Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0236/02

SCIENCE
HIGHER TIER
CHEMISTRY 1

A.M. THURSDAY, 26 January 2012

45 minutes

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

0236
020001

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. Do not use correction 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.

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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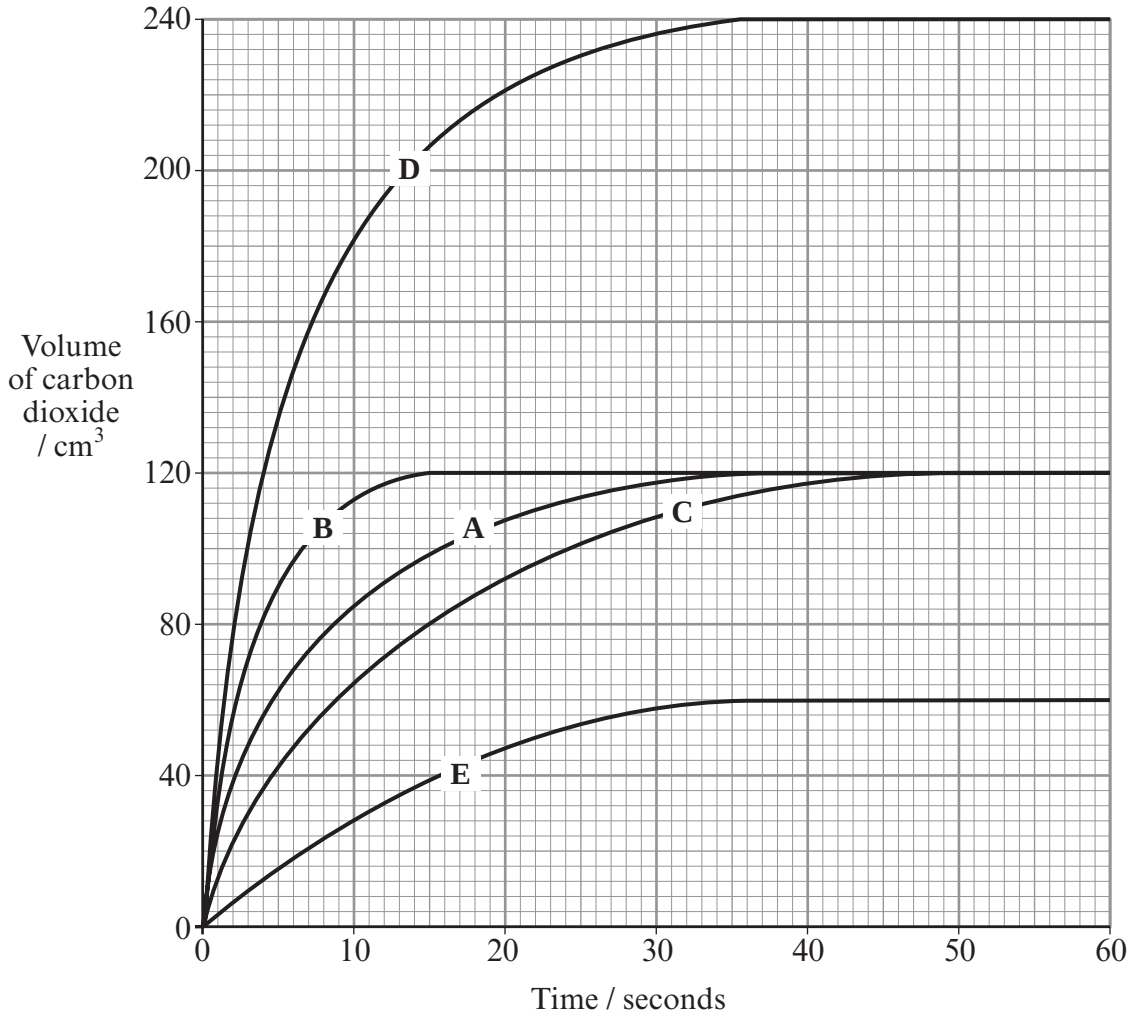
Answer **all** *questions.*

1. Marble chips (calcium carbonate) react with dilute hydrochloric acid forming carbon dioxide.

Graph **A** below, shows the volume of carbon dioxide formed during the reaction between 0.5 g of marble chips and ***excess*** dilute hydrochloric acid at 20 °C.



Give the letter, **B**-**E**, of the graph which could represent the results obtained when an ***excess*** of the same dilute hydrochloric acid as above was added to

(a) 0.5 g of marble chips at 10 °C, ... [1]

(b) 0.25 g of marble chips at 20 °C, ... [1]

(c) 1.0 g of marble chips at 20 °C, ... [1]

(d) 0.5 g of **crushed** marble chips at 20 °C. ..... [1]

2. Crude oil is a mixture of compounds called hydrocarbons, which can be separated into fractions.

(a) Give the name of the process which separates crude oil into fractions. [1]

.....

(b) The table below shows some information about the main fractions obtained.

Main fraction	A hydrocarbon found in this fraction	The boiling point of this hydrocarbon / °C
refinery gases	propane, C_3H_8	–42
petrol	octane, C_8H_{18}	126
naphtha	decane, $C_{10}H_{22}$	170
paraffin (kerosene)	dodecane, $C_{12}H_{26}$	216
diesel oil (gas oil)	eicosane, $C_{20}H_{42}$	344

Use only the information in the table to answer parts (i)-(iv).

(i) State how the number of carbon atoms in a hydrocarbon affects its boiling point. [1]

.....

(ii) Suggest a value for the **lowest** temperature needed to boil **all** the named hydrocarbons in the table. [1]

..... °C

(iii) Decane boils at 170 °C. State the temperature at which decane gas condenses to a liquid. [1]

..... °C

(iv) Name the elements present in **all** the fractions. [1]

..... and .....

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3. Sodium is found in Group 1 of the Periodic Table of Elements.

(a) When a freshly cut piece of sodium is exposed to air, its cut surface quickly reacts with oxygen forming sodium oxide.

(i) Sodium is normally stored in a liquid to prevent this reaction occurring.

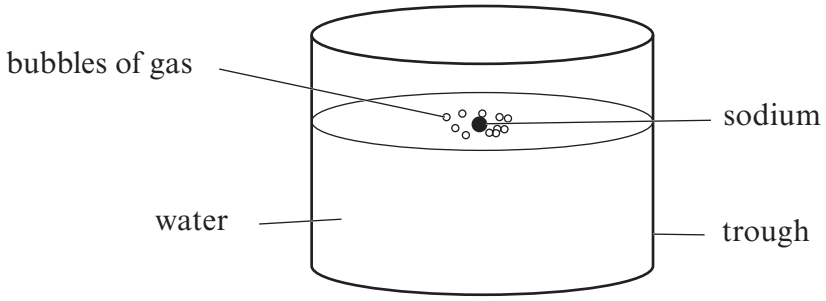
Give the name of this liquid. [1]

.....

(ii) Balance the **symbol** equation for the reaction between sodium and oxygen. [1]

..... Na + ... O_2 ⟶ ..... Na_2O

(b) The diagram below shows sodium reacting with water.



(i) Using the information in the diagram, state one **unusual** physical property of sodium that is not common to most metals. [1]

.....

(ii) Universal indicator turns purple when added to the water after the sodium has reacted. Give the reason for this colour change. [1]

.....

(iii) Give the **name** of the gas formed when sodium reacts with water. [1]

.....

(iv) Name a Group 1 metal which would react **less** vigorously with water than sodium does. [1]

.....

4. *(a)* Use the **data** and **key** on the Periodic Table of Elements, shown on the **back page of this examination paper**, to answer parts (i) and (ii).

(i) I. The element which has the electronic structure 2,3 is ..... [1]

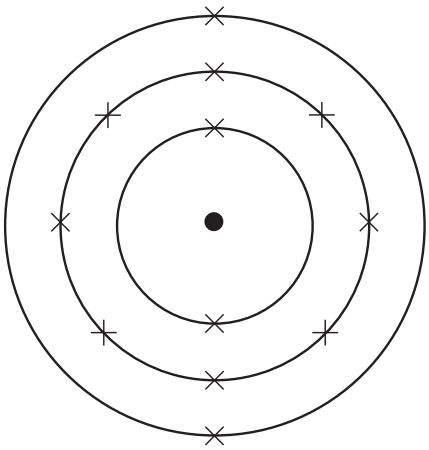
II. The element which is in Group 2 and Period 2 is ..... [1]

III. The element which has the highest atomic number in Group 1 is

..... [1]

IV. An element which has the same number of electrons in its outer orbit (shell) as carbon is ..... [1]

(ii) The diagram below shows the electronic structure of an element in the Periodic Table.



Using **X** to represent an electron, draw a similar style diagram to show the electronic structure of the element which lies directly **below** this one in the Periodic Table. [1]

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(b) Use the **table of common ions** on the **inside of the back cover of this examination paper** to help you answer this question.

(i) Give the **formulae** of the **ions** present in the compound aluminium oxide, Al_2O_3. [1]

Positive ion ..... Negative ion .....

(ii) Give the chemical formula for calcium nitrate. [1]

.....

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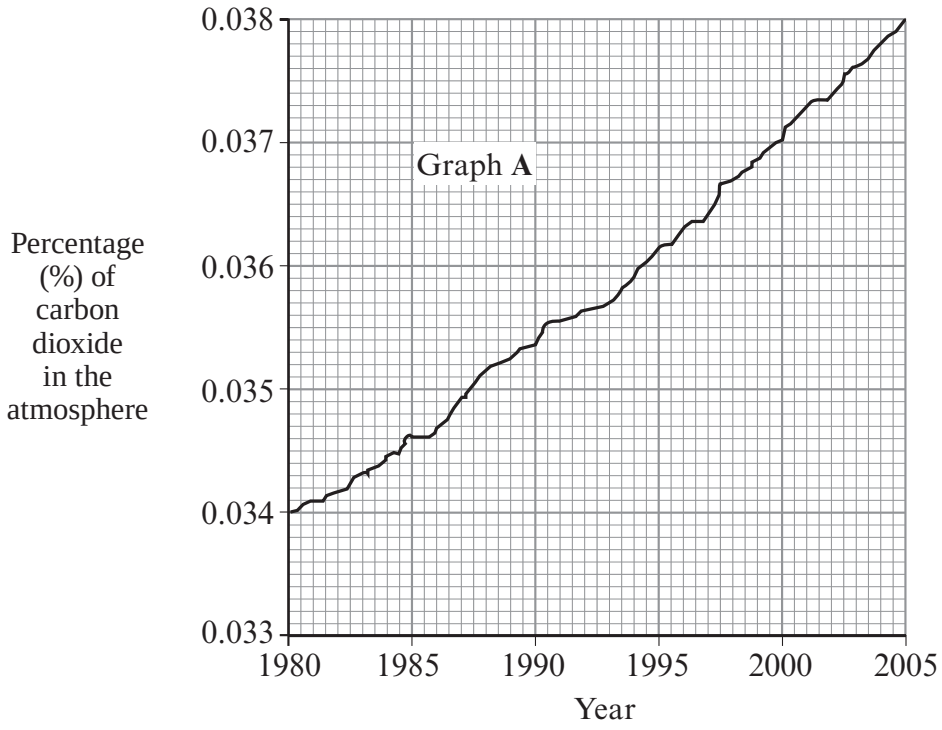
5. *(a)* Graph **A** shows the percentage (%) of carbon dioxide in the Earth's atmosphere between 1980 and 2005.



(i) Use the graph to find the increase in percentage (%) of carbon dioxide in the Earth's atmosphere between 1980 and 2005. [1]

.....

(ii) Give **one** cause for the increase in carbon dioxide in the atmosphere. [1]

.....

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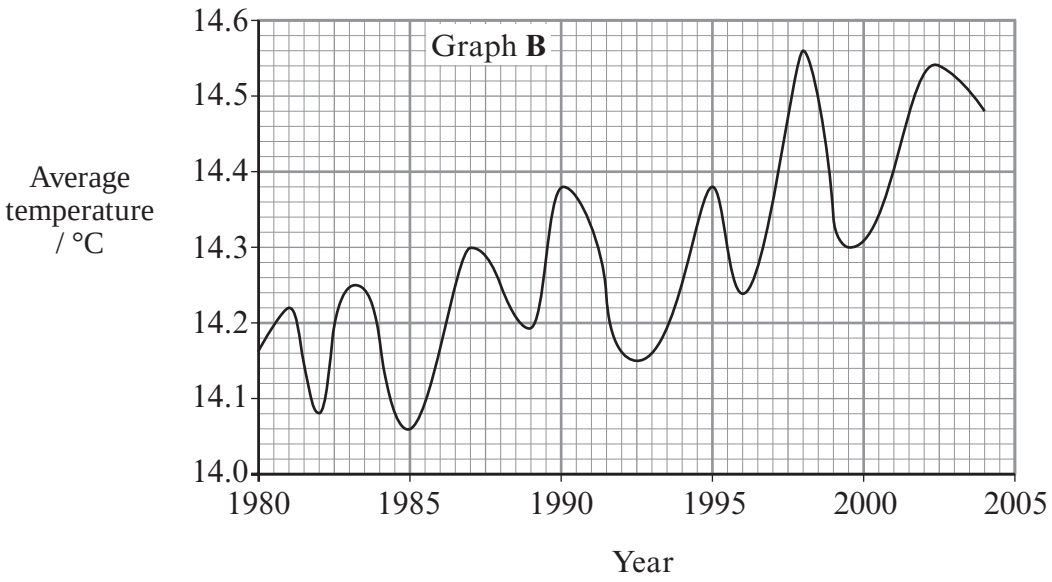
(b) Graph **B** shows the change in the average temperature of the Earth's atmosphere between 1980 and 2004.



(i) Give the year when the Earth's average temperature first reached 14.3 °C. [1]

.....

(ii) Using a ruler draw a line **on the graph** to show the **overall trend** in the Earth's average temperature between 1980 and 2004. [1]

(iii) In Wales many people live around the coast. Give **one** way the increase in the average global temperature could cause problems for these people. [1]

.....

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6. *(a)* The table below shows some physical properties of three Group 7 elements.

Element	Melting point / °C	Boiling point / °C	Density / g cm^{-3}
chlorine	–101	–35	0.0029
bromine	–7	59	3.1
iodine	114	184	4.9

(i) A sample of bromine is put in a test tube in a water bath at 65 °C. Describe what will happen to it. [1]

.....

(ii) Fluorine is **above** chlorine in Group 7. Predict the **state** (solid, liquid or gas) of fluorine at 20 °C.

..... [1]

(iii) Astatine is **below** iodine in Group 7. Suggest an approximate value for the **melting point** of astatine.

..... °C [1]

(b) Bromine, Br_2, reacts with sodium forming sodium bromide.

Write a balanced **symbol** equation for this reaction. [3]

..... + ... ⟶ .....

(c) **A**, **B** and **C** represent solutions of the sodium halides, NaCl, NaBr and NaI, but not necessarily in that order.
Chlorine, Cl_2, bromine, Br_2, and iodine, I_2, were added separately to each sodium halide solution.
The table below shows the results obtained from the series of experiments.

Halogen	Solution of sodium halide		
	A	**B**	**C**
chlorine, Cl_2	no reaction	solution turns brown	solution turns orange
bromine, Br_2	no reaction	solution turns brown	no reaction
iodine, I_2	no reaction	no reaction	no reaction

Use the information in the table to identify each of the halide solutions. [2]

A .....

B .....

C .....

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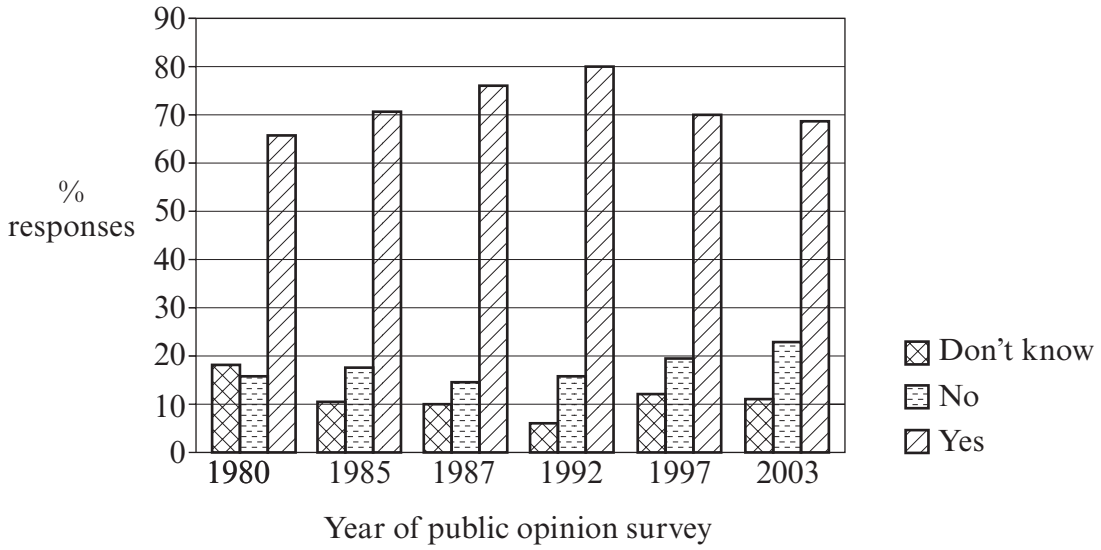
7. *(a)* Many medical and scientific organisations support the fluoridation of drinking water as safe and beneficial for public health.

Over the past 20 years national surveys have been carried out to find public opinion on the fluoridation of drinking water.

The graph below shows the responses to a question used in one particular survey:

"Do you think fluoride should be added to water if it can reduce tooth decay?"



(i) State how the graph can be used to support the argument for the fluoridation of drinking water. [1]

.....

(ii) Some opponents of fluoridation disagree with the wording of the question in the survey saying it was biased.

Give **one** reason why some opponents believed the question was biased. [1]

.....

.....

(iii) Give **one** factor which is important to consider when choosing the sample of people to be surveyed. [1]

.....

(b) Give **one ethical** and **one medical** reason opponents of fluoridation use to support their views. [2]

Ethical .....

Medical .....

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8. The diagram below shows how the continents are arranged today.

In 1915, Alfred Wegener proposed the theory of continental drift which was not accepted by other scientists.

(a) State what Wegener suggested about how the continents were originally arranged. [1]

.....

(b) Give the evidence Wegener used to support his theory. [3]

.....

.....

.....

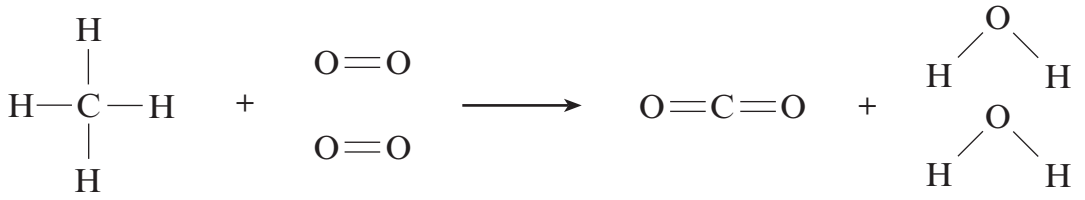
(c) About 50 years after Wegener put forward his theory, scientists began to accept it.

State the evidence that resulted in other scientists accepting Wegener's theory. [1]

.....

Examiner only

9. When methane burns in air carbon dioxide and water are formed.



The relative amounts of energy needed to break the bonds in the above reaction are shown in the table below.

Bond	Amount of energy needed to break the bond / kJ
C═O	805
C—H	413

Note: The amount of energy released in making a bond is equal and opposite to that needed to break the bond.

Use the bond energy values in the table above to help you answer parts *(a)* and *(b)*.

(a) The relative energy needed to break all the bonds in the reactants is 2648 kJ. Calculate the amount of energy needed to break an O═O bond. [2]

.....

.....

.....

(b) The relative energy released when all the bonds in the products are formed is 3466 kJ. Calculate the amount of energy released in making an O—H bond. [2]

.....

.....

.....

(c) The burning of methane gives out heat and is said to be exothermic. Use the values for energy needed (2648 kJ) and energy released (3466 kJ) to support the observation that the reaction is exothermic.

[1]

.....

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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^{+}		

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 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: