Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A217/01

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

Unit 3: Modules B6 C6 P6
(Foundation Tier)

WEDNESDAY 22 JUNE 2011: Morning
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 (SJF/SW) 11MEP06247 47191

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**
- **Answer ALL the questions.**

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.**
- **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

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

ELECTRIC CIRCUITS

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

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

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

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

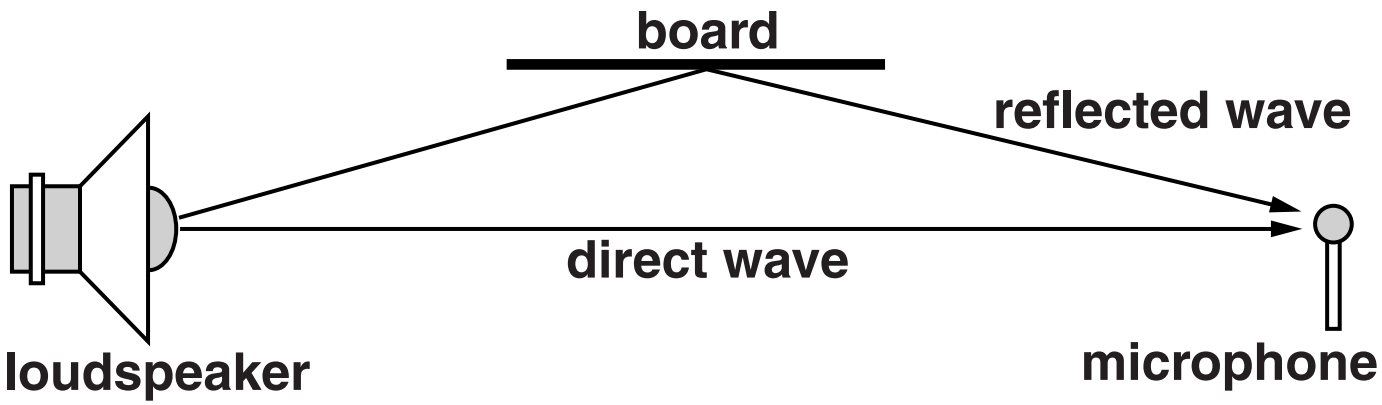
$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

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

Answer ALL questions.

1 The diagram shows two paths for sound to get from a loudspeaker to a microphone.



(a) The loudspeaker produces a steady sound.

The microphone detects no sound.

Why does the microphone detect no sound?

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

The board has absorbed all of the sound. ☐

The reflected wave cancels out the direct wave. ☐

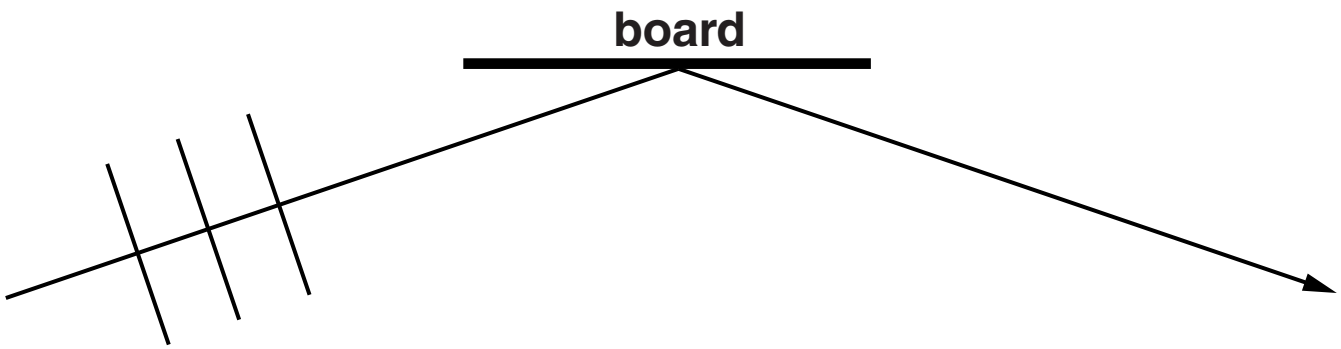
The microphone is too close to the loudspeaker. ☐

The direct wave arrives in step with the reflected wave. ☐

[1]

(b) Some of the sound gets to the microphone by reflecting off a board.

The diagram shows three wavefronts of the wave BEFORE it hits the board.



Draw on the diagram to show the wavefronts AFTER they have all hit the board. [2]

(c) Draw straight lines to link each PROPERTY of a sound wave to its DESCRIPTION.

PROPERTY	DESCRIPTION
speed	the distance between the same point on two adjacent waves
frequency	the distance moved by the wave in one second
wavelength	the number of vibrations of the wave in one second

[2]

[Total: 5]

2 Dentists use X-rays to image teeth.

(a) X-rays are part of the electromagnetic spectrum.

Add X-rays to this spectrum in the correct place.

radio waves				ultraviolet		gamma rays

increasing frequency ⟶

[1]

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

FREQUENCY GLASS SPACE

SPEED WATER WAVELENGTH

All waves in the electromagnetic spectrum share one property.

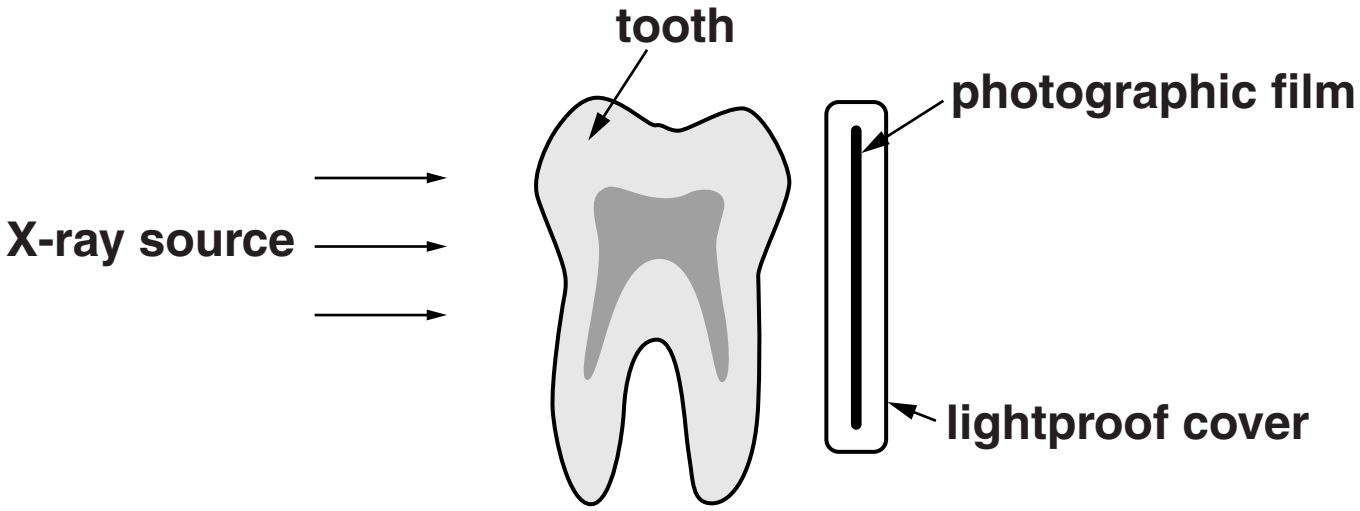
They have the same _____

when they travel through _____ **.**

[2]

(c) A dentist needs to image a tooth.

She places an X-ray source in front of the tooth and a photographic film behind it.



Explain how the image is formed on the photographic film.

_____

_____

_____

_____ **[2]**

[Total: 5]

3 Julie uses a baby monitor so that she can hear when her baby cries in another room.

The monitor has a radio transmitter, which she places in the baby's room, and a receiver which she keeps with her.

(a) The transmitter uses digital transmission.

The digital code uses only two symbols.

What are these symbols called?

Put a (ring) around the correct answer.

LEFT AND RIGHT **ONE AND ZERO**

PLUS AND MINUS **UP AND DOWN** **[1]**

(b) Complete the sentences for the baby monitor system by putting a (ring) around the correct words in bold.

The transmitter changes the radio waves in a process which is called DEMODULATION / DIFFRACTION / MODULATION / REFLECTION .

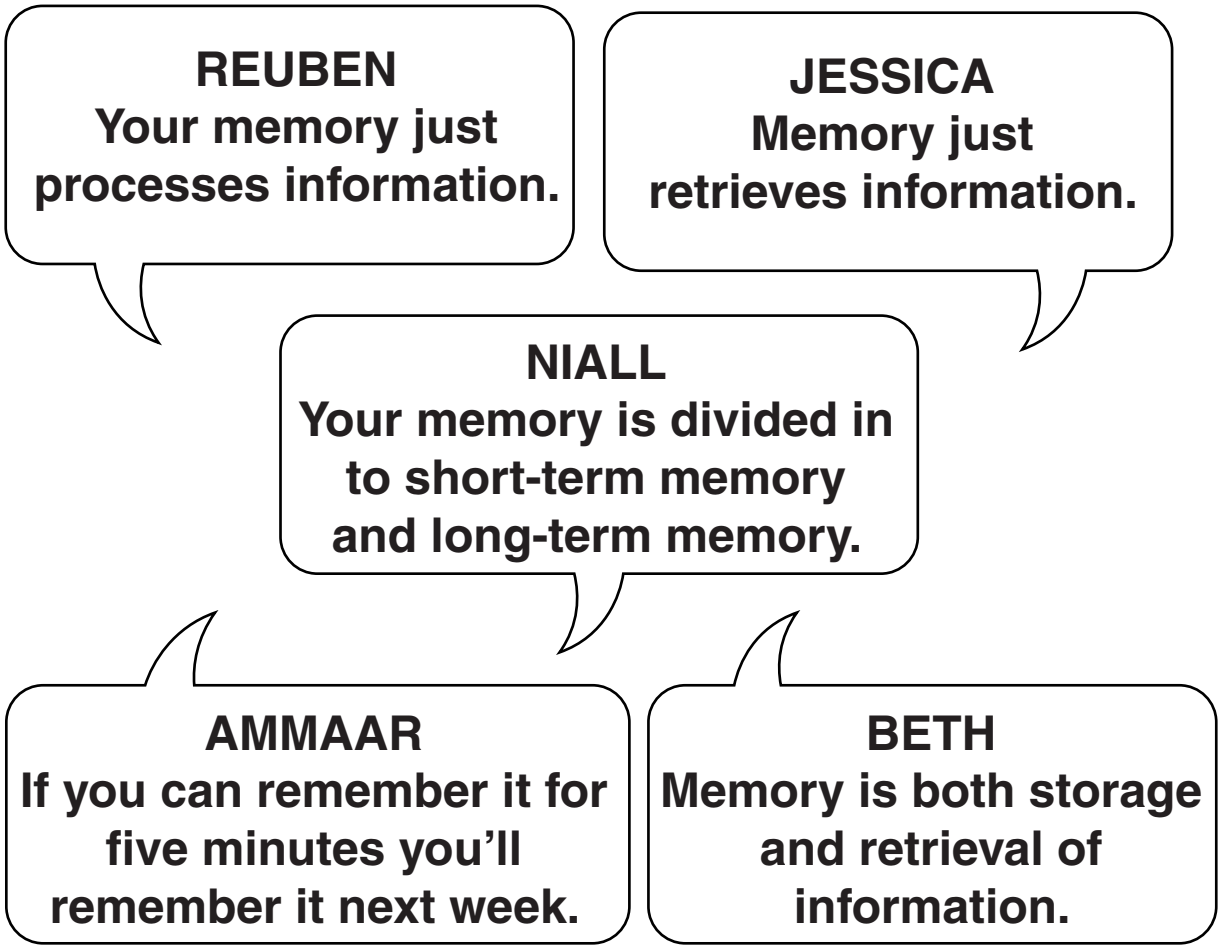
As the waves travel away from the transmitter, some CHARGE / LIGHT / NOISE / SOUND is picked up along the way.

The receiver converts the pattern of radio wave pulses into INFRARED / INTERFERENCE / MICROWAVES / SOUND . [3]

[Total: 4]

4 Anil has to make up a new password to go on his school computer system.

(a) He talks to some classmates about the problem of making it a password he can remember.



Which TWO classmates make correct statements about memory?

answer _____ and _____[2]

(b) Anil knows that the part of his brain concerned with memory also has other functions.

Suggest ONE other function of this part of the brain.

_____ **[1]**

(c) Scientists have used different methods to study this part of the brain.

Give ONE of these methods.

_____ **[1]**

[Total: 4]

5 The human nervous system contains many neurons.

(a) Put (rings) around the correct words to complete the sentences.

The central nervous system is made up of the

brain and PERIPHERAL NERVES /

RECEPTOR CELLS / SPINAL CORD .

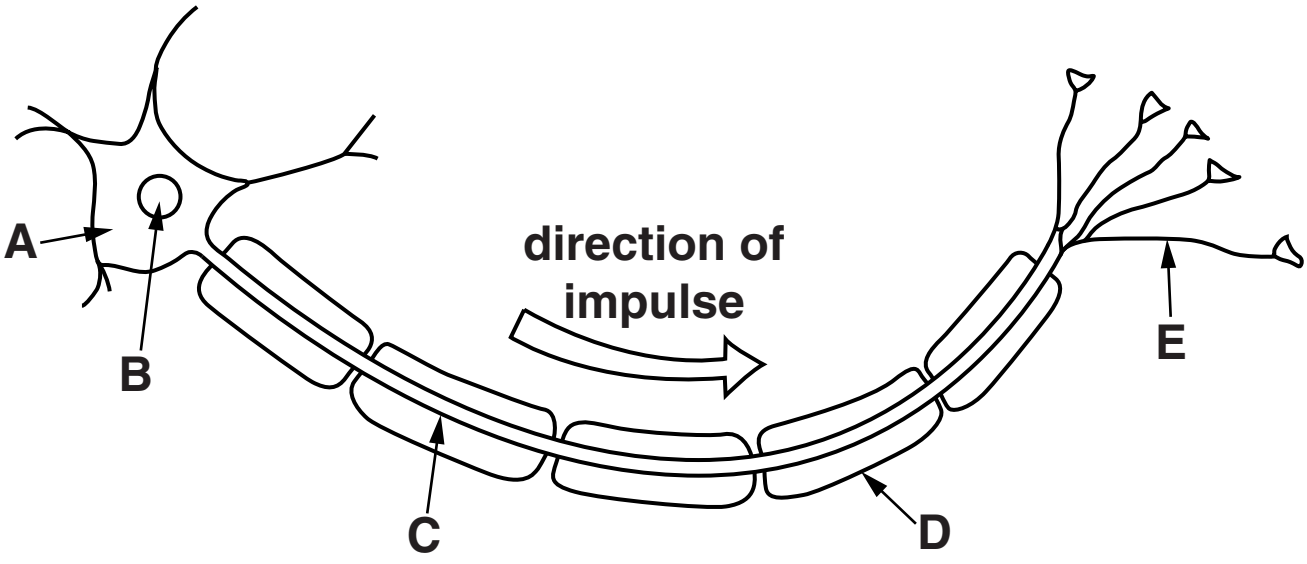
Receptors are connected to the brain by

EFFECTOR / MOTOR / SENSORY neurons .

Gaps between adjacent neurons are called

SENSORS / SHEATHS / SYNAPSES . [3]

(b) This is a diagram of a motor neuron.



Which letter, A, B, C, D or E, labels the ...

(i) ... axon? answer _____[1]

(ii) ... fatty sheath? answer _____[1]

(c) The motor neuron can form part of a reflex arc.

Reflexes allow a fast involuntary response to a harmful stimulus.

Describe the main features of a reflex arc.

In your answer include ideas about

- **receptors**
- **neurons**
- **effectors.**

_____

_____

_____

_____ **[3]**

[Total: 8]

6 A woodlouse relies on simple reflex actions.

When it is placed in a bright dry environment it tries to move to a dark moist place.

Complete the sentences by putting a (ring) around the correct words.

A change in environment is called a

SHIFT / STIMULUS / STRIKE .

Simple reflex actions are usually a disadvantage in

DEALING WITH A NEW SITUATION /

FINDING FOOD / SHELTERING FROM PREDATORS .

[2]

[Total: 2]

7 Flour mills in the nineteenth century sometimes exploded.

Flour mills grind wheat grains into flour, a fine powder.

Wheat grains will burn slowly in air.

Flour dust burns much more quickly than wheat grains.

The rooms inside the flour mill had clouds of flour dust in the air.

A single spark was enough to make the flour dust explode.

Why is the reaction of a cloud of flour dust more violent?

Use ideas about rate of reaction and the size of flour particles in your answer.

_____

_____

_____

_____ **[2]**

[Total: 2]

8 David has limescale on the wall of his house.

He knows that limescale is calcium carbonate, so he decides to remove it using hydrochloric acid.

(a) Fill in the boxes to write the word equation for this reaction.

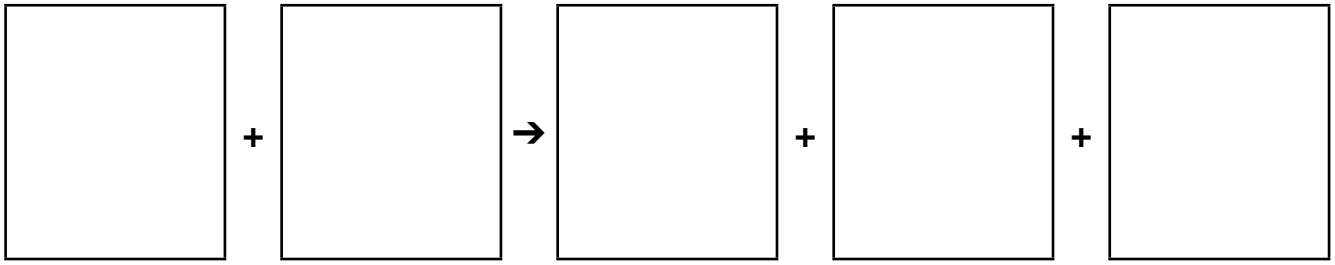
CALCIUM CARBONATE

CALCIUM CHLORIDE

CARBON DIOXIDE

HYDROCHLORIC ACID

WATER



[1]

(b) One of the substances made in this reaction is a salt.

Which one?

_____ **[1]**

(c) He measures the pH of the acid before he starts.

(i) Put a (ring) around the pH number of the acid.

1 7 9 13 23 [1]

(ii) What can he use to find the pH of the acid?

Put ticks (✓) in the boxes next to the TWO best answers.

the Periodic Table ☐

universal indicator ☐

pH meter ☐

litmus paper ☐ **[1]**

(d) He has some acid left over.

He neutralises it before he throws it away.

What will the pH be once the acid is neutralised?

Put a (ring) around the correct answer.

1 3 7 11 13 [1]

[Total: 5]

9 Titanium oxide is a white solid which is used in paint.

Impurities in natural titanium oxide spoil its white colour, so they are removed.

To remove the impurities two chemical reactions are carried out.

reaction 1 – the solid titanium oxide, TiO_2, is converted into liquid titanium chloride, $TiCl_4$.

reaction 2 – the liquid titanium chloride, $TiCl_4$, is later converted back into titanium oxide, TiO_2.

(a) Complete the balanced symbol equation for reaction 2 by adding in the state symbols.

$$TiCl_4 (\_\_\_\_) + O_2 (\_\_\_\_) \rightarrow TiO_2 (\_\_\_\_) + 2Cl_2 (\_\_\_\_)$$

[1]

(b) The impurities do not take part in these reactions.

This makes them easy to remove.

Suggest

- **why this makes them easy to remove**
- **how you might remove them**
- **at which stage they are removed.**

_____

_____

_____

_____ **[3]**

(c) The factory checks the titanium oxide ore to see how pure it is.

They find that 300 tonnes of ore contains 210 tonnes of titanium oxide.

How do they calculate the percentage of titanium oxide in the ore?

Put a (ring) around the correct calculation.

$$\frac{300 \times 100}{210} \qquad \frac{210 \times 100}{300} \qquad \frac{300}{210 \times 100} \qquad \frac{210}{300 \times 100}$$

[1]

(d) The chlorine used in the process is toxic and oxidising.

Put a (ring) around the TWO hazard symbols which should be used for chlorine.

[2]

[Total: 7]

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.