Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

GCSE

4472/01

ADDITIONAL SCIENCE/CHEMISTRY

CHEMISTRY 2
FOUNDATION TIER

P.M. MONDAY, 20 May 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**4**	
3.	**7**	
4.	**4**	
5.	**6**	
6.	**4**	
7.	**7**	
8.	**8**	
9.	**5**	
10.	**5**	
11.	**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 **11**.

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. *(a)* Choose words from the box below to answer parts (i) and (ii).

chlorine	**copper**	**electron**
lithium	**magnesium**	**proton**

Give the name of

(i) a particle found in the nucleus of an atom, [1]

.....

(ii) an alkali metal. [1]

.....

(b) Complete the table below by naming the elements and the type of bonding present in ammonia, NH_3. [2]

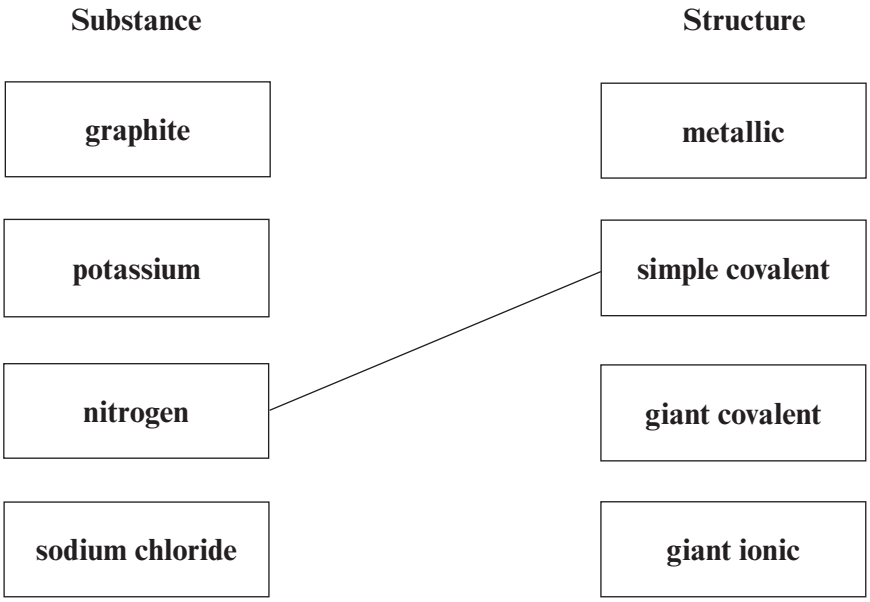
Compound	Names of elements	Bonding
ammonia, NH_3		

4

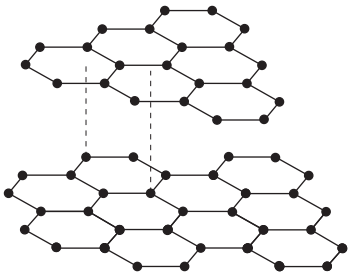
Examiner only

2. *(a)* Draw a line to link each substance with its structure. [2]

One has already been done for you.



(b) State which of the substances in part *(a)* has the structure shown by the following diagram. [1]



Substance .....

(c) Nitrogen is an example of an **element** with a simple covalent structure.

Name a **compound** with the same structure. [1]

.....

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3. *(a)* Atoms consist of particles called electrons, neutrons and protons.

Complete the following table by giving the charge on an electron and the mass of a neutron. [2]

	Mass	Charge
electron	negligible	.....
neutron	.....	neutral (0)
proton	1	positive (+1)

(b) Potassium is represented as $^{39}_{19}$K.

Element **X** has 9 electrons, 10 neutrons and 9 protons.

Write the information for element **X** in the same form as above. [1]

$$\square^{\square}_{\square}\mathbf{X}$$

(c) Chlorine has two isotopes: chlorine-35 and chlorine-37.

Complete the table below. [2]

	chlorine-35	chlorine-37
Atomic number	17	17
Mass number	35	37
Number of electrons	.....	17
Number of neutrons	18	.....
Number of protons	17	17

(d) The atomic number of sodium is 11.

Place a tick (✓) in the box next to the electronic structure of sodium. [1]

11	☐
2,9	☐
4,7	☐
2,4,5	☐
2,8,1	☐

(e) Element **Z** is found in Group 2 and in Period 4 of the Periodic Table.

Place a tick (✓) in the box next to the electronic structure of element **Z**. [1]

2,4	☐
4,2	☐
2,8,2	☐
2,8,8,2	☐
2,8,8,4	☐

Examiner only

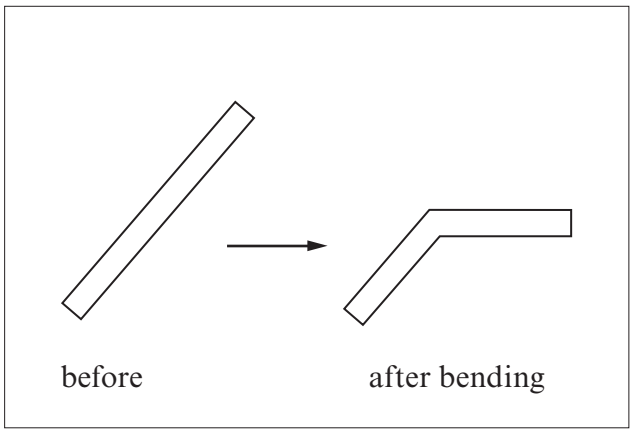
4. *(a)* The box below shows the names of some types of smart material.

hydrogel	**photochromic pigment**
shape memory alloy	**thermochromic pigment**

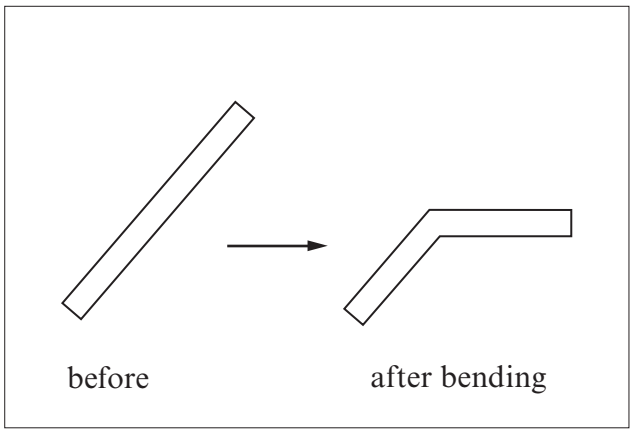
Choose from the box the type of smart material that changes colour with changing temperature. [1]

.....

(b) A teacher showed a class samples of two different types of plastic, **A** and **B**. One was a thermoplastic and the other a shape memory polymer. The teacher bent both samples and gave them to one of the students.



A



B

Describe what the student should do to find out which is the thermoplastic and which is the shape memory polymer.

Include the observations for **both** samples. [3]

.....

.....

.....

.....

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5. *(a)* Lithium, sodium, potassium and rubidium are the first four members of Group 1 in the Periodic Table.

The following table gives the melting points and boiling points of lithium, potassium and rubidium.

Element	Melting point (°C)	Boiling point (°C)
lithium	180	1330
sodium	-	-
potassium	64	774
rubidium	39	688

Using the information in the table, choose from below the pair of values most likely to be the melting point and the boiling point of sodium. [1]

Pair **A**	Pair **B**	Pair **C**	Pair **D**
59 910	113 735	98 890	134 1498

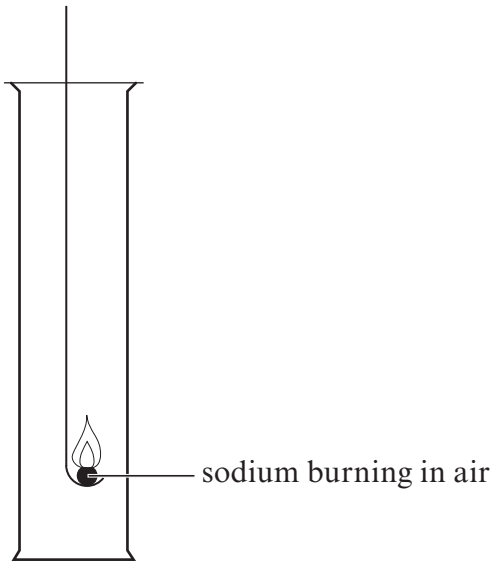
Pair ☐

(b) State why sodium is stored in oil. [1]

.....

.....

(c) Sodium burns vigorously in air.



(i) Give the colour of the flame. [1]

.....

(ii) Give the **word** equation for the reaction that takes place when sodium burns in air. [2]

..... + ... ⟶ .....

(iii) Sodium also reacts vigorously with chlorine. Balance the symbol equation for the reaction between sodium and chlorine. [1]

$$\square\ Na + Cl_2 \longrightarrow \square\ NaCl$$

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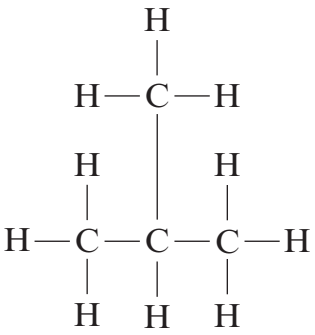
6. *(a)* Give the **molecular** formula of the substance with the structural formula shown below.



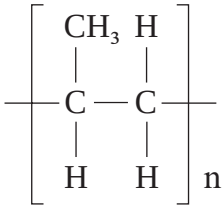
Molecular formula ..... [1]

(b) Give the name and the **structural** formula of the hydrocarbon with the molecular formula C_3H_8. [2]

Name .....

Structural formula

(c) Polypropene is represented as shown below.



Give the **molecular** formula of the monomer used to make polypropene. [1]

Molecular formula .....

4

Examiner only

7. The following word equation represents the reaction between zinc and dilute hydrochloric acid.

zinc + hydrochloric acid ⟶ zinc chloride + hydrogen

You are asked to carry out an experiment to show how **particle size** affects the speed of this reaction.

(a) (i) Describe how you would carry out the experiment. [2]

.....

.....

.....

.....

(ii) State how you would make it a fair test. [2]

.....

.....

.....

(iii) State how you would know which particle size gives the fastest reaction. [1]

.....

.....

(b) A catalyst was added to the reaction mixture above.

(i) State how the catalyst would affect the **time** needed to produce a given volume of hydrogen. [1]

.....

.....

(ii) State how you would expect the catalyst to affect the total **volume** of hydrogen produced. [1]

.....

.....

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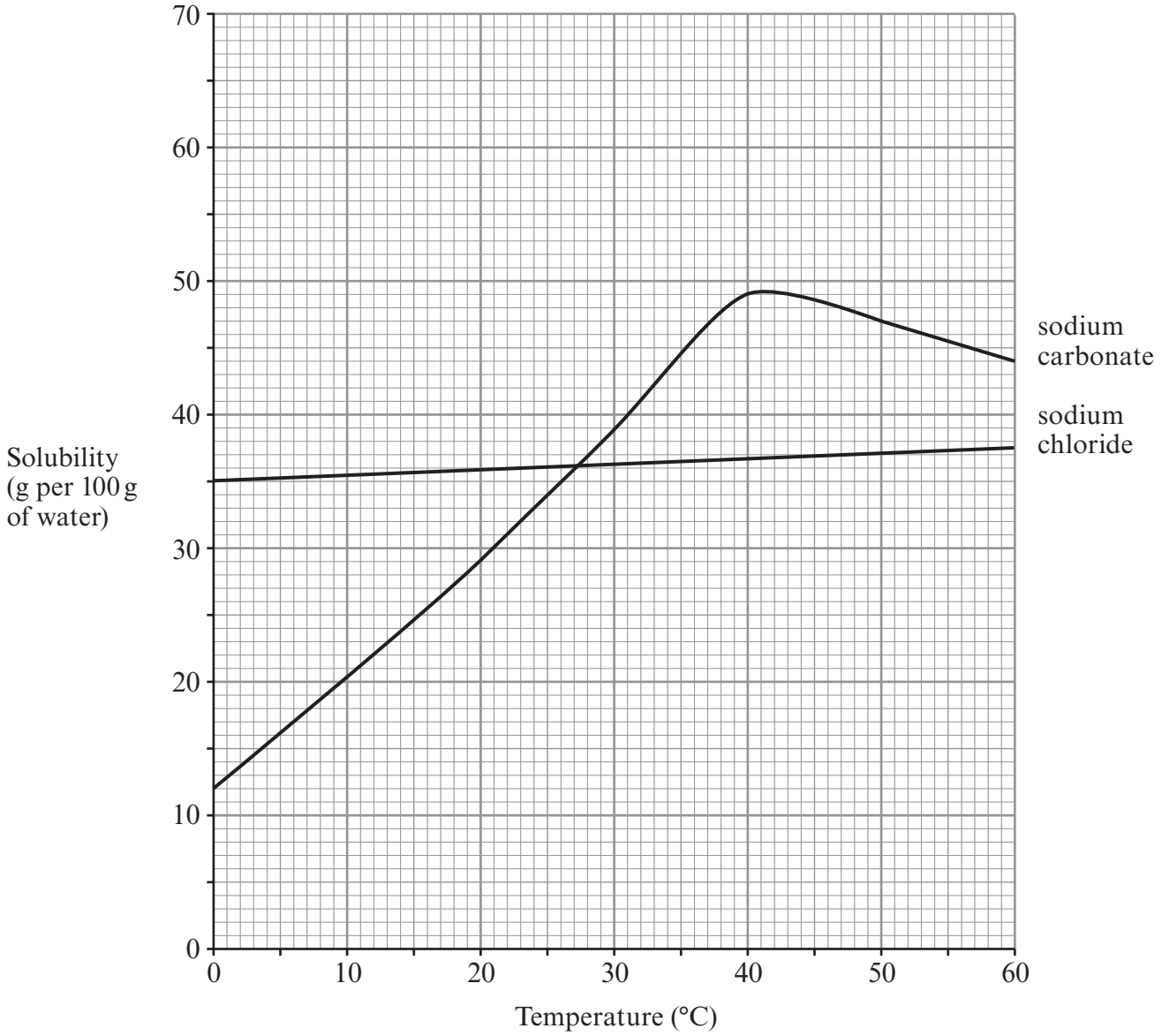
8. The graphs below show the solubilities of sodium chloride and sodium carbonate in water at different temperatures.



(a) Describe the trend in the solubility of sodium carbonate. [1]

.....

.....

Examiner only

(b) The table below shows the solubility of sodium bromate in water at different temperatures.

Temperature (°C)	0	10	20	30	40	50	60
Solubility (g per 100 g of water)	25	29	35	41	48	55	64

Plot the results from the table on the grid opposite and draw a suitable line. [3]

(c) List the three sodium compounds in order of solubility at 40 °C. [1]

Most soluble .....

.....

Least soluble .....

(d) The solubility of silver chloride is 0.0002 g in 100 g of water at room temperature, 20 °C.

You are given a mixture of sodium chloride and silver chloride powder. Describe how you would obtain a sample of silver chloride from the mixture. [3]

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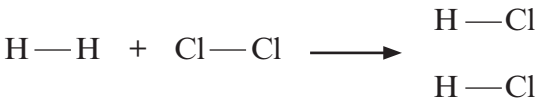
Examiner only

9. The reaction between hydrogen and chlorine to give hydrogen chloride can be represented by the following equation.



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

Bond	Amount of energy needed to break the bond (kJ)
H — H	436
Cl — Cl	242
H — Cl	431

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

(a) Using the bond energy values in the table, calculate

(i) the relative energy needed to break all the bonds in the **reactants**, [2]

.....

.....

(ii) the relative energy given out when all the bonds in the **product** are formed. [2]

.....

.....

(b) Using your answers to part *(a)*, state whether the reaction between hydrogen and chlorine is exothermic or endothermic and give a reason for your answer. [1]

.....

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10. *(a)* A group of students carry out an experiment to investigate the relative hardness of four samples of water, **A**, **B**, **C** and **D**.

The students add soap solution, 0.5 cm^3 at a time, to sample **A**. The mixture is shaken after each addition. The volume of soap solution needed to produce 1 cm of lather is recorded. They test samples **B**, **C** and **D** in exactly the same way. They then repeat the experiment after boiling each sample of water.

The results obtained are shown in the table below.

Water sample	Volume of soap solution needed (cm^3)	
	Before boiling	After boiling
A	10.5	10.5
B	1.5	1.5
C	6.0	1.5
D	9.5	7.0

(i) State which water sample is the hardest and give a reason for your answer. [1]

.....

.....

(ii) State which water sample contains both permanent and temporary hard water and give a reason for your answer. [2]

.....

.....

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Examiner only

(b) A different group of students carry out a similar investigation with the same water samples, **A**, **B**, **C** and **D**.

Their results are as follows.

Water sample	Volume of soap solution needed (cm^3)	
	Before boiling	After boiling
A	6.0	6.0
B	1.0	1.0
C	3.5	1.0
D	5.5	3.0

Compare the results obtained by the two groups, commenting on the similarity and suggesting a reason for the difference. [2]

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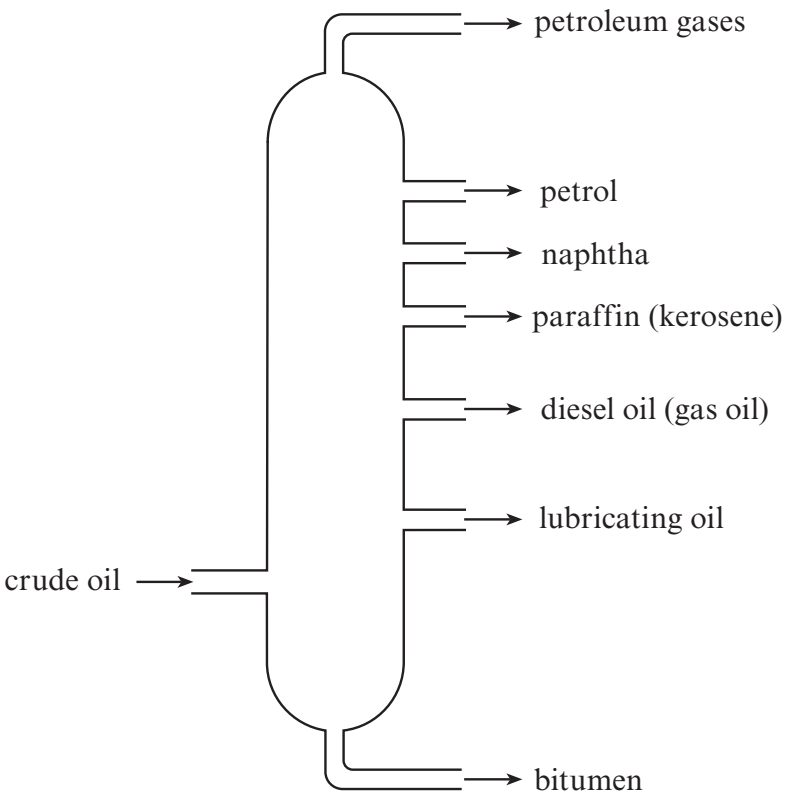
Examiner only

11. The diagram below represents the separation of crude oil into useful fractions in industry.



Write an account of this industrial process. [6 QWC]

Include in your answer

- the name of the separation method,
- what crude oil is,
- a description of how crude oil is separated.

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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: