gas **A** .....

Gas **B** .....

(ii) Which stage involves a reversible reaction? ..... [1]

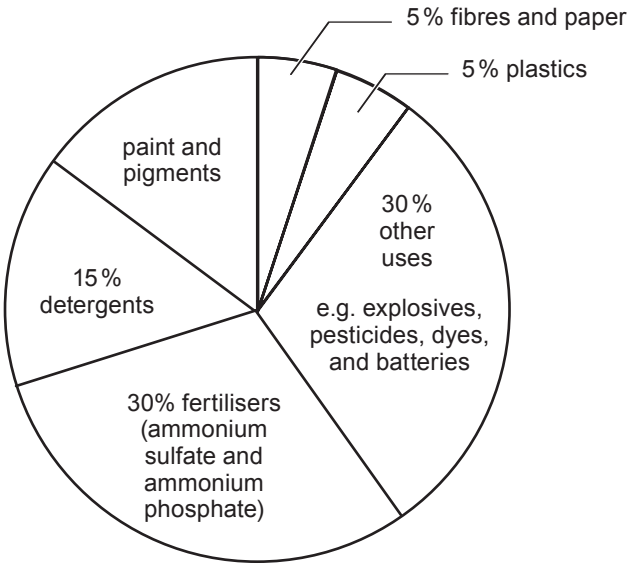
(iii) Give a reason why gas **B** is not dissolved directly in water during stage 3. [1]

.....

.....

Examiner only

(b) The following pie chart shows the uses of sulfuric acid.



(i) Calculate the percentage of sulfuric acid used for making paint and pigments. [2]

Percentage used for making paint and pigments = ... %

(ii) One important use of sulfuric acid is in the production of fertilisers. Complete the following **word** equation for the production of ammonium sulfate. [1]

sulfuric acid + ... ⟶ ammonium sulfate

(iii) This type of fertiliser can be washed into rivers. Explain why this is a cause for concern. [3]

.....

.....

.....

.....

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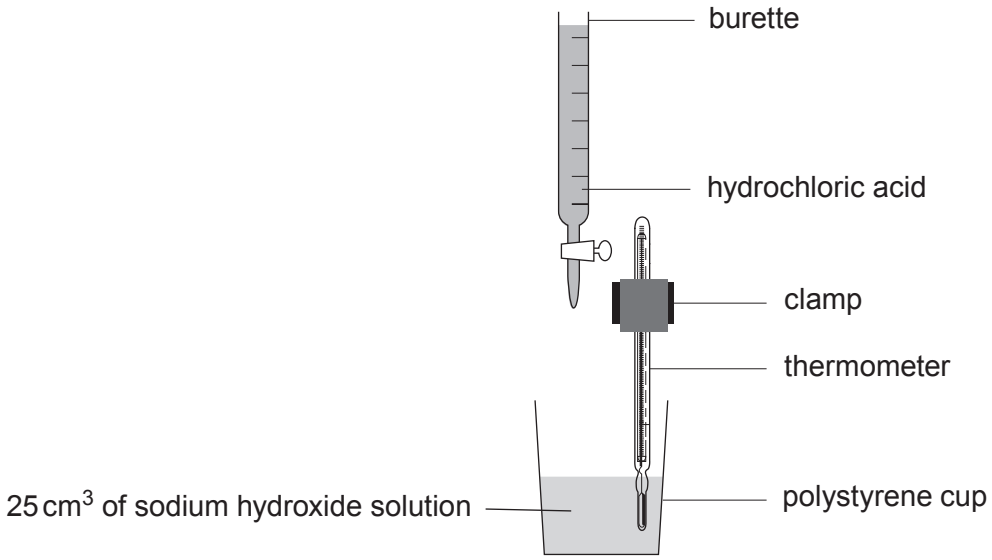
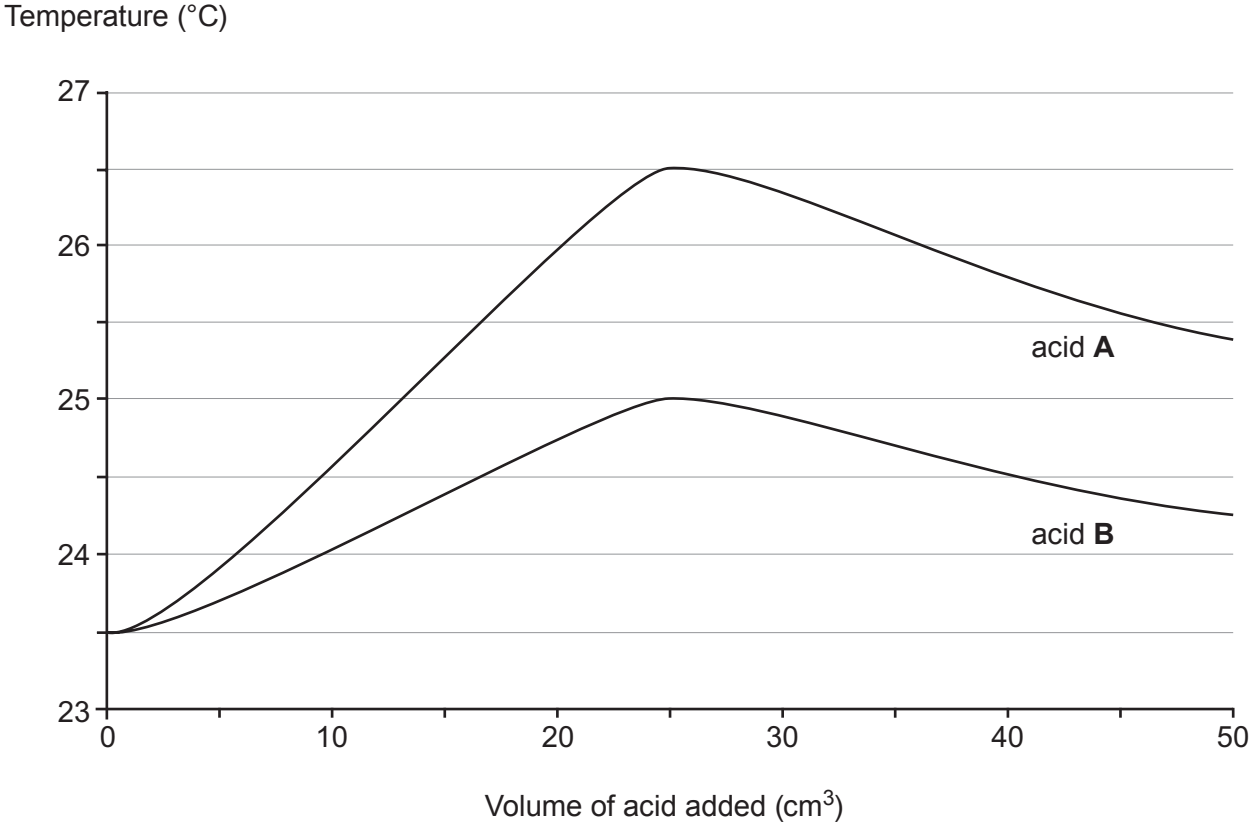
Turn over.

Examiner only

6. The apparatus below can be used to measure the temperature as a neutralisation reaction takes place.



The graphs below show how the temperature changes when acids **A** and **B** are added separately to 25 cm^3 of sodium hydroxide solution.



Examiner only

(a) Use the graphs opposite to find the

(i) volume of acid required to neutralise the sodium hydroxide solution in both experiments, [1]

.....

(ii) maximum temperature **rise** for acid **B**. [1]

.....

(b) State which acid, **A** or **B**, is stronger and give a reason for your answer. [1]

Stronger acid .....

Reason .....

.....

(c) Describe how an indicator could be used to find the exact volume of acid needed for neutralisation. [3]

.....

.....

.....

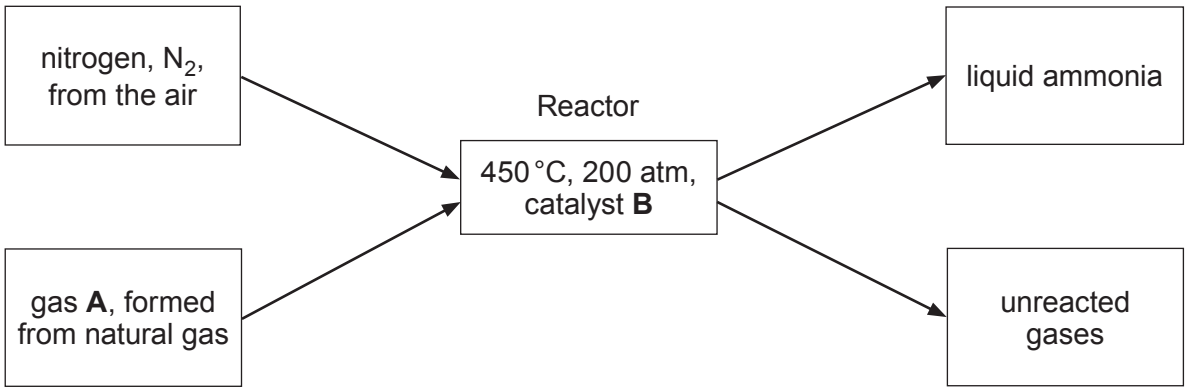
.....

6

Turn over.

Examiner only

7. Ammonia is produced during the Haber process. The reaction is summarised in the diagram below.



(a) Give the name of gas **A**. ..... [1]

(b) Name catalyst **B** and state why it is used. [2]

.....

.....

(c) The yield of ammonia is only 28 % therefore 72 % of the gases remain unreacted.

Describe what happens to these unreacted gases and state why this is important. [2]

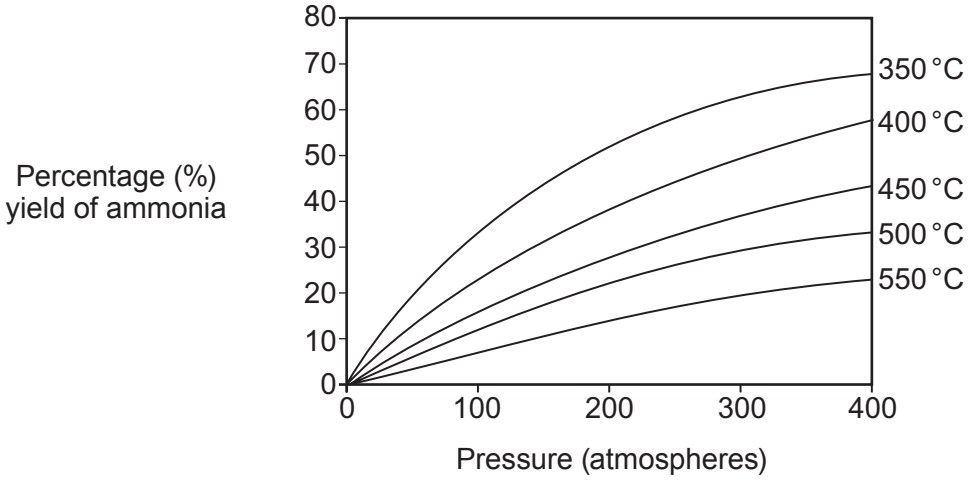
.....

.....

.....

Examiner only

(d) The following graph shows the effect of temperature and pressure on the yield of ammonia during the Haber process.



Describe how the yield of ammonia varies with temperature and pressure. [2]

Temperature

.....

.....

Pressure

.....

.....

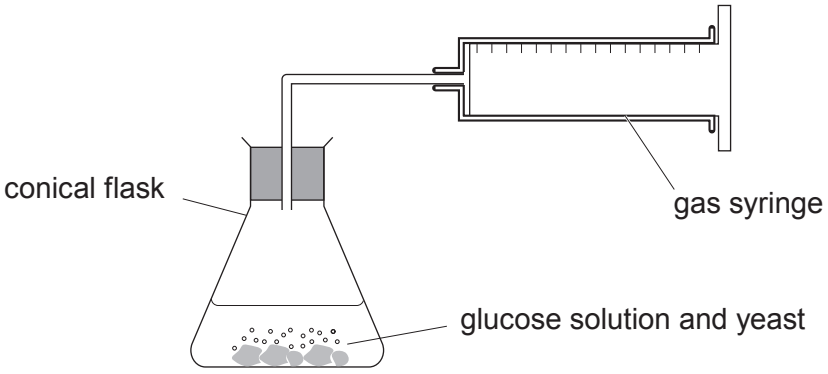
(e) Write a balanced **symbol** equation for the production of ammonia. [3]

..... + ... ⇌ .....

10

Examiner only

8. A pupil investigated the effect of temperature on the rate of fermentation using the apparatus shown below.



The experiment was carried out three times at five different temperatures. The volume of gas collected after 10 minutes was recorded each time. The results are shown below.

Temperature (°C)	Volume of gas collected after 10 minutes (cm^3)			
	1	2	3	Mean
20	9	8	7	8
30	38	40	(32)	39
40	52	53	54	53
50	35	32	33	33
60	12	11	12	12

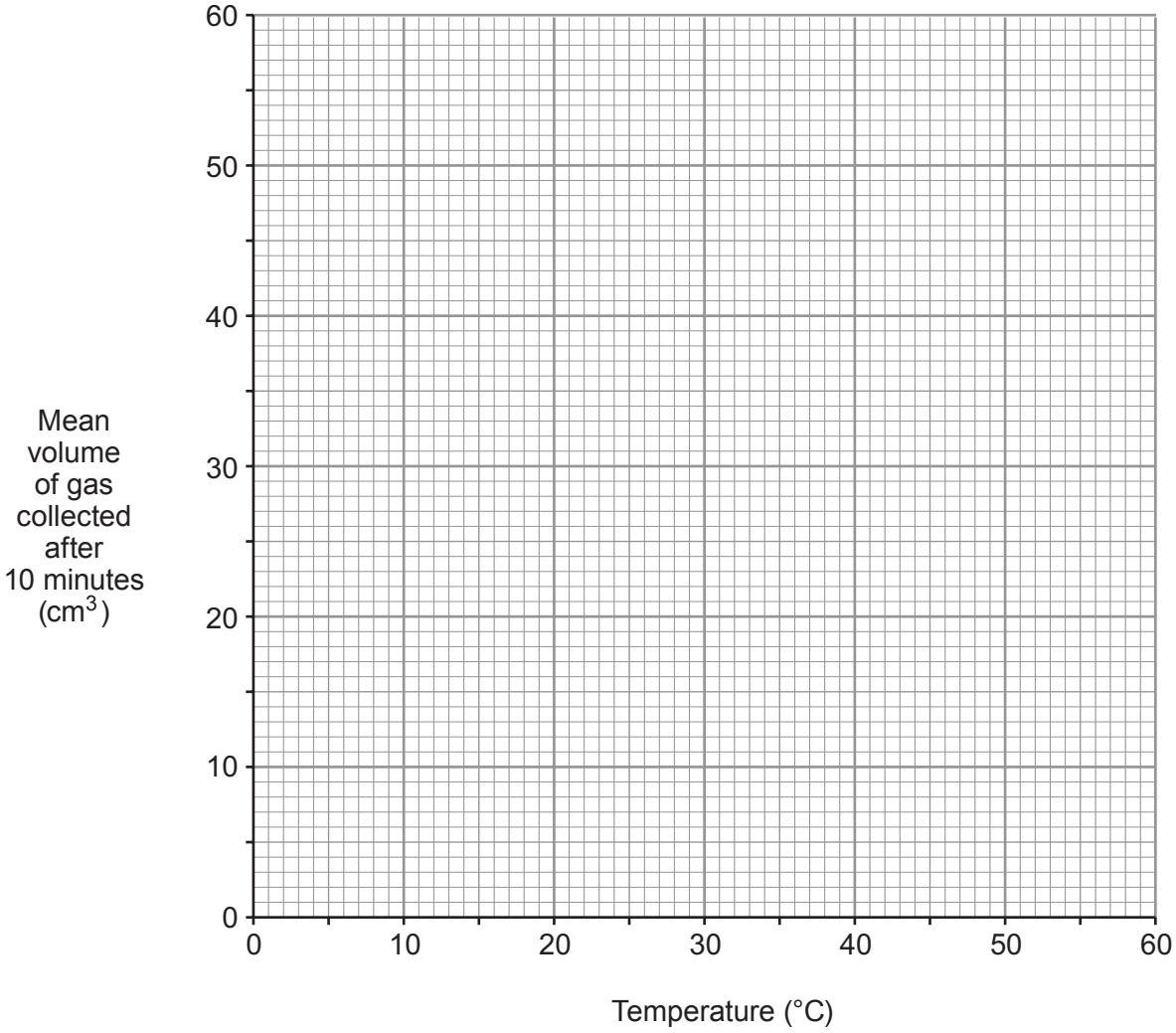
(a) Suggest why the circled value is considered to be anomalous. [1]

.....

.....

(b) Plot a graph of the **mean** volume of gas collected against temperature on the grid opposite. [2]

Examiner only



(c) State what conclusions can be drawn from the graph. [2]

.....

.....

.....

.....

(d) Write a **word** equation for the reaction taking place. [2]

..... ⟶ ..... + ...

(e) Yeast produces a catalyst that allows this reaction to take place. Name the **type** of catalyst produced by yeast. [1]

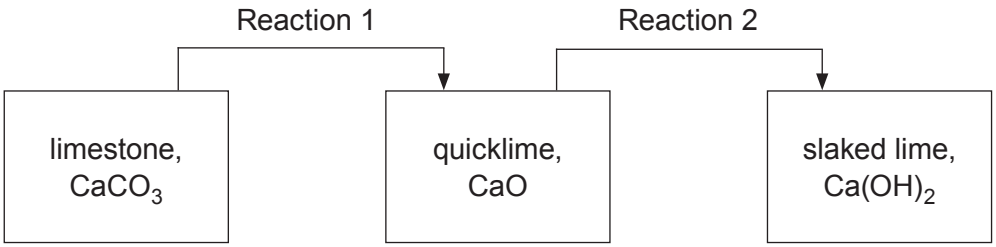
.....

8

Turn over.

Examiner only

9. Limestone, $CaCO_3$, is an important raw material. It can be converted into other useful materials as shown in the diagram below.



Describe how these reactions can be carried out in a laboratory.
Your answer should include:

- the conditions required for each reaction;
- observations at each stage;
- equations for the reactions taking place. [6 QWC]

6

END OF PAPER

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^{+}	Sulfate	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 Sulfur	$^{35}_{17}$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: