

Wednesday 18 January 2012 – Morning

**GCSE GATEWAY SCIENCE
CHEMISTRY B**

B741/01 Chemistry modules C1, C2, C3 (Foundation 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)

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- 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).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

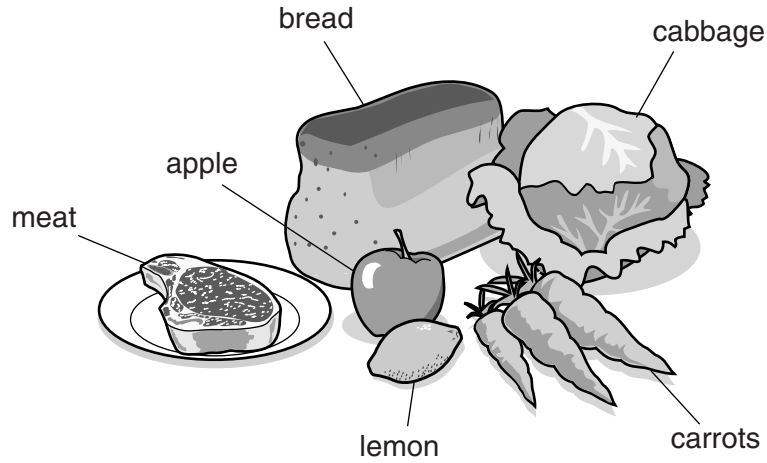
- Your quality of written communication is assessed in questions marked with a pencil (✎)
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

Section A – Module C1

1 This question is about chemical changes.

(a) Look at the picture of some foods.



Lemon, apple, cabbage and carrots can be eaten raw.

Meat is usually cooked.

A chemical change happens when meat is cooked.

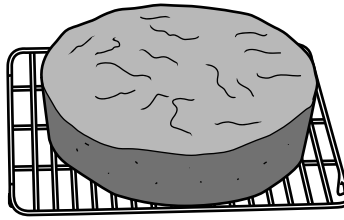
Explain why this is a chemical change.

.....

.....

..... [2]

(b) Amir is making a cake.



He adds baking powder to the cake mixture.

Baking powder contains sodium hydrogencarbonate.

Sodium hydrogencarbonate, NaHCO_3 , breaks down when heated in an oven.

Sodium carbonate, Na_2CO_3 , carbon dioxide, CO_2 , and water, H_2O , are made.

(i) Why does the baking powder help the cake to rise?

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

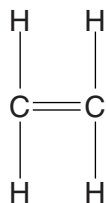
(ii) Write the **balanced symbol** equation for this reaction.

..... [2]

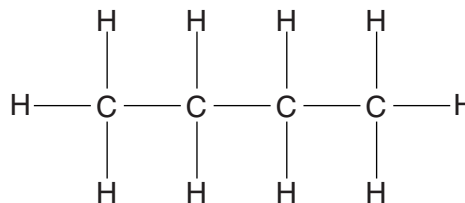
[Total: 5]

2 Compounds **A**, **B**, **C** and **D** are hydrocarbons.

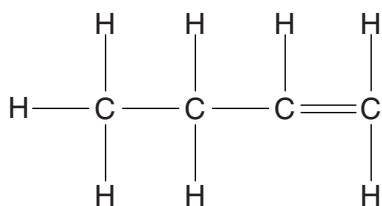
Look at the displayed formulas for compounds **A**, **B**, **C** and **D**.



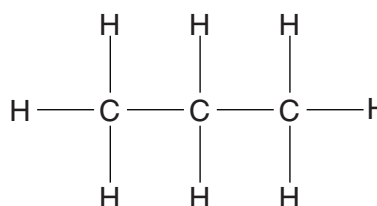
compound **A**



compound **B**



compound **C**



compound **D**

(a) One of the compounds contains a total of **12 atoms**.

Which one?

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

answer

[1]

(b) Write down the **molecular formula** of compound **B**.

answer

[1]

(c) Look at the displayed formulas of these compounds.

Explain why they are all hydrocarbons.

.....

 [2]

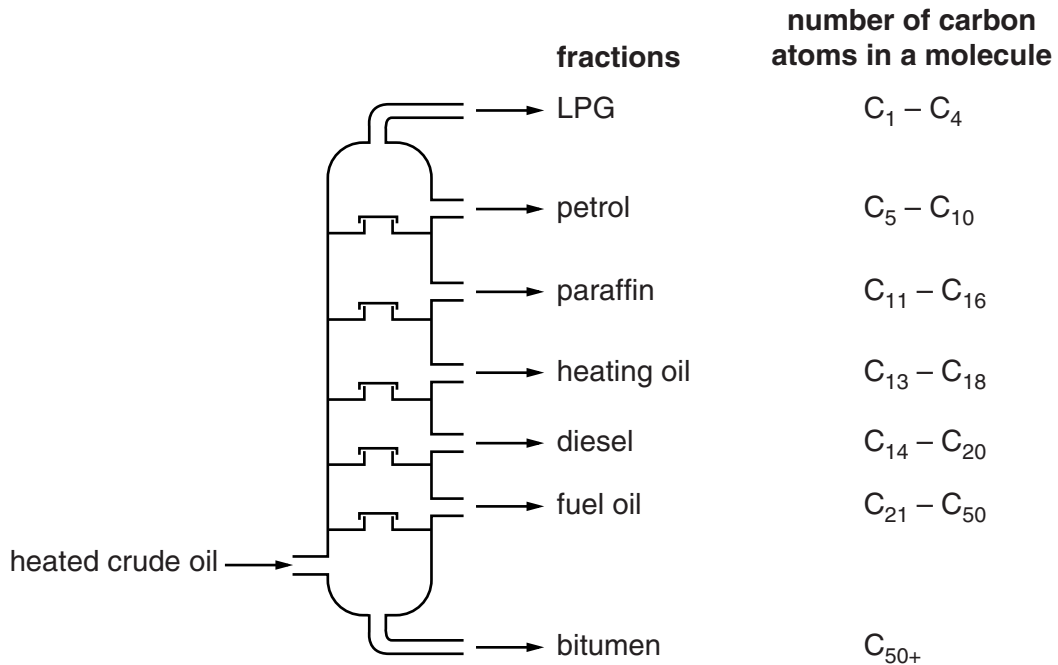
[Total: 4]

4 This question is about fuels.

(a) Crude oil is separated into many fractions by fractional distillation.

Look at the diagram.

It shows a fractionating column.



Octane has the molecular formula C_8H_{18} .

Write down the name of the fraction which contains octane.

..... [1]

(b) Oil companies continue to look for more deposits of oil.

New deposits of crude oil may be found deep under water.

To reach the oil, deep wells have to be drilled.

Write down **two** risks to the environment that deep water drilling for crude oil might bring.

.....

 [2]

(c) Look at the table.

The table shows the percentage of each fraction in crude oil.

The table also shows the percentage of each fraction needed for everyday use.

fraction	% in crude oil	% needed
LPG	4	4
petrol	5	22
heating oil	9	5
diesel	19	23
paraffin	13	8
fuel oil and bitumen	50	38

(i) There is not enough petrol made by fractional distillation.

How does the table show this?

.....
 [1]

(ii) More petrol needs to be made.

The name of the chemical reaction which can be used to make more petrol is **cracking**.

Write about cracking.

Include the conditions needed.

.....

 [2]

[Total: 6]

5 This question is about cosmetics.

(a) Julie wants to buy a new perfume.

She finds three perfumes being advertised on a website.

She researches the properties of these perfumes.

perfume A	perfume B	perfume C
does not react with water	does not react with water	does not react with water
may irritate the skin	does not irritate the skin	does not irritate the skin
evaporates easily	does not evaporate	evaporates easily
dissolves in water	dissolves in water	does not dissolve in water

Julie likes the smell of the three perfumes and they all cost the same amount.

She does not know which perfume to buy.

Look at the properties of the three perfumes.

Choose the best perfume for Julie to buy.

perfume

Explain your answer.

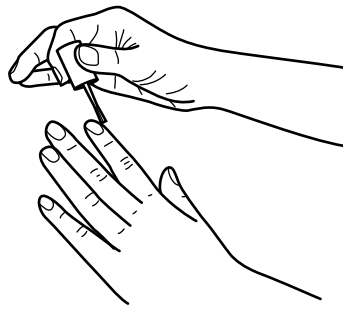
.....

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..... [3]

(b) Julie's nails are covered in nail varnish.



Julie washes her hands. The water does not remove the nail varnish.

Look at these words.

dissolve

insoluble

soluble

solute

solution

solvent

Using one or more of these words, explain why water does not remove the nail varnish.

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

[Total: 4]

Section B – Module C2

6 George is researching information about construction materials on the internet.

Look at his results.

material	formula	density in g/cm ³	relative hardness (1=soft, 10=very hard)	relative strength (1=weak, 500=very strong)
brick	no information	2.0	6	3
steel	mainly Fe	7.7	6	400
limestone	CaCO ₃	2.4	3	7
granite	mainly SiO ₂	2.9	7	23
lead	Pb	11.4	1	12
marble	CaCO ₃	2.7	5	15
copper	Cu	8.9	3	200

(a) Write down the name of one material which is an **element**.

Choose from the table.

..... [1]

(b) Which material can be used to make a 1 kg mass which has the **lowest** volume?

Choose from the table.

..... [1]

(c) Which material would be the **most** scratch resistant?

Choose from the table.

Explain your answer.

.....

.....

..... [2]

(d) Look at the picture of a girder bridge.



Which material would be best to use to make the girders of this bridge?

Choose from the table.

Explain your answer.

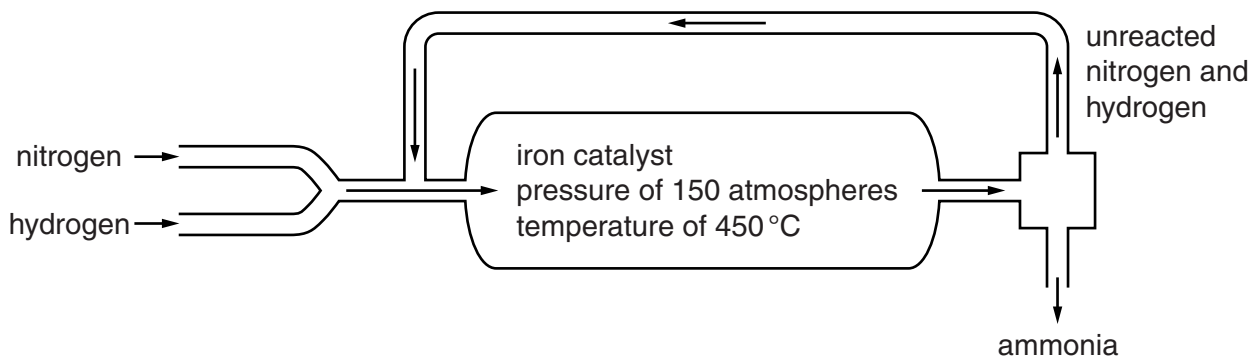
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..... [2]

[Total: 6]

7 Look at the diagram. It shows how ammonia is made in the Haber process.



(a) Write a **word** equation for the process.

..... [1]

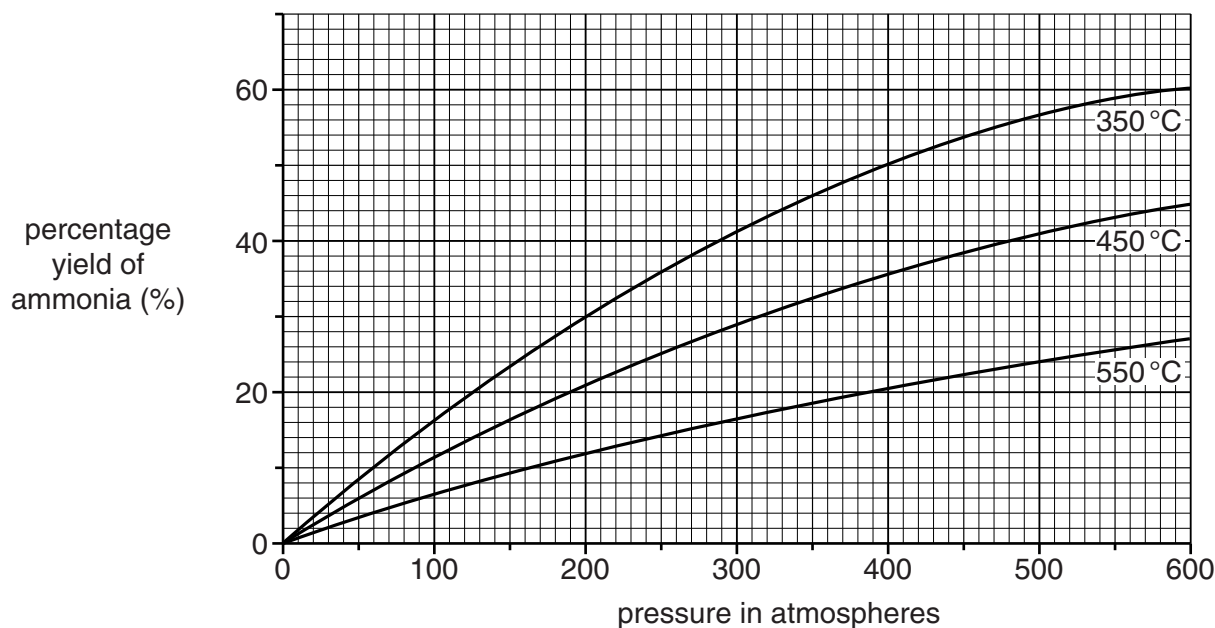
(b) The reaction is **reversible**.

What symbol is used to represent a reversible reaction?

..... [1]

(c) Look at the graph.

It shows the percentage yield of ammonia at different temperatures and pressures.



What is the percentage yield of ammonia at **350 °C** and **200 atmospheres**?

answer%

[1]

(d) Look at the graph.

(i) What conditions, shown on the graph, give the **highest** yield of ammonia?

pressure = atmospheres

temperature = °C [1]

(ii) It is too expensive to use these conditions to make ammonia.

Suggest why.

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

(e) Ammonia is used to make ammonium nitrate, NH_4NO_3 .

Ammonium nitrate is a fertiliser.

What is the number of **different elements** in the formula, NH_4NO_3 ?

..... [1]

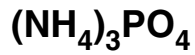
[Total: 7]

8 Jade and Philip are studying fertilisers.

(a) Ammonium phosphate is a fertiliser.

Fertilisers contain essential elements.

The formula of ammonium phosphate is



Which **essential elements** for plant growth are in ammonium phosphate?

..... [1]

(b) (i) How are fertilisers **absorbed** by plants?

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

(ii) Write about how fertilisers are **beneficial** and the **problems** they can cause.

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

[Total: 4]

9 Scientists accept that the surface of the Earth is made up of tectonic plates.

(a) Describe the main parts of the **structure** of the Earth and what happens when tectonic plates meet.

You may wish to draw a diagram.



The quality of written communication will be assessed in your answer to this question.

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..... [6]

(b) Geologists study the structure of the Earth.

This is not an easy thing to do.

Explain why.

.....

.....

..... [2]

[Total: 8]

Section C – Module C3

10 Medical drugs are speciality chemicals.



They are often made in a batch process rather than a continuous process.

(a) What is the difference between a **batch** process and a **continuous** process?

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

(b) Medical drugs often cost a lot of money to make and develop.

One factor that affects the cost is the research and testing that has to be done.

Write down **other** factors that affect the cost of making and developing a medical drug.

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

(c) Medical drugs are tested to make sure they are safe to use.

The research and testing of medical drugs may include

- animal testing
- testing on human volunteers.

Scientists have different views about the use of animals or humans for drug testing.

Sarah is a scientist.

Sarah
I think scientists should use animal testing.
Medical drugs may be poisonous to humans.



Suggest **two** other views that scientists may have about testing on animals or humans.

.....

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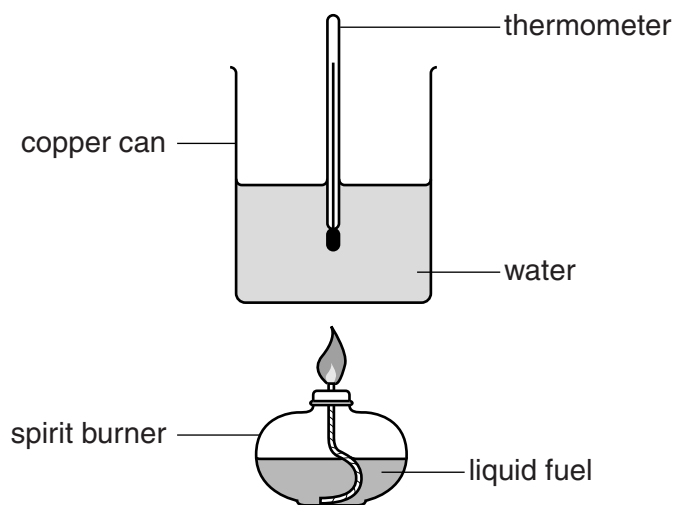
..... [2]

[Total: 6]

11 Petrol is a mixture of hydrocarbons.

David investigates the energy released when four of these hydrocarbons are burned.

Look at the apparatus he uses.



Each time, he burns 0.5 g of hydrocarbon and heats 100 g of water.

David measures the temperature of the water before heating.

He measures the temperature again when the hydrocarbon has finished burning.

These are his results.

hydrocarbon	temperature of water in °C	
	at start	at end
hexane	20	40
heptane	19	41
octane	15	39
nonane	18	45

(a) Which hydrocarbon releases the **most** energy?

Explain your answer.

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

(b) Nonane has the molecular formula C_9H_{20} .

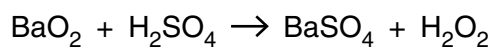
How many **atoms** are there in one molecule of nonane?

..... [1]

[Total: 3]

12 Hydrogen peroxide has the molecular formula H_2O_2 .

Hydrogen peroxide can be manufactured by reacting barium peroxide, BaO_2 , with sulfuric acid, H_2SO_4 .



Barium sulfate, BaSO_4 , is a waste product.

Look at the table of relative formula masses, M_r .

formula	relative formula mass, M_r
BaO_2	169
H_2SO_4	
BaSO_4	233
H_2O_2	34

(a) Calculate the relative formula mass for sulfuric acid, H_2SO_4 .

The relative atomic mass, A_r , of H = 1, of S = 32 and of O = 16.

.....

relative formula mass = [1]

(b) Show that the **atom economy** for the reaction is 12.7%.

.....

 [1]

(c) The manufacture of hydrogen peroxide has an atom economy of 12.7%.

The process is not very 'green'.

Explain why.

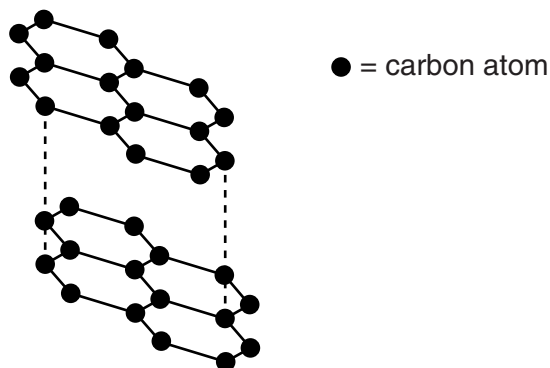
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 [2]

[Total: 4]

13 Graphite is a form of carbon.

Look at the diagram of the structure of graphite.



(a) Look at the statements about graphite.

Put ticks (✓) in the boxes next to the **two** correct statements.

graphite has a low melting point

graphite conducts electricity when solid

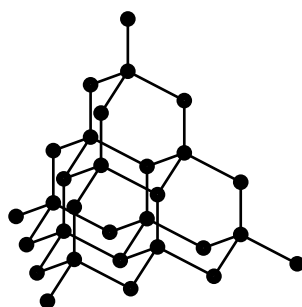
graphite is colourless

graphite is insoluble in water

graphite is extremely hard

[2]

(b) Look at the diagram of another form of carbon.



What is the name of this form of carbon?

..... [1]

[Total: 3]

14 Magnesium reacts with dilute hydrochloric acid.

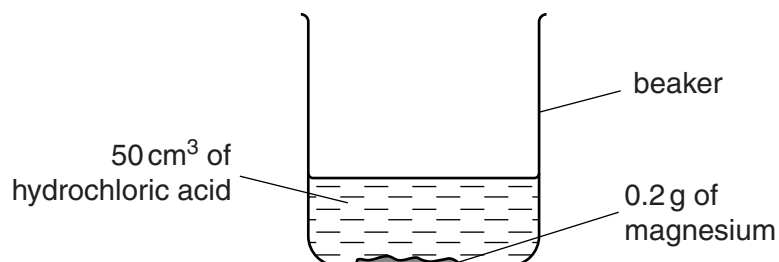
Magnesium chloride and hydrogen are made.

(a) Write down the **word** equation for this reaction.

..... [1]

(b) Peter and Rachel investigate the reaction between magnesium and hydrochloric acid.

Look at the apparatus they use.



They time how long it takes for all of the magnesium to react (the reaction time).

Look at their results.

experiment	temperature of acid	concentration of acid	magnesium ribbon or powder	reaction time in seconds
A	cold	dilute	ribbon	240
B	warm	dilute	ribbon	100
C	cold	concentrated	ribbon	120
D	cold	dilute	powder	50

(i) Peter and Rachel conclude that the reaction time gets shorter as the temperature and concentration of acid increase.

Explain how their results show this.

.....

 [2]

- (ii) Peter and Rachel can use a model called **collision theory** to explain how factors affect the rate of a reaction.

They know the rate of reaction increases when

- the temperature of the acid increases
- magnesium powder is used instead of magnesium ribbon.

Explain why, using collision theory.



The quality of written communication will be assessed in your answer to this question.

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..... [6]

[Total: 9]

END OF QUESTION PAPER



The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 Mg magnesium 12	13 Al aluminium 13	14 Si silicon 14	15 P phosphorus 15	16 S sulfur 16	17 Cl chlorine 17	18 Ar argon 18								
	19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27	30 Ni nickel 28	31 Cu copper 29	32 Zn zinc 30	33 Ga gallium 31	34 Ge germanium 32	35 As arsenic 33	36 Se selenium 34	37 Br bromine 35	38 Kr krypton 36
	37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium [98]	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Sn tin 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54
	55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium [209]	85 At astatine [210]	86 Rn radon [222]
	[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						

1	H	hydrogen	1
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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.