OCR
RECOGNISING ACHIEVEMENT

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B624/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

ADDITIONAL SCIENCE B

Unit 2 Modules B4 C4 P4 (Higher Tier)

WEDNESDAY 11 JUNE 2008

Afternoon
Time: 1 hour

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
                          Ruler (cm/mm)

Candidate Forename		Candidate Surname	

Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE

Section	Max.	Mark
A	20	
B	20	
C	20	
TOTAL	60	

This document consists of **22** printed pages and **2** blank pages.

2

EQUATIONS

$$\text{speed} = \frac{\text{distance}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2}\,mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

3

BLANK PAGE

Question 1 starts on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

4

Answer **all** the questions.

Section A – Module B4

1 Kathy grows her own tomato plants.

(a) The soil Kathy uses does not have enough nitrate.
Some of her plants show signs of nitrate deficiency.

Describe **two** signs of nitrate deficiency the plants would show.

1 ....

2 ....[2]

(b) Kathy decides to use fertiliser on her soil.

Look at the picture of the bag of fertiliser.
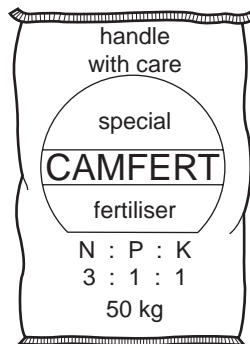
(i) The plants grown by Kathy use the nitrates.

What do the plants make using the nitrates?

....[1]

(ii) The fertiliser also contains magnesium.

What do plants use the magnesium for?

....[1]

(c) Kathy has grown too many tomatoes to eat all at once.
She decides to turn them into tomato chutney by cooking them with vinegar.

Vinegar helps to preserve the tomatoes.

Explain how.

....

....[2]

5

(d) Kathy's friend John also grows tomatoes.

However, John does not use any soil.

The diagram shows John's plants.

solution of fertiliser in water   sterile pellets   solution recycled
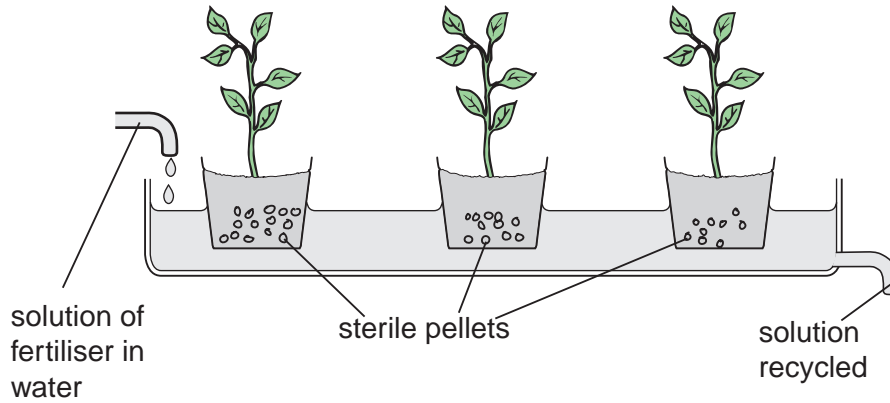
(i) Write down the name given to the method John uses.

....[1]

(ii) Write down **one** advantage and **one** disadvantage of this method compared to growing plants in soil.

advantage...

....

disadvantage ....

....[2]

[Total: 9]

[Turn over

2 Look at the diagram. It shows a food chain.

40 lettuces   100 caterpillars   10 blue tits
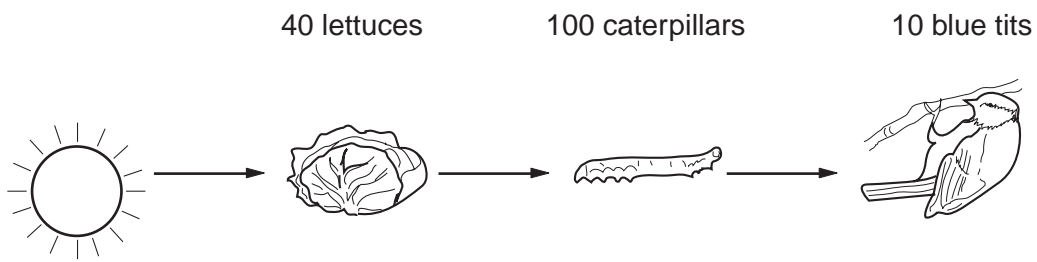
(a) (i) Finish the pyramid of **numbers** to include the caterpillars and blue tits.

Make sure the bars are drawn to scale.

40 lettuces
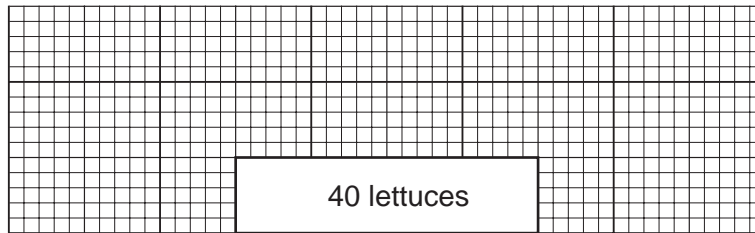
[1]

(ii) A pyramid of **biomass** for this food chain would be a different shape.

Describe how the shape would be different.
You may use a diagram to help you answer.

....

....[1]

(b) Energy is 'lost' from each stage of the food chain.

Write down **one** way in which energy is lost.

....[1]

(c) When blue tits die, nitrogen in their bodies can be used by plants.

This is part of the nitrogen cycle.

The table contains some bacteria found in the nitrogen cycle.

Describe the role of each bacterium next to the name.

bacteria	role in nitrogen cycle
denitrifying bacteria	
nitrifying bacteria	
nitrogen-fixing bacteria	

[3]

[Total: 6]

[Turn over

8

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PLEASE DO NOT WRITE ON THIS PAGE

3 Look at the diagram.

It shows the cellular structure of a leaf.
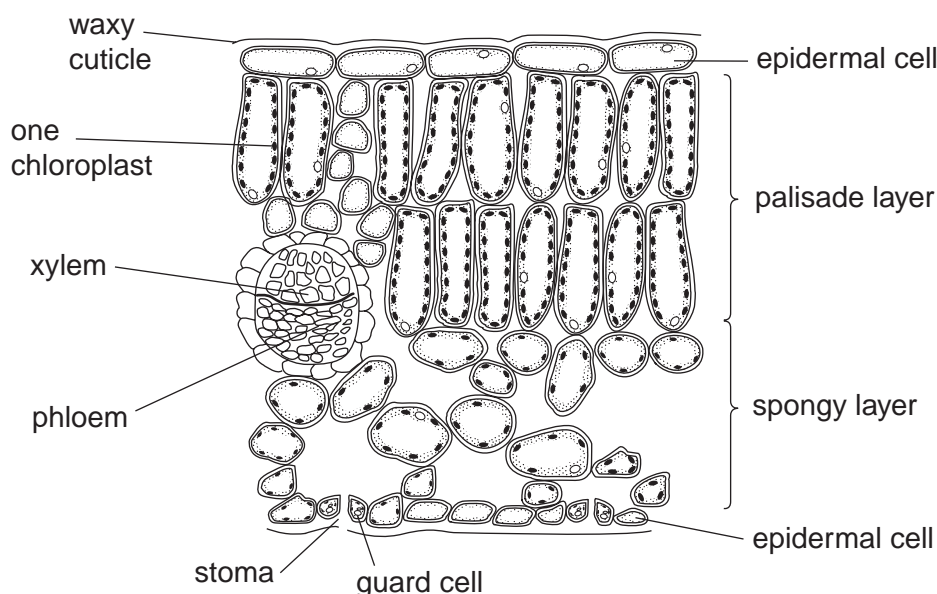
(a) (i) Describe the **job** of xylem.

....

....[1]

(ii) Describe the **structure** of xylem.

....

....[1]

(b) The leaf is adapted for efficient photosynthesis.

(i) Photosynthesis needs efficient gas exchange.

Explain how the spongy layer is adapted for efficient gas exchange.

....

....

....[2]

(ii) Describe and explain **one other** way the leaf is adapted for photosynthesis.

....

....[1]

[Total: 5]

[Turn over

10

Section B – Module C4

4 This question is about the reactions of acids.

(a) Look at the diagram. It shows the apparatus used to neutralise an acid with an alkali.
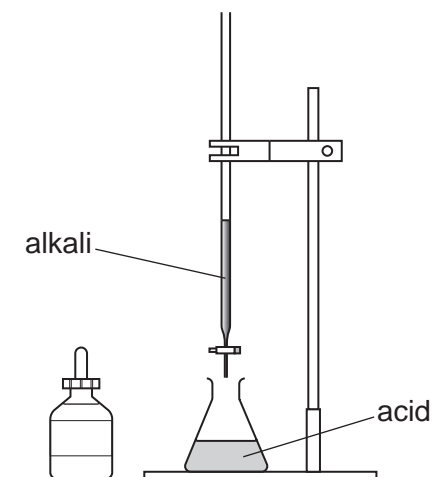
The alkali is added to the acid.

The pH number of the solution increases.

Explain why.

....[1]

(b) Calcium carbonate reacts with hydrochloric acid.

A salt called calcium chloride is made.

Calcium carbonate also reacts with **nitric acid**.

Write down the **name** of the salt that is made.

....[1]

(c) Copper oxide, CuO, neutralises hydrochloric acid, HC*l*.

Copper chloride, CuC*l*$_2$, and water are made.

(i) What type of substance is copper oxide?

Choose from the list.

allotrope

base

fertiliser

salt

answer .... [1]

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

....[2]

[Total: 5]

[Turn over

5 Julie works for a drugs company.

She is making a new medicine to treat heart disease.

(a) One of the chemicals needed to make the medicine is extracted from a plant.

Describe **one** way chemicals can be extracted from plants.

Your answer should include

- what is done to the plant
- how the chemical is removed
- how the chemical is purified.

You may wish to draw a diagram.

....

....

....

....

....[3]

(b) A new medicine is expensive to develop.

Research and development costs contribute to the high costs of medicines.

Explain how.

....

....[1]

[Total: 4]

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13

6 This question is about chemical calculations.

(a) Calcium hydroxide has the formula $Ca(OH)_2$.

Calculate the relative formula mass (M_r) of calcium hydroxide.

(The relative atomic mass (A_r) for Ca = 40, for O = 16 and for H = 1.)

....

....

....

answer .... [1]

(b) Calcium carbonate reacts with hydrochloric acid.

Calcium chloride, carbon dioxide and water are made.

Look at the symbol equation for the reaction.

$$CaCO_3 \ + \ 2HCl \ \rightarrow \ CaCl_2 \ + \ CO_2 \ + \ H_2O$$

Calculate the mass of calcium chloride, $CaCl_2$, that can be made from 50 g of calcium carbonate, $CaCO_3$.

(The relative atomic mass (A_r) for Ca = 40, for C = 12, for O = 16, for H = 1 and for Cl = 35.5.)

....

....

....

....

answer .... [2]

[Total: 3]

[Turn over

7 This question is about drinking water.

(a) Water purification has three processes.

They are **filtration**, **sedimentation** and **chlorination**.

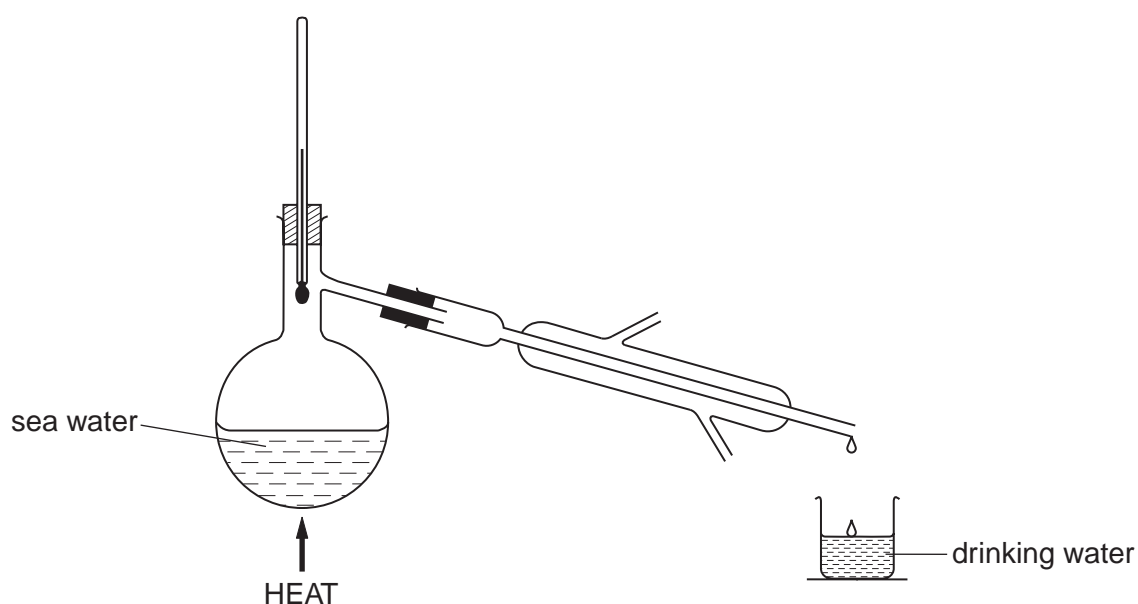Complete the table to explain why each process is used.

Sedimentation has been done for you.

process	why it is used
filtration	....
sedimentation	It allows very small solid particles to settle out.
chlorination	....

[2]

(b) Drinking water can be made by the distillation of sea water.

Look at the diagram. It shows the distillation of sea water.

sea water

HEAT

drinking water

The distillation of sea water to make drinking water is an expensive process.

Explain why.

....[1]

(c) Drinking water sometimes contains chloride ions.

Silver nitrate reacts with sodium chloride.

Sodium nitrate and silver chloride are made.

Write a **word** equation for this reaction.

....[1]

[Total: 4]

[Turn over

8 Look at the diagrams. They show the structures of diamond and graphite.
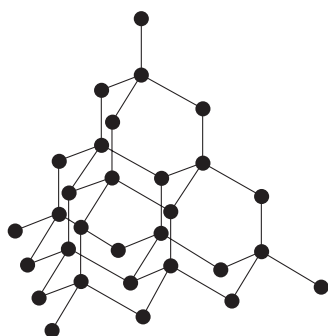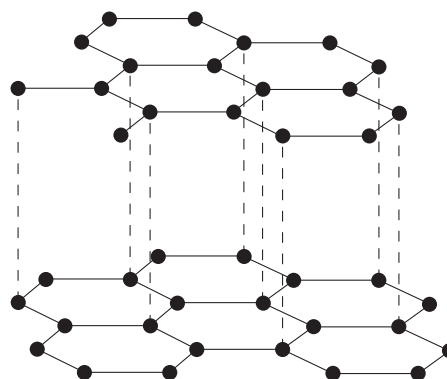
diamond   **graphite**

(a) Diamond is used in cutting tools because it is hard and has a high melting point.

Diamond is also used to make jewellery.

Explain why.

....[1]

(b) Diamond does not conduct electricity.

Explain why.

....[1]

(c) Look at the diagram.

It shows the apparatus used in the electrolysis of a solution.

X —————— electrolyte

Y

+ -

power
pack
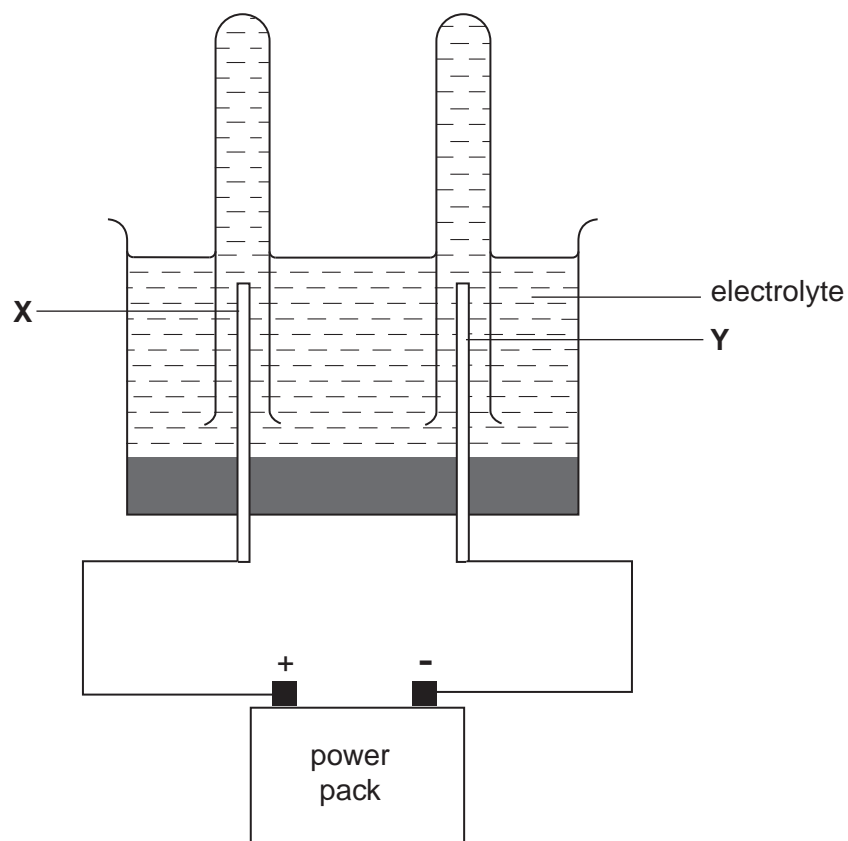
Electrodes **X** and **Y** are both made of graphite.

Suggest why.

....[1]

(d) Buckminsterfullerene is another solid form of carbon.

It is used to make **nanotubes**.

Nanotubes can be used as semiconductors in electrical circuits.

Write down **one other** use of nanotubes.

Choose from the list.

industrial catalysts

lubricants

making fertilisers

pencil leads

answer .... [1]

[Total: 4]

[Turn over

Section C – Module P4

9 **(a)** Static electricity can be dangerous in lightning strikes.

    (i) Write down **one other** situation where static electricity can be dangerous.

....

....[1]

    (ii) How can this danger be reduced?

....

....[1]

(b) Look at the pictures.

Petra holds two strips
of polythene in her hand.
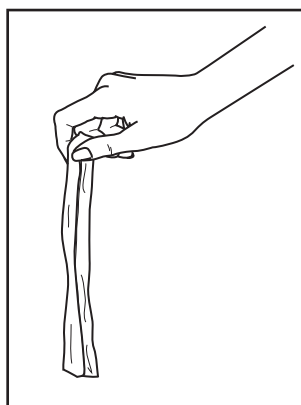
When she rubs the strips
with a duster, the two strips
move apart.
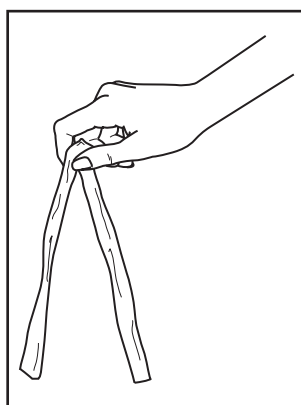
Explain why the two strips move apart.

In your answer, write about

- charges
- forces.

....

....

....

....

....[3]

[Turn over for the remainder of question 9

(c) Static electricity can be useful in spray painting cars.

During the process, the paint particles and the car are charged.

(i) All the paint particles are given the **same** charge.

Explain why.

....

....[1]

(ii) The car is given an **opposite** charge to the paint particles.

Explain why.

....

....[1]

(d) Write down **one advantage** of painting cars using static electricity.

....

....[1]

[Total: 8]

10 Chris builds this circuit.
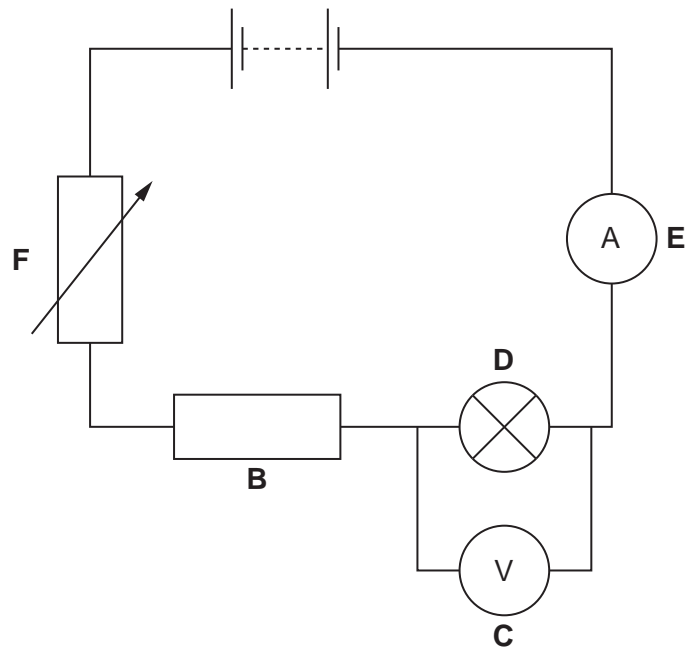
(a) She changes the **current** flowing in the circuit.

Which component does she use to change the current in the circuit?

Choose from **B**, **C**, **D**, **E** or **F**.

answer .... [1]

(b) Chris takes the readings on the two meters.

The reading on the ammeter is 0.5 A.

The reading on the voltmeter is 3 V.

Calculate the resistance of the lamp.

The equations on page 2 may help you.

....

....

answer .... ohms [2]

[Total: 3]

11 (a) Radioactive sources can be used as **tracers** in medicine.

They give out beta or gamma radiation.

    (i) Why are alpha sources **not** used as tracers?

....

....[1]

    (ii) How does the radioactive tracer get into the body?

....

....[1]

    (iii) How is information from the tracer collected?

....

....[1]

  (b) Gamma rays and X-rays have similar properties and similar wavelengths.

They are made in different ways.

How are X-rays made?

....

....

....

....[2]

[Total: 5]

12 This question is about the breakdown of nuclei.

(a) Selina measures the activity from some radioactive material.

It gives 1600 counts per minute.

The half-life of the radioactive material is 30 minutes.

Calculate the count rate after 2 hours.

....

....

....

answer .... counts per minute   [2]

(b) The reaction that produces heat in a nuclear reactor is a **chain reaction**.

If left alone, it can go out of control.

Explain how scientists stop a nuclear reaction going out of control.

....

....

....

....[2]

[Total: 4]

END OF QUESTION PAPER

The Periodic Table of the Elements

Key

| relative atomic mass |
| atomic symbol |
| name |
| atomic (proton) number |

1
H
hydrogen
1

Group 1	Group 2											Group 3	Group 4	Group 5	Group 6	Group 7	Group 0
																	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

*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.

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