OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B642/02

CHEMISTRY B

Unit 2 Modules C4 C5 C6
(Higher Tier)

*C U P / T 6 4 0 2 1 *

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Friday 23 January 2009
Morning

Duration: 1 hour

*B 6 4 2 0 2 *

Candidate Forename						Candidate Surname				
Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Section	**Max.**	**Mark**
A	**20**	
B	**20**	
C	**20**	
TOTAL	**60**	

Answer **all** the questions.

Section A – Module C4

1 Stowmarket Synthetics make a washing-up liquid.

The washing-up liquid is used to clean dirty plates.

(a) Rachel and James work for Stowmarket Synthetics.

They want to investigate the cleaning power of the washing-up liquid at different temperatures.

To make the investigation fair they always use

- 1 cm^3 of washing up liquid
- 1000 cm^3 of water
- identical dirty plates.

Look at the table. It shows the results of their investigation.

temperature of water in °C	number of dirty plates that could be cleaned	height of foam produced in cm
10	15	15
20	19	16
30	23	14
40	27	15
50	31	15

Rachel and James make two conclusions from the table of results.

Write about **two** conclusions Rachel and James can make.

1 .....

.....

2 .....

..... **[2]**

(b) One of the ingredients in the washing-up liquid is a detergent.

Write about how the detergent helps to remove fat and grease from dirty plates.

Use ideas about

- the chemical structure of a detergent molecule
- intermolecular forces.

A labelled diagram may help you answer this question.

.....

.....

.....

.....

..... **[3]**

[Total: 5]

2 This question is about acids and bases.

(a) Look at the table. It shows the name and formula of some bases.

name of base	formula of base
ammonia	NH_3
calcium hydroxide	$Ca(OH)_2$
copper oxide	CuO
sodium oxide	Na_2O

Which base has a formula with five **atoms** in total?

..... **[1]**

(b) **(i)** Copper oxide reacts with dilute sulfuric acid.

It makes copper sulfate and one other product.

What is the name of the **other product**?

..... **[1]**

(ii) Copper oxide reacts with dilute nitric acid to make a salt.

What is the name of the **salt**?

..... **[1]**

(c) Copper carbonate reacts with dilute nitric acid. It makes a gas.

What is the name of this **gas**?

..... **[1]**

(d) Calcium hydroxide contains hydroxide ions, OH^-.

Nitric acid contains hydrogen ions, H^+.

Calcium hydroxide solution reacts with nitric acid.

This is a neutralisation reaction.

Write down the **ionic equation** for this neutralisation reaction.

..... **[1]**

[Total: 5]

3 Medicines and pharmaceutical drugs are speciality chemicals.

They are made on demand in small amounts called batches.

New drugs are often extremely expensive to develop and make.

This is because it often takes years to develop drugs before they can be used by the public.

The drugs need to be thoroughly tested and researched before use.

Write about three **other** reasons why developing and making new drugs is extremely expensive.

1 .....

.....

2 .....

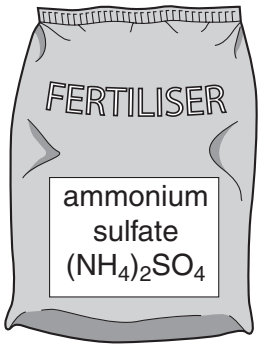
.....

3 .....

..... **[3]**

[Total: 3]

4 Ammonium sulfate is a fertiliser used by farmers.



Ammonium sulfate has the formula $(NH_4)_2SO_4$.

(a) Cassie makes some ammonium sulfate crystals.

(i) She uses an acid with a base.

What is the name of the **base** she uses?

..... **[1]**

(ii) She predicts she should make 24.6 g of crystals.

She actually makes 4.92 g of crystals.

What is her percentage yield?

.....

.....

.....

percentage yield = ... % **[2]**

(b) Calculate the percentage of **nitrogen** by mass in ammonium sulfate, $(NH_4)_2SO_4$.

The relative atomic mass (A_r) of H is 1, of N is 14, of O is 16 and of S is 32.

.....

.....

.....

.....

percentage by mass = ... % **[2]**

(c) The use of a fertiliser such as ammonium sulfate makes crops grow bigger and faster increasing crop yield.

Explain why.

.....

.....

.....

..... **[2]**

[Total: 7]

Section B – Module C5

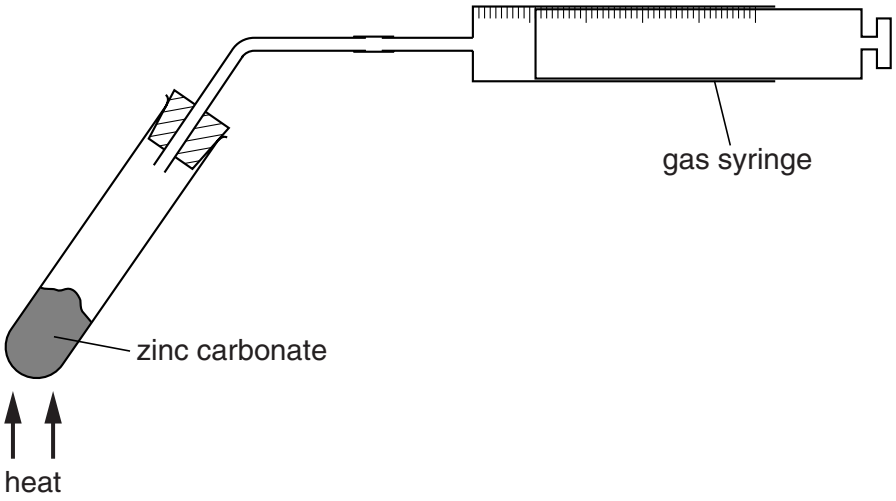
5 Viviana investigates the thermal decomposition of zinc carbonate.

She puts 0.47 g of zinc carbonate into a test-tube.

She then heats the zinc carbonate using a blue Bunsen flame.

Carbon dioxide and zinc oxide are made.

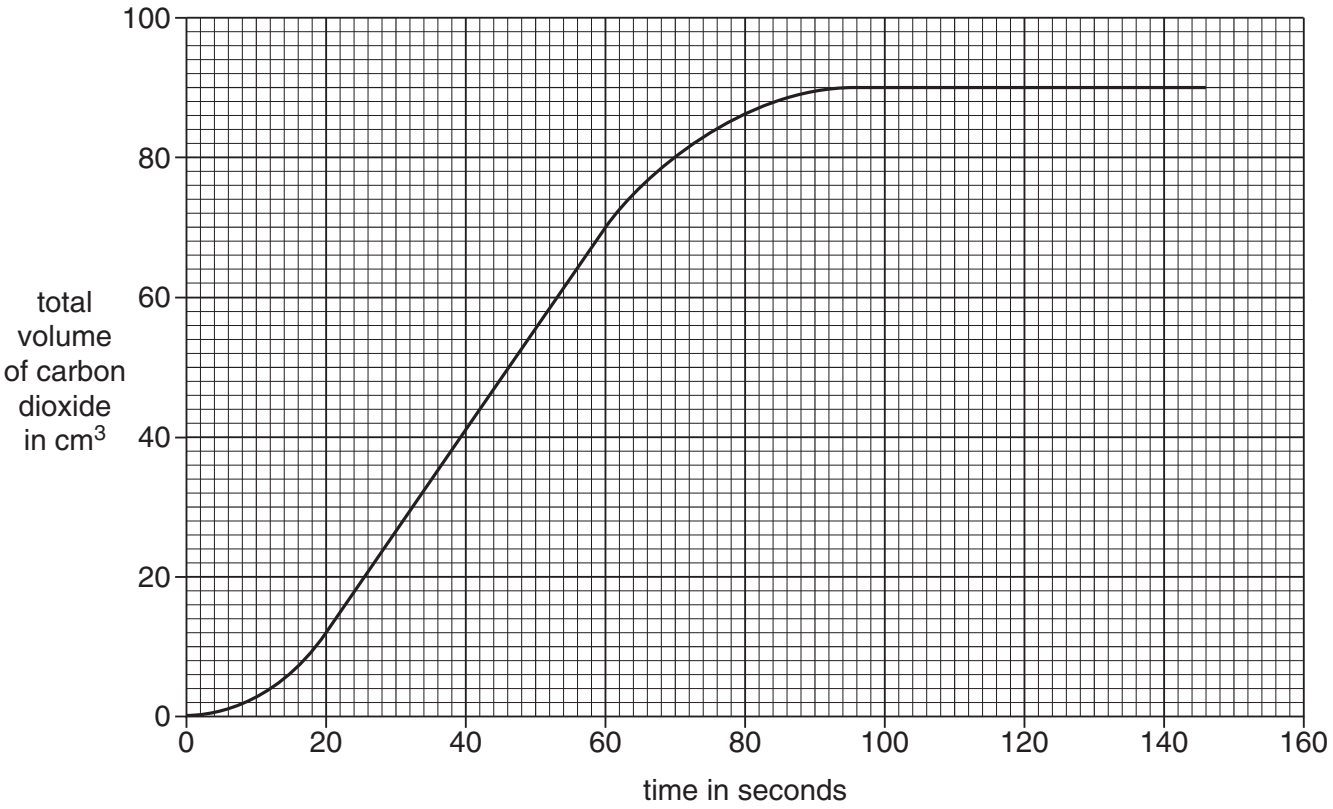
Look at the apparatus she uses.



She uses a gas syringe to collect the carbon dioxide made.

Every 30 seconds she measures the total volume of carbon dioxide in the gas syringe.

Look at the graph of Viviana's results.



(a) (i) How long does it take to make 50 cm^3 of carbon dioxide?

..... seconds **[1]**

(ii) At what time does the reaction stop?

..... seconds **[1]**

Turn over for the remainder of question 5

(b) At the end of the experiment Viviana finds out how much zinc oxide she made.

Look at her table of results.

substance	mass in grams
mass of zinc carbonate before heating	0.47
mass of zinc oxide after heating	0.30
mass of carbon dioxide made	0.17

(i) How many moles of carbon dioxide, CO_2, are made in the experiment?

The relative atomic mass (A_r) of C is 12 and of O is 16.

.....

.....

.....

number of moles = ... **[2]**

(ii) Viviana repeats the experiment.

This time she uses **0.94** g of zinc carbonate instead of 0.47 g.

Predict how much zinc oxide she should make.

.....

.....

mass of zinc oxide = ... g **[1]**

[Total: 5]

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Question 6 begins on page 12.

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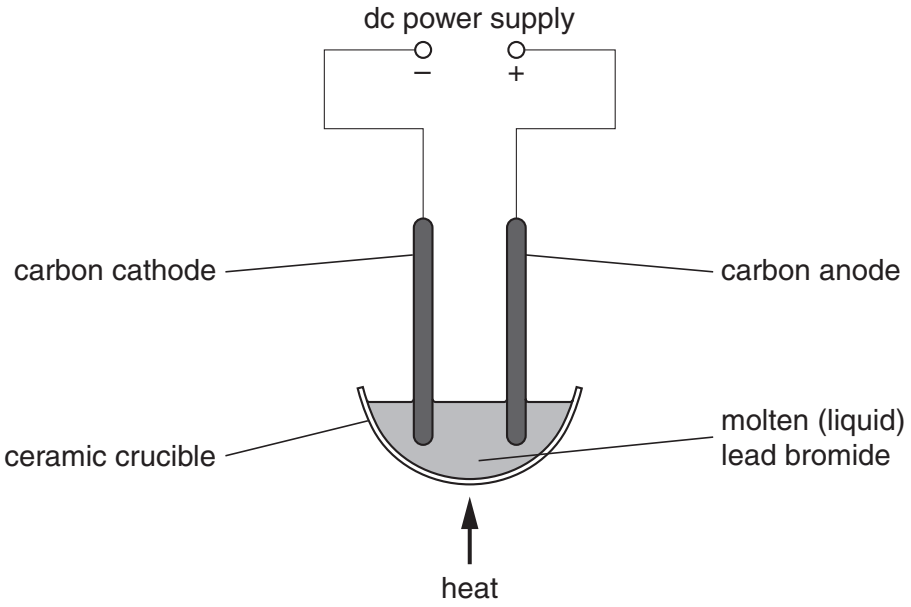
6 This question is about electrolysis.

Look at the diagram.

It shows the apparatus needed for the electrolysis of molten (liquid) lead bromide.



Look at the symbol equation. It shows how lead bromide is broken down during electrolysis.

$$PbBr_2 \rightarrow Pb + Br_2$$

(a) Electrolysis involves the movement of ions.

Molten (liquid) lead bromide can be electrolysed but **solid** lead bromide cannot.

Explain why.

.....

.....

..... **[2]**

(b) Molten lead bromide contains lead ions, Pb^{2+}, and bromide ions, Br^-.

Bromide ions lose electrons at the anode to make bromine molecules, Br_2.

Construct the equation for this electrode reaction.

Use e^- to represent an electron.

..... **[2]**

(c) During an experiment 9.65 A is passed through molten lead bromide for 100 seconds.

A mass of 1.035 g of lead was made at the cathode.

In a second experiment 19.3 A is passed through molten lead bromide for 50 seconds.

The same mass of lead was made at the cathode.

Explain why.

Use ideas about current and time.

.....

.....

.....

..... **[2]**

[Total: 6]

7 Sulfur, air and water are raw materials used to make sulfuric acid.

Sulfuric acid is made by the Contact Process.

(a) Complete the word equation for **stage 1** of the Contact Process.

Stage 1 ..... + ... → sulfur dioxide

Stage 2 sulfur dioxide + oxygen ⇌ sulfur trioxide

Stage 3 sulfur trioxide + water → sulfuric acid **[1]**

(b) Look at **stage 2**.

The conditions used for **stage 2** are

- 450 °C
- atmospheric pressure
- a catalyst.

(i) What is the name or formula of the catalyst used?

..... **[1]**

(ii) Explain the conditions used in the Contact Process.

Use ideas about

- rate of reaction
- position of equilibrium.

catalyst

rate of reaction .....

.....

position of equilibrium .....

.....

450 °C

rate of reaction .....

.....

position of equilibrium .....

..... **[4]**

[Total: 6]

8 Imran researches acids using the internet.

He finds out that both strong and weak acids react with magnesium ribbon to make hydrogen.

Imran adds a 1 cm length of magnesium ribbon to 50 cm^3 of ethanoic acid.

He adds another 1 cm length of magnesium ribbon to 50 cm^3 of hydrochloric acid.

Both acids have the same concentration.

He finds the hydrochloric acid reacts much faster.

Explain why.

Use ideas about

- strong and weak acids
- hydrogen ions
- collision theory.

.....

.....

.....

.....

..... **[3]**

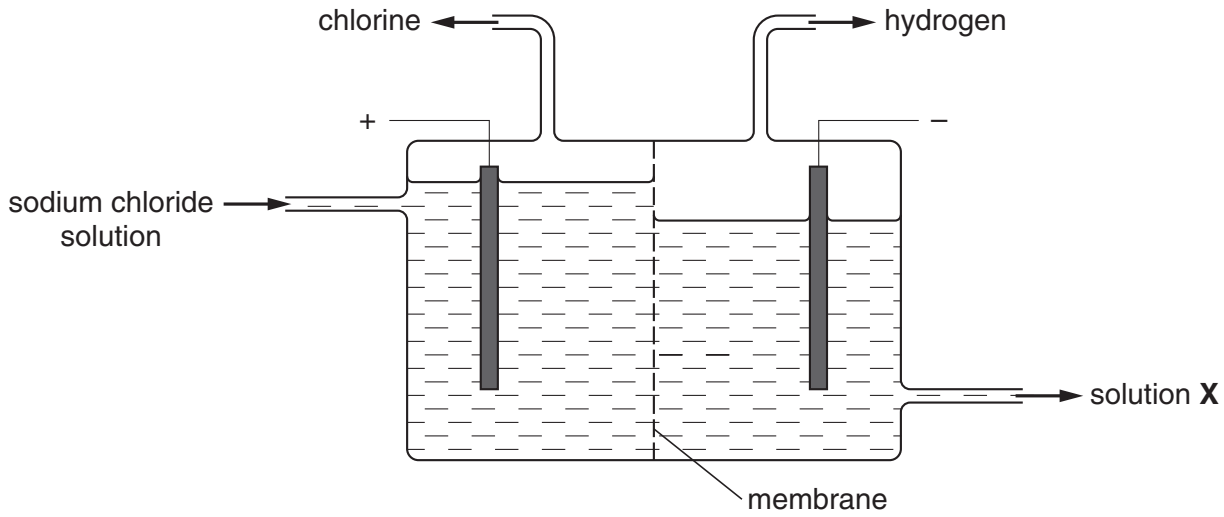
[Total: 3]

Section C – Module C6

9 This question is about sodium chloride and chemicals obtained from it.

A solution of concentrated sodium chloride is electrolysed.

Look at the diagram. It shows the apparatus used.



Hydrogen gas and chlorine gas are produced.

(a) Solution **X** is also made in the electrolysis cell.

What is the name of solution **X**?

..... **[1]**

(b) During electrolysis hydrogen ions, H^+, are turned into hydrogen gas, H_2.

Write a balanced **symbol** equation for this reaction. Use e^- to represent an electron.

..... **[2]**

(c) Very dilute sodium chloride solution is electrolysed.

Chlorine gas is no longer given off at the positive electrode.

A different gas is given off.

Write down the name of this gas.

..... **[1]**

(d) Sodium chloride (salt) solution is obtained in Cheshire by **solution mining**.

Write down **one** hazard caused by solution mining.

..... **[1]**

[Total: 5]

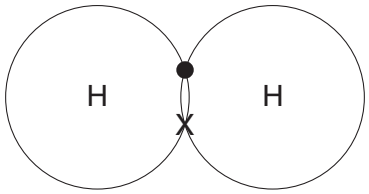
10 This question is about the ozone layer.

The ozone layer is damaged by free radicals.

Chlorofluorocarbons, CFCs, are one source of free radicals.

Most CFCs are now banned in the UK.

(a) Look at the diagram. It shows a 'dot and cross' diagram for a hydrogen molecule.



The two hydrogen atoms are joined by a covalent bond.

This covalent bond is a shared pair of electrons.

The covalent bond can be broken to make two free radicals.

Explain what happens to the electrons when free radicals are made.

.....

..... **[1]**

(b) Small numbers of free radicals can do a lot of damage to the ozone layer.

Explain why.

.....

..... **[1]**

(c) Chlorofluorocarbons will continue to damage the ozone layer for a long time after they have been banned.

Explain why.

..... **[1]**

(d) Suggest a replacement for chlorofluorocarbons.

..... **[1]**

[Total: 4]

11 This question is about the hardness of water.

Hardness of water is caused by chemicals dissolved in the water.

There are two types of hardness, temporary and permanent.

(a) Look at the list of chemicals.

calcium hydrogencarbonate

calcium sulfate

sodium chloride

sodium hydroxide

Complete the sentences using chemicals from the list.

(i) **Temporary** hardness is caused by ..... . **[1]**

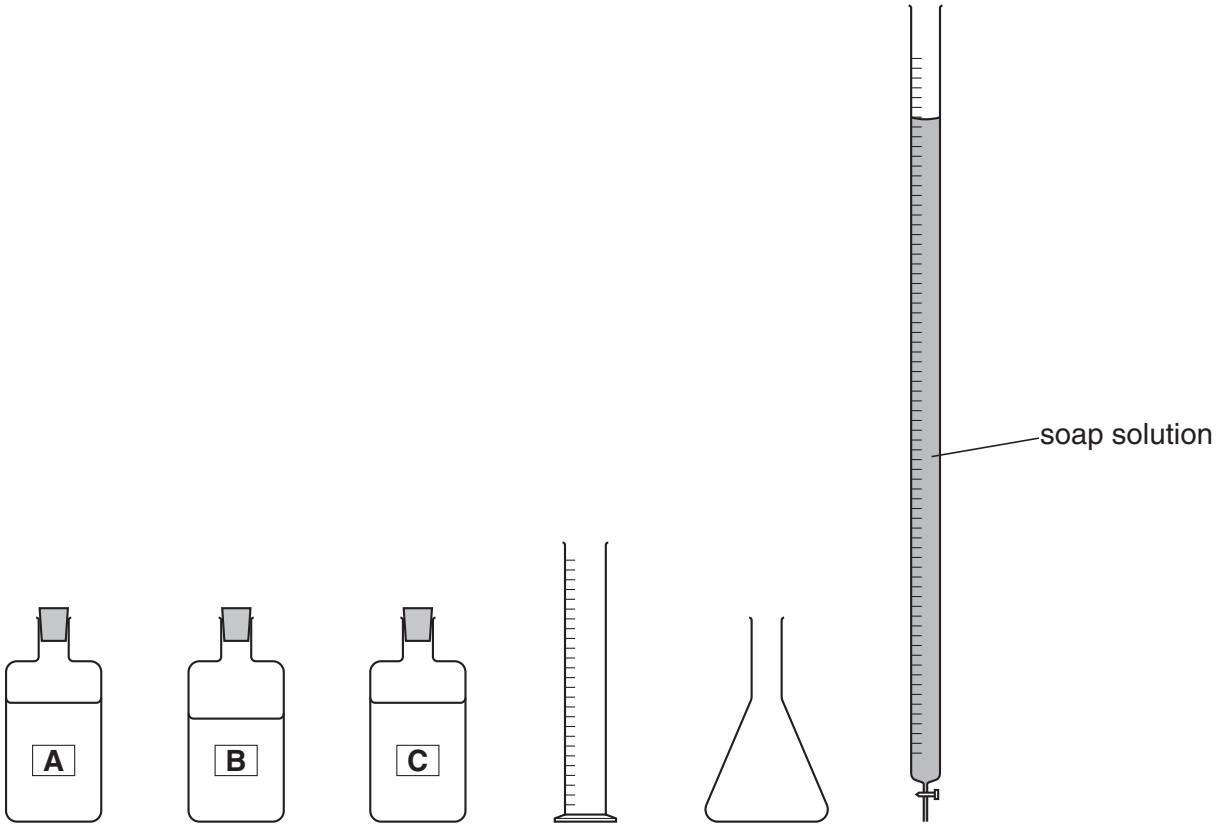
(ii) **Permanent** hardness is caused by ..... . **[1]**

(b) Claire collects water samples from three different places, **A**, **B** and **C**.

They have different amounts of hardness.

She wants to compare the hardness of these samples.

Look at the diagram. It shows the apparatus she uses.



Write about how Claire uses the apparatus to compare the hardness of the water samples.

.....

.....

.....

.....

..... **[3]**

(c) Washing soda (sodium carbonate) can soften hard water.

Explain how.

.....

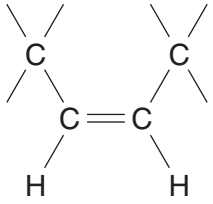
..... **[1]**

[Total: 6]

12 This question is about fats and oils.

(a) Vegetable oils are often unsaturated.

Look at the displayed formula. It is part of a molecule of vegetable oil.



An unsaturated oil has at least one carbon-carbon double bond.

Bromine water can be used to test for unsaturation in fats and oils.

Explain how.

.....

.....

..... **[2]**

(b) Vegetable oils are used to make margarine.

Vegetable oils are liquids. Margarine is solid.

Which **element** is reacted with vegetable oil to make margarine?

..... **[1]**

(c) Fats can be turned into soap by heating with sodium hydroxide solution.

What is the name of this process?

Choose from the list.

distillation

fermentation

saponification

saturation

answer ..... **[1]**

(d) Fats and oils all belong to a particular group of chemicals.

Look at the list.

alcohols

analgesics

emulsions

esters

What is the name of this group?

Choose from the list.

answer ..... **[1]**

[Total: 5]

END OF QUESTION PAPER

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The Periodic Table of the Elements

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
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **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	178 **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	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.