Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4462/01

SCIENCE A
FOUNDATION TIER
CHEMISTRY 1

A.M. MONDAY, 14 January 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**5**	
3.	**7**	
4.	**6**	
5.	**3**	
6.	**7**	
7.	**6**	
8.	**6**	
9.	**6**	
10.	**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. Do not use gel pen or correcting fluid.

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.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

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

You are reminded that assessment will take into account the quality of written communication used in your answer to question **10**.

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. *(a)* The box below contains the names of seven different substances.

aluminium	**iodine**	**nitrogen dioxide**	**crude oil**
sodium	**sulfur**	**water**	

Use **only** the substances given above to answer parts (i)-(iii).

Each substance can be used once, more than once or not at all.

(i) Name **two** metals. [1]

..... and .....

(ii) Name **two** compounds. [1]

..... and .....

(iii) Name **one** mixture. [1]

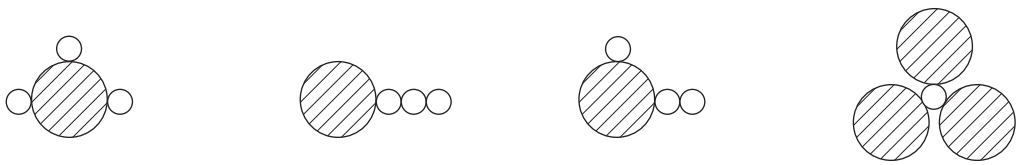
.....

(b) The key below represents atoms of some elements.

carbon, C oxygen, O nitrogen, N hydrogen, H

(i) Ammonia has the formula NH_3.

Choose the letter of the diagram below that represents a molecule of ammonia. [1]



A **B** **C** **D**

Letter ☐

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(ii) Use the **key** to draw a diagram representing a molecule of

I oxygen, O_2, [1]

II carbon dioxide, CO_2. [1]

(iii) The chemical formula of sodium carbonate is Na_2CO_3.

I State how many carbon atoms are present in the formula Na_2CO_3. [1]

.....

II Give the **total** number of atoms shown in the formula. [1]

.....

8

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2. *(a)* Sulfuric acid is a **strong** acid.

Place a tick (✓) in the box with the pH value of sulfuric acid. [1]

pH value	
1	☐
5	☐
7	☐
9	☐
14	☐

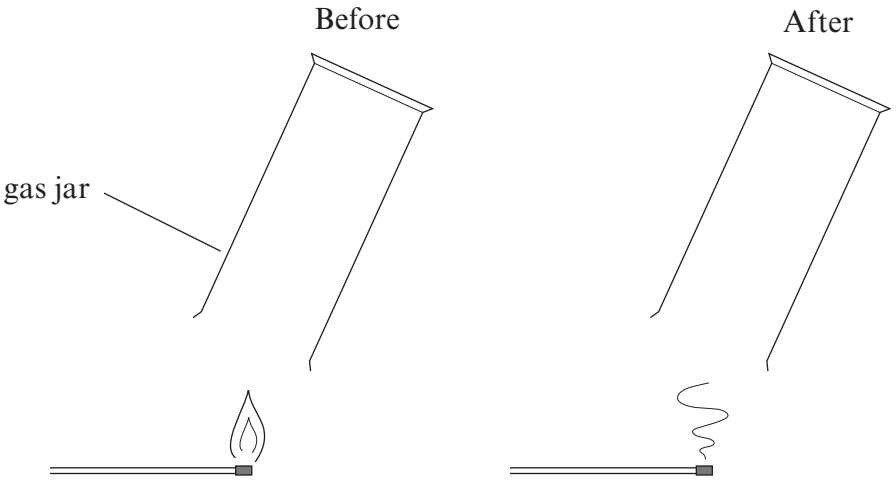
(b) Give the chemical name of an acid other than sulfuric acid. [1]

.....

(c) Name the gas given off when dilute sulfuric acid reacts with sodium carbonate. [1]

.....

(d) The gas given off in part *(c)* was collected in a gas jar. The gas jar was turned upside down over a burning splint as shown in the diagrams below.



Suggest **two** properties of this gas that are shown by this experiment. [2]

.....

.....

5

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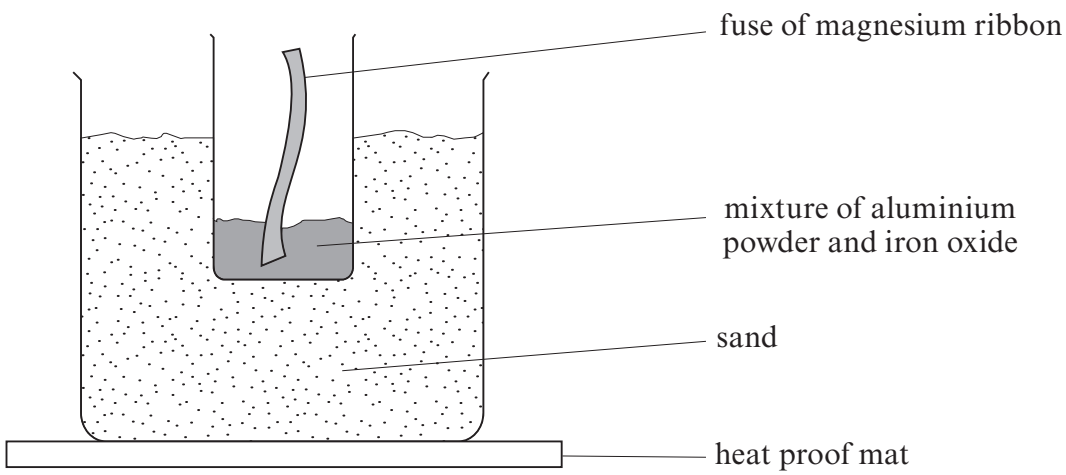
3. The Thermit reaction is a reaction between aluminium powder and iron oxide.
It can be demonstrated in a chemistry laboratory using the apparatus shown in the diagram below.



(a) State why the magnesium ribbon fuse is able to start the reaction. [1]

.....

(b) (i) Complete the **word** equation for the reaction that takes place between aluminium and iron oxide. [1]

aluminium + iron oxide ⟶ ..... + ...

(ii) State which reactant is reduced and give a reason for your answer. [1]

.....

.....

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(c) Titanium is extracted from titanium chloride by reacting it with sodium at 1000 °C in a reactor. The only other substance in the reactor is argon gas.

(i) Balance the symbol equation for the reaction that takes place in the reactor. [1]

$$TiCl_4 + \square\ Na \longrightarrow Ti + \square\ NaCl$$

(ii) What does this reaction tell you about the reactivity of titanium? [1]

.....

.....

(iii) Suggest a reason why the reactor contains argon and not air. [1]

.....

.....

(iv) Suggest a reason why extracting titanium from titanium chloride is an expensive process. [1]

.....

.....

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7

Turn over.

Examiner only

4. The percentage of carbon dioxide in air is 0.04%.

State, giving a reason in each case, how you would expect the percentage of carbon dioxide to change

(a) in a crowded classroom, [2]

.....

.....

.....

.....

(b) in a greenhouse full of plants on a sunny day, [2]

.....

.....

.....

.....

(c) in the furnace of a coal-fired power station. [2]

.....

.....

.....

.....

6

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5. Complete the following table. [3]

Compound	Formula	Names of elements present
lead iodide	PbI_2	lead and iodine
.....	NaBr	sodium and bromine
sulfuric acid	H_2SO_4	.....
potassium oxide	.....	potassium and oxygen

3

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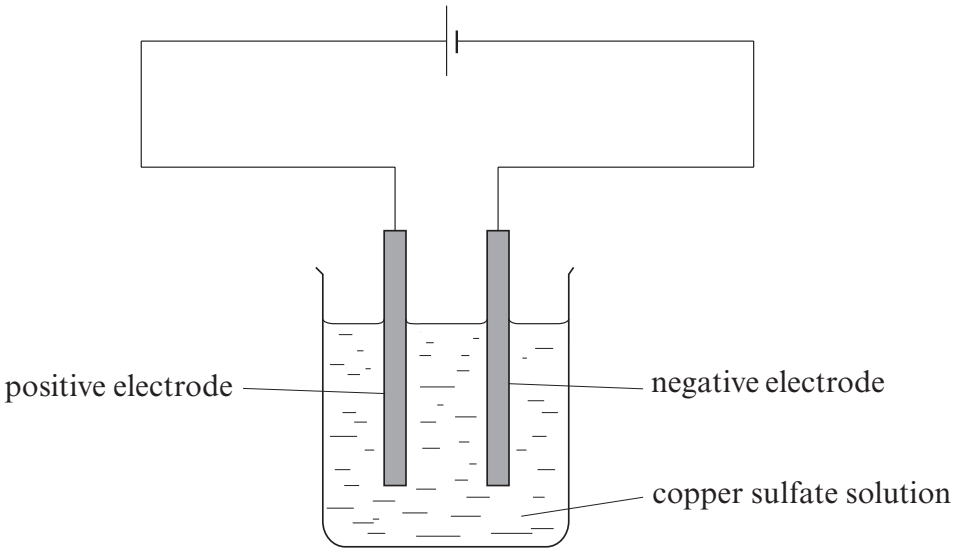
6. The electrolysis of copper sulfate solution was carried out using the apparatus shown in the diagram below. During the electrolysis, copper metal was deposited on the negative electrode.



(a) Identify the electrolyte. [1]

.....

(b) State the name given to a positive electrode. [1]

.....

(c) The following results were obtained during the electrolysis of copper sulfate solution. The mass of the negative electrode was measured at intervals.

Initial mass of the negative electrode = 20.2 g

Time (min)	Mass of negative electrode and deposited copper (g)	Mass of copper deposited (g)
0	20.2	0.0
20	20.7	0.5
40	21.0	.....
60	21.2	1.0
90	21.4	1.2
120	21.4	1.2

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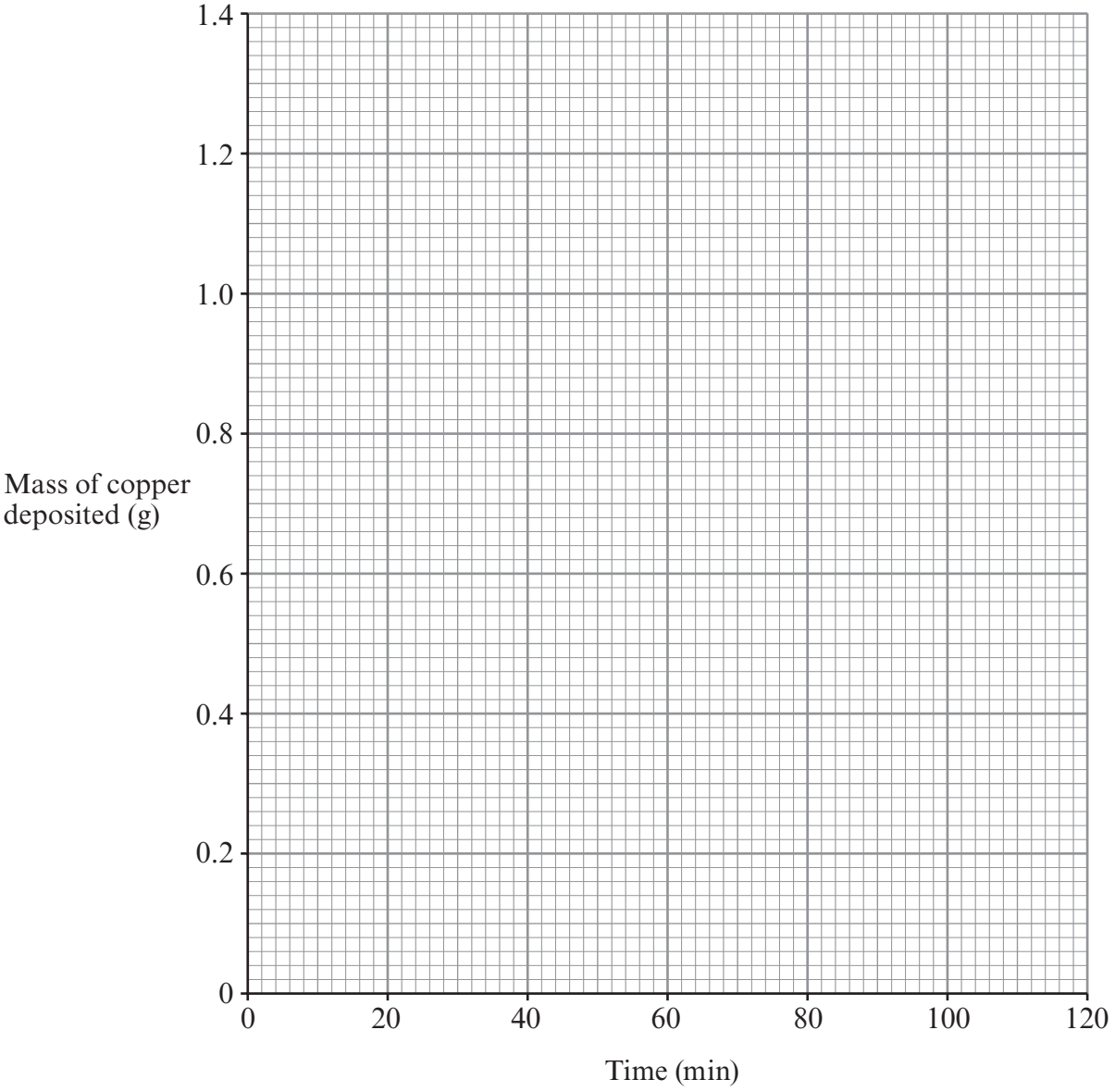
(i) Complete the table opposite by calculating the mass of copper deposited after 40 minutes. [1]

(ii) Plot the data on the grid below and draw a suitable line. [3]



(iii) Use the graph to find the mass of copper deposited after 30 minutes. [1]

..... g

7

Turn over.

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7. The following table shows some information about some Group 7 elements.

Name	Formula	State at room temperature (20 °C)	Colour of vapour	Melting point (°C)
chlorine	Cl_2	gas	yellow-green	–101
bromine	.....	liquid	orange-brown	–7
iodine	I_2	solid	purple	114

(a) Give the formula for bromine. ..... [1]

(b) A pupil predicted the **boiling point** of chlorine to be –10 °C.

Using the information in the table, suggest **two** reasons why the pupil gave this value. [2]

.....

.....

.....

(c) Chlorine is a poisonous gas.

State **one** use of chlorine which relates to its poisonous nature. [1]

.....

(d) Fluorine is above chlorine in this group of the Periodic Table.

Use the information in the table to predict **two** properties of fluorine. [2]

.....

.....

.....

6

Examiner only

8. The following table shows the main products formed during the burning of coal and hydrogen.

Fuel	Main product(s) of burning
coal	carbon dioxide sulfur dioxide water
hydrogen	water

(a) (i) Name the **three** elements that must be present in coal to give the products shown in the table. [1]

.....

(ii) Coal is a finite (non-renewable) resource.

State what is meant by a *finite resource*. [1]

.....

.....

(b) (i) Balance the symbol equation for the burning of hydrogen in air. [1]

$$\square\ H_2 + O_2 \longrightarrow \square\ H_2O$$

(ii) State the chemical test for hydrogen gas and give the expected result. [1]

.....

.....

(iii) Give **two** disadvantages of using hydrogen as a fuel. [2]

1. .....

.....

2. .....

.....

6

Examiner only

9. *(a)* Crude oil is a mixture of hydrocarbons.
State how it was formed. [2]

.....

.....

(b) The table below shows properties of some fractions that can be obtained from crude oil.

Fraction	Size of molecule (number of carbon atoms)	Boiling point range (°C)	Colour of fraction	Viscosity at room temperature	How it burns
fuel gas	C_1-C_4	–160 to 20	colourless		very easily with a clean yellow flame
petrol	C_5-C_{10}	20 to 70	pale yellow	runny	easily with a clean yellow flame
naphtha	C_8-C_{12}	70 to 120	yellow	fairly runny	quite easily with a yellow flame and some soot
kerosene	C_{10}-C_{16}	120 to 240	dark yellow	quite viscous	harder to burn with quite a smoky flame
diesel oil and lubricating oil	C_{15}-C_{30}	240 to 350	brown	viscous	hard to burn and a smoky flame

Examiner only

Use the information in the table opposite to answer parts (i) and (ii).

(i) Describe how any **two** properties of crude oil fractions depend on the size of the molecule. [2]

.....

.....

.....

(ii) Two fuels used in caravans are propane, C_3H_8, and butane, C_4H_{10}. Both fuels are used in the summer but propane is preferred during the winter.

Explain why. [2]

.....

.....

.....

.....

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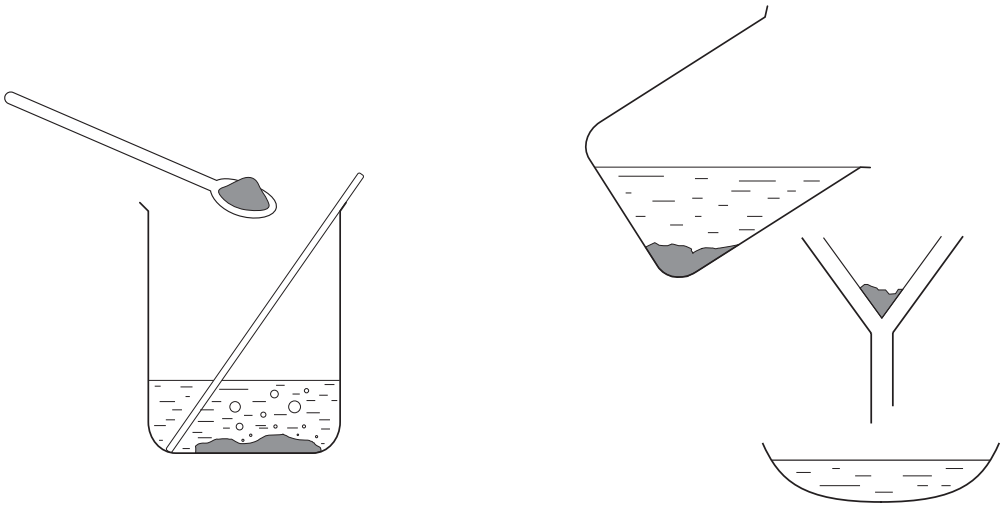
10. Copper sulfate crystals can be prepared by reacting copper carbonate with dilute sulfuric acid.

The unlabelled diagrams below show two of the three stages involved.



Describe the preparation of copper sulfate crystals by this method. [6 QWC]
Include in your answer what you would expect to **see** at each stage.

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END OF PAPER

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Question number	Additional page, if required. Write the question numbers in the left-hand margin.

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Question number	**Additional page, if required. Write the question numbers in the left-hand margin.**

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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^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

PERIODIC TABLE OF ELEMENTS

1	2	Group										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: