

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**GATEWAY SCIENCE**  
**CHEMISTRY B**

**B641/02**

Unit 1 Modules C1 C2 C3 (Higher Tier)

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)

**Wednesday 25 May 2011**  
**Morning**

**Duration: 1 hour**



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

**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.

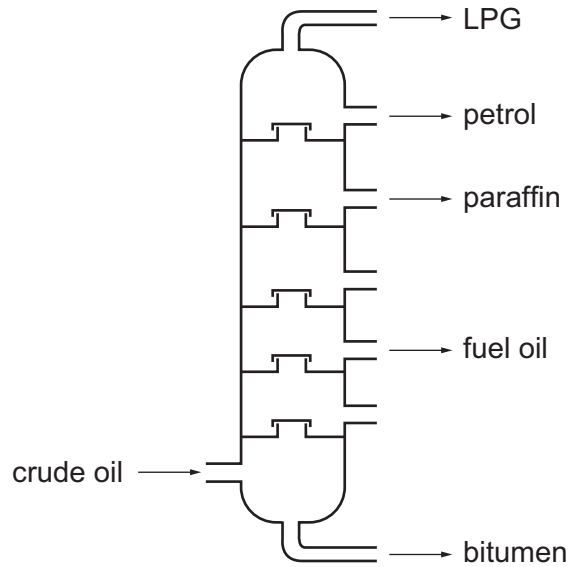
Answer **all** the questions.

**Section A – Module C1**

1 Crude oil is a fossil fuel.

(a) Crude oil is separated into useful substances by fractional distillation.

Look at the diagram. It shows a fractionating column.



The LPG comes out of the top of the fractionating column.

Explain why.

Use ideas about boiling points.

.....

..... [1]

(b) Look at the table.

It shows the amount of some substances made from 100 tonnes of crude oil.

It also shows the amount of each substance needed for everyday use.

substance	amount made in tonnes (supply)	amount needed in tonnes (demand)
LPG	5	10
petrol	10	25
paraffin	15	15
fuel oil	40	30

(i) For which substance does the supply match the demand?

..... [1]

(ii) Some substances from crude oil are cracked to make petrol.

Cracking is used to match supply with demand.

Explain how.

Use the information in the table to help you.

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

(c) Petrol contains octane,  $C_8H_{18}$ .

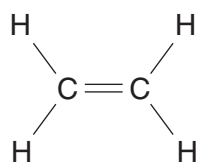
Octane is a **hydrocarbon**.

Explain why.

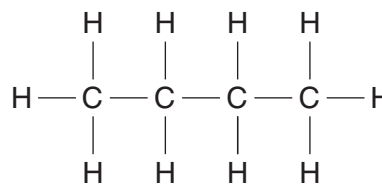
.....  
 ..... [1]

[Total: 5]

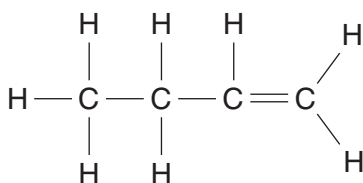
2 Look at the displayed formulas of some compounds.



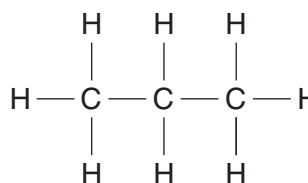
compound **A**



compound **B**



compound **C**



compound **D**

(a) One compound has a molecule with 13 covalent bonds.

Which compound?

Choose **A**, **B**, **C** or **D**.

answer .....

[1]

(b) Look at the displayed formula of compound **D**.

The molecular formula of this compound is  $C_3H_8$ .

Write down the **molecular formula** of compound **B**.

answer .....

[1]

(c) Look at the displayed formula of compound **A**.

Compound **A** is called ethene.

(i) Ethene is **unsaturated**.

Explain why.

..... [1]

(ii) Poly(ethene) is made from ethene in a reaction called addition polymerisation.

Draw the displayed formula of **poly(ethene)**.

[2]

[Total: 5]

3 Ahmed and Mary want to buy a new car.

They cannot decide which type of car to buy.

One car uses petrol and one car uses hydrogen as fuel.

The table lists some information about the two fuels.

	petrol	hydrogen
state at room temperature	liquid	gas
cost	high	high
combustion products	water, carbon dioxide, carbon monoxide	water

(a) Explain the **advantages** and **disadvantages** of choosing **hydrogen** as a fuel.

Your answer should include **one** advantage and **one** disadvantage.

You may use the table to help you.

.....

.....

.....

..... [2]

(b) Octane is a hydrocarbon in petrol.

Octane burns in air.

Carbon dioxide and water are made.

Write down the **word equation** for this reaction.

..... [1]

[Total: 3]

4 This question is about energy changes.

Alison puts 100g of water into each of four beakers.

She writes down the temperature of the water in each beaker.

She then adds 2g of a different solid to each beaker.

She stirs the mixtures and measures the temperature again.

Look at her results.

solid	temperature before adding solid in °C	temperature after adding solid in °C
<b>A</b>	20	20
<b>B</b>	19	12
<b>C</b>	20	35
<b>D</b>	18	20

(a) Which solid has an endothermic reaction with water?

Choose **A**, **B**, **C** or **D**.

.....

Explain your answer.

..... [1]

(b) Calculate the amount of energy transferred in the reaction between solid **C** and water.

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

The specific heat capacity of water is 4.2J/g°C.

.....  
 .....  
 .....

answer ..... J [2]

[Total: 3]

5 (a) Nylon is used to make many outdoor clothes.

Jill has a coat made of nylon.

Look at the picture. It shows her coat.



One property of nylon is that it is waterproof.

Write down **two** other useful properties of Nylon.

- 1 .....
- 2 ..... [2]

(b) When Jill exercises she sweats. Her nylon coat does not allow the sweat to escape.

Jill buys a new coat made of Gore-Tex®.

Gore-Tex® is made of nylon which has been laminated with a polymer membrane.

The Gore-Tex® allows the sweat to escape but prevents rain water getting in.

Explain how.

- .....
- .....
- ..... [2]

[Total: 4]

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Section B – Module C2

6 This question is about building materials.

A new shopping centre has been built in Liverpool.



(a) (i) The builders had to choose a material for the floor of the shopping centre.

Three possible materials were granite, limestone and marble.

Write down the names of the three materials in order of **increasing** hardness.

**least hard** .....

.....

**hardest** .....

[1]

(ii) Explain why there is a difference in hardness between granite, limestone and marble.

Use ideas about rock **types**.

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

(b) Granite is made from molten magma. Granite has **large** crystals.

Explain why granite has large crystals.

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

[Total: 4]

7 Land Rovers are made mostly of steel.



A new Land Rover is to be made mostly of aluminium.

(a) The new Land Rover will be 225 kg lighter.

Explain why this is an advantage.

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

(b) Write down one **other** advantage and one disadvantage of making the new Land Rover out of aluminium.

advantage .....

disadvantage ..... [2]

- (c) Car engines make carbon monoxide and oxides of nitrogen.

Carbon monoxide and oxides of nitrogen are pollutants.

A catalytic converter decreases the amount of these pollutants released.

Look at the table.

The table shows the amounts of these pollutants released.

	carbon monoxide in g/km	oxides of nitrogen in g/km
BMW Z4	0.516	0.019
Ford Fiesta	0.353	0.058
Honda Civic	0.290	0.013
Land Rover Discovery	0.958	0.029
Vauxhall Astra	0.192	0.053

- (i) Colin drives his Vauxhall Astra on a 100 km journey.

What mass of carbon monoxide is made during the journey?

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

- (ii) Colin's car releases most carbon monoxide per minute when the engine is cold.

Suggest why.

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

- (iii) In the catalytic converter, carbon monoxide, CO, and nitric oxide, NO, react together.

Nitrogen, N<sub>2</sub>, and carbon dioxide are made.

Write a **balanced symbol** equation for this reaction.

..... [2]

[Total: 7]

8 This question is about alloys.

(a) The table gives information about some alloys.

alloy	main metal or metals	use
amalgam	.....	tooth fillings
brass	.....	hinges, door knobs
bronze	copper and tin	statues
solder	.....	joining metals
steel	iron	bridges, ships

Complete the table.

Choose your answers from the list.

**copper and lead**

**copper and zinc**

**lead and tin**

**lead and zinc**

**mercury**

[2]

(b) Nitinol is a **smart alloy** made from nickel and titanium.

The alloy has a property called 'shape memory'.

Nitinol can be used instead of steel to make spectacle frames.



Write about why nitinol is better than steel for making spectacles.

Your answer should include

- what is meant by 'shape memory'
- how the properties of nitinol are different from steel.

.....

.....

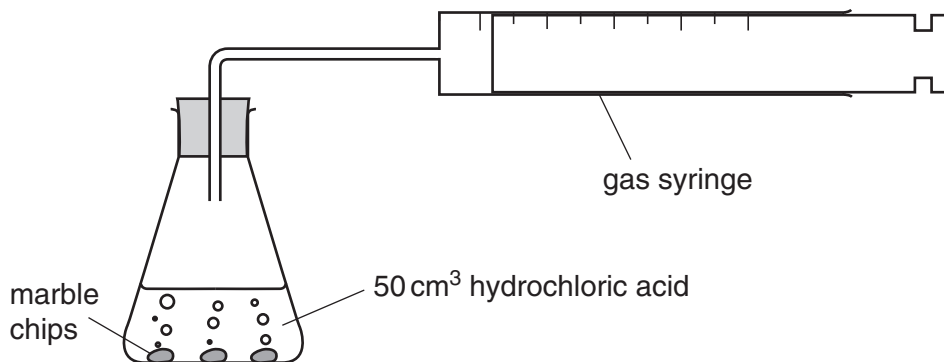
.....

..... [2]

[Total: 4]

9 Wendy investigates the reaction between marble chips and hydrochloric acid.

Wendy does three experiments, **A**, **B** and **C**.

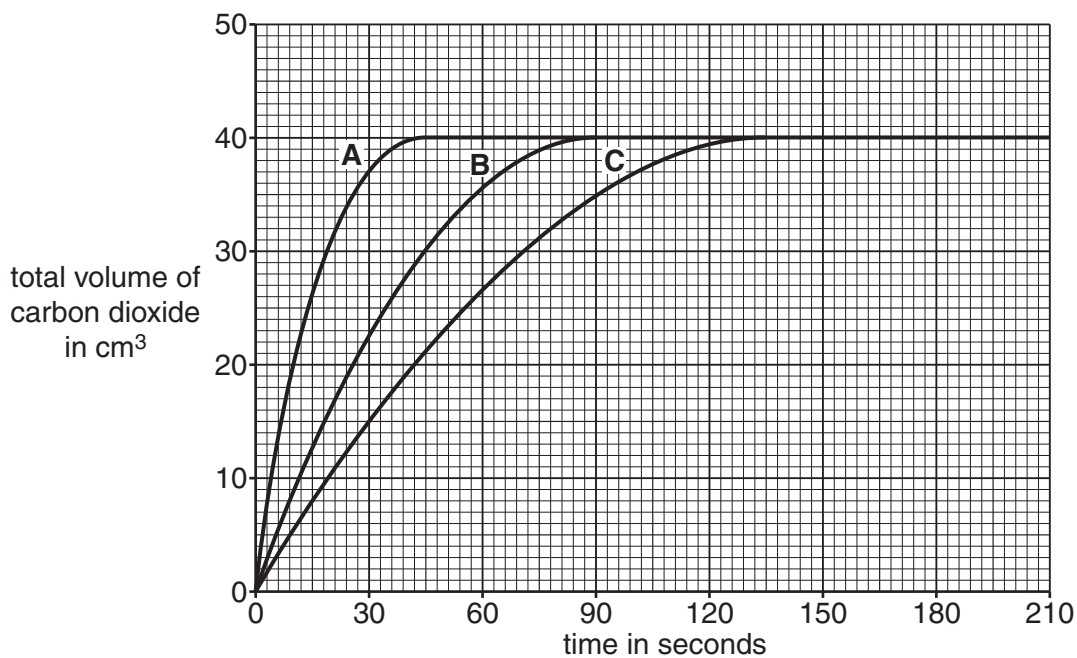


In each experiment she uses a different size of marble chip.

She uses the same mass of marble in each experiment.

She also uses the same concentration of acid.

Look at the graph of Wendy's results.



(a) (i) In which experiment were the smallest marble chips used?

Choose **A**, **B** or **C**.

answer .....

[1]

(ii) Look at the line for experiment **B**.

When is the rate of reaction **greatest**?

Choose your answer from the list.

**0 – 30 seconds**

**30 – 60 seconds**

**60 – 90 seconds**

**90 – 120 seconds**

answer ..... seconds [1]

(iii) Look at the line for experiment **C**.

Calculate the rate of reaction during the first 30 seconds.

.....  
.....  
.....

answer ..... cm<sup>3</sup>/s [2]

(b) Wendy repeats experiment **C** at **40 °C** instead of **20 °C**.

The reaction is faster.

Explain why.

Use ideas about particles.

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

**[Total: 5]**

## Section C – Module C3

10 This question is about elements in the Periodic Table.

Look at the list of elements.

aluminium	lithium
beryllium	neon
calcium	nitrogen
fluorine	potassium
iron	sulfur

Choose **only** elements from the list to answer the questions.

Each element can be used **once, more than once** or **not at all**.

The Periodic Table on the back page may help you.

(a) Write down the **name** of the element which gives a lilac flame when it burns.

..... [1]

(b) Write down the **name** of an element which has 7 electrons in its outer shell.

..... [1]

(c) Write down the **name** of the element with an electronic structure of 2.8.8.2.

..... [1]

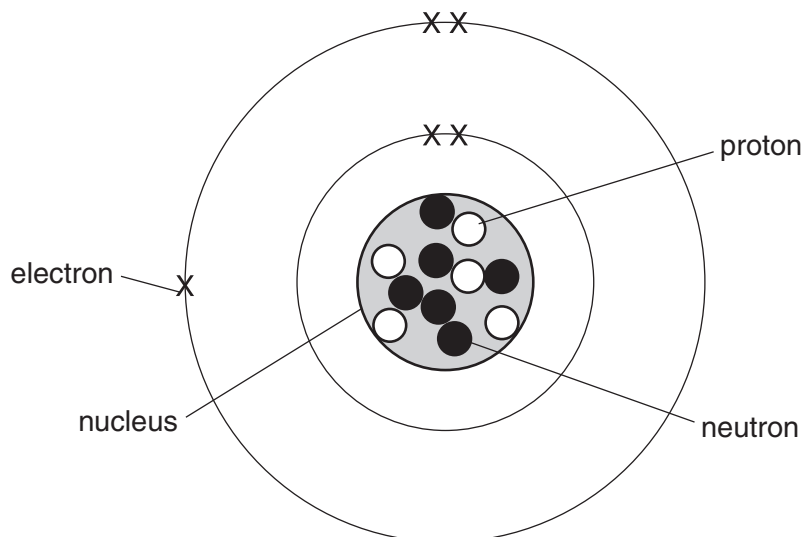
[Total: 3]



11 This question is about atomic structure.

Look at the diagram.

It shows the structure of an atom of boron.



(a) What is the **mass** number of this boron atom?

answer .....

[1]

(b) Another isotope of boron has a mass number of 12.

Write down the number of **protons** in this isotope.

answer .....

[1]

[Total: 2]

12 This question is about the halogens.

(a) Mandy investigates the reaction between chlorine and sodium iodide solution.

She adds a solution of chlorine to sodium iodide solution.

Iodine is made.

Write down the **word** equation for this reaction.

..... [1]

(b) Mandy now adds chlorine to a solution of sodium bromide.

Sodium bromide solution is colourless.

The solution changes colour when chlorine is added.

Write down the colour of the solution after chlorine is added.

..... [1]

(c) Mandy fills a gas jar with chlorine gas,  $Cl_2$ .

She gently warms a small piece of sodium then puts it in the chlorine gas.

A violent reaction occurs. Sodium chloride is made.

Write down the **balanced symbol** equation for this reaction.

..... [2]

(d) (i) The bond in a chlorine molecule is a shared pair of electrons.

What type of bond is this?

Choose from the list.

**covalent**

**intermolecular**

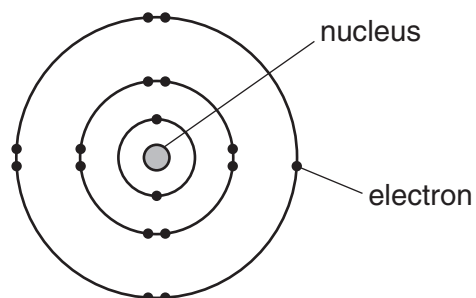
**ionic**

**metallic**

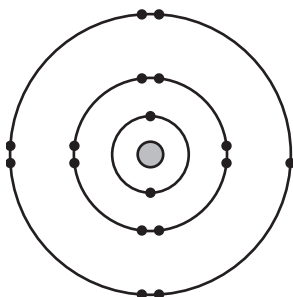
answer ..... [1]

(ii) Look at the diagram.

It shows an atom of chlorine.



Complete the 'dot and cross' diagram below to show the bonding in a molecule of chlorine,  $Cl_2$ .



[2]

[Total: 7]

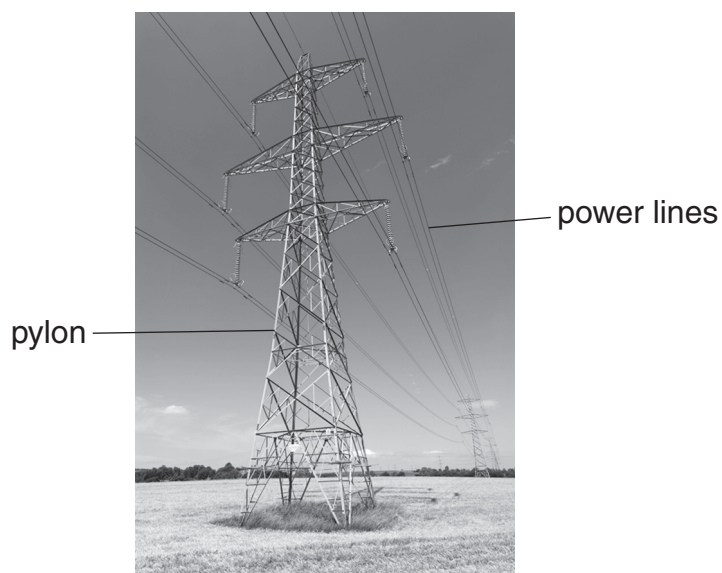
13 This question is about metals.

(a) Look at the table of data for the properties of some metals.

	aluminium	copper	iron	lead
density in g/cm <sup>3</sup>	2.7	8.9	7.9	11.4
relative electrical conductivity	40	64	11	5
relative strength	70	220	210	15

Look at the picture of some power lines.

These power lines are made from aluminium.



Explain why aluminium is used for making power lines.

The information in the table may help you.

.....

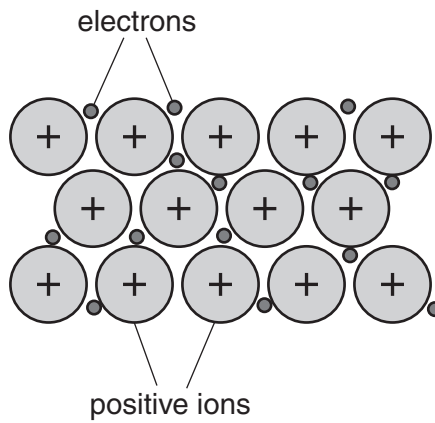
.....

.....

..... [2]

(b) Look at the diagram.

It shows the structure of a metal.



Metals are good conductors of electricity.

Explain why.

Use the diagram to help you.

.....

.....

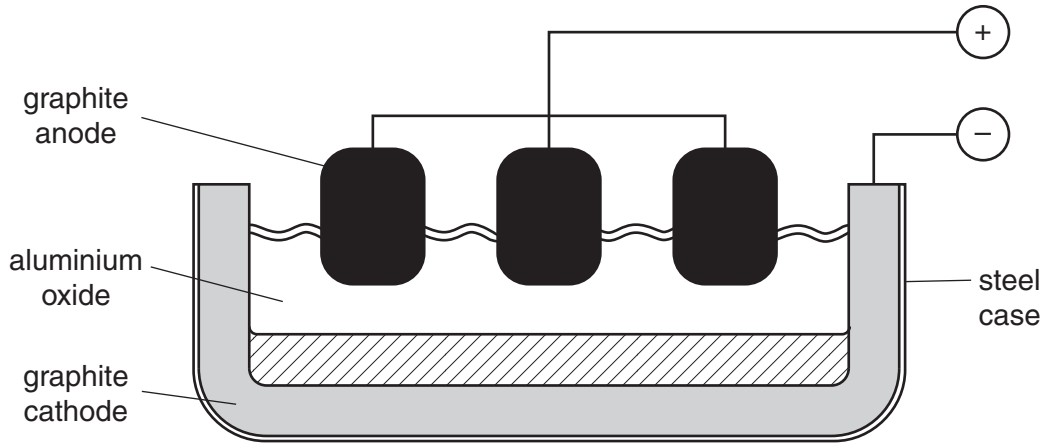
..... [2]

[Total: 4]

14 Aluminium is extracted from its mineral using electricity.

Look at the diagram.

It shows the equipment that is used.



(a) The aluminium oxide is broken down by electrolysis.

(i) Write down the name of the substance made at each electrode.

anode .....

cathode .....

[1]

(ii) What happens to the graphite anodes during electrolysis?

.....

..... [1]

(b) Cryolite is added to the aluminium oxide.

Cryolite decreases the **cost** of making aluminium.

Explain why.

.....

.....

..... [2]

[Total: 4]

END OF QUESTION PAPER

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# The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9	20 <b>Ne</b> neon 10	
23 <b>Al</b> aluminum 13	24 <b>Mg</b> magnesium 12	27 <b>Al</b> aluminum 13	28 <b>Si</b> silicon 14	31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	40 <b>Ar</b> argon 18	
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20	45 <b>Sc</b> scandium 21	70 <b>Ga</b> gallium 31	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36	
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	115 <b>In</b> indium 49	122 <b>Sb</b> antimony 51	128 <b>Te</b> tellurium 52	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54	
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	204 <b>Tl</b> thallium 81	209 <b>Pb</b> lead 82	207 <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86	
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	Elements with atomic numbers 112-116 have been reported but not fully authenticated					
55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	65 <b>Zn</b> zinc 30	63.5 <b>Cu</b> copper 29	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	131 <b>Bi</b> bismuth 83	
59 <b>Ni</b> nickel 28	59 <b>Co</b> cobalt 27	103 <b>Rh</b> rhodium 45	197 <b>Hg</b> mercury 80	106 <b>Pd</b> palladium 46	195 <b>Pt</b> platinum 78	201 <b>Hg</b> mercury 80		
101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	192 <b>Ir</b> iridium 77	[272] <b>Rg</b> roentgenium 111	195 <b>Pt</b> platinum 78	[271] <b>Ds</b> darmstadtium 110			
186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	[268] <b>Mt</b> meitnerium 109		192 <b>Ir</b> iridium 77	[277] <b>Hs</b> hassium 108			
[98] <b>Tc</b> technetium 43	186 <b>Re</b> rhenium 75	[266] <b>Bh</b> bohrium 107		190 <b>Os</b> osmium 76	[277] <b>Hs</b> hassium 108			
52 <b>Cr</b> chromium 24	184 <b>W</b> tungsten 74	[266] <b>Sg</b> seaborgium 106		190 <b>Os</b> osmium 76	[277] <b>Hs</b> hassium 108			
51 <b>V</b> vanadium 23	184 <b>W</b> tungsten 74	[262] <b>Db</b> dubnium 105		190 <b>Os</b> osmium 76	[277] <b>Hs</b> hassium 108			
48 <b>Ti</b> titanium 22	178 <b>Hf</b> hafnium 72	[261] <b>Rf</b> rutherfordium 104		190 <b>Os</b> osmium 76	[277] <b>Hs</b> hassium 108			
91 <b>Zr</b> zirconium 40	178 <b>Hf</b> hafnium 72	[261] <b>Rf</b> rutherfordium 104		190 <b>Os</b> osmium 76	[277] <b>Hs</b> hassium 108			
93 <b>Nb</b> niobium 41	181 <b>Ta</b> tantalum 73	[262] <b>Db</b> dubnium 105		190 <b>Os</b> osmium 76	[277] <b>Hs</b> hassium 108			
93 <b>Nb</b> niobium 41	181 <b>Ta</b> tantalum 73	[262] <b>Db</b> dubnium 105		190 <b>Os</b> osmium 76	[277] <b>Hs</b> hassium 108			

1	<b>H</b> hydrogen 1
---	---------------------------

relative atomic mass
atomic symbol
name
atomic (proton) number

Key

\* 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.