Surname	Centre Number	Candidate Number
Other Names		0

wjec cbac

GCSE

3430U20-1

S19-3430U20-1

WEDNESDAY, 12 JUNE 2019 – MORNING

SCIENCE (Double Award)

Unit 2: CHEMISTRY 1
FOUNDATION TIER

1 hour 15 minutes

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

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ADDITIONAL MATERIALS

In addition to this examination 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. 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. If you run out of space, use the additional page 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.

Question **6** is a quality of extended response (QER) question where your writing skills will be assessed.

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

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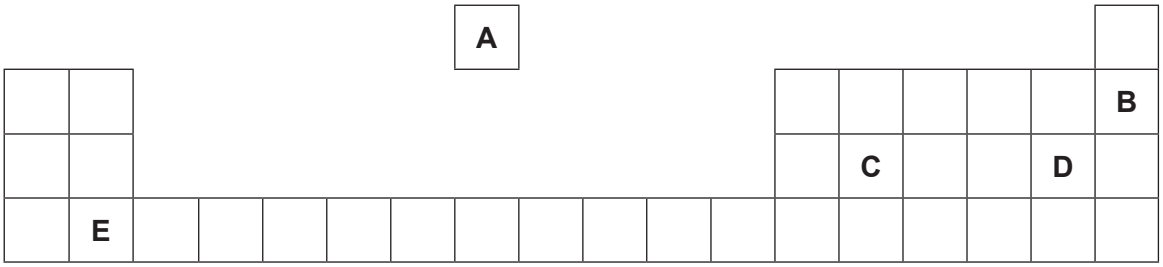
Answer **all** *questions.*

1. Elements **A**, **B**, **C**, **D** and **E** are shown in the Periodic Table.

These letters are **not** the chemical symbols for the elements.



Give the **letter** of the element which fits each description below. [5]

	Letter
is in Group 2	.....
makes a 'pop' noise with a lit splint	.....
has both metal and non-metal properties	.....
reacts with lithium to make lithium chloride	.....
is unreactive	.....

5

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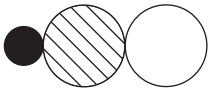
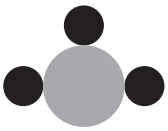
2. Diagrams **A**, **B**, **C** and **D** represent hydrogen (H_2), sulfur dioxide (SO_2), hypochlorous acid (HClO) and phosphine (PH_3) but **not in that order**.

A



B



C

D

(a) (i) Give the **letter** of the diagram that represents an element. Give a reason for your answer. [2]

Letter .....

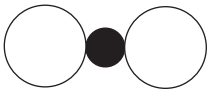
Reason .....

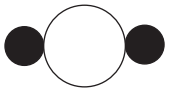
.....

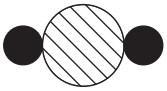
(ii) Give the **letter** of the diagram that represents SO_2. [1]

.....

(iii) Use diagrams **A**, **B**, **C** and **D** above to work out which of the following diagrams represents water (H_2O). **Circle** the correct diagram. [1]







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(b) (i) Calculate the relative molecular mass (M_r) of hypochlorous acid, HClO. [1]

A_r(H) = 1 A_r(O) = 16 A_r(Cl) = 35.5

M_r = ...

(ii) The relative molecular mass (M_r) of sulfur dioxide is 64.

Calculate the percentage by mass of sulfur in sulfur dioxide, SO_2. [2]

A_r(S) = 32

Percentage = ... %

(c) Phosphine (PH_3) is made when phosphorus and hydrogen react.

Put a tick (✓) in the box next to the correctly balanced symbol equation for this reaction. [1]

$2P + 3H_2 \longrightarrow PH_3$ ☐

$2P + 3H_2 \longrightarrow 2PH_3$ ☐

$2P + 3H_2 \longrightarrow 3PH_3$ ☐

$2P + 3H_2 \longrightarrow 4PH_3$ ☐

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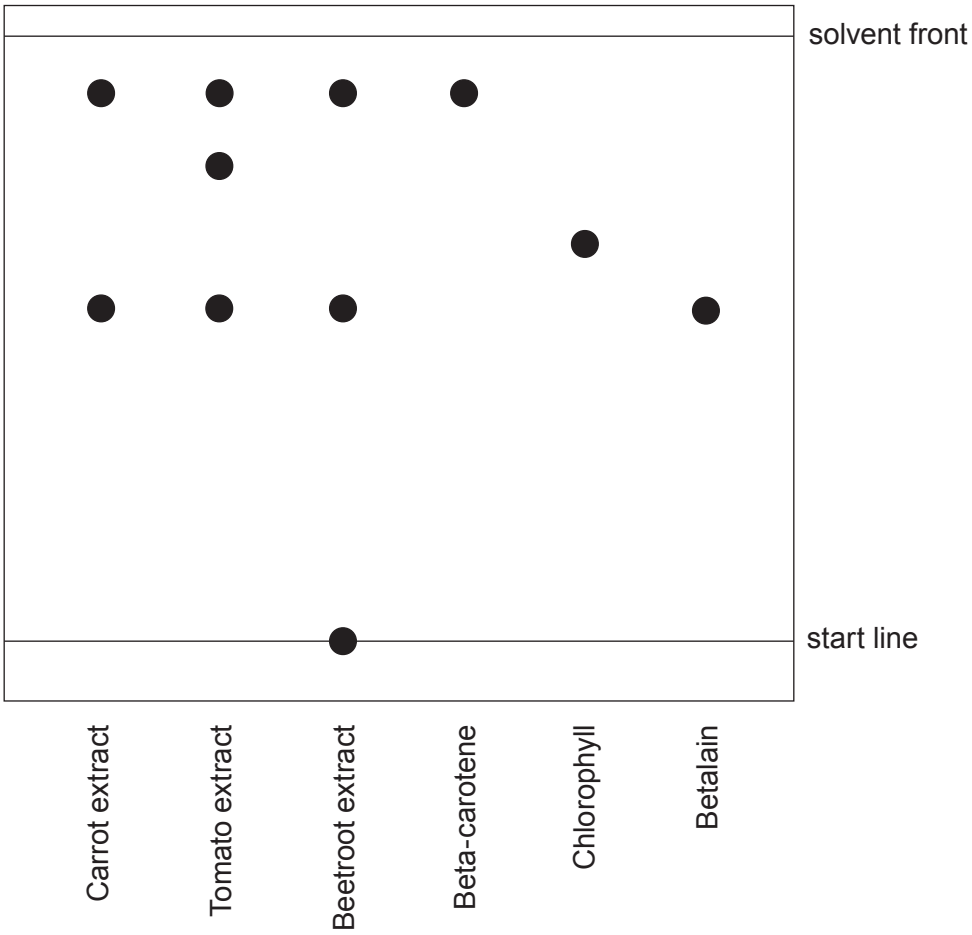
3. A student investigates the pigments found in some fruit and vegetables.

She obtains some coloured extracts from carrots, tomatoes and beetroot.

She places a spot of each extract on chromatography paper, along with spots of the three pigments beta-carotene, chlorophyll and betalain.

The diagram shows the chromatogram at the end of the experiment.



(a) Give the names of **all** the substances which are **not** mixtures. Give a reason for your choice. [1]

Substances

.....

Reason

.....

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(b) Put a tick (✓) in the boxes next to the **two** conclusions that can be drawn from the chromatogram. [2]

chlorophyll is not present in carrot, tomato or beetroot extracts ☐

beta-carotene is present in carrot extract but not present in tomato extract ☐

both beta-carotene and betalain are present in beetroot extract ☐

betalain is present in tomato extract but not present in carrot extract ☐

both carrot and beetroot extracts contain a pigment other than beta-carotene, chlorophyll and betalain ☐

(c) One of the pigments present in the carrot extract has travelled 4.4 cm above the start line.

The solvent front has travelled 8.0 cm. Calculate the R_f value of the pigment using the following equation. [2]

$$R_f = \frac{\text{distance travelled by pigment}}{\text{distance travelled by solvent front}}$$

R_f = ...

(d) Give the reason why there is a spot remaining on the start line in the chromatogram for beetroot. [1]

.....

.....

6

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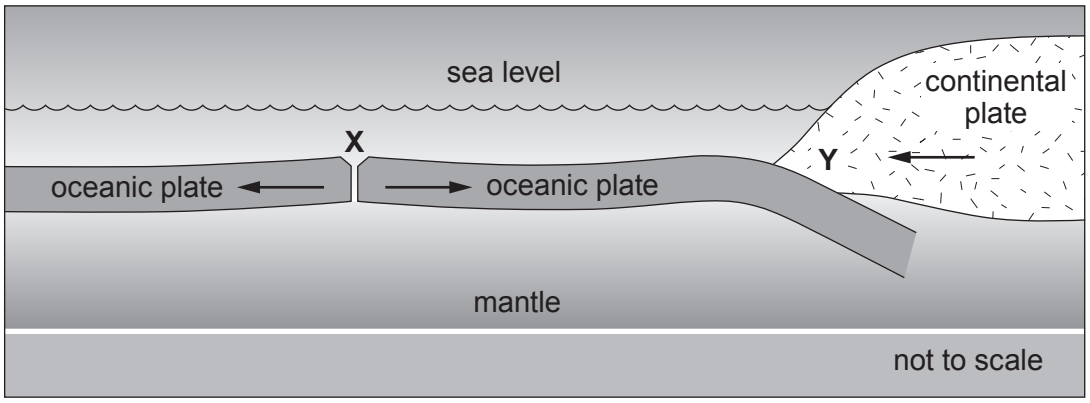
4. The Earth's crust is broken up into tectonic plates.

The diagram shows two plate boundaries **X** and **Y**.



(a) Describe what happens as the plates move apart at plate boundary **X**. [2]

.....

.....

.....

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(b) The two types of plate have different densities as shown in the table.

Type of plate	Density (g/cm^3)
continental	4.7
oceanic	5.0

At boundary **Y** the oceanic plate is pushed **underneath** the continental plate.

(i) State why the oceanic plate is pushed underneath the continental plate. [1]

.....

(ii) State what happens to the oceanic plate when it goes underneath the continental plate. [1]

.....

(iii) Underline the name of the type of plate boundary seen at **Y**. [1]

destructive **constructive** **conservative**

(c) Using satellite imaging, scientists discovered that one oceanic plate had moved 537 cm over 600 years. Calculate the mean rate of movement of the plate over this time. [2]

$$\text{rate} = \frac{\text{distance}}{\text{time}}$$

Rate = ... cm/year

7

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5. Planet **J** is similar in size to the Earth. However, the temperature on planet **J** is about 470 °C and the clouds in its atmosphere are made of sulfuric acid.

A group of students investigated the properties of some metals. Their aim was to see if they could find a metal suitable for designing a spacecraft to explore planet **J**. Their findings are shown below.

Zinc – fizzes quite vigorously with sulfuric acid, has a melting point of 420 °C and a density of 7.1 g / cm^3	Copper – has a melting point of 1083 °C, does not react with sulfuric acid and has a density of 8.9 g / cm^3
Sodium – has a density of 1.0 g / cm^3, reacts explosively with sulfuric acid and has a melting point of 98 °C	Magnesium – has a density of 1.7 g / cm^3, a melting point of 650 °C and it fizzes vigorously with sulfuric acid
Titanium – does not react with sulfuric acid, has a melting point of 1675 °C and a density of 4.5 g / cm^3	Lead – has a melting point of 328 °C, a density of 11.3 g / cm^3 and does not react with sulfuric acid

The spacecraft needs to withstand the conditions on the surface of planet **J**. The mass of the spacecraft also needs to be as low as possible in order for it to have enough energy to escape the Earth's gravity.

(a) Which **one** of these statements best describes why magnesium is an **unsuitable** metal for the spacecraft? Put a tick (✓) in the box next to the correct answer. [1]

its density is 1.7 g / cm^3 ☐

its melting point is 650 °C ☐

it fizzes vigorously with sulfuric acid ☐

it is malleable ☐

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(b) Small amounts of lead are sometimes used in electrical circuits.

Which **one** of these statements best describes why lead would **not** be suitable for use in the electrical circuits of the spacecraft? Put a tick (✓) in the box next to the correct answer. [1]

it does not react with sulfuric acid ☐

it is ductile ☐

it would melt when it lands on planet **J** ☐

its density is 11.3 g / cm^3 ☐

(c) The students decided that titanium is the most suitable metal from which to build the spacecraft.

Put a tick (✓) in the boxes next to the **two** statements that best describe the reasons for their choice. [2]

it does not react with sulfuric acid ☐

it is expensive ☐

it is a good conductor of heat ☐

it is non-magnetic ☐

it has a melting point much higher than the temperature on planet **J** ☐

it is shiny so will reflect the sun's rays ☐

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(d) Sodium reacts explosively with sulfuric acid. Sodium sulfate and hydrogen are produced. Complete and balance the equation for this reaction. [2]

☐ Na + H_2SO_4 ⟶ ..... + H_2

6

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6. Several areas of the UK add fluoride to drinking water.

State the benefit of fluoridation and discuss the reasons why some people are opposed to it.
[6 QER]

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6

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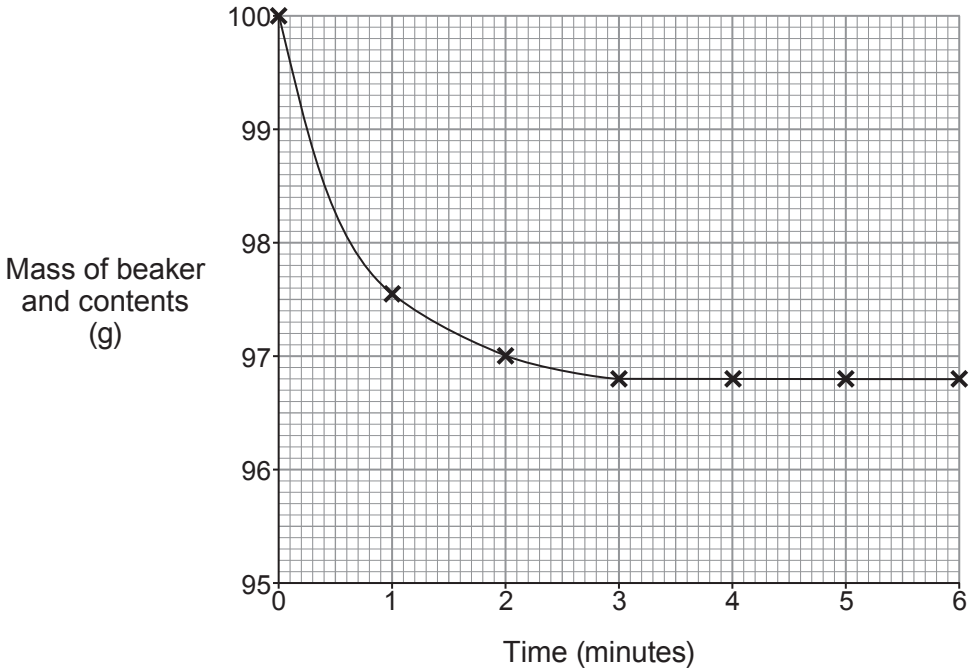
7. Powdered calcium carbonate was added to an excess of dilute hydrochloric acid in a beaker.

The mass of the beaker and its contents was recorded every minute for 6 minutes.

The graph shows the results.



The equation for the reaction is

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$$

(a) Describe how the mass of the beaker and its contents changes over the first minute. Give the reason for this change. [2]

.....

.....

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(b) (i) Use the graph to determine the time taken for the reaction to finish. [1]

.....

(ii) When is the reaction at its fastest? Tick (✓) the correct box. [1]

from 0 – 0.5 minutes ☐

from 1 – 1.5 minutes ☐

from 2 – 2.5 minutes ☐

from 3 – 3.5 minutes ☐

(c) Use your graph to calculate the mean rate of the reaction during the **first two minutes**.

Use the following equation. [2]

$$\text{rate} = \frac{\text{decrease in mass of beaker and contents (g)}}{\text{time (minutes)}}$$

Rate = ... g / minute

(d) The experiment was repeated using the same mass of calcium carbonate but as a **lump** instead of a powder.

On the grid opposite, sketch the graph you would expect to obtain from this second experiment. [1]

7

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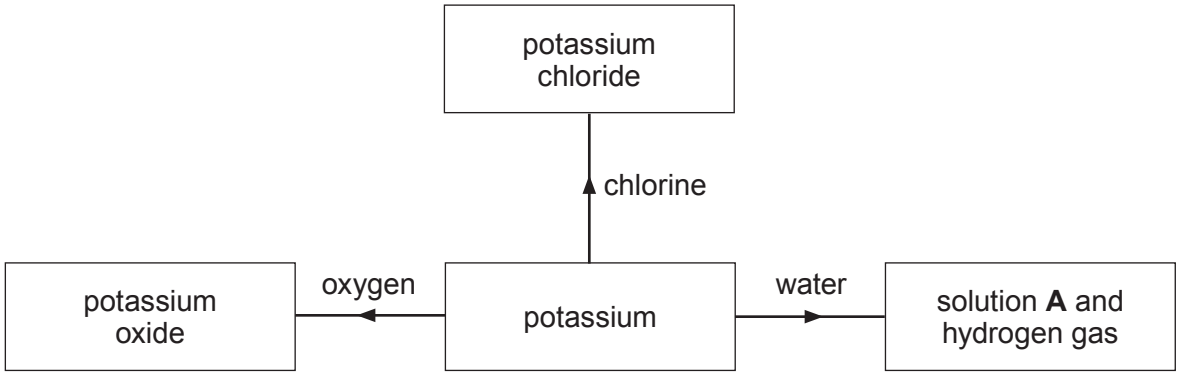
8. *(a)* The table gives information about some elements.

Element	Electronic structure	Group	Period
oxygen	2,6	6	2
chlorine	.....	7	3
.....	2,8,5	5	3
potassium	2,8,8,1	1	.....

Complete the table. [3]

(b) The flow chart shows some of the reactions of potassium.



(i) State **one** observation you would make when potassium reacts with water. [1]

.....

.....

(ii) Apart from wearing gloves and safety goggles, give **one** safety precaution that should be taken when adding potassium to water. [1]

.....

.....

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(iii) Give the formula of solution **A**. [1]

.....

(iv) Suggest a value for the pH of solution **A**. [1]

.....

(v) Name a Group 1 metal that is **more** reactive than potassium. [1]

.....

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9. *(a)* The Earth's early atmosphere around 4 000 million years ago contained mainly carbon dioxide and water vapour produced by volcanoes.

(i) Explain why the large percentage of water vapour in the Earth's atmosphere decreased over geological time. [2]

.....

.....

.....

(ii) Give **two** reasons why the percentage of carbon dioxide in the Earth's atmosphere has decreased over geological time. [2]

.....

.....

.....

(b) During the last 250 years the percentage of carbon dioxide in the Earth's atmosphere has increased from 0.03 % to 0.04 %. This has led to increased global warming. Give **one** reason for this increase and explain why global warming is a cause for concern. [2]

.....

.....

.....

.....

.....

.....

(c) Ammonia present in the Earth's early atmosphere reacted with oxygen to produce nitrogen and water vapour. Complete the balancing of the symbol equation for this reaction. [1]

$$\square\ NH_3 + 3O_2 \longrightarrow \square\ N_2 + 6H_2O$$

7

END OF PAPER

Question number	Additional page, if required. Write the question number(s) 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+}		

THE PERIODIC TABLE

	Group 1	2										3	4	5	6	7	0
							1 H Hydrogen 1										4 He Helium 2
	7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
	23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key