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RECOGNISING ACHIEVEMENT

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A216/01

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A
UNIT 2 – Modules B5 C5 P5 (Foundation Tier)

FRIDAY 25 JANUARY 2008

Morning
Time: 40 minutes

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

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

*C U P / T 5 0 9 5 0 *

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.
- Do **not** write outside the box bordering each page.
- 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 **42**.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Qu.	**Max**	**Mark**
1	4	
2	7	
3	4	
4	3	
5	2	
6	4	
7	4	
8	4	
9	5	
10	5	
TOTAL	42	

This document consists of **19** printed pages and **1** blank page.

[Turn over

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

kinetic energy = $\frac{1}{2}$ × mass × [velocity]^2

Electric Circuits

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

energy transferred = power × time

power = potential difference × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

wave speed = frequency × wavelength

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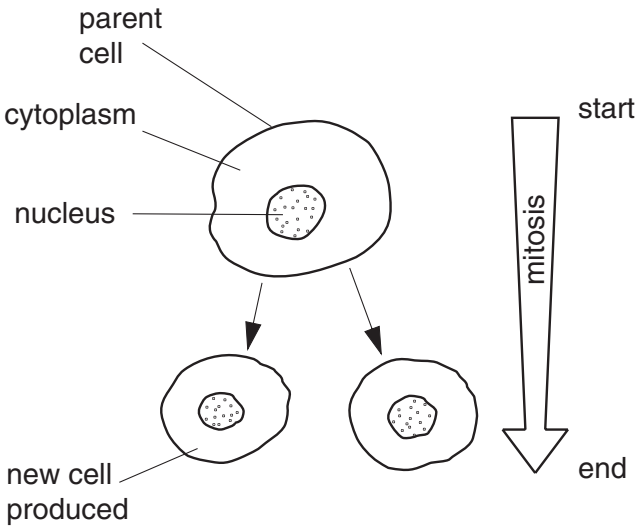
Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 James is studying cells which are undergoing mitosis.



(a) James counts the number of chromosomes in the nuclei at the start and at the end of mitosis.

What does he notice about the number of chromosomes in each nucleus?

Put a tick (✓) in the correct box.

The chromosome number had decreased at the end of mitosis. ☐

The chromosome number had increased at the end of mitosis. ☐

The chromosome number had stayed the same at the end of mitosis. ☐ [1]

(b) What happens to the number of organelles in the cytoplasm **before** the start of mitosis?

Put a ring around the correct answer.

decreases **increases** **stays the same** [1]

(c) Here are some statements about mitosis.

Some statements are true. Some are false.

Write **true** or **false** in the box next to each statement.

statement	true / false
The new cells produced are gametes.	
The new cells produced are identical to each other.	
There are four new cells produced from each complete mitosis.	
The new cells produced are identical to the parent cell.	

[2]

[Total: 4]

2 This question is about genes.

(a) The control of protein synthesis has a number of steps.

The steps, **A, B, C** and **D**, are in the **wrong** order.

A the genes hold the genetic code and stay in the nucleus

B protein is made in the cytoplasm

C a gene copy leaves the nucleus

D the genetic code is copied

Put the steps in the **correct** order.

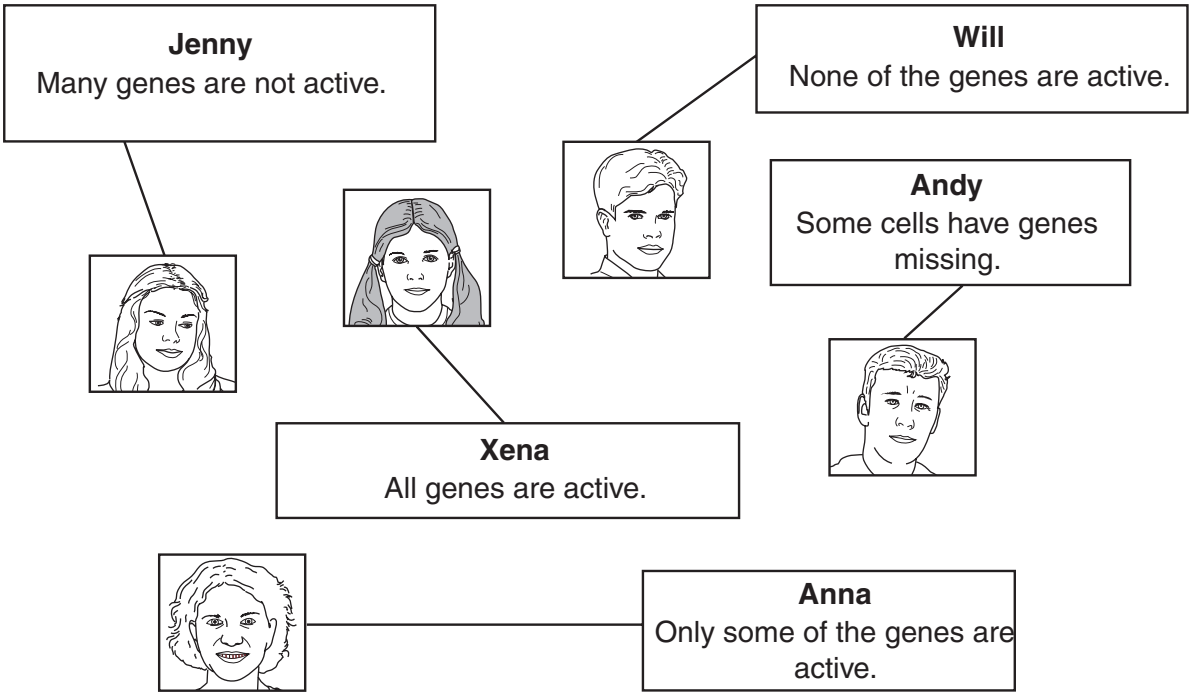
The first one has been done for you.

A			

[2]

(b) Body cells inside one human contain the same genes but they produce different proteins.

Five people were asked to suggest how this might happen.



Which **two** people gave the best answers?

Put a (ring) around their names.

Jenny **Anna** **Xena** **Will** **Andy** [2]

(c) Some of the statements are true. Some are false.

Put a tick (✓) in the correct box for each statement.

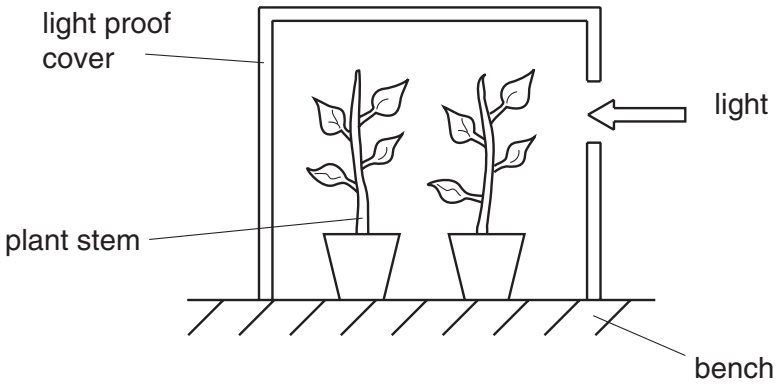
statement	true	false
DNA bases always pair up in the same way.		
DNA contains three different types of bases.		
DNA in different gametes is always the same.		
DNA is identical in new cells produced from the same parent cell by mitosis.		
DNA has a double helix structure.		

[3]

[Total: 7]

3 Theo is carrying out some experiments using plants.

He puts some young plants in a box and shines a light through a hole in the side of the box.



(a) In which direction will the stems bend?

Put a tick (✓) in the correct box.

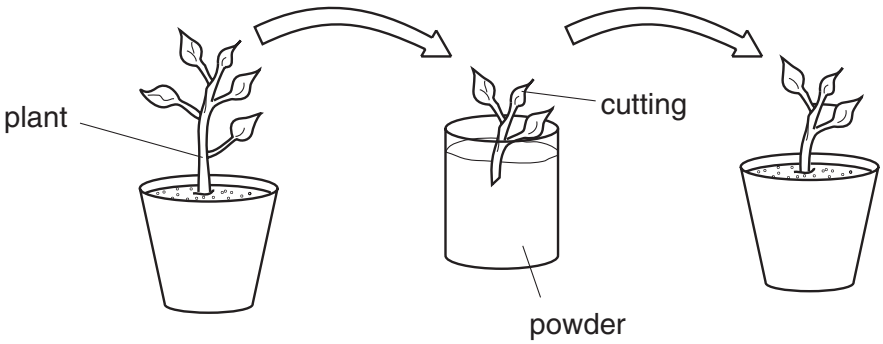
away from the light ☐

towards the light ☐

not at all ☐ [1]

(b) Theo's teacher asks him to take some cuttings from an older plant.

He dips the cut surface of the stem in powder before planting it in some soil.



(i) What does the powder contain?

Put a (ring) around the correct answer.

fertiliser **hormones** **pesticides** [1]

(ii) The cutting grows into a new plant.

Complete the sentences using words from the list below.

leaf **phloem** **root** **unspecialised**

The cut stem grows to form new ..... cells.

New xylem tissue forms from ..... cells.

[2]

[Total: 4]

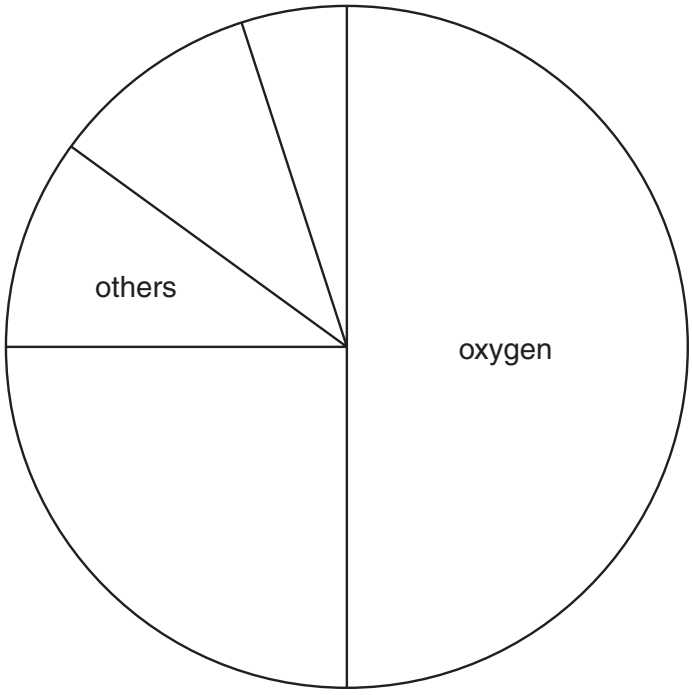
4 The rocks in the Earth's crust are made of many different elements.

The table shows approximate amounts of some of these elements.

element	percentage by mass (%)
oxygen	50
silicon	25
aluminium	10
iron	5
others	10

(a) Use the names of the various elements to **label the pie chart** to show this information.

The labels for two of the elements have been completed for you.



[2]

(b) Which element is there the most of?

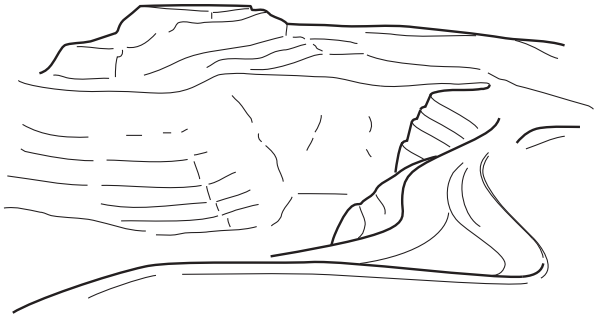
Write the name of the element in the space below.

..... [1]

[Total: 3]

5 Some rocks contain copper.

Copper mines are very big.



Why are copper mines so big?

Put ticks (✓) in the boxes next to the **two** best explanations.

There is only a very small percentage of copper in the copper ore. ☐

There is a demand for large amounts of copper. ☐

Larger mines create more jobs. ☐

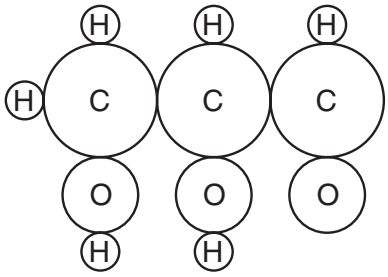
Larger mines are easier to dig. ☐

Mines have always been very big. ☐

[2]

[Total: 2]

6 Mary draws a diagram of a chemical compound.



(a) Put a ring around the number of **different elements** in this compound.

3 **4** **6** **10** [1]

(b) Put a ring around the **name** of each **element** in this compound.

carbon **copper** **helium**

hydrogen **osmium** **oxygen** [2]

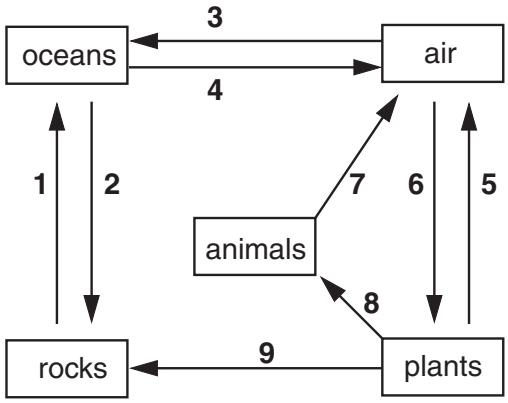
(c) What is the **formula** of this compound?

Put a ring around the correct answer.

$C_3H_60_3$ **C_3H_8** **C_2H_5OH** **C_2H_5COOH** [1]

[Total: 4]

7 **(a)** Wilhelmina draws part of the carbon cycle.



(i) Which stage of the cycle (**1 to 9**) shows carbon being transferred to animals?

..... [1]

(ii) Carbon can get from the **air** into the **rocks** by two different routes.

Put **numbers** from the carbon cycle in the boxes to show **both** of these routes.

	first stage	second stage
Route A		
Route B		

[1]

(b) Wilhelmina finds out the composition of some of the molecules involved in the carbon cycle.

	% composition by mass			
	carbon	hydrogen	oxygen	nitrogen
fat	76.9	12.4	10.7	–
carbohydrate	40	6.7	53.3	–
DNA	33.2	4.0	44.3	8.6
protein	32	6.7	42.7	18.6

(i) Which **two** types of molecules contain **only** carbon, hydrogen and oxygen?

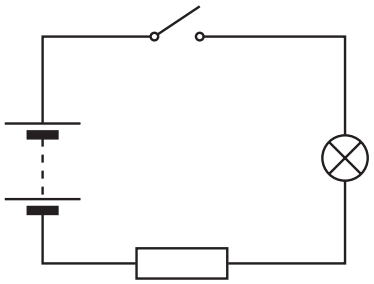
..... and ..... [1]

(ii) Name **all** the elements in protein.

..... [1]

[Total: 4]

8 Karen makes this electric circuit.



(a) When the switch is open, the lamp does not light.

Put a tick (✓) in **one** box to show the best way to complete each sentence.

(i)

The air gap in the switch acts as

	tick (✓)
a conductor	
an insulator	
a transformer	
a transmitter	

[1]

(ii)

When the switch is closed,

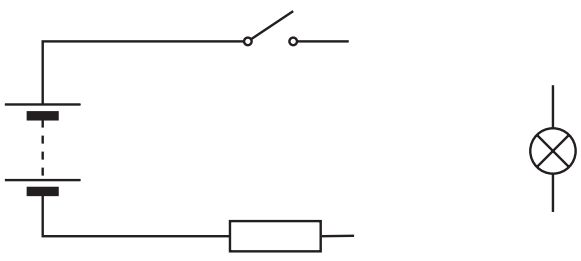
	tick (✓)
charge	
potential difference	
resistance	
voltage	

moves round the circuit.

[1]

(b) Karen now connects an ammeter to measure the current in the lamp.

Add an ammeter to the circuit diagram **and** complete the circuit.



[1]

(c) The lamp only glows dimly when Karen presses the switch.

Karen wants to increase the current in the lamp.

She tries different ways of doing this.

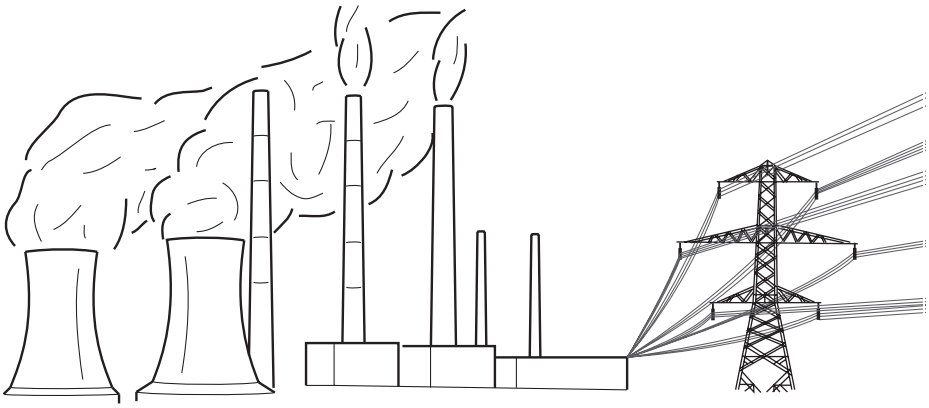
Complete the table by writing **true** or **false** in each box.

To increase the current in the lamp, Karen should ...	**true / false**
... assemble the circuit without the resistor.	
... connect the resistor in parallel with the lamp.	
... connect a second resistor in series with the lamp.	

[1]

[Total: 4]

9 Most of our mains electricity is made in power stations.

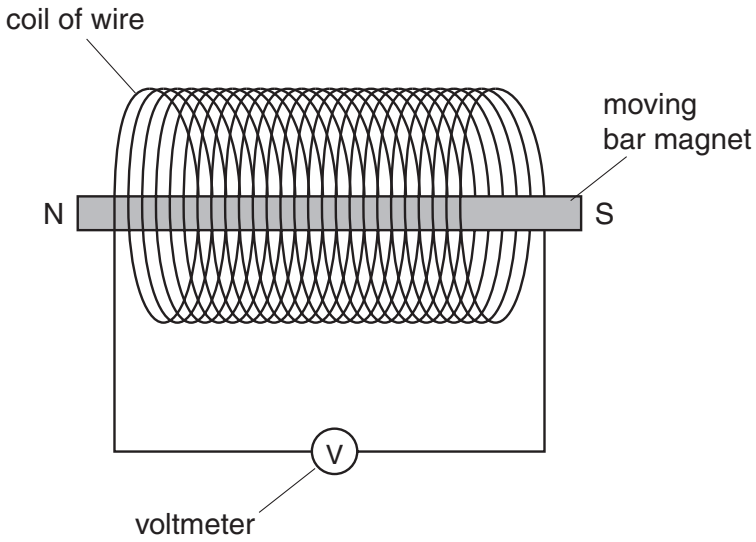


(a) What is the name of the machine which produces electricity in a power station?

Put a (ring) around the correct answer.

generator **reactor** **transformer** [1]

(b) Jake produces electricity by moving a bar magnet into a coil of wire.



Complete the sentences.

Choose the correct **numbers** from this list.

You may use each number once, more than once or not at all.

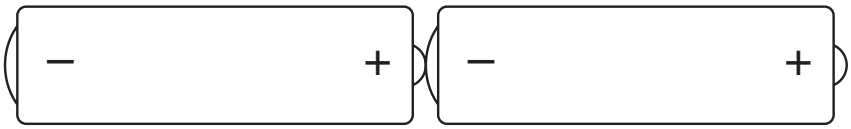
−0.5 **0.0** **+0.5**

As Jake moves the magnet into the coil, the voltmeter reads −0.5 V.

When Jake leaves the magnet in the coil, the voltmeter reads …… V.

As Jake moves the magnet back out of the coil, the voltmeter reads ……V. [2]

(c) Jake knows that batteries also make electricity.



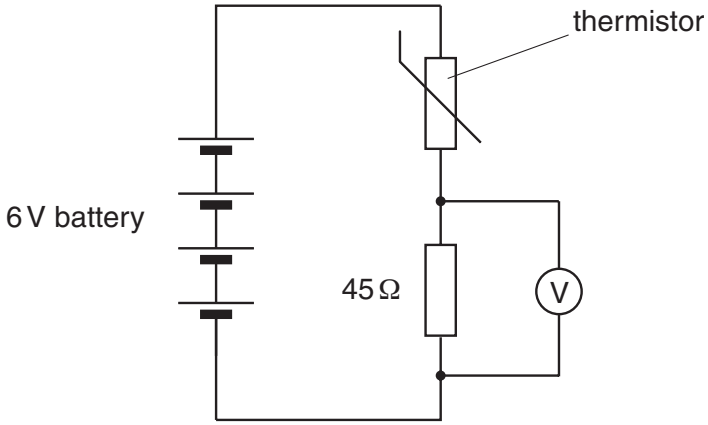
Draw lines to join the **source of electricity** to its **type of current** and **how it behaves**.

source of electricity	**type of current**	**how it behaves**
The current from a battery is ...	... a.c. ...	... and regularly changes direction.
	… d.c. ...	... and always goes round in circles.
	… p.c. ...	... and always goes in the same direction.

[2]

[Total: 5]

10 This circuit uses a thermistor.



(a) What affects the **resistance** of a thermistor?

Put a (ring) around the correct answer.

light intensity **pressure** **temperature** [1]

(b) The battery provides a potential difference of 6 V for the circuit.

Complete the sentences.

Choose correct words from this list.

current **energy** **force** **power** **voltage**

Potential difference is another term for …… .

It is a measure of the …… transferred from charge as it passes through a component. [2]

(c) The battery provides a potential difference of 6 V for the circuit.

The voltmeter reads 2 V.

What is the potential difference across the thermistor?

Put a (ring) around the correct answer.

2 V **4 V** **6 V** **8 V** [1]

(d) Two of the cells are removed from the battery.

This reduces the reading of the voltmeter to only 1 V.

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

	tick (✓)
The voltmeter reading goes down because ...	
... there is more current in the resistor.	
... there is less resistance in the thermistor.	
... there is less potential difference across the battery.	

[1]

[Total : 5]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							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.