

Surname	Centre Number	Candidate Number
Other Names		0



GCSE – NEW

3430U20-1



SCIENCE (Double Award)

**Unit 2: CHEMISTRY 1
FOUNDATION TIER**

FRIDAY, 16 JUNE 2017 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	4	
3.	10	
4.	12	
5.	7	
6.	6	
7.	9	
8.	6	
Total	60	

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 continuation 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.

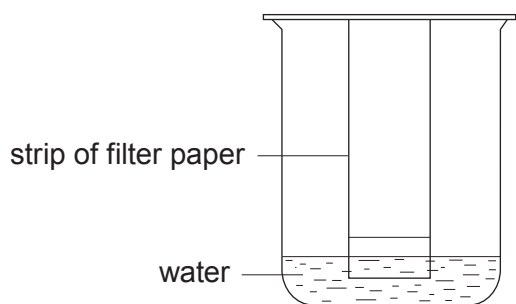
The Periodic Table is printed on the back cover of this paper and the formulae for some common ions on the inside of the back cover.



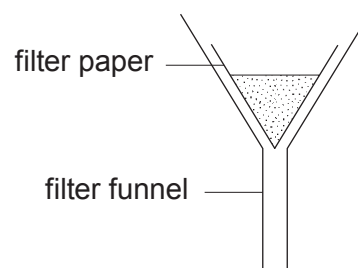
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Answer all questions.

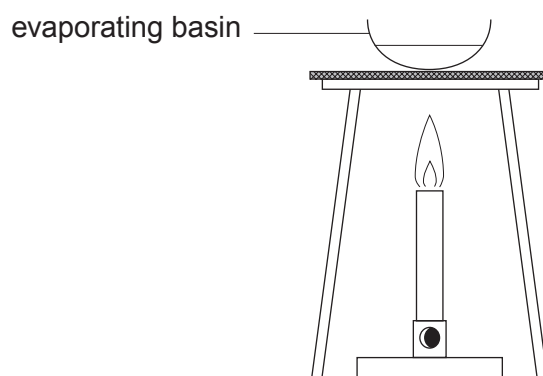
1. (a) The diagrams show three methods, **A**, **B** and **C**, used to separate mixtures.



A



B



C

Give the letter, **A**, **B** or **C**, of the method you would use to:

- (i) remove sand from sea-water,

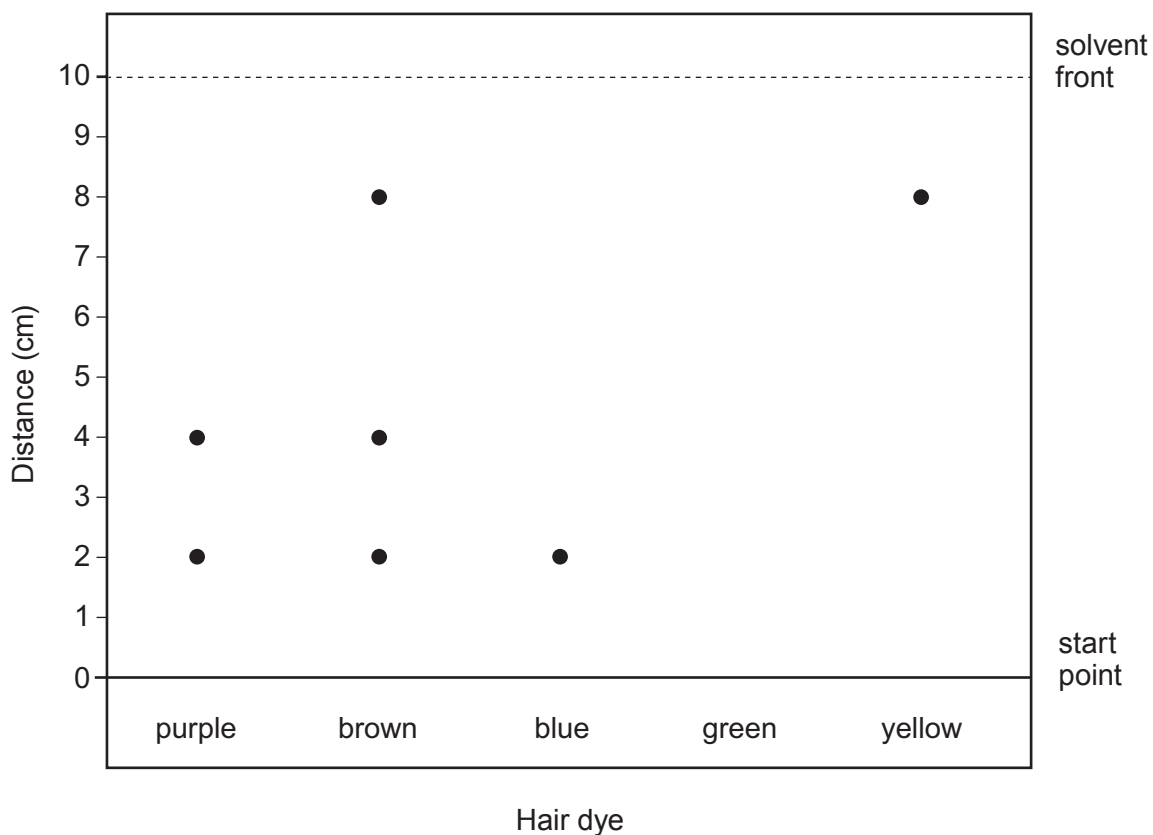
[1]

- (ii) show that sea-water contains salt.

[1]



(b) Paper chromatography was used to show the pigments present in different hair dyes.



- (i) Give the **two** dyes that are mixed to make brown hair dye. [1]

..... and

- (ii) Green hair dye is made by mixing together blue and yellow dyes.
Draw on the diagram the result that you would expect to see for green hair dye. [1]

- (iii) The R_f value of a substance can be used to identify that substance.
 The R_f value of the pigment in red hair dye is 0.4.

Use the equation below to calculate the distance this red hair dye would have moved on the diagram. [2]

$$\text{distance moved} = R_f \times \text{distance moved by solvent}$$

distance moved = cm

6



2. The chemical formula of potassium carbonate is K_2CO_3 .

(a) (i) State how many carbon atoms are present in the formula, K_2CO_3 [1]

(ii) Give the **total** number of atoms shown in the formula, K_2CO_3 [1]

(b) Calculate the percentage by mass of carbon in potassium carbonate, K_2CO_3 . [2]

percentage by mass = %

4



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3. (a) Most of the tap water in Wales comes from mountain reservoirs. The water from these reservoirs is never pure.

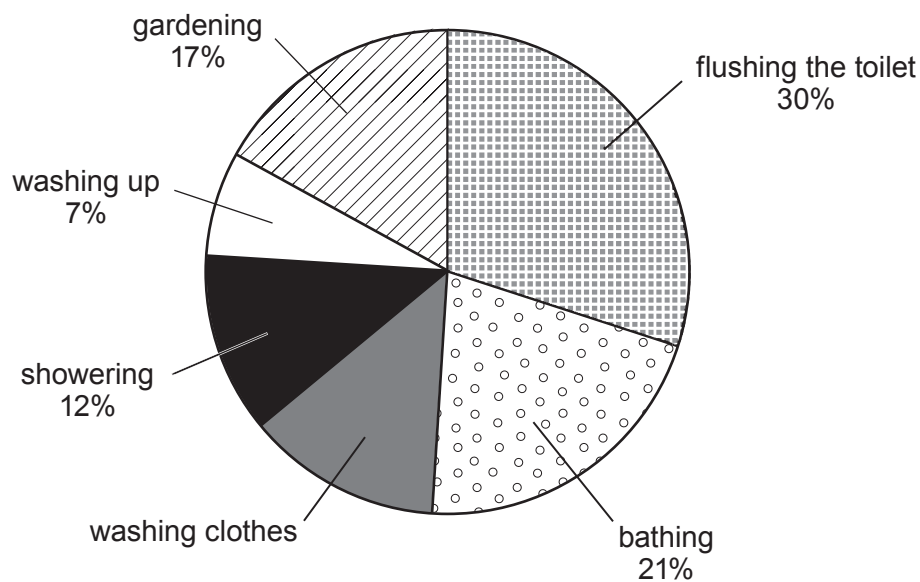
- (i) Information about some of the stages used in the treatment of tap water is shown.

Draw a line to connect each stage to the correct description. One has already been completed. [2]

Stage	Description
filtration	large insoluble particles are allowed to settle out as sludge
screening	screens are used to remove objects such as leaves, sticks and litter
chlorination	harmful bacteria are killed to make the water safe to drink
sedimentation	small insoluble particles are removed by passing the water through sand beds



- (ii) The pie chart shows some of the main uses of water in a typical Welsh home.



Use the pie chart to answer parts I and II.

- I. Calculate the percentage of water used for washing clothes. [1]

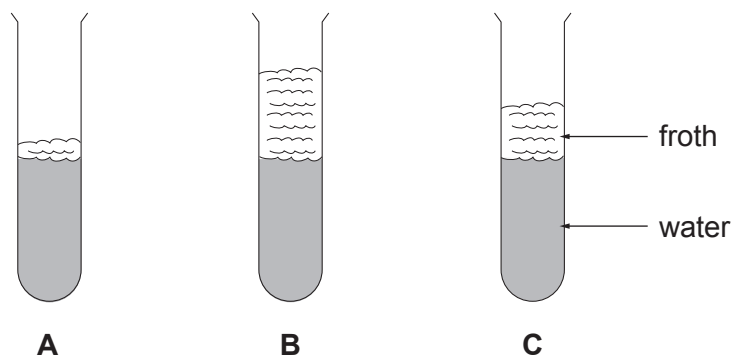
..... %

- II. Give the name of the use that accounts for three times as much water as another use. [1]

.....



- (b) 5 cm³ of three water samples, labelled **A**, **B** and **C**, were mixed with 10 drops of soap solution and shaken. One of the samples was distilled water. The boiling point of each water sample was also measured. The results obtained are shown.



Water sample	Boiling point (°C)
A	102
B	100
C	101

- (i) Place the water samples, **A**, **B** and **C**, in order of hardness. [1]

hardest

.....

softest

- (ii) Give the letter of the sample that is distilled water. Give **two** reasons for your choice. [2]

Sample

Reasons

1.

.....

2.

.....



- (iii) The volume of each water sample and soap solution was kept the same for each test. State which other variable must also be controlled before measuring the froth height. Describe how you would control this. [2]

.....

.....

.....

- (iv) Hardness in water can be caused by dissolved calcium fluoride. Give the chemical formula for calcium fluoride. [1]

.....

10

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09

4. When magnesium ribbon is added to excess hydrochloric acid, HCl, magnesium chloride and hydrogen gas are produced.

magnesium + hydrochloric acid $\longrightarrow$ magnesium chloride + hydrogen

- (a) Suggest **two** things that you would expect to **see** during this reaction. [2]

1.

2.

- (b) Write the **symbol** equation for the reaction that takes place. [3]

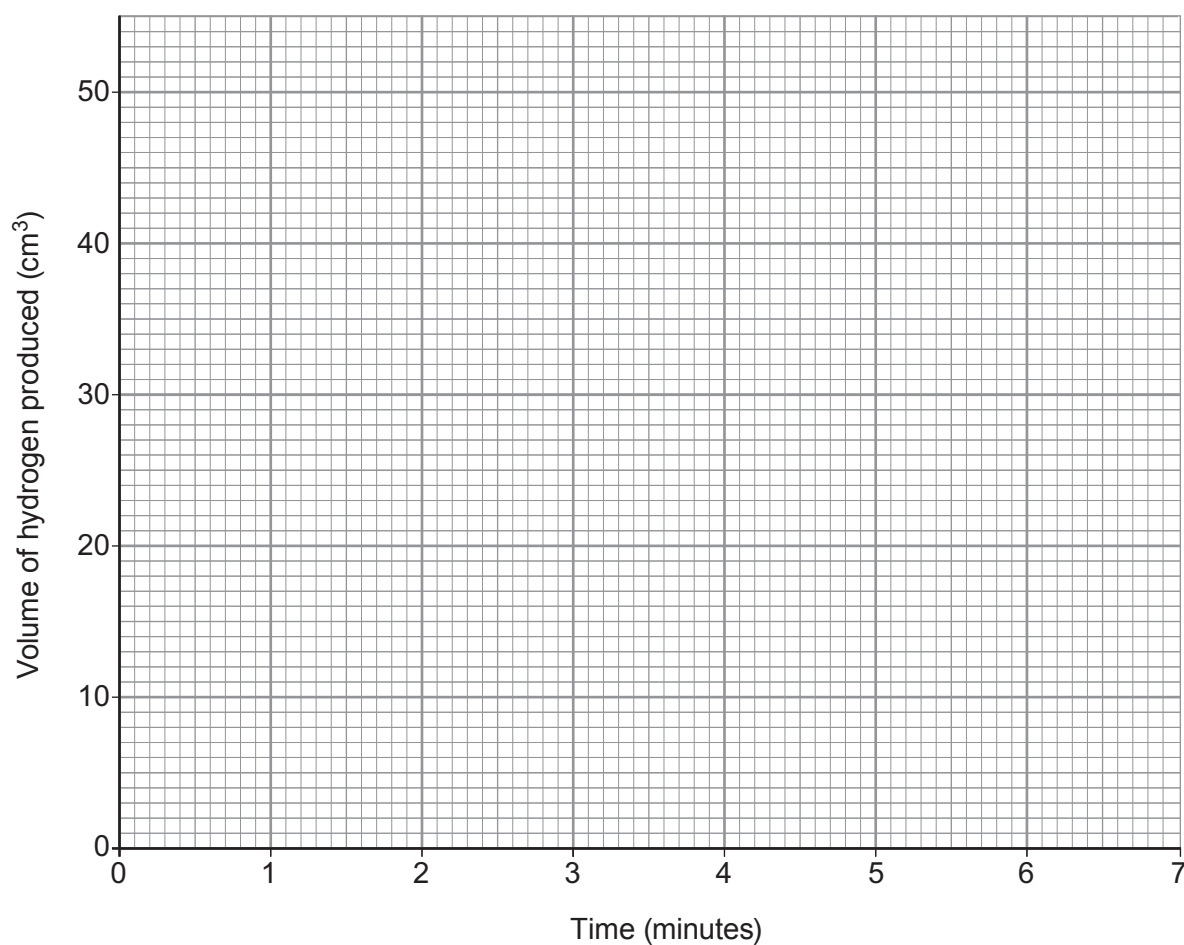
..... + $\longrightarrow$ +

- (c) Amelia recorded the volume of gas produced for 7 minutes for this reaction. She carried out the reaction at room temperature, 20 °C. The results she collected are shown in the table.

Time (minutes)	Volume of hydrogen produced (cm ³)
0	0
1	15
2	28
3	32
4	45
5	49
6	50
7	50

- (i) Plot a graph of her results **on the grid opposite**. Draw a suitable line and label it **A**. [3]





(ii) Use the graph to find:

- I. the volume of gas produced in 90 seconds, [1]
- II. the time taken for the reaction to end. [1]

(iii) **On the same grid**, sketch the graph that would be obtained if Amelia repeated the same experiment at 40 °C. Label it **B**. [2]



5. The following information is about the Group 7 elements of the Periodic Table, called the halogens.

Group 7 – the halogens

Group 7 – the halogens																		He
H																		He
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Ti	Pb	Bi	Po	At	Rn	
Fr	Ra																	

The Group 7 elements all exist as diatomic molecules, meaning their atoms go around in pairs. Fluorine is found at the top of the group, astatine is at the bottom of the group.

Chlorine, atomic number 17, is a pale green gas at room temperature (20 °C). It has a melting point of –101 °C. Bromine, atomic number 35, is a red-brown liquid at room temperature. It has a melting point of –7 °C. Iodine, atomic number 53, is a grey solid at room temperature. It has a melting point of 114 °C.

Chlorine is used to make bleaches, to treat public drinking water and to sterilise public swimming pools. Bromine is used by gardeners in pesticides, to prevent insects from harming plants. Iodine solution is used as an antiseptic on wounds and on patients before being operated on.

- (a) Which **one** of these statements best describes the trend in the melting points of the Group 7 elements as you go down the group? Tick (✓) the correct answer. [1]

The melting point increases

☐

The melting point decreases

☐

The melting point increases and then decreases

☐

There is no trend in the melting point

☐

- (b) What is the correct formula for chlorine gas? Tick (✓) the correct answer. [1]

CL2

☐

Cl₂

☐

cl₂

☐

2Cl

☐


- (c) Predict a value for the boiling point of chlorine and explain your answer. [2]

Boiling point of chlorine °C

Explanation

- (d) Give the property that the Group 7 elements have that means they can be used as described in the text. [1]

- (e) Decide whether the following statements about astatine are true or false. [2]

Astatine ...	True / False
... is a solid at room temperature	
... conducts electricity	
... has a melting point higher than 114 °C	
... is coloured	

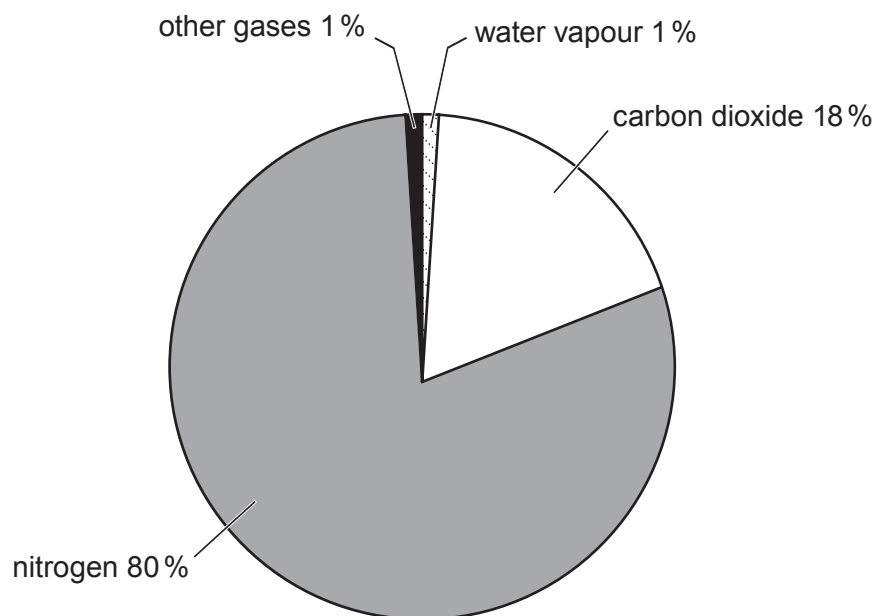


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7. (a) The Earth's atmosphere has evolved over millions of years to its present composition. The pie chart shows the composition of the atmosphere at one stage of its evolution.



- (i) Describe the **main** differences in the composition of the atmosphere shown in the pie chart and that present on the Earth today. [3]

.....

.....

.....

.....

- (ii) **Complete the table** to describe simple chemical tests that can be used in the laboratory to identify hydrogen and carbon dioxide. [2]

Gas	Test carried out	Expected observation
hydrogen		
carbon dioxide		



- (b) During the last 250 years the level of carbon dioxide in the atmosphere has increased. Most scientists believe that the increase in the level of carbon dioxide in the atmosphere has resulted in global warming.

The table below shows some data about the atmosphere between 1750 and 2000.

Year	Concentration of carbon dioxide in the atmosphere (parts per million)	Average global temperature (°C)
1750	278	13.3
1800	282	13.4
1850	288	13.5
1900	297	13.7
1950	310	14.0
2000	368	14.6

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

- (i) Describe the trend in average global temperature between 1750 and 2000. [2]

.....

.....

.....

- (ii) Calculate the percentage increase in the concentration of carbon dioxide in the atmosphere from 1750 to 1850. [2]

percentage increase = %



8. (a) The following table gives information about some atoms, **A-E**.

A-E are not the chemical symbols of the elements.

Atom	Number of protons	Number of neutrons
A	12	12
B	10	10
C	6	8
D	11	12
E	6	6

- (i) Give the letter, **A-E**, of the atom with a mass number of 12. [1]

.....

- (ii) Give the letter, **A-E**, of the atom found in Group 1 of the Periodic Table. [1]

.....

- (iii) Choose the letters, **A-E**, of the atoms that are isotopes. Give the reason for your choice. [2]

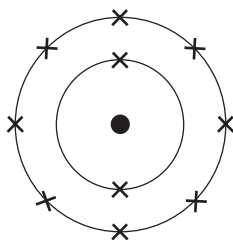
Letters and

Reason

.....



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



- (i) Using $\times$ to represent an electron, draw a diagram to show the electronic structure of the element which lies directly **below** this one in the Periodic Table. [1]

- (ii) Explain why both of these elements are chemically unreactive. [1]

.....

.....

END OF PAPER



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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

1

2

Group

3

4

5

6

7

0

¹ H Hydrogen 1

⁷ Li Lithium 3	⁹ Be Beryllium 4
²³ Na Sodium 11	²⁴ Mg Magnesium 12
³⁹ K Potassium 19	⁴⁰ Ca Calcium 20
⁸⁶ Rb Rubidium 37	⁸⁸ Sr Strontium 38
¹³³ Cs Caesium 55	¹³⁷ Ba Barium 56
²²³ Fr Francium 87	²²⁶ Ra Radium 88
	²²⁷ Ac Actinium 89

¹¹ B Boron 5	¹² C Carbon 6	¹⁴ N Nitrogen 7	¹⁶ O Oxygen 8	¹⁹ F Fluorine 9	²⁰ Ne Neon 10
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
⁷⁰ Ga Gallium 31	⁷³ Ge Germanium 32	⁷⁵ As Arsenic 33	⁷⁹ Se Selenium 34	⁸⁰ Br Bromine 35	⁸⁴ Kr Krypton 36
¹¹⁵ In Indium 49	¹¹⁹ Sn Tin 50	¹²² Sb Antimony 51	¹²⁸ Te Tellurium 52	¹²⁷ I Iodine 53	¹³¹ Xe Xenon 54
²⁰⁴ Tl Thallium 81	²⁰⁷ Pb Lead 82	²⁰⁹ Bi Bismuth 83	²¹⁰ Po Polonium 84	²¹⁰ At Astatine 85	²²² Rn Radon 86

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
⁵² Cr Chromium 24	⁵¹ V Vanadium 23	⁴⁸ Ti Titanium 22	⁴⁵ Sc Scandium 21	⁹⁹ Tc Technetium 43	¹⁰⁶ Pd Palladium 46
⁹⁶ Mo Molybdenum 42	⁹³ Nb Niobium 41	⁹¹ Zr Zirconium 40	⁸⁹ Y Yttrium 39	¹⁰⁸ Ag Silver 47	¹¹² Cd Cadmium 48
¹⁸⁴ W Tungsten 74	¹⁸¹ Ta Tantalum 73	¹⁷⁹ Hf Hafnium 72	¹³⁹ La Lanthanum 57	¹⁹⁵ Pt Platinum 78	²⁰¹ Hg Mercury 80
¹⁹² Ir Iridium 77	¹⁹⁰ Os Osmium 76	¹⁰³ Rh Rhodium 45	¹⁰¹ Ru Ruthenium 44	¹⁹⁷ Au Gold 79	²⁰⁴ Pb Lead 82
¹⁸⁶ Re Rhenium 75	¹⁸⁸ Os Osmium 76	¹⁷⁹ Hf Hafnium 72	¹⁷⁹ Hf Hafnium 72	¹⁹⁷ Au Gold 79	²⁰⁴ Pb Lead 82

Key

^{A_r} Symbol Name Z

relative atomic mass

atomic number