

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

H B621/02

Unit 1 Modules B1 C1 P1
HIGHER TIER
MONDAY 21 MAY 2007

Morning
Time: 1 hour

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



* C O P / T 3 0 5 9 5 *

Candidate
Name

Centre
Number

| | | | | |
|--|--|--|--|--|
| | | | | |
|--|--|--|--|--|

Candidate
Number

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- **WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.**

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- 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

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

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

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{fuel energy input} = \text{waste energy output} + \text{electrical energy output}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{kilowatt hours} = \text{power (kW)} \times \text{time (h)}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer **all** the questions.

Section A - Module B1

1 Jane wears glasses.

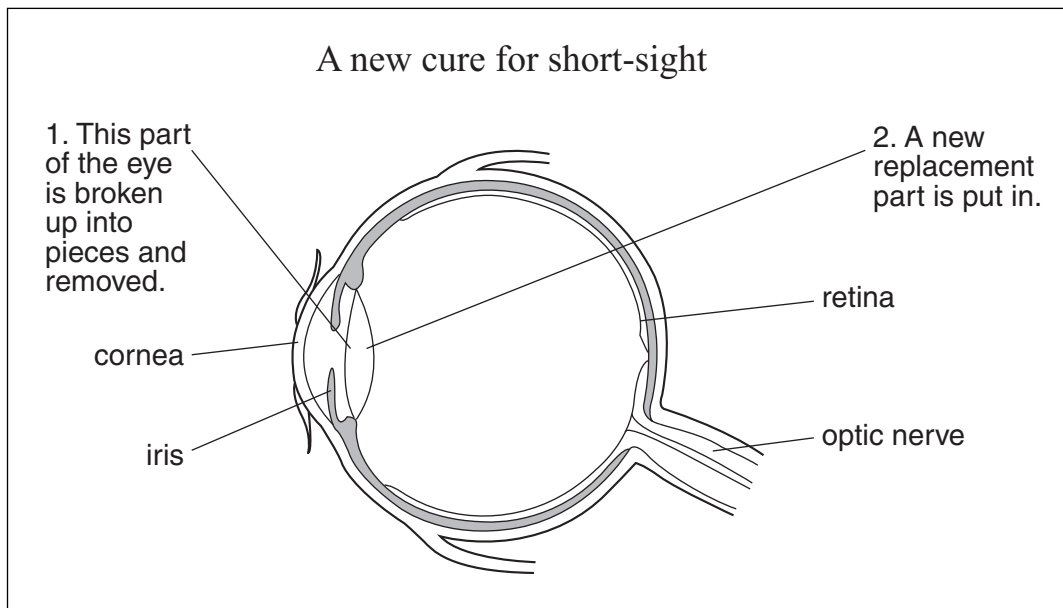
This is because she is short-sighted.



© OCR

Jane reads an article in a newspaper.

It describes a new operation to cure short-sight.



(a) Several parts of the eye are labelled in the diagram.

Describe the function of the following two parts.

(i) The function of the **cornea** is

.....

(ii) The function of the **iris** is

.....

[2]

(b) Why is the lens replaced in people who are short-sighted?

.....[1]

(c) Write down **one other type of surgery** that Jane could have to cure her short-sight.

.....[1]

(d) Other people may be red-green colour blind.

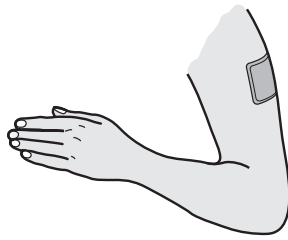
What is the cause of this?

.....[1]

[Total: 5]

2 An article appeared in the newspaper about a new type of drug.

A New Type of Contraceptive



A skin patch has been developed as a contraceptive.
 It contains a mixture of two female sex hormones.
 The patch is worn on the arm. It slowly releases the hormones through the skin and into the bloodstream.
 Each patch lasts for a week.
 The patch was tested on animals before women were allowed to use it.

(a) The patch contains oestrogen, a female sex hormone.

(i) Oestrogen controls the female secondary sexual characteristics.

Write down **one** of these characteristics.

.....[1]

(ii) The patch also contains another female hormone.

Suggest which hormone this is.

.....[1]

(b) These two hormones working together can prevent a woman becoming pregnant.

Explain how.

.....
[2]

(c) The patch was used on animals before it was allowed to be used on women.

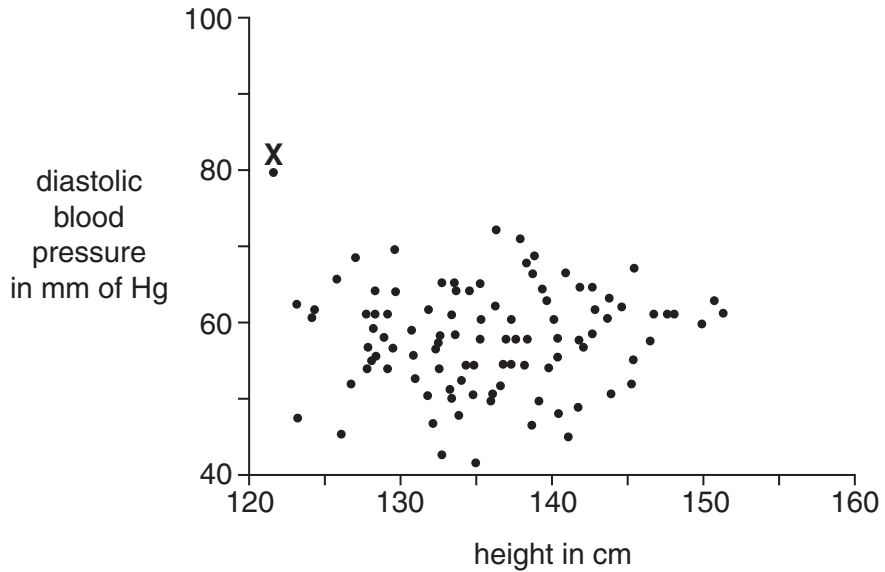
Suggest why some people may object to using animals in this way.

.....
[1]

[Total: 5]

[Turn over

- 3 A scientist measured the blood pressure and height of a large number of 9-year-old children. He plotted the children's diastolic pressure against their height on a graph.



- (a) Child X has a blood pressure of 120 / 80.

What does this represent?

Put a tick (✓) in the box next to the correct answer.

a diastolic pressure of 120 and a height of 80

a diastolic pressure of 120 and a systolic pressure of 80

a systolic pressure of 120 and a diastolic pressure of 80

a systolic pressure of 120 and a height of 80

[1]

- (b) Look at the graph.

What does the graph show about the way diastolic blood pressure varies with height?

.....

.....[1]

(c) The scientist looks at all the children that are 135 cm tall.

He plots their diastolic blood pressure against their **weight**.

Suggest what pattern the scientist might find.

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

(d) Low blood pressure and high blood pressure may have different effects on the body.

Write down **one** effect of each.

Low blood pressure may lead to

High blood pressure may lead to
[2]

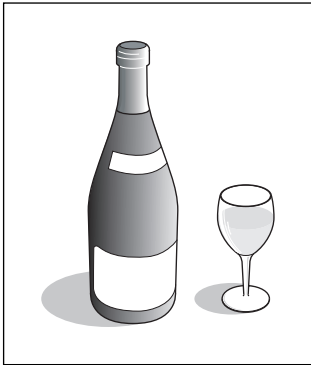
[Total: 5]

8
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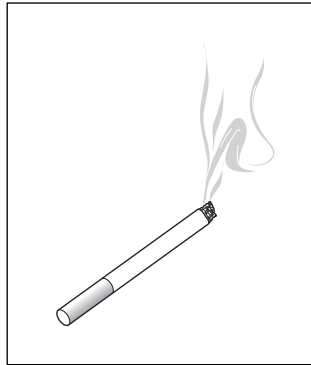
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4 This question is about drugs.

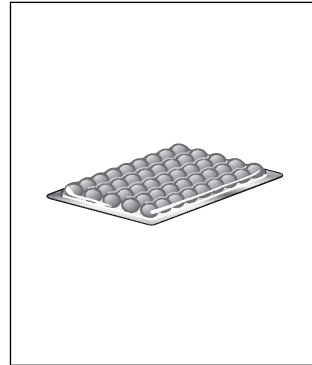
Examples of different drugs are shown below.



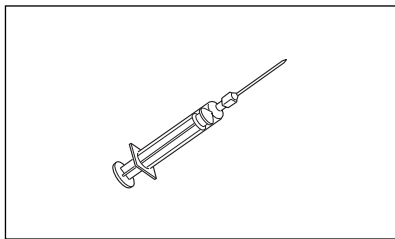
alcohol



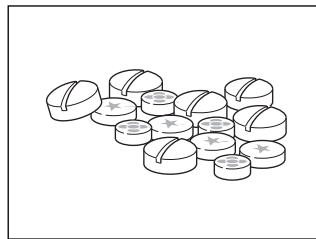
nicotine



LSD



anabolic steroids



ecstasy

(a) Write down **one** drug from the diagram that is hallucinogenic.

.....[1]

(b) LSD is described as a Class A drug and anabolic steroids as Class C drugs.

Explain why drugs are put in different classes.

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

(c) Alcohol is a depressant.

Explain how depressants affect the working of the nervous system.

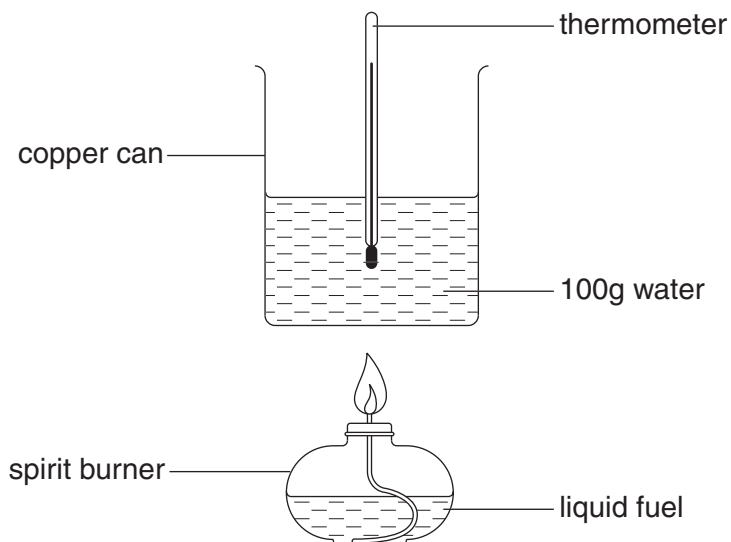
.....
.....
.....
.....[2]

[Total: 5]

Section B - Module C1

5 Rachel and Paul are investigating some fuels.

(a) Look at the diagram. It shows the apparatus they use.



They burn 1.5g of fuel each time.

Look at their table of results.

| fuel | starting temperature of water in °C | final temperature of water in °C | temperature change in °C |
|----------|-------------------------------------|----------------------------------|--------------------------|
| paraffin | 20 | 45 | 25 |
| petrol | 20 | 40 | 20 |
| ethanol | 18 | 45 | 27 |
| propanol | 15 | 45 | 30 |

(i) Burning fuels is an **exothermic** reaction.

What is meant by an exothermic reaction?

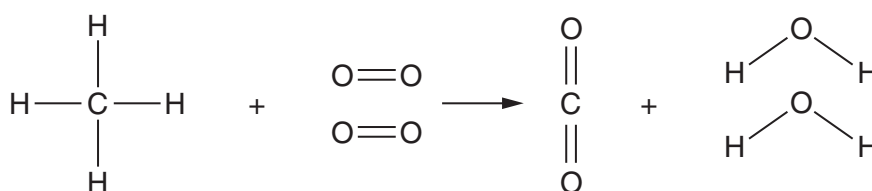
.....[1]

- (ii) Calculate the energy given out when 1.5g of **petrol** burns and heats 100g of water. (Specific heat capacity of water is 4.2J/g°C.)

.....

answer J [2]

- (b) Look at the equation. It shows what happens when methane burns.



During this reaction, bonds are broken and new bonds are made.

Complete the sentences.

Breaking bonds is an process.

When new bonds are made, energy is
 [2]

[Total: 5]

12
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6 Nick is cooking an egg.



He chooses to **fry** the egg.

(a) Frying an egg is a chemical change.

Explain why.

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

(b) Write down **two** reasons why some foods need to be cooked before they are eaten.

1
2[2]

(c) Eggs are a good source of protein.

Explain the changes that happen to an egg when it is cooked.

Your answer should include

- what happens to the protein molecules
- the name of the process that changes the protein molecules.

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

[Total: 5]

7 This question is about crude oil and its fractions.

(a) Look at the table. It shows the percentages of some fractions made from crude oil.

It also shows the percentages needed.

| fraction | amount made (%) (supply) | amount needed (%) (demand) |
|-----------------|-------------------------------------|---------------------------------------|
| gases | 5 | 10 |
| petrol | 10 | 25 |
| naphtha | 5 | 3 |
| paraffin | 15 | 10 |
| gas oil | 5 | 5 |
| fuel oil | 40 | 30 |

(i) The supply of one fraction exactly matches the demand for it.

Which fraction?

.....[1]

(ii) There is not enough petrol made to meet the demand for it.

Explain how an oil refinery solves this problem.

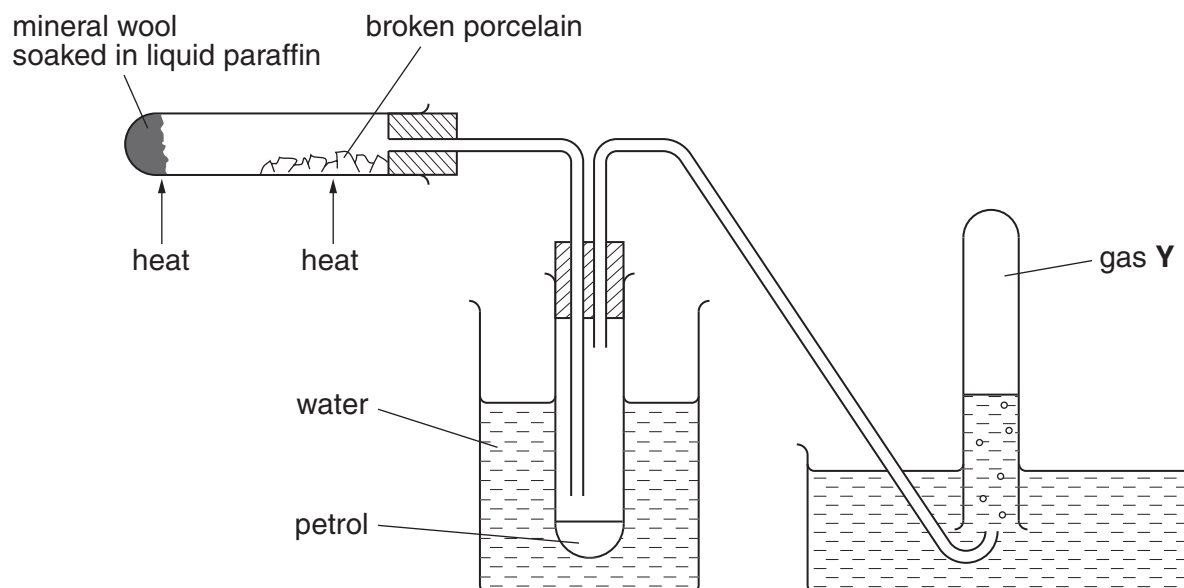
Use the information in the table to help you.

.....

[2]

(b) Lesley and Emily investigate what happens when liquid paraffin is heated.

Look at the diagram. It shows the apparatus they use.



The experiment changes large hydrocarbon molecules into smaller, more useful molecules.

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

Choose from:

carbon dioxide

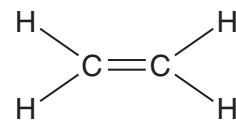
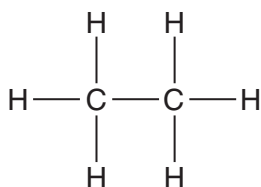
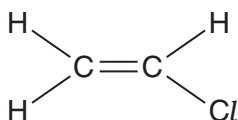
ethene

oxygen

answer[1]

[Total: 4]

8 Look at the six formulae.



Answer the questions.

Choose all your answers from the six formulae above.

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

(a) Write down the formula that is made up of 5 **atoms**.

.....[1]

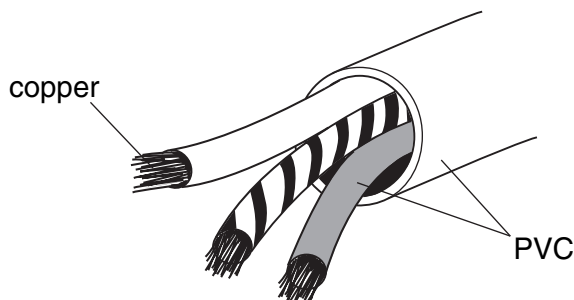
(b) Write down the formula of ethene.

.....[1]

[Total: 2]

9 This question is about polymers.

(a) PVC is a polymer used to cover copper when electrical wires are made.



One property of PVC, which makes it useful for covering electrical wires, is that it lasts a long time.

Write about **other** properties of PVC which make it useful for covering electrical wires.

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

(b) Disposing of waste plastics can sometimes cause problems.

Waste plastics can be disposed of in landfill sites or by burning them.

Write about the problems caused by these methods of disposal.

One problem with landfill sites is

.....

One problem with burning waste plastics is

.....

[2]

[Total: 4]

Section C - Module P1

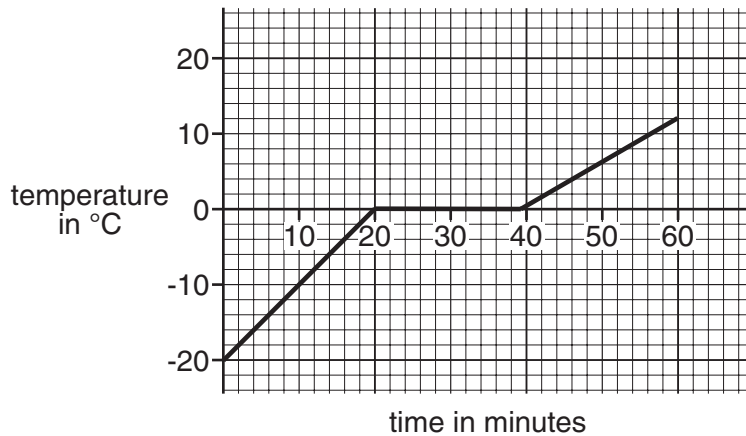
10 This question is about temperature and energy transfer.

(a) John takes a packet of frozen peas out of his freezer.

The peas are covered in ice.

He measures the temperature of the peas every few minutes for an hour.

Look at the graph of his results.



The temperature does not change between 20 minutes and 40 minutes.

Explain why.

In your answer you should state

- what is happening inside the packet of peas
- why the temperature does not change.

.....

.....

.....

.....[2]

(b) After 40 minutes, the temperature of the bag of peas goes up slowly.

This is because water has a high specific heat capacity.

Complete the sentence below.

The specific heat capacity is the amount of energy needed to

.....

.....

..... . [2]

(c) Look at the table.

It shows the masses and specific heat capacities of different objects.

| object | mass in kg | specific heat capacity in J/kg °C |
|--------|------------|-----------------------------------|
| A | 1.0 | 4200 |
| B | 2.0 | 800 |
| C | 0.5 | 6000 |
| D | 3.0 | 1200 |

The different objects are all at the same high **temperature**.

Which object stores the most heat energy?

Choose from: **A B C D**

answer [1]

[Total: 5]

11 (a) In the past, people carried messages on foot or on horseback.

It took a long time for the message to get to where it was going.

It is better to use light for sending messages.

We cannot hear messages sent using light.

When light is used to send a message, a code is needed.

Write down the name of the code that uses flashes of light.

..... code [1]

(b) A laser produces a beam of red light.

All the waves have the same frequency.

The red light has a speed of 3×10^8 (300 000 000) m/s in a vacuum.

The wavelength of red light is 6×10^{-7} m (0.0000006 m).

(i) Calculate the frequency of red light.

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

answer Hz [3]

(ii) In a laser beam, all the waves are in phase with each other.

Explain what 'in phase' means.

You may use a diagram in your answer.

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

[Total: 6]

12 (a) Earthquakes produce shock waves.

The waves produced by earthquakes can travel inside the Earth.

They are called seismic waves.

There are two sorts of seismic waves: p-waves and s-waves.

Look at the table.

It compares p-waves and s-waves.

Complete the table.

| feature of wave | p-waves | s-waves |
|------------------------|--------------------|----------------|
| speed | faster | slower |
| travel through | solids and liquids | |
| type | | |

[3]

(b) There is a layer of ozone around the Earth.

This protects the Earth from some damaging ultraviolet rays.

Environmental pollution is causing holes in the ozone layer.

Which **main** pollutant is causing these holes?

.....[1]

[Total: 4]

13 (a) Infrared radiation can be used to cook food.

Infrared radiation cannot penetrate food.

The centre of the food still gets hot.

Explain how.

In your answer describe

- what happens to the infrared radiation
- how the energy gets to the centre of the food.

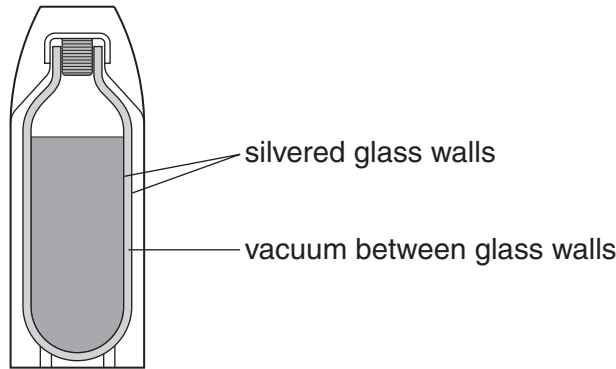
.....

.....

.....[2]

(b) Alan has a vacuum (Thermos) flask.

Look at the diagram.



The flask can be used to keep hot liquids hot.

Write about how the labelled parts of the flask help to keep liquids hot.
In your answer include the:

- method of heat transfer involved
- why the heat transfer is reduced.

(i) the silvered glass walls

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

(ii) the vacuum between the walls

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

[Total: 5]

END OF QUESTION PAPER

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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 C carbon 6 | 13 Al aluminium 13 | 14 N nitrogen 7 | 15 P phosphorus 15 | 16 O oxygen 8 | 17 F fluorine 9 | 18 Ne neon 10 |
| 19 K potassium 19 | 20 Ca calcium 20 | 23 V vanadium 23 | 24 Cr chromium 24 | 25 Mn manganese 25 | 26 Fe iron 26 | 27 Co cobalt 27 | 28 Ni nickel 28 | 29 Cu copper 29 | 30 Zn zinc 30 |
| 37 Rb rubidium 37 | 38 Sr strontium 38 | 40 Ca calcium 20 | 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 |
| 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 |
| 87 Fr francium 87 | 88 Ra radium 88 | 89 Ac* actinium 89 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 107 Bh bohrium 107 | 108 Hs hassium 108 | 109 Mt meitnerium 109 | 110 Ds darmstadtium 110 |
| 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 |
| 223 Fr francium 87 | 226 Ra radium 88 | 227 Ac* actinium 89 | 261 Rf rutherfordium 104 | 262 Db dubnium 105 | 266 Sg seaborgium 106 | 268 Mt meitnerium 109 | 271 Ds darmstadtium 110 | 272 Rg roentgenium 111 | 201 Hg mercury 80 |
| 131 Xe xenon 54 | 127 I iodine 53 | 128 Te tellurium 52 | 119 Sn tin 50 | 122 Sb antimony 51 | 125 Bi bismuth 83 | 126 Po polonium 84 | 127 At astatine 85 | 128 Rn radon 86 | 112-116 Elements with atomic numbers 112-116 have been reported but not fully authenticated |
| 84 Kr krypton 36 | 80 Br bromine 35 | 79 Se selenium 34 | 75 As arsenic 33 | 73 Ge germanium 32 | 70 Ga gallium 31 | 65 Zn zinc 30 | 63.5 Cu copper 29 | 59 Ni nickel 28 | 59 Co cobalt 27 |
| 40 Ar argon 18 | 35.5 Cl chlorine 17 | 32 S sulfur 16 | 31 P phosphorus 15 | 28 Si silicon 14 | 27 Al aluminium 13 | 24 Mg magnesium 12 | 24 Cr chromium 24 | 24 Cr chromium 24 | 24 Cr chromium 24 |
| 20 Ne neon 10 | 19 F fluorine 9 | 16 O oxygen 8 | 14 N nitrogen 7 | 12 C carbon 6 | 11 B boron 5 | 9 Be beryllium 4 | 9 Be beryllium 4 | 9 Be beryllium 4 | 9 Be beryllium 4 |
| 4 He helium 2 | | | | | | | | | |

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

1
H
hydrogen
1

* 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