

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

3430UB0-1



S25-3430UB0-1

FRIDAY, 13 JUNE 2025 – MORNING

SCIENCE (Double Award)

**Unit 2 – CHEMISTRY 1
HIGHER TIER**

1 hour 15 minutes

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 or correction fluid.

You may use a pencil for graphs and diagrams only.

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.

Question **10(a)** 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.

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

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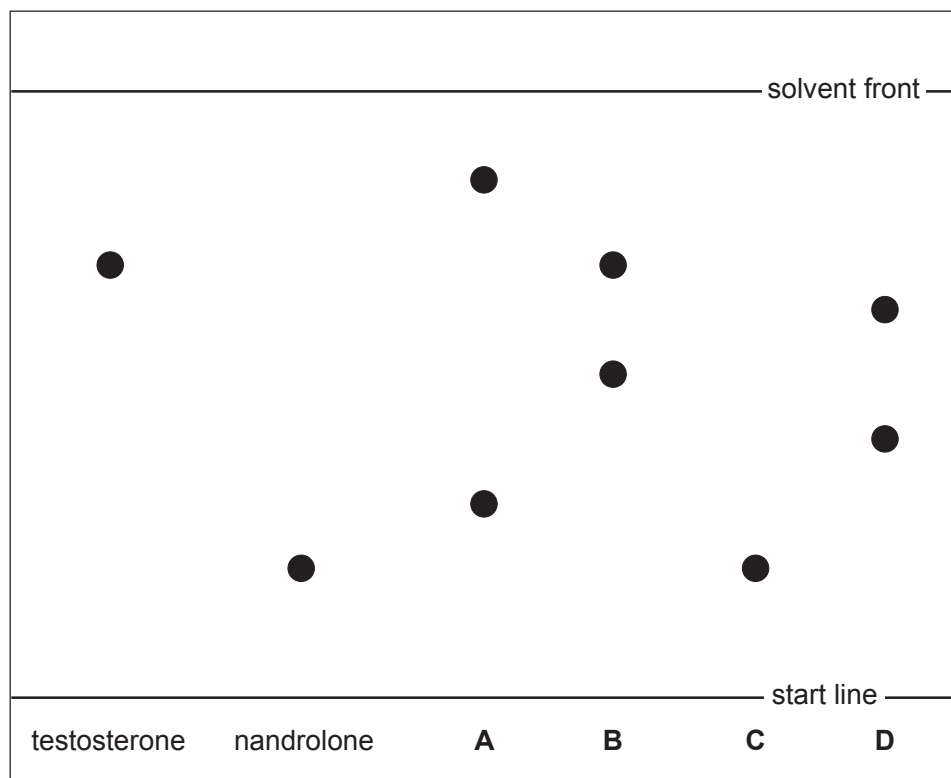
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Answer **all** questions.

1. (a) Testosterone and nandrolone are anabolic steroids, which have been used by some athletes to enhance performance. Chromatography can be used to test if athletes have taken these steroids.

Urine samples from four athletes, **A-D**, were tested to find out whether they have taken testosterone or nandrolone.

The chromatogram shows the results obtained.



- (i) Measure the required distances and find the R_f value of the spot given by testosterone.

[1]

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

$$R_f = \dots\dots\dots$$



(ii) State the conclusions that can be drawn about athletes **A-D**.

[3]

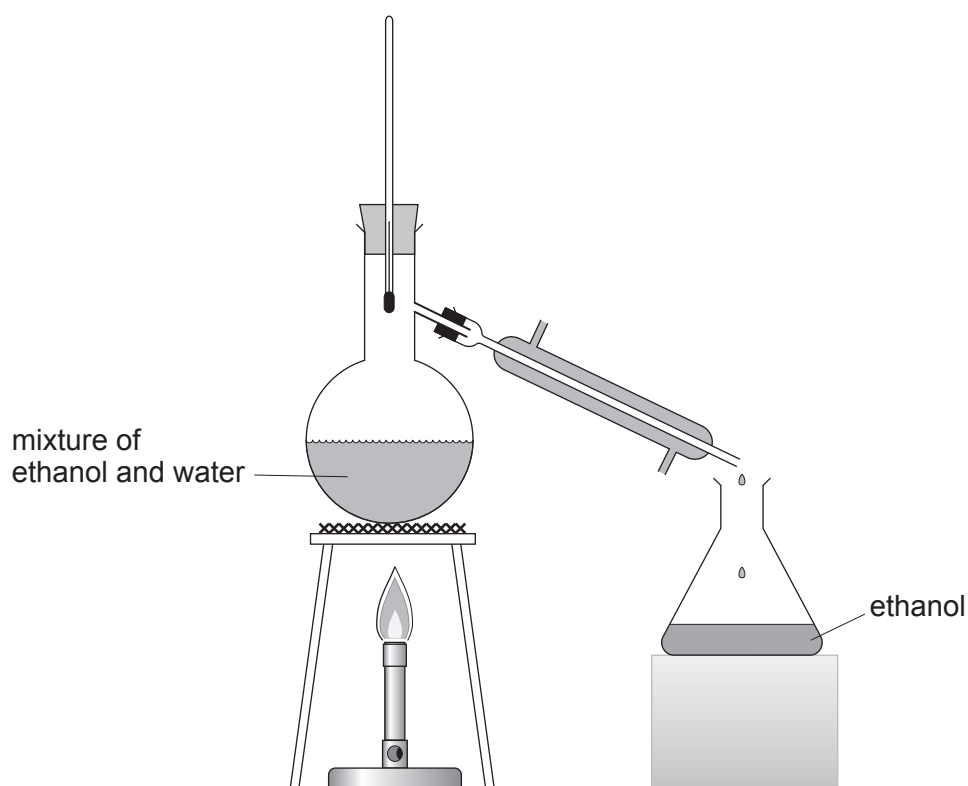
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(b) Ethanol can be separated from water by distillation using the apparatus shown.



Explain why ethanol can be separated from water by distillation.

[2]

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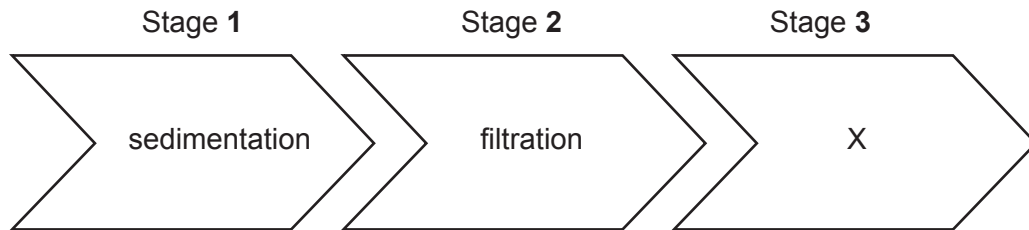
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2. Drinking water needs to be treated and purified before it is safe to drink.

The diagram shows the three main stages in the treatment of water before it enters the mains water system.



- (a) Describe what happens in stage 1.

[1]

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- (b) Stage 3 makes water safe to drink.

Name the substance that is added to water in stage 3 and state why this makes water safe to drink.

[2]

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3. (a) A Year 10 class carried out two tests to identify compounds **X** and **Y**.

Some of their results and conclusions are shown in the table.

Compound	Flame test		Add silver nitrate solution	
	Observation	Symbol of ion	Observation	Symbol of ion
X	yellow flame seen			Cl^-
Y		K^+	yellow precipitate formed	I^-

Both compounds contain only two ions.

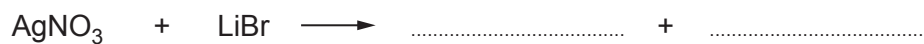
- (i) Use the information given to **complete the table**. [3]

- (ii) Name compound **Y**. [1]

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- (b) Complete the symbol equation for the reaction between silver nitrate solution and lithium bromide solution by writing the formulae for the products. [2]

silver nitrate + lithium bromide $\longrightarrow$ silver bromide + lithium nitrate



4. (a) The nucleus of an atom contains protons and neutrons.

The nucleus of a helium atom is shown.



● proton
○ neutron

The diagram below shows the nuclei of four different atoms, **A-D**.



A



B



C



D

A-D are **not** the chemical symbols for the elements.

- (i) Give the letter, **A-D**, that represents an atom that has an atomic number of 5. [1]

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- (ii) Give the letter, **A-D**, that represents an atom that has a mass number of 9. [1]

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- (b) In the Periodic Table, fluorine is represented as ${}^{19}_{9}\text{F}$.

Complete the table to show the number of neutrons in a fluorine **atom** and the number of electrons in a fluoride **ion**. [2]

	Fluorine atom, F	Fluoride ion, F ⁻
protons	9	9
electrons	9	
neutrons		10



- (c) Fluorine reacts with iron to produce iron(III) fluoride.

Complete and balance the symbol equation for this reaction.

[2]



6



5. Bouncy balls can be made by reacting warm borax solution and PVA glue. Starch is added as a catalyst.

(a) State why catalysts are added to chemical reactions. Explain how they work. [2]

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- (b) A fixed volume of borax solution and PVA glue was mixed with different masses of starch at 20 °C.

The time taken for the bouncy ball to harden with each mass of starch was recorded and the results are shown in the table.

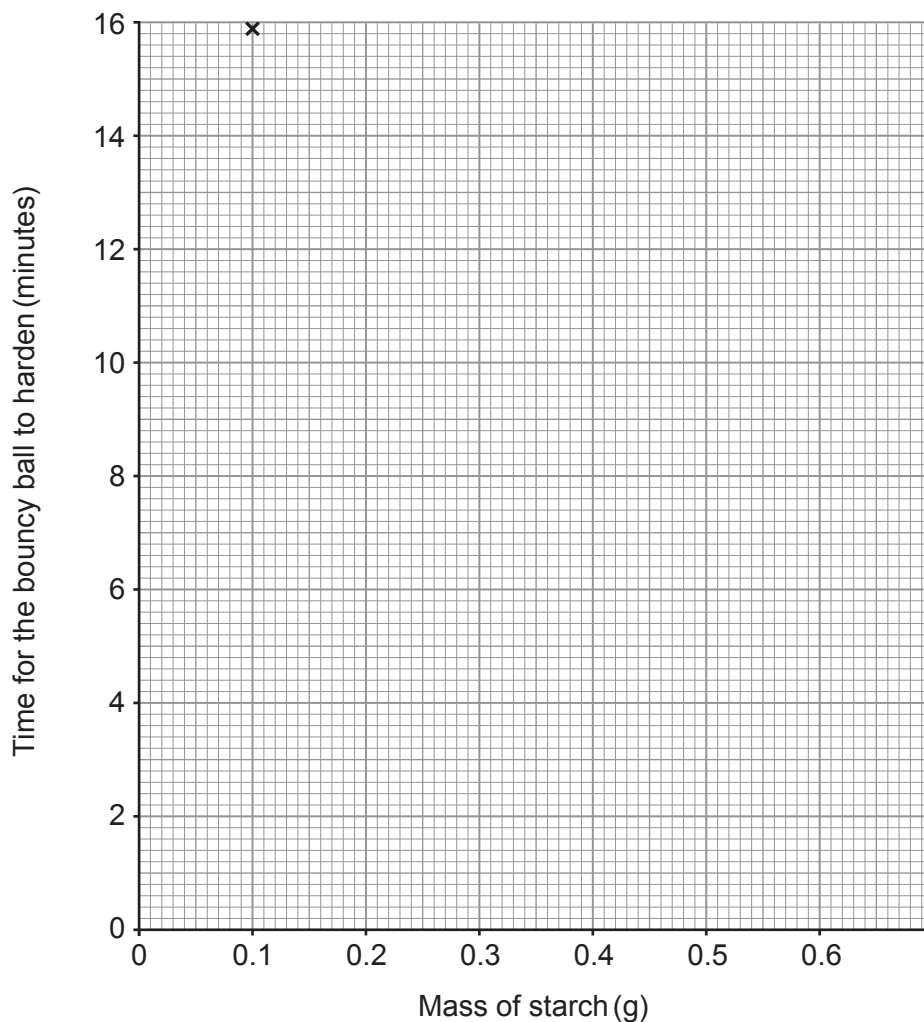
Mass of starch (g)	Time for the bouncy ball to harden (minutes)
0.1	15.9
0.2	9.4
0.3	5.6
0.4	4.0
0.5	3.4
0.6	3.4



- (i) Plot these results on the grid below and draw a suitable line.

The first point has been plotted for you.

[2]



- (ii) Describe the relationship between the mass of starch and the time for the bouncy ball to harden.

[2]

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- (c) Suggest what you would expect to happen if the experiment were repeated at a higher temperature.

[1]

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6. (a) The map shows the distribution of fossil remains of Cynognathus and Glossopteris.

Cynognathus was a **land** reptile up to 3 m long. Glossopteris was a type of fern growing in ancient **forests**.



- (i) Describe what the map shows and state what conclusion Alfred Wegener drew from this observation. [2]

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- (ii) Ammonites lived in the **oceans** around 150 million years ago.



Suggest why ammonite fossils would **not** have been useful for Wegener in proposing his theory. [1]

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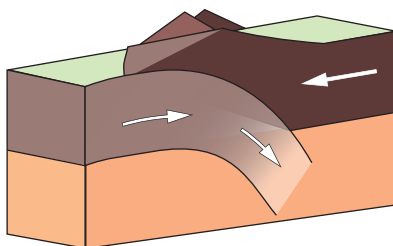
- (iii) Give **one** other piece of evidence that Wegener used to support his theory. [1]

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- (b) A destructive plate boundary is found along the western coast of South America.

The diagram shows a typical destructive plate boundary.



Describe what happens at a destructive plate boundary. [3]

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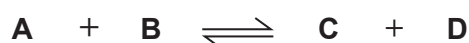
7. In most reactions, the reactants react to make products as shown.



These reactions are irreversible, which means that when the products are formed they can't be converted back to the reactants.

However, other reactions are **reversible**, which means that the products can be converted back to the reactants.

These reactions are represented using a different symbol ($\rightleftharpoons$).



In these reactions, the forward and backward reaction happen constantly.

If the forward and backward reactions are happening at the same rate, the amounts of reactants and products stay the same.

The total amount of reactants (**A** and **B**) and products (**C** and **D**) can be changed by changing the conditions as shown in the table.

Temperature (°C)	Pressure (atm)	Catalyst	Amount of A and B (%)	Amount of C and D (%)
100	50	no	60	40
100	50	yes	60	40
200	50	no	70	30
200	50	yes	70	30
200	80	no	60	40
200	80	yes	60	40



- (a) Use the information in the table. Tick (✓) the **three** statements that are true for this reversible reaction. [3]

adding a catalyst does not affect the amount of reactants or products

☐

adding a catalyst increases the amount of products

☐

adding a catalyst increases the amount of reactants

☐

increasing the pressure increases the amount of products

☐

increasing the pressure increases the amount of reactants

☐

increasing the temperature increases the amount of products

☐

increasing the temperature increases the amount of reactants

☐

- (b) Use the particle theory to explain why increasing the concentration of a reactant can increase the rate of a reaction. [2]

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5



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8. Use your knowledge of electronic structure to explain why the reactivity of the Group 1 elements increases on going down the group.

[3]

Examiner
only

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3



9. (a) Temporary hardness can be removed from water by boiling.

Suggest why it becomes more expensive to use a kettle over time in a hard water area.

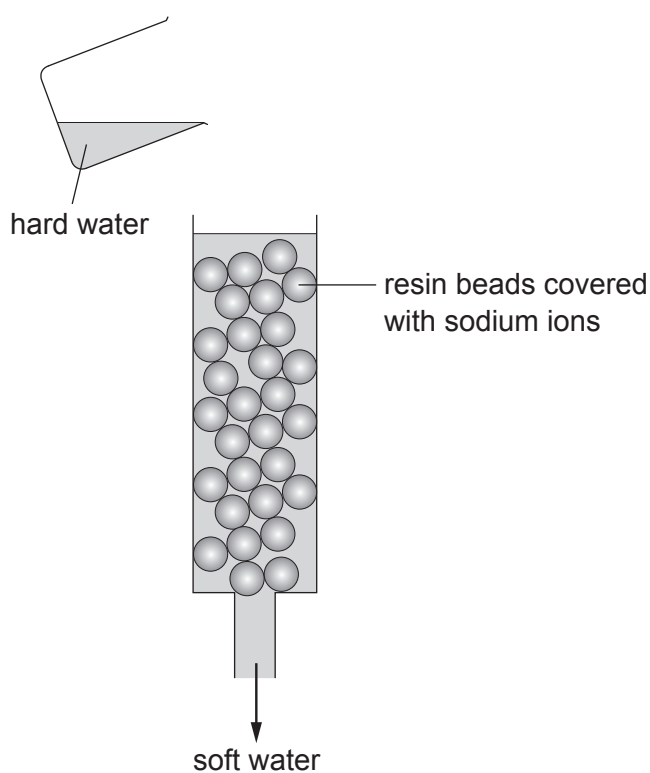
[2]

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- (b) Temporary and permanent hardness can be removed from water using the apparatus shown.



- (i) State how permanent hardness is removed by the resin in this apparatus.

[1]

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- (ii) Apart from cost, give **one** drawback of this method.

[1]

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- (c) A sample of permanent hard water contains 0.025 mol of magnesium sulfate.

Use the formula to calculate the mass of magnesium sulfate in the sample. [2]

$$M_r(\text{MgSO}_4) = 120$$

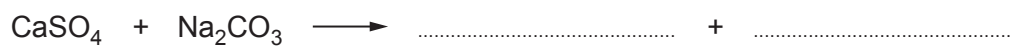
$$\text{number of moles} = \frac{\text{mass}}{M_r}$$

Mass = g

- (d) Permanent hardness in water can be caused by calcium sulfate.

This can be removed by reacting with sodium carbonate in the form of washing soda.

Complete the symbol equation for this reaction. [2]



10. (a) The reactivity of the Group 7 elements changes down the group. It is possible to determine their reactivity by reacting them with halide salts.

The table shows the results obtained when each Group 7 element was placed into solutions of the halides of other elements.

A tick (✓) indicates that a reaction took place and a cross (✗) indicates that no reaction took place.

		Halogen		
		iodine	chlorine	bromine
Halide	sodium iodide		✓	✓
	sodium chloride	✗		✗
	sodium bromide	✗	✓	

Use the results to give the order of reactivity of the Group 7 elements. Explain your answer in terms of the reactions taking place. Include an appropriate equation in your answer. [6 QER]

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- (b) Iron chloride is produced by heating iron strongly in chlorine gas.

A sample of iron chloride was found to contain 3.36 g of iron and 6.39 g of chlorine.

Calculate the simplest formula for this iron chloride. You **must** show your working. [3]

$$A_r(\text{Fe}) = 56$$

$$A_r(\text{Cl}) = 35.5$$

Simplest formula

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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													19 F Fluorine 9	20 Ne Neon 10						
23 Na Sodium 11		24 Mg Magnesium 12													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

Key

A_r	relative atomic mass
Symbol	
Name	
Z	atomic number