

Surname	Centre Number	Candidate Number
Other Names		0



**GCSE**

4493/02

**CHEMISTRY**

**CHEMISTRY 3  
HIGHER TIER**

P.M. MONDAY, 20 May 2013

1 hour

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

#### 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.

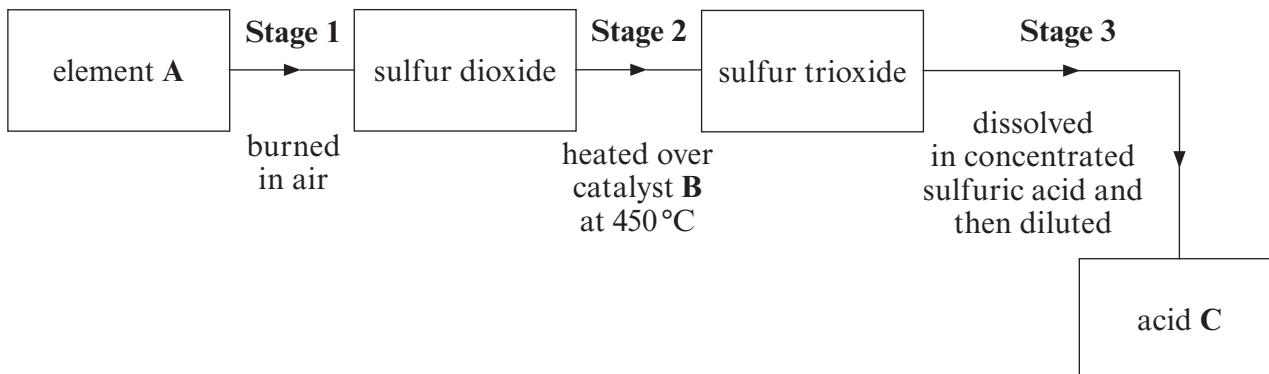
Assessment will take into account the quality of written communication (QWC) used in your answer to questions **4** and **10**.

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.

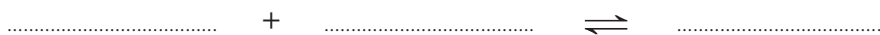
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Answer **all** questions.

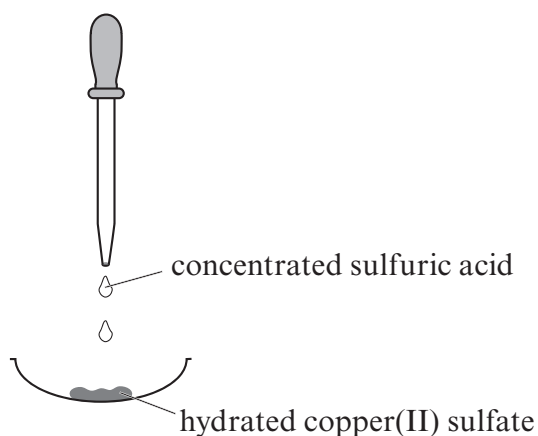
1. (a) The flow diagram below shows the stages in the Contact Process.



- (i) Give the name of
- I element **A**, ..... [1]
- II catalyst **B**, ..... [1]
- III acid **C**. ..... [1]
- (ii) Write a **balanced symbol** equation for the formation of sulfur trioxide, in **stage 2**. [3]



- (b) A few drops of concentrated sulfuric acid were added to some crystals of hydrated copper(II) sulfate,  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .



- Describe **two** changes in the appearance of copper(II) sulfate as it is dehydrated. [2]

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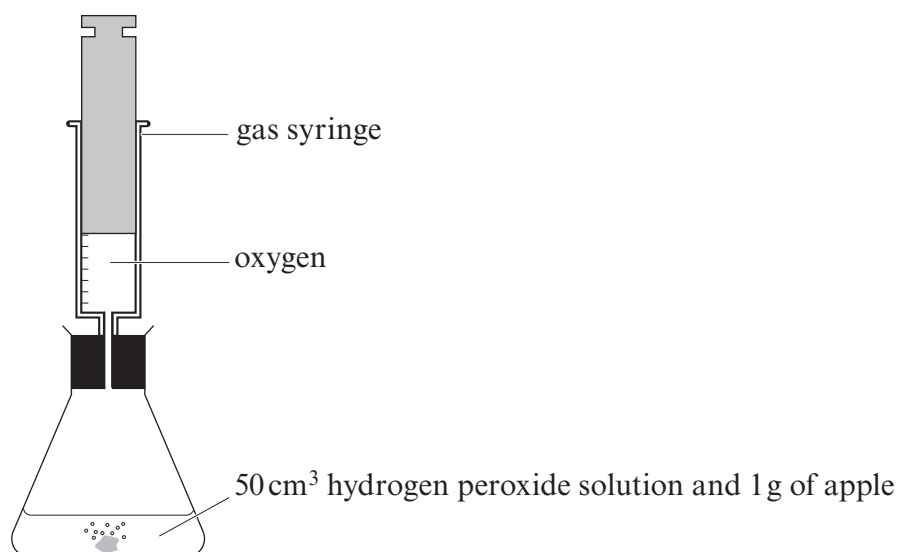
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2. Enzymes are catalysts produced by living cells. The enzyme catalase is found in both animal and plant cells. Catalase breaks down hydrogen peroxide into water and oxygen.



Some pupils were given samples of apple, carrot, potato and liver. They were asked to investigate the effect of these substances on hydrogen peroxide solution.

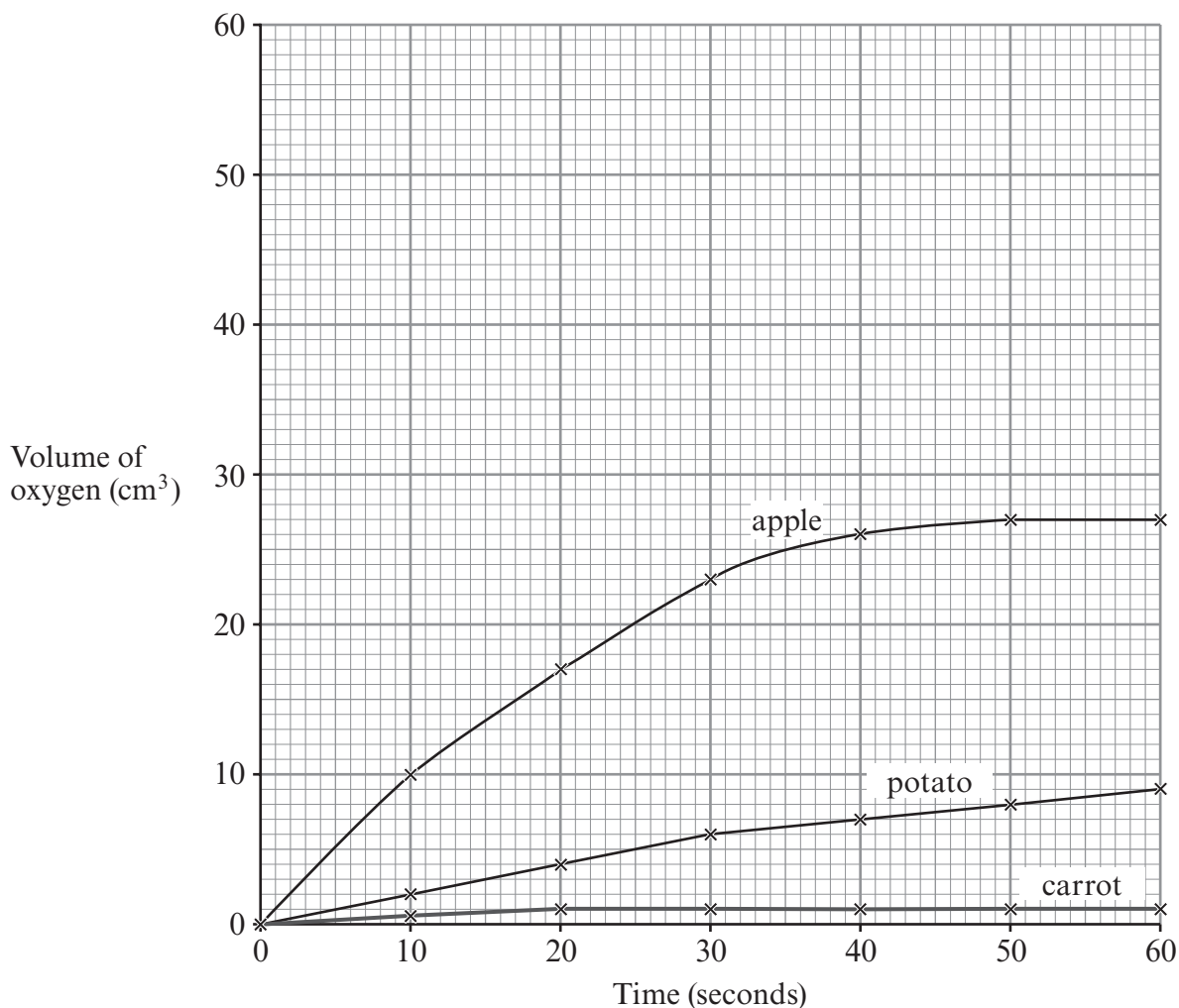
1g of each substance was added separately to 50 cm<sup>3</sup> of hydrogen peroxide solution and the volume of oxygen formed was recorded every 10 seconds. The diagram below shows the apparatus used.



The table below shows the results recorded by the group.

	Substance	Time (seconds)						
		0	10	20	30	40	50	60
Volume of oxygen formed (cm <sup>3</sup> )	apple	0	10	17	23	26	27	27
	carrot	0	0.5	1	1	1	1	1
	potato	0	2	4	6	7	8	9
	liver	0	29	43	49	50	50	50

The results for the apple, carrot and potato have been plotted on the graph opposite.

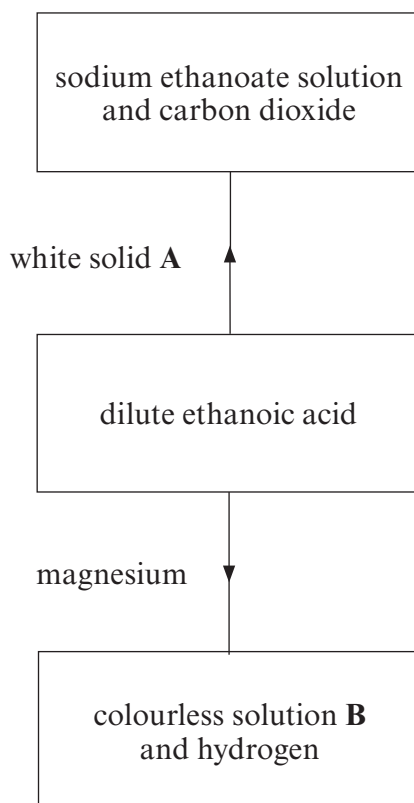


- (a) Plot the results for liver on the grid and draw a suitable line. [3]
- (b) Apart from using the same mass of each substance and the same volume of hydrogen peroxide solution, state **one other** way you would try to make the investigation a fair test. [1]

- (c) Assuming it is the presence of catalase that is responsible for the decomposition of hydrogen peroxide, give **one** conclusion that can be drawn from the results. [1]

- (d) Describe the chemical test you would carry out to show that the gas formed is oxygen. [1]

3. (a) The flow diagram below shows some reactions of ethanoic acid,  $\text{CH}_3\text{COOH}$ .



- (i) Name white solid **A**. ..... [1]
- (ii) Name colourless solution **B**. ..... [1]
- (b) Dilute ethanoic acid reacts with magnesium less vigorously than dilute sulfuric acid of equal concentration.  
Give the reason for this difference in behaviour. [1]
- .....
- (c) Ethanoic acid is formed when an alcoholic drink such as wine is left exposed to the air.  
Give the name of the compound in wine which turns into ethanoic acid. [1]
- .....



5. Ethanol,  $C_2H_5OH$ , can be formed from glucose,  $C_6H_{12}O_6$ , by the process of fermentation using yeast.

(a) Give **two** conditions necessary for this process to occur. [2]

Condition 1 .....

Condition 2 .....

(b) Balance the symbol equation below which represents the process. [1]



(c) Name the separation method used to

(i) recover the yeast, ..... [1]

(ii) obtain ethanol from the mixture. .... [1]

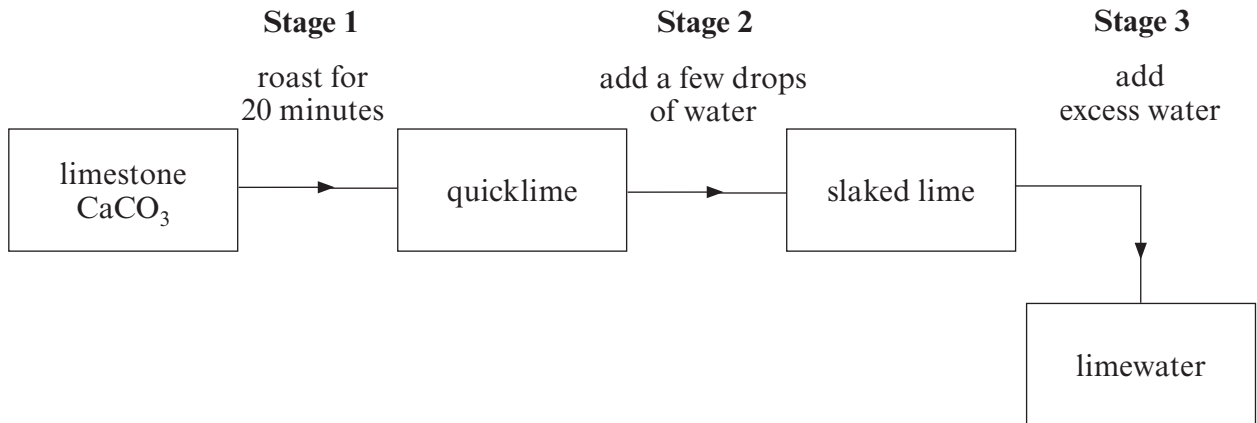
(d) Ethanol is a biofuel alternative to petrol and is widely used in cars in Brazil.

Give **one** advantage of using ethanol rather than petrol to fuel cars. [1]

.....



6. (a) The flow chart below outlines the stages involved in the preparation of limewater from limestone.



- (i) Write a **balanced symbol** equation for the reaction taking place in **stage 2**. [3]



- (ii) Give the **stage** in the flow chart which

I is extremely exothermic,

[1]

II demonstrates thermal decomposition.

[1]

- (iii) Describe a simple test you would carry out to show that limewater is formed in **stage 3**. Include the result of the test. [1]

.....

- (b) Limestone is an important raw material obtained by quarrying. There are advantages and disadvantages associated with limestone quarrying.

In your opinion do the advantages of limestone quarrying outweigh the disadvantages? Give **two** reasons to support your answer. [2]

*Opinion (Yes or No)* .....

*Reasons to support your opinion*

.....

.....

.....

.....

7. Organic substances are arranged in families of compounds with similar properties.

- (a) The table below shows the first four members of two families of organic compounds, alkanes and alcohols.

Alkanes	Alcohols
methane $\text{CH}_4$	methanol $\text{CH}_3\text{OH}$
ethane $\text{C}_2\text{H}_6$	ethanol $\text{C}_2\text{H}_5\text{OH}$
propane $\text{C}_3\text{H}_8$	propanol $\text{C}_3\text{H}_7\text{OH}$
butane $\text{C}_4\text{H}_{10}$	butanol $\text{C}_4\text{H}_9\text{OH}$

The general formula for members of the alkane family is  $\text{C}_n\text{H}_{2n+2}$ .

Give the general formula for members of the alcohol family.

[1]

.....

- (b) Isomers are compounds which have the same molecular formula but different structural formulae.

Propanol has two isomers. Draw the **two** positional isomers of propanol.

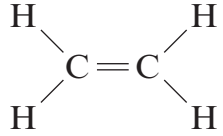
[2]

Isomer 1	Isomer 2
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(c) Another family of organic compounds is the alkene family.

Complete the table below.

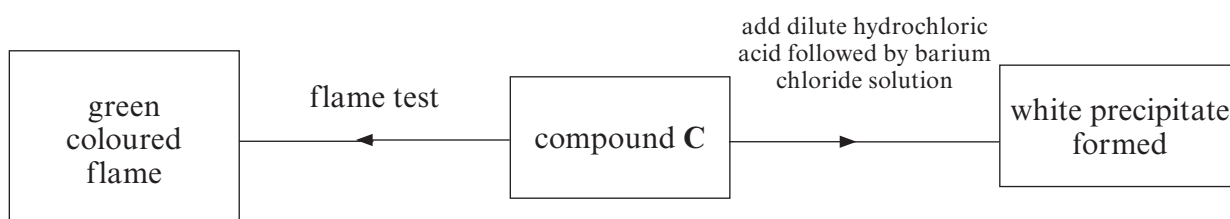
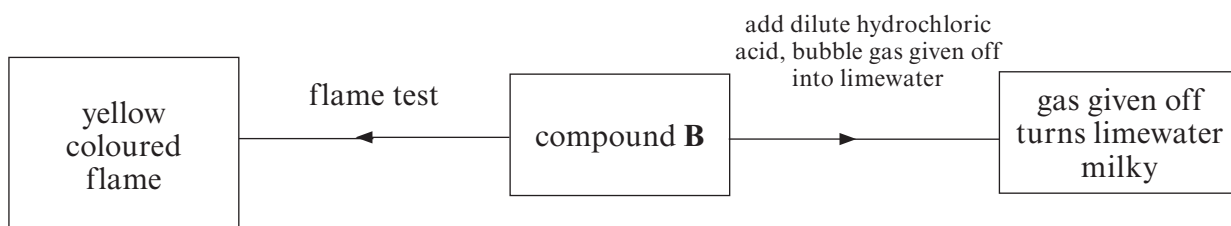
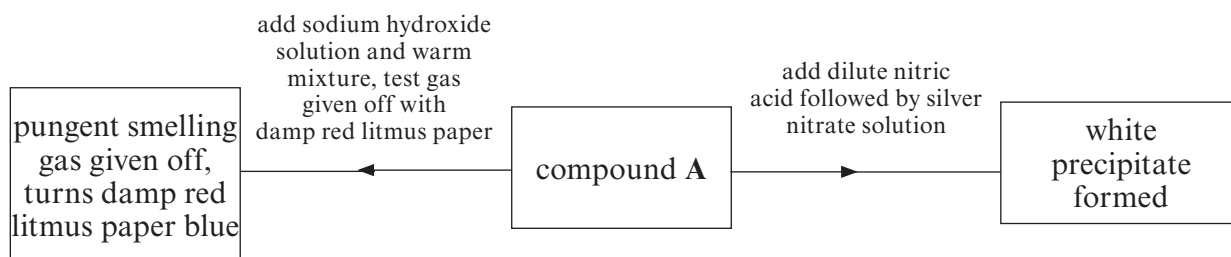
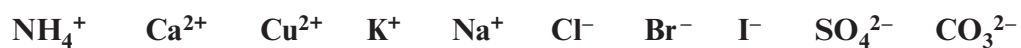
[2]

Name	Molecular formula	Structural formula
ethene	$C_2H_4$	
	$C_3H_6$	

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8. (a) The flow charts below show tests carried out on compounds **A**, **B** and **C** and the results of those tests.

The compounds were known to include some of the following ions.



Use the information to give the **chemical formulae** of compounds **A**, **B** and **C**.

[3]

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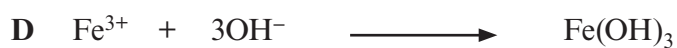
**A** .....

**B** .....

**C** .....

(b) Aqueous iron(III) ions form an orange-brown precipitate when mixed with aqueous sodium hydroxide.

Give the letter **A**, **B**, **C**, **D** or **E** for the ionic equation which correctly represents this reaction. [1]



Letter

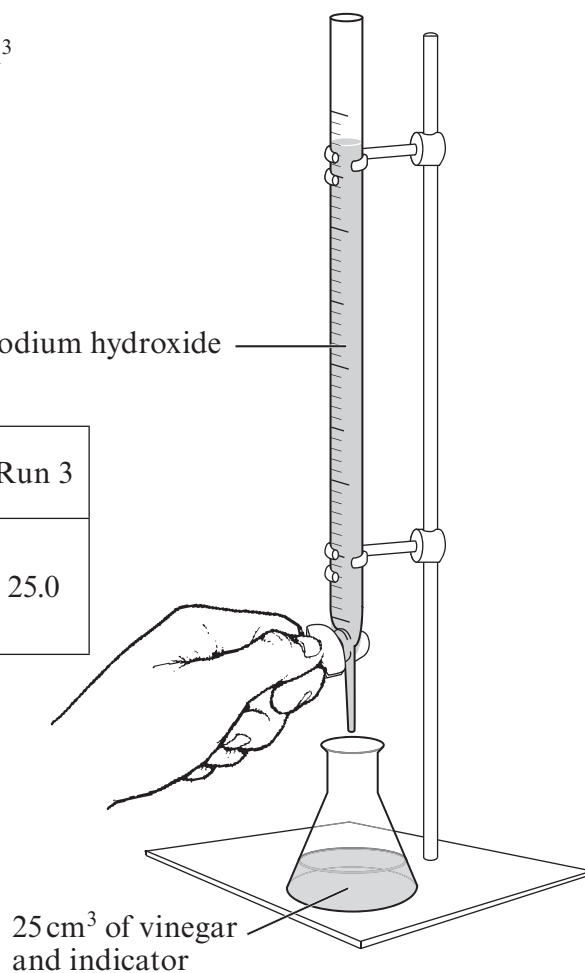
9. A food scientist was asked to check the quality of a bottle of vinegar. Vinegar contains ethanoic acid,  $\text{CH}_3\text{COOH}$ .

The apparatus shown was used to find the concentration of ethanoic acid in the vinegar.

Dilute sodium hydroxide of concentration  $0.1 \text{ mol/dm}^3$  was added a little at a time to  $25 \text{ cm}^3$  of vinegar until the indicator changed colour. The procedure was carried out three times.

	Run 1	Run 2	Run 3
Volume of sodium hydroxide added ( $\text{cm}^3$ )	25.2	24.8	25.0

dilute sodium hydroxide



- (a) Calculate the mean volume of sodium hydroxide needed to neutralise  $25 \text{ cm}^3$  of vinegar. [1]

- (b) Ethanoic acid reacts with sodium hydroxide solution according to the equation below.



Using the mean volume of sodium hydroxide from part (a), calculate the concentration of the ethanoic acid in mol/dm<sup>3</sup>. [3]

*Concentration of ethanoic acid* = ..... mol/dm<sup>3</sup>

- (c) The label on the vinegar bottle states that it contains 5 g of ethanoic acid, CH<sub>3</sub>COOH, in 100 cm<sup>3</sup> vinegar.

$$A_r(\text{H}) = 1 \quad A_r(\text{C}) = 12 \quad A_r(\text{O}) = 16$$

- (i) Calculate the relative molecular mass,  $M_r$ , of ethanoic acid. [1]

$M_r$  = .....

- (ii) Using your answers to parts (b) and (c)(i) show whether the information on the label is correct. [2]

.....  
 .....





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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**

		$^1_1\text{H}$ Hydrogen								
		$^4_2\text{He}$ Helium							$^{20}_{10}\text{Ne}$ Neon	
$^3_7\text{Li}$ Lithium	$^4_9\text{Be}$ Beryllium	$^{11}_5\text{B}$ Boron		$^{12}_6\text{C}$ Carbon	$^{14}_7\text{N}$ Nitrogen	$^{16}_8\text{O}$ Oxygen	$^{19}_9\text{F}$ Fluorine	$^{20}_{10}\text{Ne}$ Neon		
$^{23}_{11}\text{Na}$ Sodium	$^{24}_{12}\text{Mg}$ Magnesium	$^{27}_{13}\text{Al}$ Aluminium		$^{28}_{14}\text{Si}$ Silicon	$^{31}_{15}\text{P}$ Phosphorus	$^{32}_{16}\text{S}$ Sulfur	$^{35}_{17}\text{Cl}$ Chlorine	$^{40}_{18}\text{Ar}$ Argon		
$^{39}_{19}\text{K}$ Potassium	$^{40}_{20}\text{Ca}$ Calcium	$^{70}_{31}\text{Ga}$ Gallium		$^{73}_{32}\text{Ge}$ Germanium	$^{75}_{33}\text{As}$ Arsenic	$^{79}_{34}\text{Se}$ Selenium	$^{80}_{35}\text{Br}$ Bromine	$^{84}_{36}\text{Kr}$ Krypton		
$^{86}_{37}\text{Rb}$ Rubidium	$^{88}_{38}\text{Sr}$ Strontium	$^{115}_{49}\text{In}$ Indium		$^{119}_{50}\text{Sn}$ Tin	$^{122}_{51}\text{Sb}$ Antimony	$^{128}_{52}\text{Te}$ Tellurium	$^{127}_{53}\text{I}$ Iodine	$^{131}_{54}\text{Xe}$ Xenon		
$^{133}_{55}\text{Cs}$ Caesium	$^{137}_{56}\text{Ba}$ Barium	$^{204}_{81}\text{Tl}$ Thallium		$^{207}_{82}\text{Pb}$ Lead	$^{209}_{83}\text{Bi}$ Bismuth	$^{210}_{84}\text{Po}$ Polonium	$^{210}_{85}\text{At}$ Astatine	$^{222}_{86}\text{Rn}$ Radon		
$^{223}_{87}\text{Fr}$ Francium	$^{226}_{88}\text{Ra}$ Radium	$^{201}_{80}\text{Hg}$ Mercury		$^{207}_{79}\text{Au}$ Gold	$^{195}_{78}\text{Pt}$ Platinum	$^{197}_{79}\text{Au}$ Gold	$^{204}_{81}\text{Tl}$ Thallium	$^{207}_{82}\text{Pb}$ Lead		
		$^{89}_{39}\text{Y}$ Yttrium		$^{139}_{57}\text{La}$ Lanthanum	$^{227}_{89}\text{Ac}$ Actinium					
		$^{55}_{25}\text{Mn}$ Manganese		$^{99}_{43}\text{Tc}$ Technetium	$^{186}_{75}\text{Re}$ Rhenium					
		$^{56}_{26}\text{Fe}$ Iron		$^{101}_{44}\text{Ru}$ Ruthenium	$^{190}_{76}\text{Os}$ Osmium					
		$^{59}_{27}\text{Co}$ Cobalt		$^{103}_{45}\text{Rh}$ Rhodium	$^{192}_{77}\text{Ir}$ Iridium					
		$^{59}_{28}\text{Ni}$ Nickel		$^{106}_{46}\text{Pd}$ Palladium	$^{195}_{78}\text{Pt}$ Platinum					
		$^{64}_{29}\text{Cu}$ Copper		$^{108}_{47}\text{Ag}$ Silver	$^{197}_{79}\text{Au}$ Gold					
		$^{65}_{30}\text{Zn}$ Zinc		$^{112}_{48}\text{Cd}$ Cadmium	$^{201}_{80}\text{Hg}$ Mercury					
		$^{52}_{24}\text{Cr}$ Chromium		$^{96}_{42}\text{Mo}$ Molybdenum	$^{184}_{74}\text{W}$ Tungsten					
		$^{51}_{23}\text{V}$ Vanadium		$^{93}_{41}\text{Nb}$ Niobium	$^{181}_{73}\text{Ta}$ Tantalum					
		$^{48}_{22}\text{Ti}$ Titanium		$^{91}_{40}\text{Zr}$ Zirconium	$^{179}_{72}\text{Hf}$ Hafnium					
		$^{45}_{21}\text{Sc}$ Scandium		$^{89}_{39}\text{Y}$ Yttrium	$^{139}_{57}\text{La}$ Lanthanum					

Key:

