

Surname	Centre Number	Candidate Number
Other Names		0



**GCSE**

4472/01

**ADDITIONAL SCIENCE/CHEMISTRY**

**CHEMISTRY 2  
FOUNDATION TIER**

A.M. THURSDAY, 15 May 2014

1 hour

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

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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.

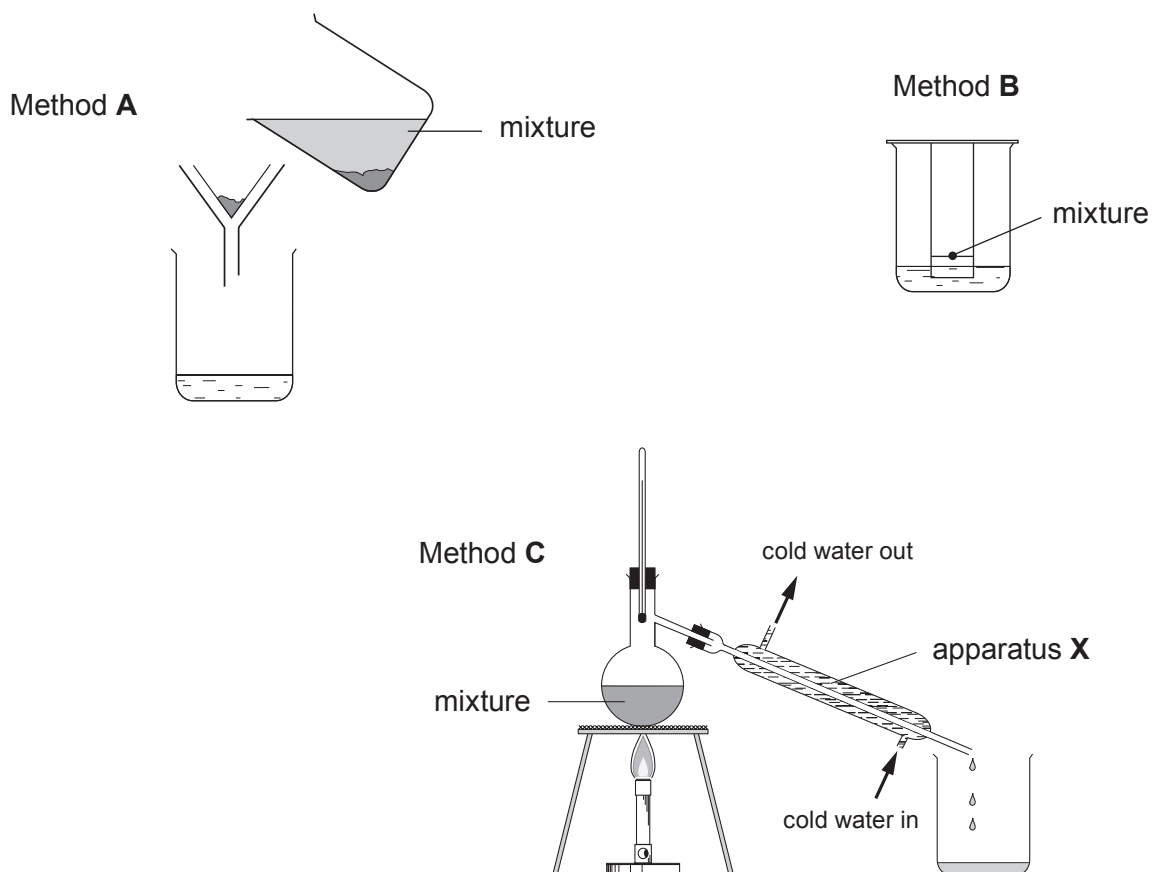
You are reminded of the necessity for good English and orderly presentation in your answers.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **10**.

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.

Answer all questions.

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



- (a) The names of the separation methods and some of the pieces of apparatus used are given in the box below.

beaker	distillation	chromatography
condenser	filter funnel	filtration

Choose the answers to parts (i) and (ii) from the box.

- (i) Name apparatus **X**.

[1]

.....

- (ii) Give the name of method **B**.

[1]

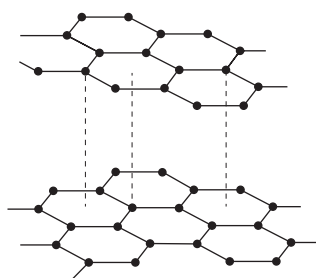
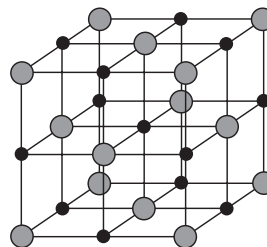
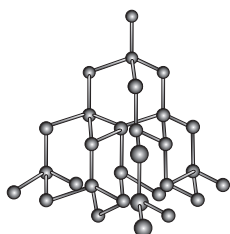
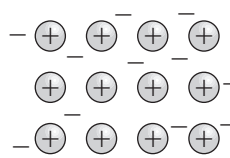
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- (b) Give the **letter** of the method you would use to separate ethanol from water.

[1]

.....

2. The following diagrams, **A**, **B**, **C** and **D**, show the structures of some substances.

**A****B****C****D**

(a) Give the letter of the structure which represents diamond. [1]

.....

(b) Name an element that has the structure **D**. [1]

.....

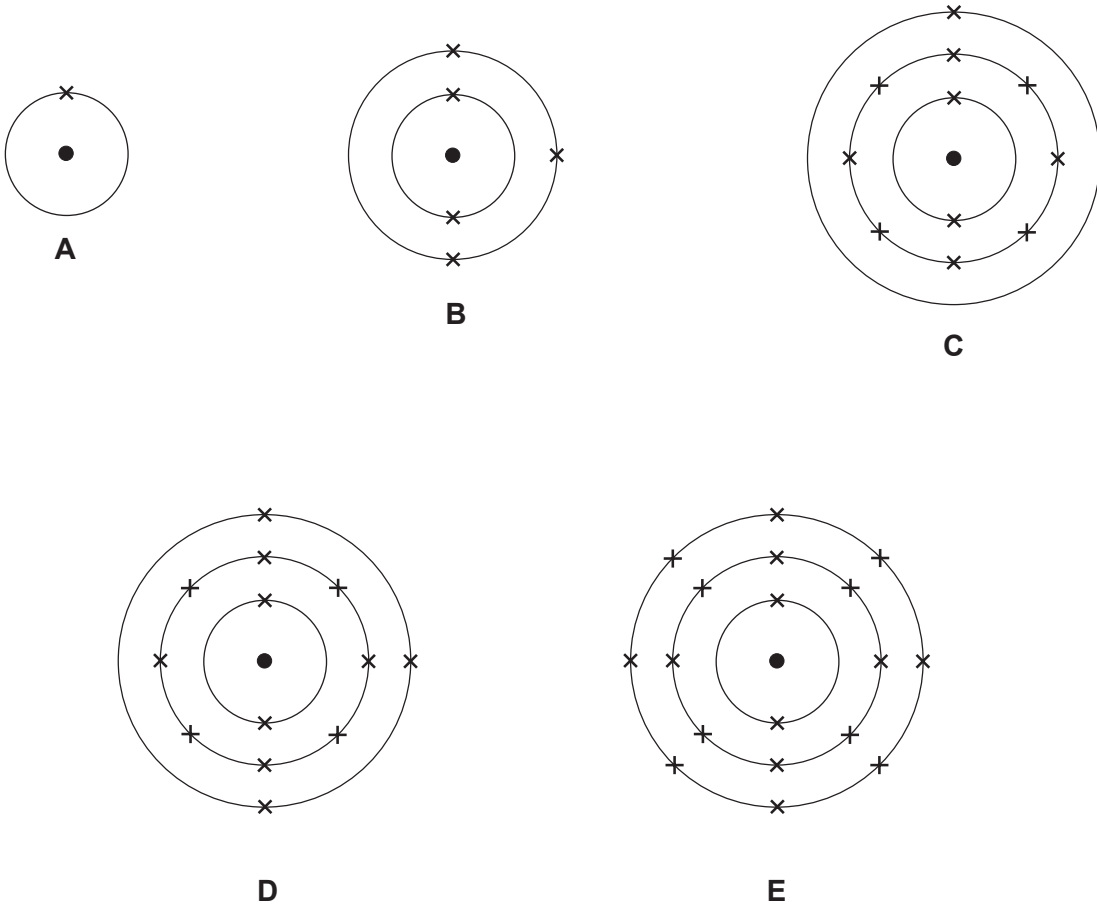
(c) Give the letter of a structure which is able to conduct electricity. [1]

.....

(d) Give the letter of the structure that represents sodium chloride. [1]

.....

3. (a) The following diagrams represent atoms of 5 different elements, **A**, **B**, **C**, **D** and **E**.  
**A**, **B**, **C**, **D** and **E** are not chemical symbols.



- (i) Give the electronic structure of **E**. ..... [1]
- (ii) Which letter represents aluminium? ..... [1]
- (iii) Give the letters of the **two** elements which are found in the same group of the Periodic Table and give a reason for your choice. [2]

.....

.....

- (b) (i) Calculate the relative formula mass ( $M_r$ ) of sodium hydroxide, NaOH. [1]

$$A_r(\text{Na}) = 23 \quad A_r(\text{O}) = 16 \quad A_r(\text{H}) = 1$$

*Relative formula mass* = .....

- (ii) Using your answer to part (i), calculate the percentage by mass of oxygen in sodium hydroxide, NaOH. [2]

*Percentage by mass of oxygen* = ..... %

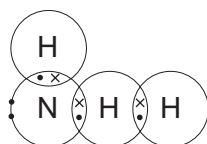
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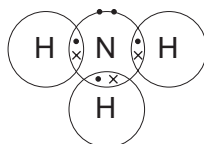
4. (a) (i) Ammonia,  $\text{NH}_3$ , is a compound that contains the elements nitrogen and hydrogen. The electronic structure for each element is given below.

N 2,5                  H 1

State which of the following dot and cross diagrams, **A**, **B** or **C**, represents the bonding in a molecule of ammonia. [1]



**A**



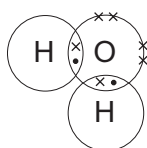
**B**



**C**

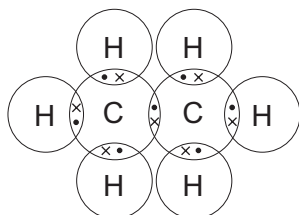
.....

- (ii) Give the **name** of the substance represented by the following dot and cross diagram. [1]



.....

- (b) The dot and cross diagram for a molecule of ethane is given below:

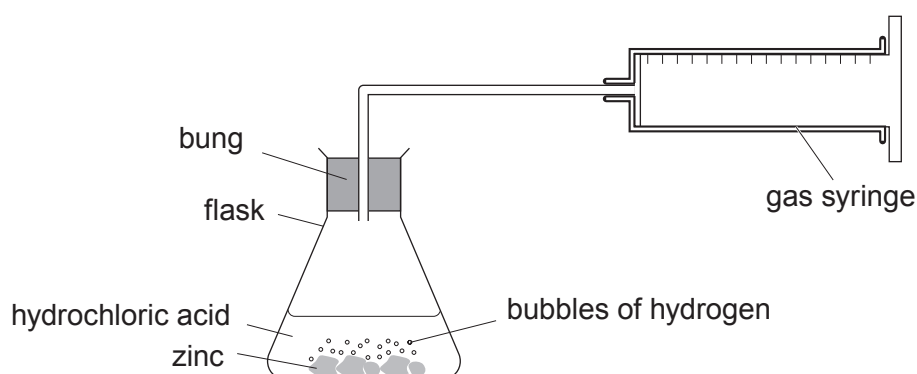


- (i) State the total number of atoms in a molecule of ethane. [1]  
.....
- (ii) State the number of bonds that can be formed by a carbon atom. [1]  
.....
- (iii) Give the molecular formula for ethane. .... [1]

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5. (a) Zinc reacts with dilute hydrochloric acid to produce hydrogen gas.

The diagram below shows apparatus that can be used to investigate the rate of the reaction between zinc and hydrochloric acid. A small amount of copper sulfate is added because it acts as a catalyst for the reaction.



A few pieces of zinc were placed in excess dilute hydrochloric acid and the volume of hydrogen produced was recorded every 10 seconds. The experiment was carried out at room temperature. The results obtained are shown below.

Time (s)	0	10	20	30	40	50	60	70
Volume of hydrogen (cm <sup>3</sup> )	0	8	33	40	45	48	49	49

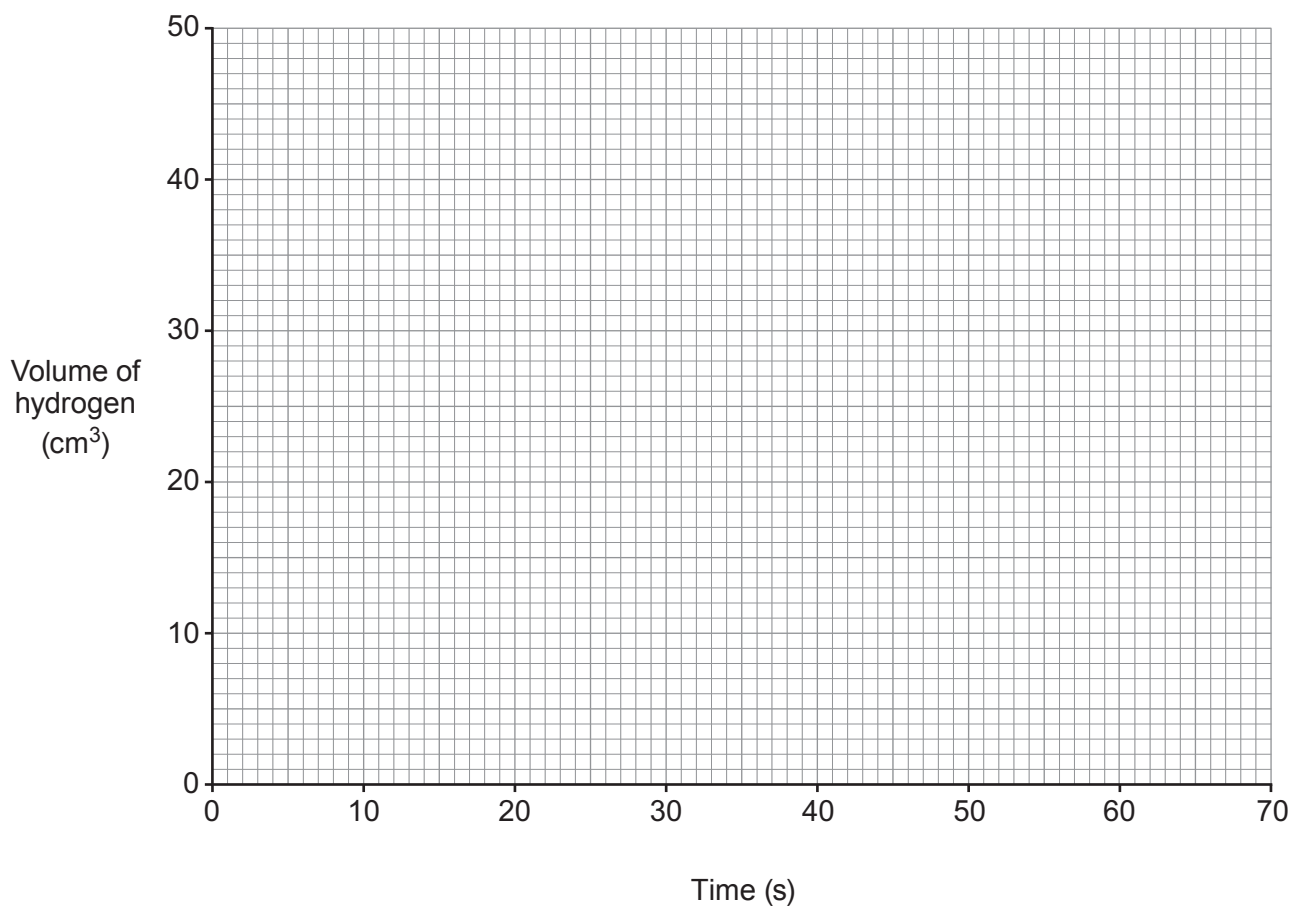
- (i) All the results were measured accurately but the volume recorded after 10 seconds is lower than expected. Suggest a possible reason for this. [1]

.....

.....



- (ii) Plot **all** the results from the table on the grid below and draw a suitable line. [3]



- (iii) Use your graph to give the volume of hydrogen expected after 10 seconds. [1]

..... cm<sup>3</sup>

- (iv) State how the graph shows that the reaction has stopped. [1]

.....  
.....

- (v) Choose statements from the box below to complete the following sentences.

<b>less time</b>	<b>more time</b>	<b>the same time</b>
------------------	------------------	----------------------

**Each statement may be used once, more than once or not at all.**

[2]

Using zinc **powder** instead of the larger pieces of zinc the reaction takes

..... .

When the experiment is repeated without the copper sulfate catalyst the reaction takes .....

- (b) A chemical reaction takes twice as long if the temperature is decreased by  $10^{\circ}\text{C}$ .

At  $30^{\circ}\text{C}$ , milk undergoes a chemical reaction that makes it go sour in 1 day.

Calculate how long it will take milk to go sour at  $10^{\circ}\text{C}$ .

[2]

.....  
.....

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6. (a) Draw a line to link each type of substance to the property that best describes it.

[1]

Examiner  
only**Type of substance**

shape memory polymer

thermoplastic

thermoset

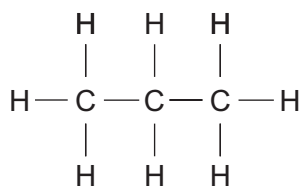
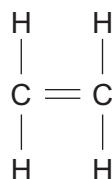
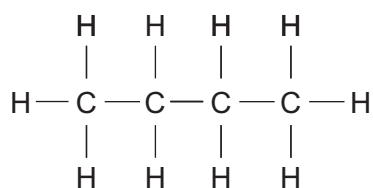
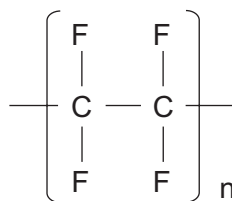
**Property**

does not change when heated

regains original shape  
when heated

softens when heated

(b) The structural formulae of four organic compounds are shown below.

**A****B****C****D**

- (i) Give the chemical name of compound **B**. ..... [1]
- (ii) Give the letter of the compound that is **not** a hydrocarbon and give a reason for your answer. [2]

.....

.....

- (iii) Give the letter of the compound that can undergo polymerisation and give a reason for your answer. [2]

.....

.....

(c) The molecular formula of propene is  $\text{C}_3\text{H}_6$ .

Draw the structural formula of propene.

[1]

7. (a) The following processes are used in the treatment of our water supply.

**sedimentation**

**filtration**

**chlorination**

State the purpose of each process.

[3]

*Sedimentation*

.....  
.....

*Filtration*

.....  
.....

*Chlorination*

.....  
.....

(b) Drinking water can be obtained by desalination.

State what is meant by *desalination* and name a process by which it can be carried out.

[2]

.....  
.....

8. Potassium reacts vigorously with water.

(a) (i) Describe what you would **observe** when potassium reacts with water. [3]

.....

.....

.....

.....

(ii) During a class demonstration the potassium exploded. Suggest what might have caused this to happen. [1]

.....

.....

(b) Complete and balance the symbol equation for the reaction between potassium and water. [2]



9. The table below shows the amount of soap solution required by different samples of water to form a permanent lather. In each case  $25\text{cm}^3$  of the water samples were used and the soap solution was added  $1\text{cm}^3$  at a time.

Sample	Volume of soap solution added ( $\text{cm}^3$ )				Mean
	Test 1	Test 2	Test 3	Test 4	
distilled water	2	2	2	2	2
<b>A</b>	8	8	9	7	8
<b>B</b>	11	18	12	13	
<b>C</b>	15	14	14	13	14
<b>A</b> after boiling	8	7	9	8	8
<b>B</b> after boiling	6	5	6	7	6
<b>C</b> after boiling	2	2	2	2	2

- (a) Two pupils, David and Haf, calculated the mean value for sample **B**. David calculated a value of 13.5 and Haf calculated a value of 12. Show how both values were obtained. State which is the better value to use and give a reason for your choice. [3]

.....

.....

.....

.....

- (b) State which of water samples **A**, **B** and **C** is the **least** hard. [1]

Water sample .....

- (c) State which of water samples **A**, **B** and **C** contains **both** temporary and permanent hardness. Give the reason for your answer. [2]

Water sample .....

Reason .....

.....

- (d) Name an ion which causes hardness in water. [1]

.....





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## FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
Aluminium	$\text{Al}^{3+}$	Bromide	$\text{Br}^-$
Ammonium	$\text{NH}_4^+$	Carbonate	$\text{CO}_3^{2-}$
Barium	$\text{Ba}^{2+}$	Chloride	$\text{Cl}^-$
Calcium	$\text{Ca}^{2+}$	Fluoride	$\text{F}^-$
Copper(II)	$\text{Cu}^{2+}$	Hydroxide	$\text{OH}^-$
Hydrogen	$\text{H}^+$	Iodide	$\text{I}^-$
Iron(II)	$\text{Fe}^{2+}$	Nitrate	$\text{NO}_3^-$
Iron(III)	$\text{Fe}^{3+}$	Oxide	$\text{O}^{2-}$
Lithium	$\text{Li}^+$	Sulfate	$\text{SO}_4^{2-}$
Magnesium	$\text{Mg}^{2+}$		
Nickel	$\text{Ni}^{2+}$		
Potassium	$\text{K}^+$		
Silver	$\text{Ag}^+$		
Sodium	$\text{Na}^+$		
Zinc	$\text{Zn}^{2+}$		

# PERIODIC TABLE OF ELEMENTS

1      2      3      4      5      6      7      0

Group

<div style="border: 1px solid black; display: inline-block; padding: 2px;"> <math>^1_1\text{H}</math> Hydrogen         </div>										$^4_2\text{He}$ Helium		
$^9_4\text{Be}$ Beryllium	$^{19}_9\text{F}$ Fluorine	$^{16}_8\text{O}$ Oxygen	$^{14}_7\text{N}$ Nitrogen	$^{12}_6\text{C}$ Carbon	$^{10}_5\text{B}$ Boron	$^{20}_{10}\text{Ne}$ Neon	$^{19}_9\text{F}$ Fluorine	$^{16}_8\text{O}$ Oxygen	$^{14}_7\text{N}$ Nitrogen	$^{12}_6\text{C}$ Carbon	$^{10}_5\text{B}$ Boron	$^{20}_{10}\text{Ne}$ Neon
$^{23}_{11}\text{Na}$ Sodium	$^{35}_{17}\text{Cl}$ Chlorine	$^{32}_{16}\text{S}$ Sulfur	$^{31}_{15}\text{P}$ Phosphorus	$^{28}_{14}\text{Si}$ Silicon	$^{27}_{13}\text{Al}$ Aluminium	$^{40}_{18}\text{Ar}$ Argon	$^{35}_{17}\text{Cl}$ Chlorine	$^{32}_{16}\text{S}$ Sulfur	$^{31}_{15}\text{P}$ Phosphorus	$^{28}_{14}\text{Si}$ Silicon	$^{27}_{13}\text{Al}$ Aluminium	$^{40}_{18}\text{Ar}$ Argon
$^{39}_{19}\text{K}$ Potassium	$^{80}_{35}\text{Br}$ Bromine	$^{79}_{34}\text{Se}$ Selenium	$^{75}_{33}\text{As}$ Arsenic	$^{73}_{32}\text{Ge}$ Germanium	$^{70}_{31}\text{Ga}$ Gallium	$^{84}_{36}\text{Kr}$ Krypton	$^{80}_{35}\text{Br}$ Bromine	$^{79}_{34}\text{Se}$ Selenium	$^{75}_{33}\text{As}$ Arsenic	$^{73}_{32}\text{Ge}$ Germanium	$^{70}_{31}\text{Ga}$ Gallium	$^{84}_{36}\text{Kr}$ Krypton
$^{86}_{37}\text{Rb}$ Rubidium	$^{127}_{53}\text{I}$ Iodine	$^{128}_{52}\text{Te}$ Tellurium	$^{122}_{51}\text{Sb}$ Antimony	$^{119}_{50}\text{Sn}$ Tin	$^{115}_{49}\text{In}$ Indium	$^{131}_{54}\text{Xe}$ Xenon	$^{127}_{53}\text{I}$ Iodine	$^{128}_{52}\text{Te}$ Tellurium	$^{122}_{51}\text{Sb}$ Antimony	$^{119}_{50}\text{Sn}$ Tin	$^{115}_{49}\text{In}$ Indium	$^{131}_{54}\text{Xe}$ Xenon
$^{133}_{55}\text{Cs}$ Caesium	$^{210}_{85}\text{At}$ Astatine	$^{210}_{84}\text{Po}$ Polonium	$^{209}_{83}\text{Bi}$ Bismuth	$^{207}_{82}\text{Pb}$ Lead	$^{204}_{81}\text{Tl}$ Thallium	$^{222}_{86}\text{Rn}$ Radon	$^{210}_{85}\text{At}$ Astatine	$^{210}_{84}\text{Po}$ Polonium	$^{209}_{83}\text{Bi}$ Bismuth	$^{207}_{82}\text{Pb}$ Lead	$^{204}_{81}\text{Tl}$ Thallium	$^{222}_{86}\text{Rn}$ Radon
$^{223}_{87}\text{Fr}$ Francium	$^{226}_{88}\text{Ra}$ Radium	$^{227}_{89}\text{Ac}$ Actinium										

Key:

