

**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	
Centre number		Candidate number	

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.

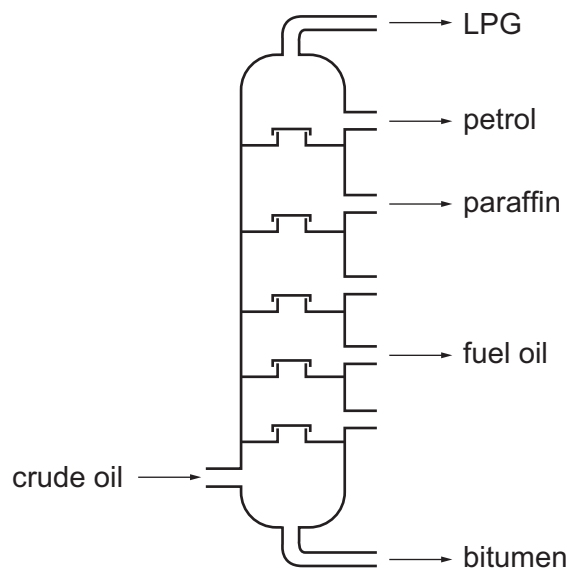
2

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]

3

(b) Look at the table.

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

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

fraction	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 fraction does the supply match the demand?

..... [1]

(ii) Some fractions 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) The petrol fraction contains octane, C_8H_{18} .

Octane is a **hydrocarbon**.

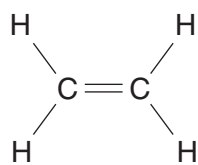
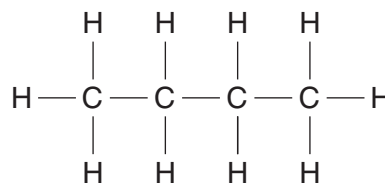
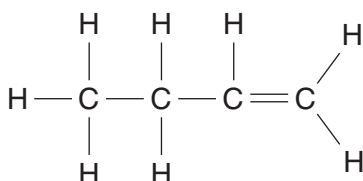
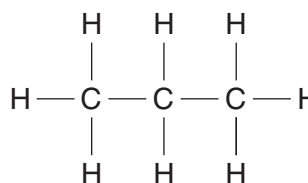
Explain why.

.....
 [1]

[Total: 5]

4

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]

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]

6

- 4 This question is about energy changes.

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

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

She then adds 2 g 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
A	20	20
B	19	12
C	20	35
D	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 4.2 J/g °C.

.....

.....

.....

answer J [2]

[Total: 3]

7

- 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) Nylon is not breathable.

When Jill exercises she perspires. The sweat cannot 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]

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

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 will be sold from 2012.

Almost all of it will be made 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 car 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 owns a Vauxhall Astra.

He drives his car 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, N₂, 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]

13

(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.

.....

.....

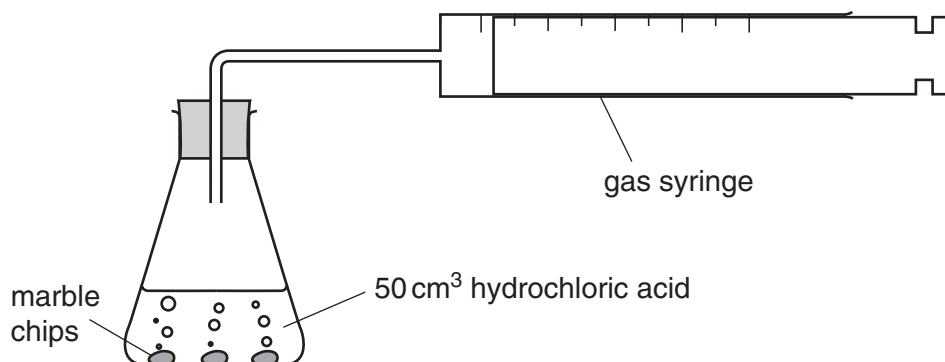
.....

..... [2]

[Total: 4]

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

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

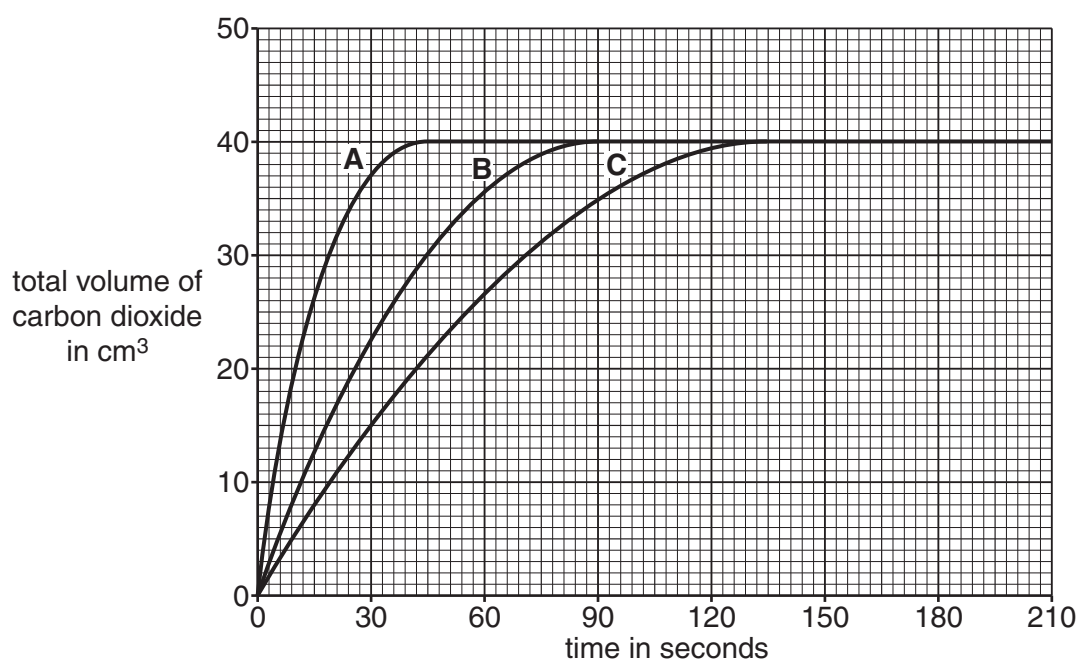


In each experiment she uses a different size of marble chip.

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]

15

(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 cm³/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.

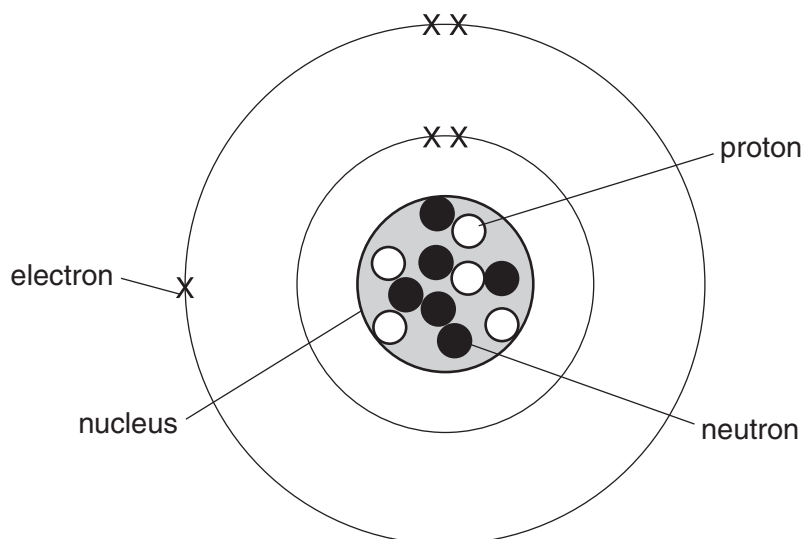
..... [1]

[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

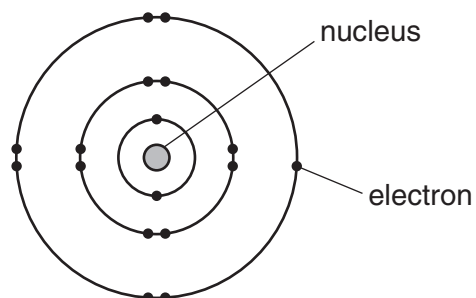
metallic

answer [1]

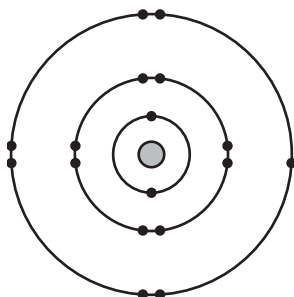
19

(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]

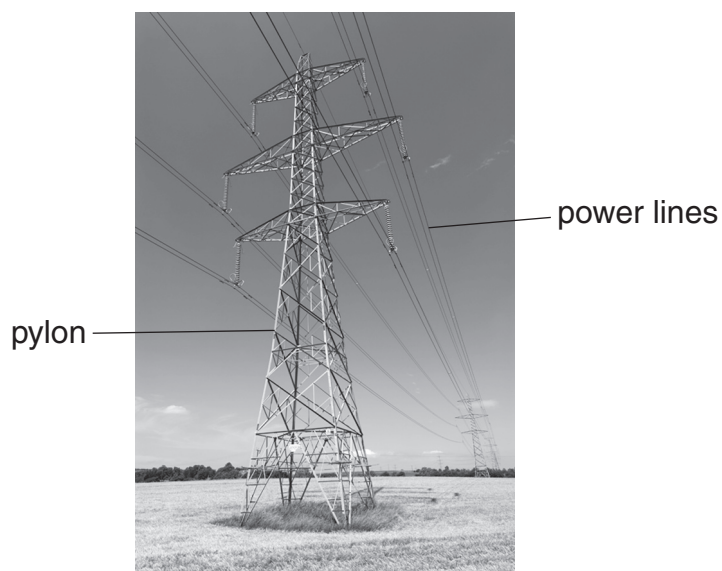
13 This question is about metals.

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

	aluminium	copper	iron	lead
density in g/cm³	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.

.....

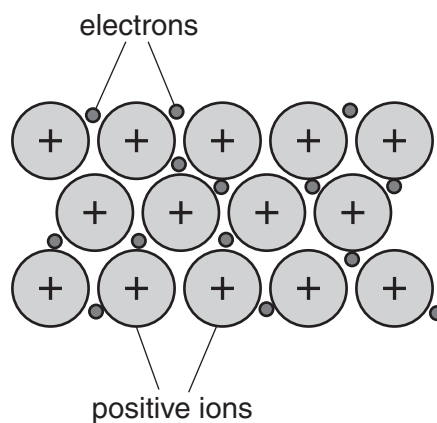
.....

.....

..... [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.

.....

.....

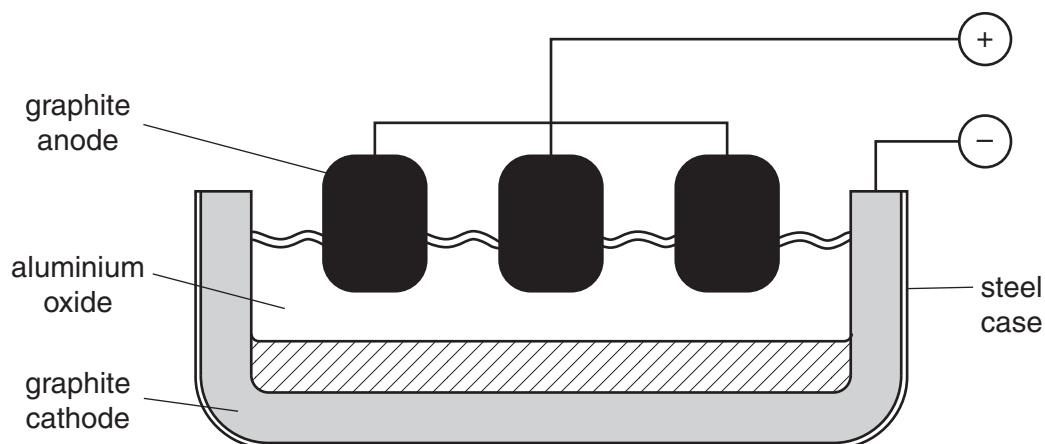
..... [2]

[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

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

The Periodic Table of the Elements

1	2	Key										3	4	5	6	7	0							
		relative atomic mass atomic symbol name atomic (proton) number																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.