

GENERAL CERTIFICATE OF SECONDARY EDUCATION **H** **B622/02**
GATEWAY SCIENCE
SCIENCE B
 Unit 2 Modules B2 C2 P2
 HIGHER TIER
THURSDAY 7 JUNE 2007

Morning
Time: 1 hour

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



* C U P / T 3 0 7 0 3 *

Candidate
Name

Centre
Number

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

Candidate
Number

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

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 **21** printed pages and **3** 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 B2

1 Look at the picture. It shows a mammal in the dense forests of Borneo.



(a) Scientists think that this mammal is a new species.

Write down **one** characteristic you can see in the picture that only mammals have.

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

(b) This mammal had never been seen by scientists before.

Suggest why.

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

(c) Large areas of the Borneo forest are being destroyed for farming.

Explain the effect the destruction might have on the new mammal.

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

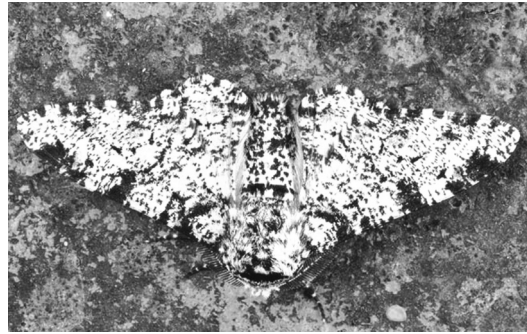
[Total: 4]

2 Look at the pictures.

They show two forms of a moth. The moths rest on trees with their wings open.



© Andrew Darrington / Alamy



© Andrew Darrington / Alamy

In polluted areas, the trees are darker than the trees in unpolluted areas.

(a) There are more dark moths than pale moths in **polluted** areas.

Explain why.

.....

.....

.....[2]

(b) A survey of moths was carried out in an **unpolluted** area.

Moths were collected in the morning.

The moths were marked with harmless paint on the underside of the wing and released.

They were then collected again later in the day.

Look at the table. It shows the results of the survey.

| | number of moths | |
|---|-----------------|-----------|
| | pale form | dark form |
| number caught first time | 500 | 467 |
| number caught the second time | 480 | 471 |
| number of marked moths caught the second time | 60 | 30 |

The population of moths in an area can be calculated using the formula:

$$\text{population} = \frac{\text{number caught first time} \times \text{number caught second time}}{\text{number of marked moths caught second time}}$$

(i) Use the formula to estimate the population of **pale** moths in the wood.

.....

[2]

(ii) This may not be the actual population of the pale moths in the wood.

Suggest a reason why.

.....
[1]

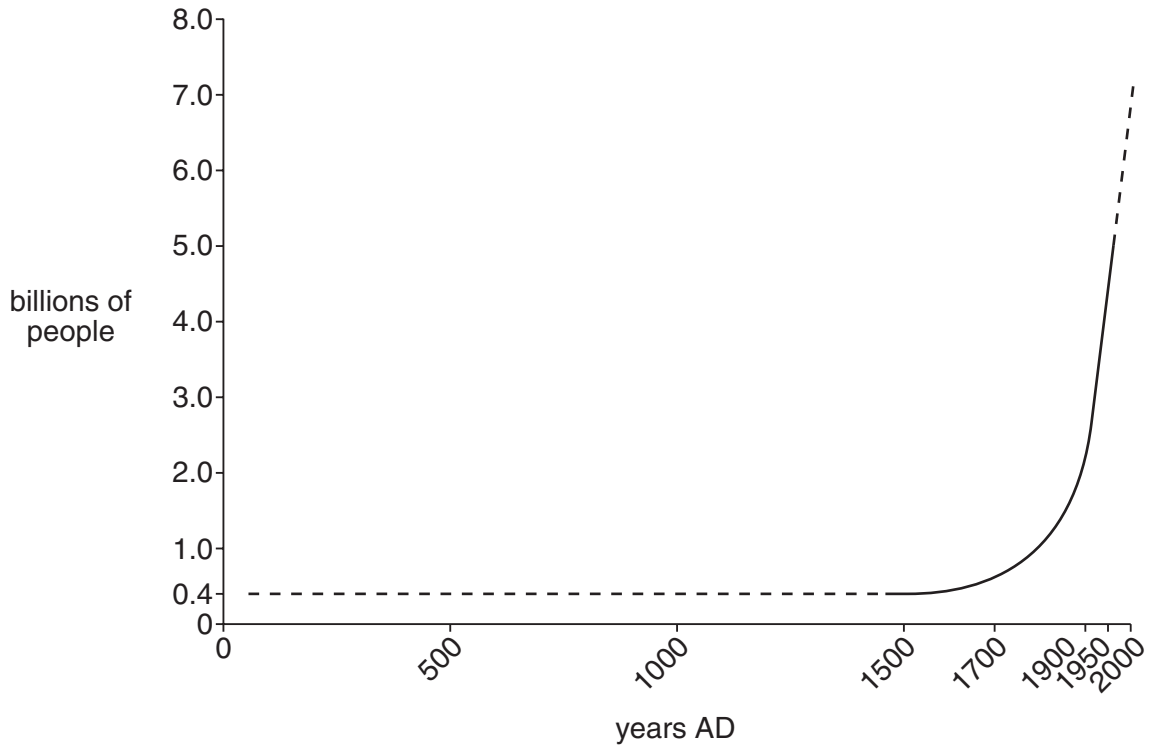
(iii) Suggest a reason why the paint was placed on the **underside** of the wing.

.....
[1]

[Total: 6]

3 Look at the graph.

It shows the human population of the world over the last 2000 years.



(a) The increase in population has led to increases in pollution.

One example is the increased release of CFCs.

The result of this is a hole in the ozone layer.

Write down **one other** example of pollution and give the result.

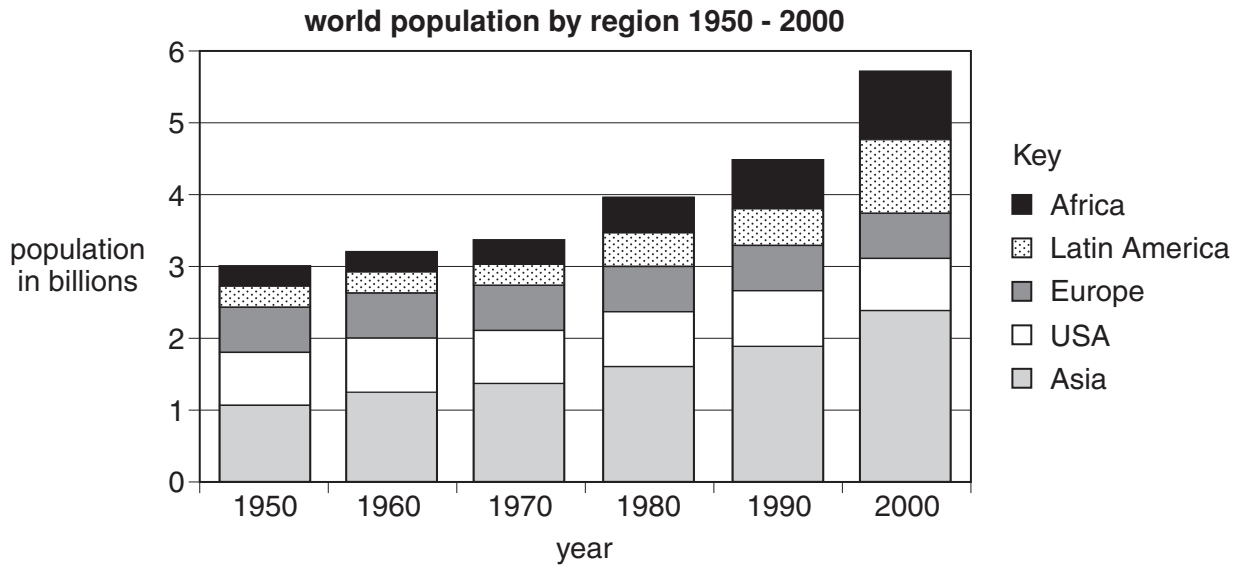
example

result

.....[2]

(b) Look at the graph.

It shows the world population by region between the years 1950–2000.



(i) In Europe, the population is constant.

Write the name of **one** area shown on the graph in which the population is continuing to grow.

.....[1]

(ii) Europe causes more pollution than Africa.

Suggest **two** reasons why.

1

.....

2

.....[2]

[Total: 5]

4 Look at the picture of an Orca.



© OCR

(a) Most mammals live on land.

Orcas are mammals that are adapted to live in water.

One adaptation is that their front legs have become flippers.

Use Darwin's theory of natural selection to explain how their front legs have evolved into flippers.

.....

.....

.....

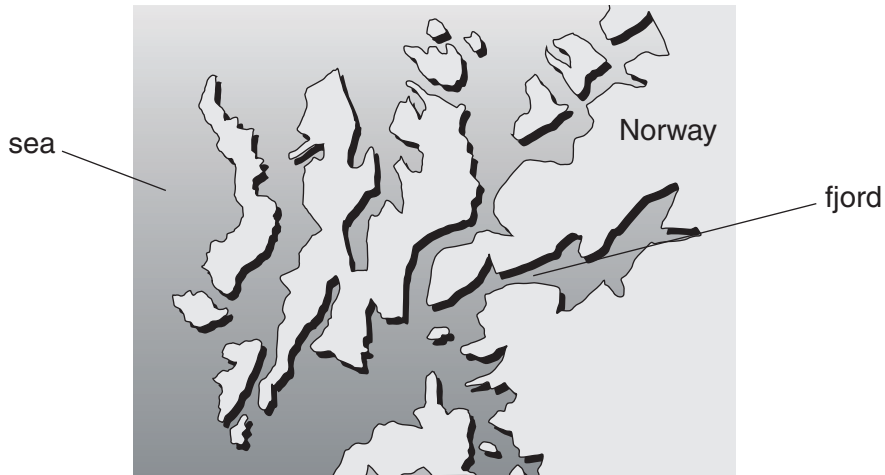
.....[2]

(b) Orcas are rare mammals that feed on herring.

Each winter, the herring move into a fjord in Norway and the Orcas follow.

This provides an excellent opportunity to see Orcas.

Many fishermen in Norway catch herring in the fjord.



(i) Suggest **one** way that the herring population can be sustained.

.....[1]

(ii) Sustaining the herring population affects the whole human population of the area, not just the fishermen.

Explain why.

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

[Total: 5]

10
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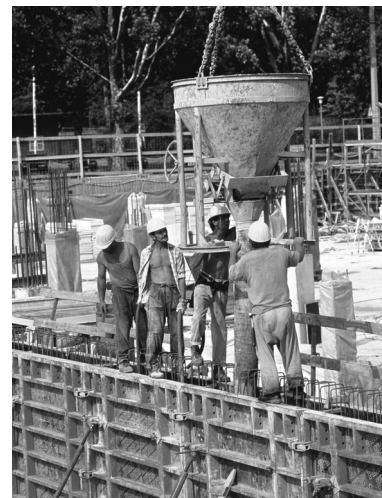
Section B – Module C2

5 This question is about construction materials.

(a) Look at this picture.

It shows reinforced concrete being made.

Reinforced concrete is a composite material containing steel rods and concrete.



© Rosenfeld Images Ltd/Science Photo Library

Reinforced concrete is a better construction material than non-reinforced concrete.

Explain why.

Use ideas about the properties of concrete and steel.

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

(b) Limestone and marble are both used to make buildings.

Limestone and marble are both forms of calcium carbonate.

Limestone is much softer than marble.

Explain why.

Use ideas about the formation of limestone and marble rock.

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

[Total: 4]

6 Clean air is a mixture of gases.

The gases include carbon dioxide, nitrogen, oxygen and water vapour.

The percentages of these gases do not change very much.

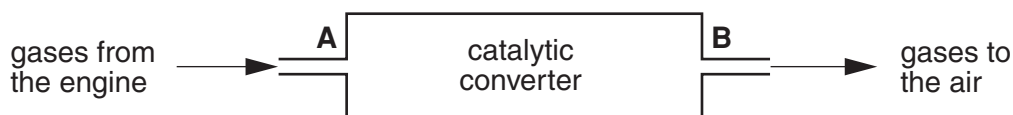
(a) Finish this table which shows the percentage of different gases in clean air.

| gas | percentage |
|----------------|------------|
| | 78% |
| oxygen | |
| carbon dioxide | 0.035% |

[2]

(b) Cars can cause air pollution.

Look at the diagram. It shows a simple view of an exhaust pipe of a car.



Look at the table. It shows the amounts of gases found at points **A** and **B**.

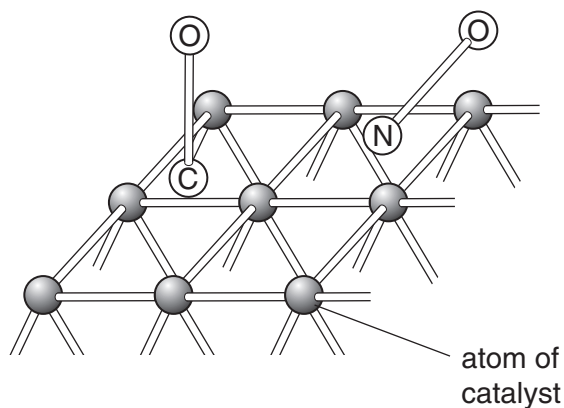
| gas | percentage of gas entering catalytic converter at A | percentage of gas leaving catalytic converter at B |
|-----------------|---|--|
| carbon dioxide | 8.0 | 9.6 |
| carbon monoxide | 5.0 | 4.1 |
| hydrogen | 2.0 | 0.8 |
| oxygen | 4.0 | 2.8 |
| nitric oxide | 0.3 | 0.0 |
| nitrogen | 71.0 | 71.3 |
| water vapour | 9.0 | 10.7 |

A catalytic converter changes carbon monoxide into carbon dioxide.

What evidence is there for this in the table?

.....
 [2]

(c) Look at the diagram. It shows a model of the surface of a catalytic converter.



In a catalytic converter, carbon monoxide molecules collide with nitric oxide molecules.

These molecules react on the surface of the catalyst.

They make nitrogen molecules and carbon dioxide molecules.

(i) Write the word equation for this reaction.

.....[1]

(ii) A powdered catalyst works better than a lump of catalyst.

Explain why.

Use ideas about particles.

.....

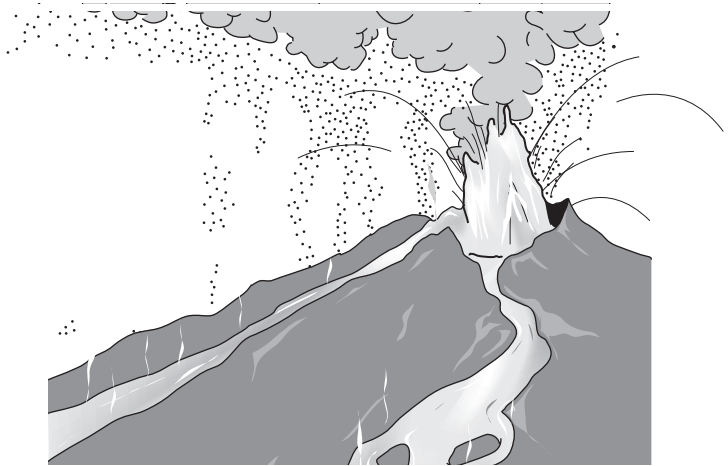
[2]

[Total: 7]

7 This picture shows an active volcano.

The liquid rock from the mantle is erupting from the volcano.

It is causing a lot of damage.



(a) Magma from the mantle is able to rise up through the Earth's crust.

Explain how. Use ideas about density.

.....
[1]

(b) Some volcanic eruptions are very violent and others are not.

Suggest why.

.....
[1]

(c) Why is it important that some geologists study volcanic eruptions?

.....
[1]

(d) The movement of tectonic plates in the lithosphere can cause the formation of volcanoes.

Explain, using a labelled diagram, what makes the tectonic plates move.

Use ideas about energy transfer within the Earth.

.....

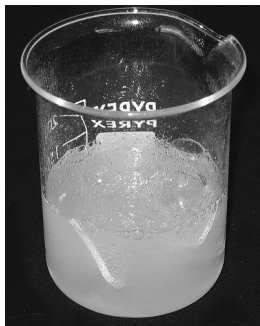
[2]

8 Magnesium ribbon reacts with dilute hydrochloric acid.

It makes hydrogen, H_2 , and magnesium chloride, $MgCl_2$.

Look at the picture.

It shows 0.5 g of magnesium ribbon reacting with 70 cm^3 of dilute hydrochloric acid.



© OCR

(a) Write the balanced symbol equation for this reaction.

.....[2]

(b) If hot acid is used instead of cold acid, the reaction goes much faster.

Explain why.

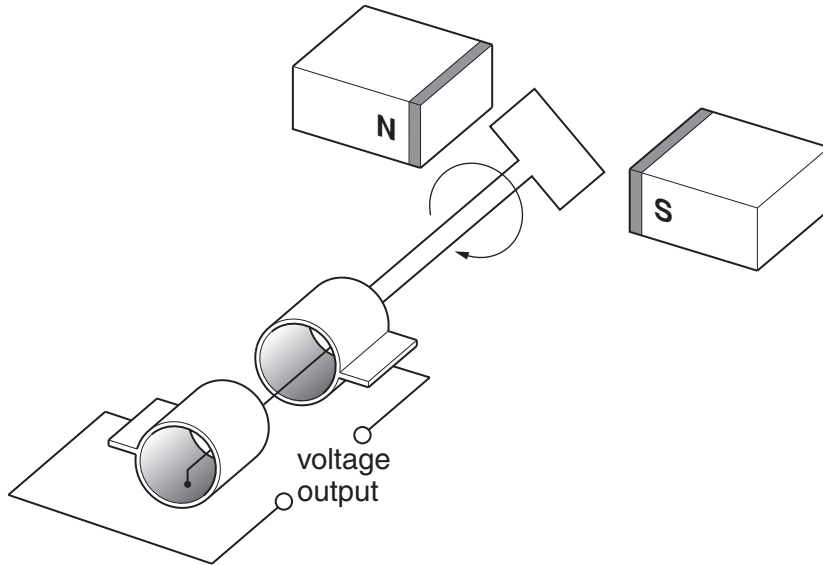
Use ideas about particles.

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

[Total: 4]

Section C – Module P2

9 Look at the diagram of a generator.



(a) Complete the sentences about how the generator works.

Choose your answers from the list.

- transformer
- current
- less
- magnet
- more

Electricity is generated by movement of the coil of wire near the magnet.

The can be increased by using faster movement.

It can also be increased by using a stronger

or turns of wire.

[2]

(b) The National Grid transmits electrical energy at very high voltages.

This reduces energy loss. Explain how.

Use the power equation to help with your answer.

.....

.....

[2]

(c) Power stations use generators to produce electricity.

The generators are left running all day and night.

At night time, this energy is supplied to houses.

It is called off-peak electricity.

Elliot uses off-peak electricity in his house.

(i) Write down one **advantage** for Elliot of using off-peak electricity.

.....[1]

(ii) Write down two **disadvantages** for Elliot of using off-peak electricity.

first disadvantage

.....

second disadvantage

.....[2]

(d) Elliot turns on his 6 kW immersion heater for 2 hours.

(i) Calculate the number of kilowatt hours (units) used by the immersion heater.

.....
.....

answerkWh [2]

(ii) The cost of a unit of electricity is 10p.

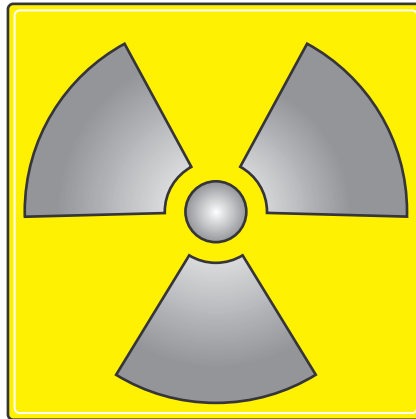
Calculate the cost of using the immersion heater for 2 hours.

.....
.....

answerpence [1]

[Total: 10]

10 This question is about nuclear radiation.



(a) Beta radiation will penetrate (go through) some materials.

Complete the table. One has been done for you.

| nuclear radiation | does it penetrate a sheet of paper? | does it penetrate a few mm of aluminium? | does it penetrate lead? |
|-------------------|-------------------------------------|--|-------------------------|
| beta | | | no |

[1]

(b) Waste from nuclear power stations is radioactive.

The scientists can bury low-level waste safely in landfill sites.

(i) Write down **two** problems of dealing safely with **low-level** waste in landfill sites.

first problem

.....

second problem

.....[2]

(ii) How can **high-level** nuclear waste be dealt with safely?

.....

.....[1]

[Total: 4]

11 People often think about how the Universe and stars began.

One theory that explains the start of the Universe is the **Big Bang**.

The Big Bang theory helps us to understand the movement of galaxies.

(a) What does the Big Bang theory tell us about the movement of **nearby** galaxies?

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

(b) What does the Big Bang theory tell us about the movement of **distant** galaxies?

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

(c) Scientists have detected microwave radiation reaching the Earth.

This radiation started soon after the Big Bang.

Where does this radiation come from?

Choose from:

- all parts of the universe**
- near parts of the universe**
- distant parts of the universe**
- our own galaxy**

answer[1]

[Total: 4]

12 Ann has a conservatory on her house.

The Sun shines into the conservatory.

Look at the diagram.



The Sun's rays go through the glass and heat the conservatory.

Ann says 'the conservatory **traps** the heat in'.

Explain how it does this.

Write about infrared waves in your answer.

.....

.....

.....

.....[2]

[Total: 2]

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 | | | | | | | | | | | 4 He helium 2 | | | | |
| 23 Na sodium 11 | 24 Mg magnesium 12 | | | | | | | | | | | 19 F fluorine 9 | | | | |
| 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 | 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 | 119 Sn tin 50 | 122 Sb antimony 51 | 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 | 207 Pb lead 82 | 209 Bi bismuth 83 | [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

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.