Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A216/01

TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

Unit 2: Modules B5 C5 P5 (Foundation Tier)

WEDNESDAY 27 JANUARY 2010: Afternoon
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (SLM/SW) MEP10219 24322/1

INSTRUCTIONS TO CANDIDATES

Write your name clearly in capital letters, your Centre Number and Candidate Number on the first page.

- Use 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.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- 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 42.
- A list of physics equations is printed on pages 4–5.
- A copy of the Periodic Table is provided.

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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

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

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

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

$$\text{power} = \text{potential difference} \times \text{current}$$

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

THE WAVE MODEL OF RADIATION

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

Answer ALL the questions.

1 (a) Plants remove carbon dioxide from the atmosphere.

What is the formula of carbon dioxide?

Put a ring around the correct answer.

C_2O CO CO_2

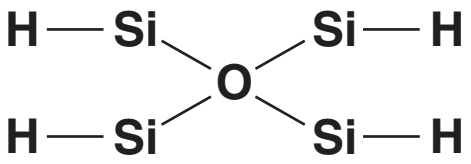
[1]

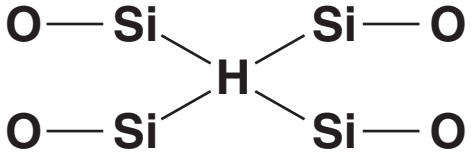
(b) Many plants contain tiny, hard lumps called plantstones.

These plants make the plantstones from silicic acid solution.

Look at the formulae below.

Put a ring around the correct formula of silicic acid, H_4SiO_4. **[1]**





(c) The plantstones are made of silicon dioxide.

They do not break down when the plant dies.

Suggest why the silicon dioxide does NOT break down.

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

Silicon dioxide …

… forms small molecules. ☐

… has a high melting point. ☐

… does not conduct electricity. ☐

… has a giant covalent structure. ☐

[1]

[Total: 3]

2 We use millions of tonnes of iron every year.

It is used to make an enormous number of things such as girders, chains and bridges.

(a) Iron is important because it is comparatively cheap and its properties are useful.

Draw straight lines to link each PROPERTY to WHY IT IS USEFUL.

You should draw four lines.

PROPERTY	WHY IT IS USEFUL
	can be used to make roof supports
good electrical conductor	
	can be hammered into different shapes
high melting point	
	can be used to make lightning conductors
malleable	
	can be used to make barbecues
strong	
	can be used to make magnets

[3]

(b) Iron is extracted from iron ore.

Iron ore contains iron oxide.

There are different types of iron oxide.

Which of these formulae corresponds to the oxide with the highest PROPORTION of iron atoms?

Put a (ring) around the correct answer.

FeO Fe_2O_3 Fe_3O_4

[1]

(c) To get iron, machines dig iron ore out of the ground.

What is iron ore made of?

A the pure element

B the element mixed with other minerals

C a pure iron compound

D an iron compound mixed with other minerals

answer _____ [1]

(d) Iron can be extracted from iron oxide by heating it in a blast furnace.

(i) A blast furnace produces melted iron and carbon dioxide.

The equation for one reaction in the blast furnace is

$$FeO(s) + CO(g) \rightarrow Fe(l) + CO_2(\ldots)$$

Carbon dioxide is a gas.

Write the state symbol, s, *l*, or g, in the bracket after the carbon dioxide. [1]

(ii) Carbon cannot extract some metals from their oxides.

Give a reason why.

_____

_____

_____ [1]

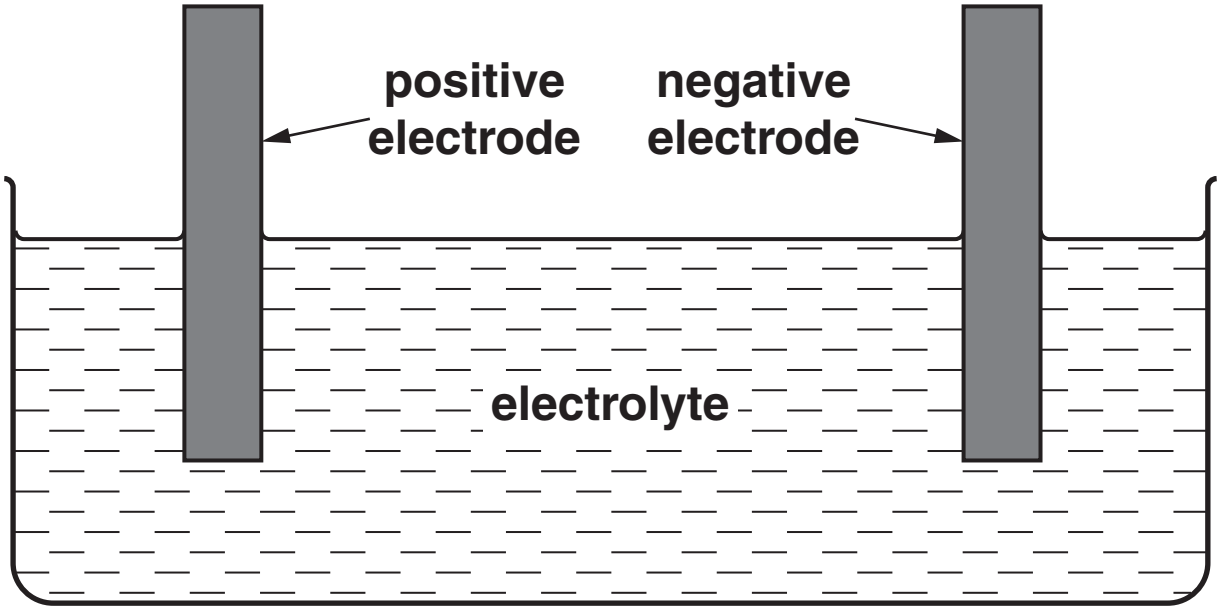
(iii) Put a ring around the metal that cannot be extracted from its oxide using carbon.

IRON COPPER ALUMINIUM ZINC

[1]

[Total: 8]

3 Some metals are extracted using electrolysis in apparatus like this.



Electrolysis only works for liquids that contain ions.

Use your understanding of ions to explain how electricity can flow through a liquid, and state where the metal will appear.

_____

_____

_____

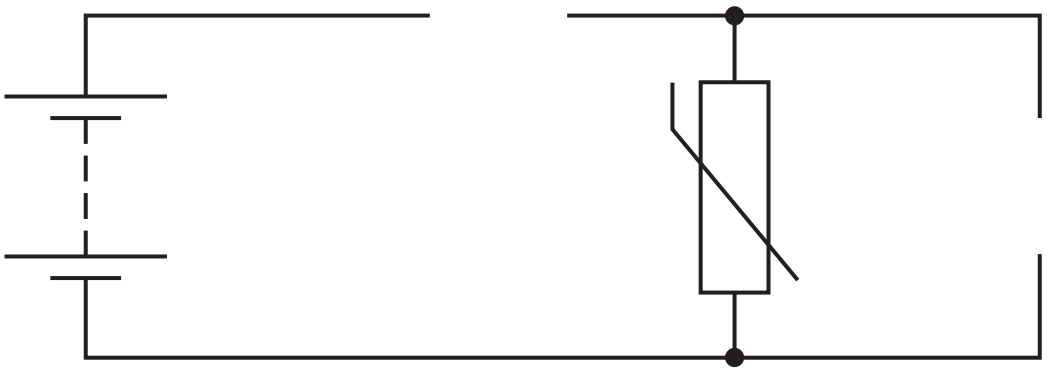
_____ [3]

[Total: 3]

4 A student investigates the effect of temperature change on a thermistor.

The circuit diagram shows a battery and a thermistor.

The circuit diagram is not finished.



(a) A voltmeter and ammeter are missing from the diagram.

Draw them in the correct places. Use the correct circuit symbols. [2]

(b) Complete the sentence. Choose words from this list.

DECREASES INCREASES STAYS THE SAME

When the temperature of the thermistor is INCREASED

the resistance of the thermistor

_____

and the reading of the ammeter

_____ . [1]

(c) Put a ring around the words that correctly complete the sentence.

The ammeter measures the flow

of CHARGE / POWER in the thermistor

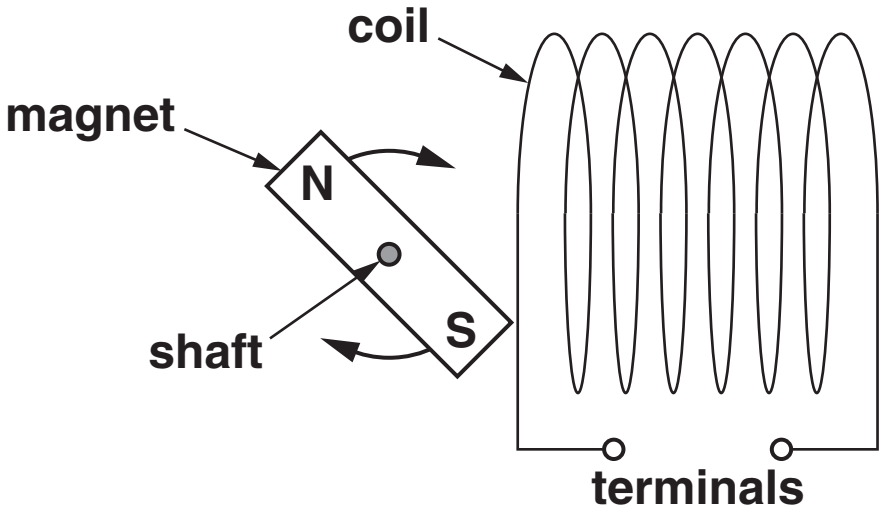
in units of AMPERES / JOULES / VOLTS.

[1]

[Total: 4]

5 The diagram shows a magnet close to a coil of wire.

The magnet can spin on the shaft so that it moves in and out of the coil.



(a) What is the name of this arrangement?

Put a (ring) around the answer.

ELECTROMAGNET

GENERATOR

TRANSFORMER

[1]

(b) When the magnet spins on the shaft, a voltage appears across the terminals of the coil.

Describe TWO things that you could do to increase the voltage.

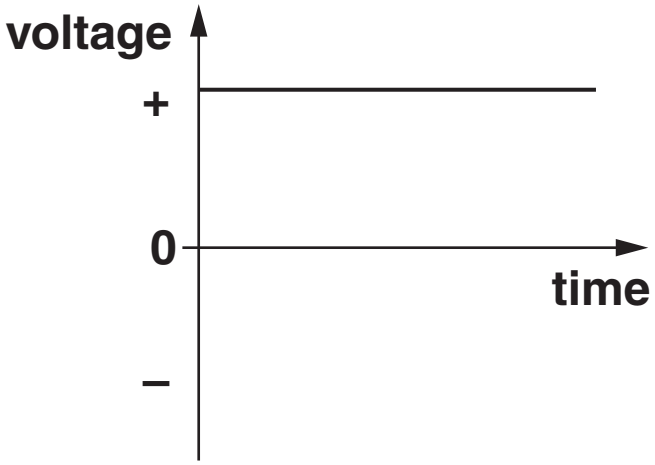
_____

_____

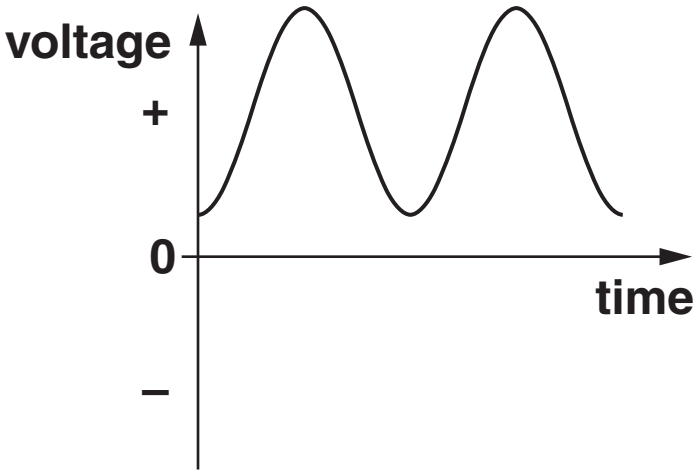
_____ [2]

(c) The magnet spins round.

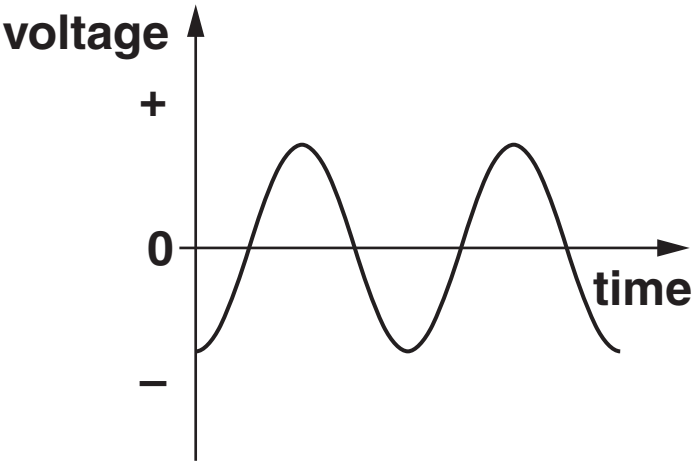
Which of these voltage-time graphs, A, B or C, is correct for the coil?



A



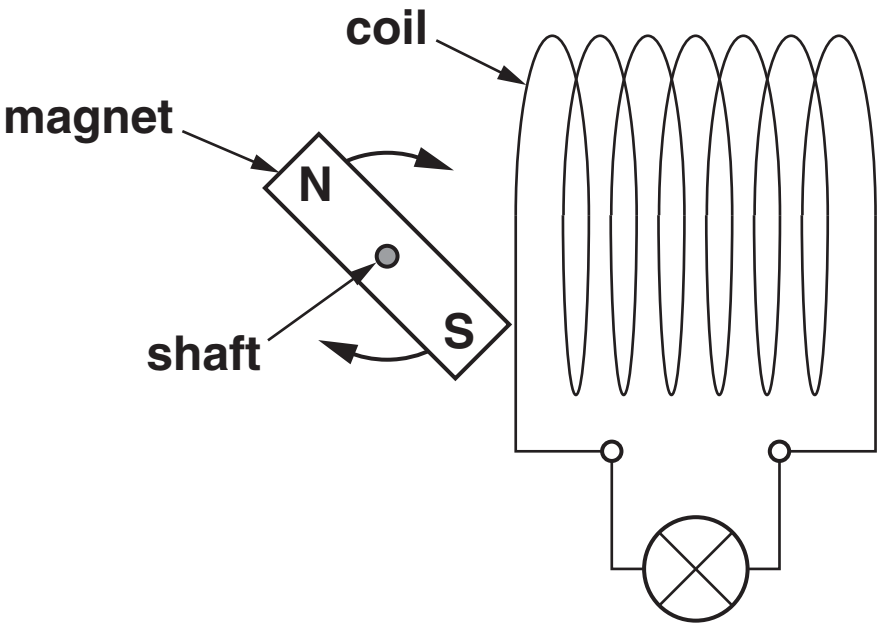
B



C

answer _____ [1]

(d) A lamp is connected to the terminals of the coil.



What effect does this have on the coil of wire?

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

There is now a current in the coil. ☐

There is no voltage across the coil. ☐

There is no magnetic field in the coil. ☐

[1]

[Total: 5]

6 A mains lamp connected to a 230V supply has a current of 0.5 A.

(a) Calculate the power of the lamp.

power = _____ W [1]

(b) Draw straight lines to join each ELECTRICAL QUANTITY with its correct DESCRIPTION.

ELECTRICAL QUANTITY	DESCRIPTION
power	the push on the electrons in the lamp
voltage	the rate of energy transfer to the lamp
current	the amount of charge moving through the lamp every second

[2]

(c) Another lamp is left on for 10 hours. If its power is 0.12 kW, how much energy is transferred to the lamp?

energy transferred = _____ kWh [1]

(d) A domestic electricity meter measures energy transfer in units of kilowatt-hours instead of joules.

Which person has the BEST reason for this?

ALAN

The joule is a very small unit of energy.

BESS

A kilowatt is a hundred watts.

CARLOS

The joule is not a unit of energy transfer.

DAVINA

Few appliances stay switched on for more than an hour.

answer _____ [1]

[Total: 5]

7 (a) Cells can divide by mitosis or by meiosis.

Here are some statements about cell division.

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

	TRUE	FALSE
Meiosis produces cells with the same number of chromosomes as the parent cell.		
Meiosis is used in sexual reproduction to produce gametes (sex cells).		
Mitosis produces cells that are identical to the parent cell.		
Mitosis produces cells that have different numbers of chromosomes.		

[2]

(b) (i) Neil and Julie want to have children.

One of Neil's sperm fertilises one of Julie's eggs.

This makes a zygote.

The sentences explain how the cells develop after fertilisation.

Complete the sentences. Use words from this list.

BODY CELL
EMBRYO
EGG
FUSION
MEIOSIS
MITOSIS
IMPLANT

Each sperm and egg cell has half the number of chromosomes of a _____ .

A zygote divides by _____ .

This forms an _____ . [3]

(ii) After the zygote divides a number of times, the cells start to specialise.

At what stage does this happen?

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

after the two cell stage ☐

after the four cell stage ☐

after the eight cell stage ☐

after the sixteen cell stage ☐

[1]

[Total: 6]

8 (a) All cells in a plant originate from the same cell.

Leaf cells contain chlorophyll, but root cells do not.

Explain why leaf and root cells in the same plant can develop differently.

Use ideas about genes in your answer.

_____

_____

_____ [2]

(b) New plants can be made by taking cuttings.

Andrew takes a cutting of a plant stem.

There are no roots on the cutting.

State
- how to make a cutting produce roots
- which cells of the cutting develop into roots.

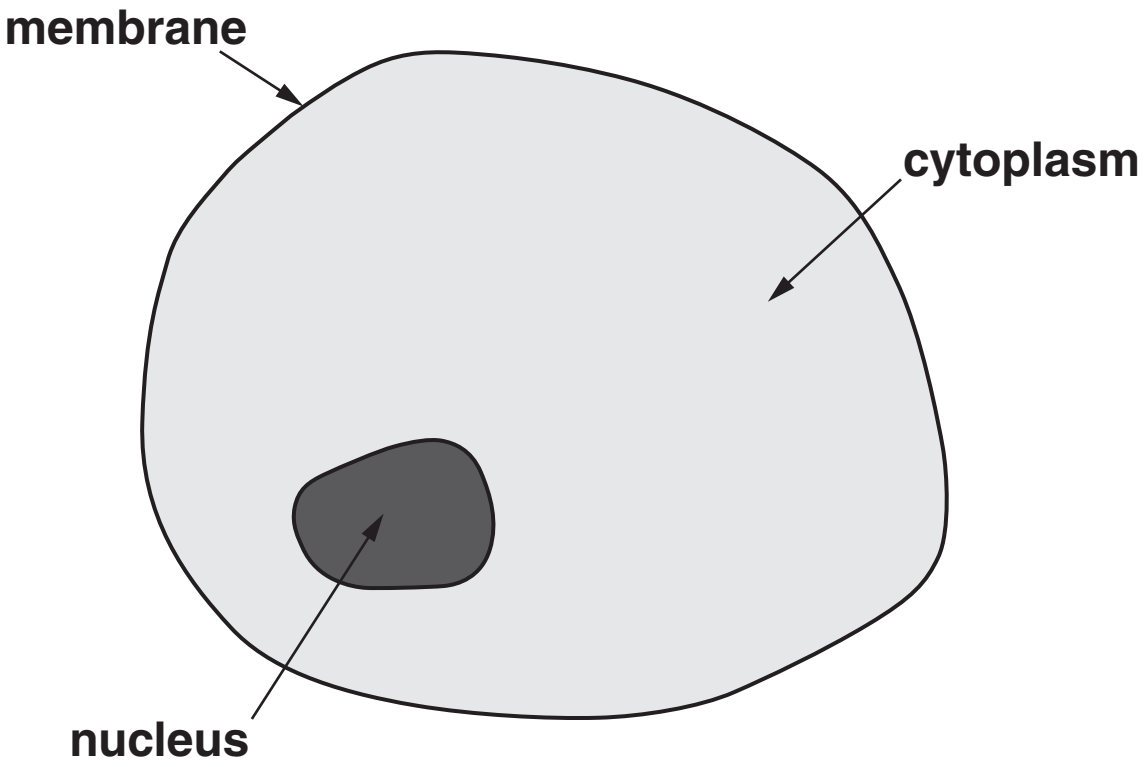
_____

_____

_____ [2]

[Total: 4]

9 This is a diagram of an animal cell.



(a) Where in the cell is the genetic code stored?

_____ [1]

(b) Where in the cell are proteins produced?

_____ [1]

(c) Put a ring around the correct word to complete these sentences.

The structure of DNA is
a SINGLE / DOUBLE / TRIPLE helix.

The DNA molecule is made up
of TWO / FOUR / EIGHT strands.

The DNA molecule contains up
to TWO / THREE / FOUR different bases.

[2]

[Total: 4]

END OF QUESTION PAPER

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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.