OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A217/01

Unit 3: Modules B6 C6 P6 (Foundation Tier)

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)

Monday 31 January 2011
Afternoon

Duration: 40 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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.
- Do **not** write in the bar codes.

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 page **2**.
- The Periodic Table is printed on the back page.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

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

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

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Question 1 starts on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

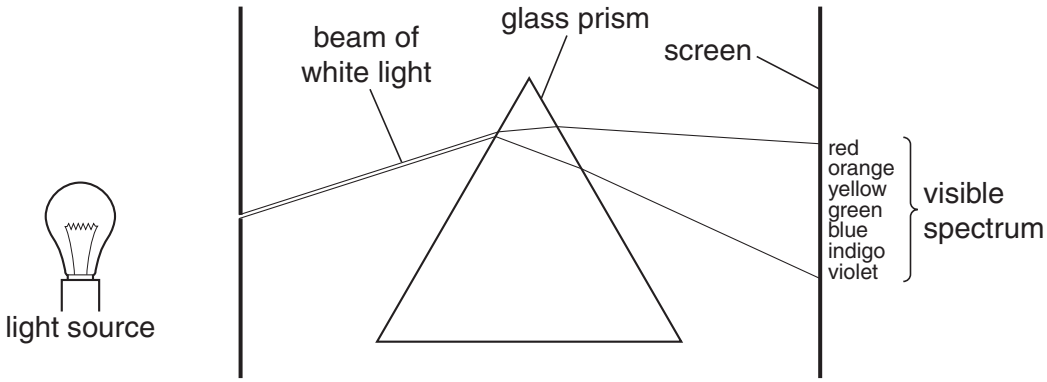
1 Isaac knows that light is made of waves.

(a) Draw a diagram of a wave.

Show clearly on the diagram the wavelength of the wave.

[2]

(b) Isaac shines a beam of white light at a glass prism.



(i) Isaac notices that the light changes direction as it enters the glass.

He decides that this is because the wavelength of the light changes.

Complete the sentences by putting a (ring) around the best option.

As the light enters the glass

- its wavelength decreases
- the speed of the light **decreases** / **increases** / **stays the same**
- the frequency of the light **decreases** / **increases** / **stays the same**.

[2]

(ii) Isaac thinks that the white light contains many different photons.

Different photons correspond to different colours.

Here are some statements about the photons.

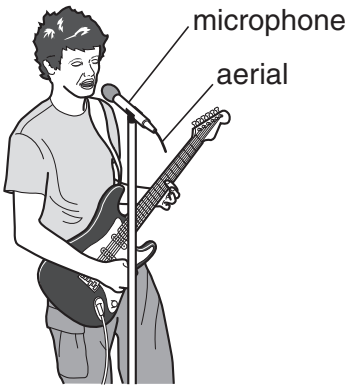
Put ticks (✓) in the boxes next to the **two** correct statements.

Shorter wavelength photons have lower frequencies.	☐
Red photons have the same energy as blue photons.	☐
Longer wavelength photons move faster through empty space.	☐
The intensity of the light depends on the number of photons arriving on the screen each second.	☐
The colour seen on the screen depends on the wavelength of the photons which arrive.	☐

[2]

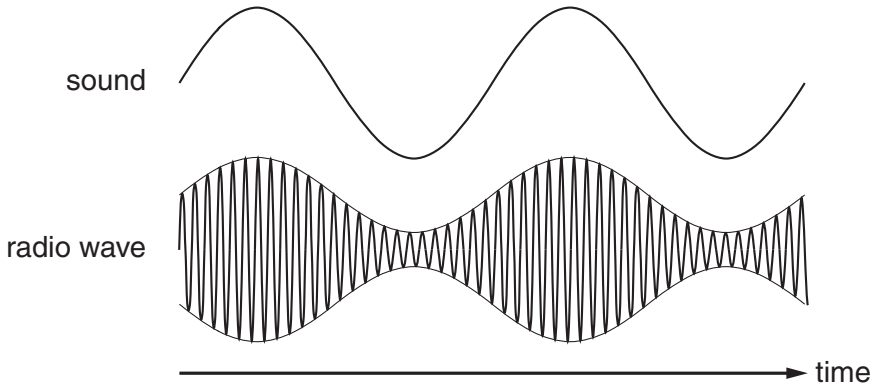
[Total: 6]

2 Paul uses a radio microphone to record a song.



(a) The diagram below shows the information in Paul's sound.

This information is carried by the radio wave leaving the aerial.



Which of these words best describes the signal transmitted from the microphone?

Put a (ring) around the correct word.

analogue **digital** **stereo** **[1]**

(b) The radio wave picks up noise as it passes from the microphone to the receiver.

The signal at the receiver passes through an amplifier.

What is the effect of the amplifier on the signal?

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

Only the amplitude of the radio wave is increased.	☐
The amplitudes of both the radio wave and the noise are increased.	☐
The information is removed from the radio wave.	☐
The noise is completely removed from the radio wave.	☐

[1]

(c) The quality of sound recording is not good.

Paul decides to use a different type of microphone.

The microphone encodes information as pulses.

Explain why this should improve the quality of the sound recording.

.....

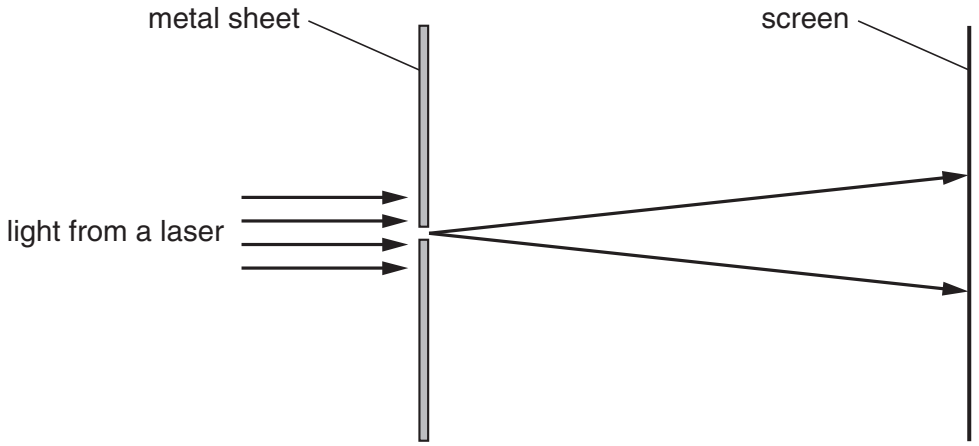
.....

.....

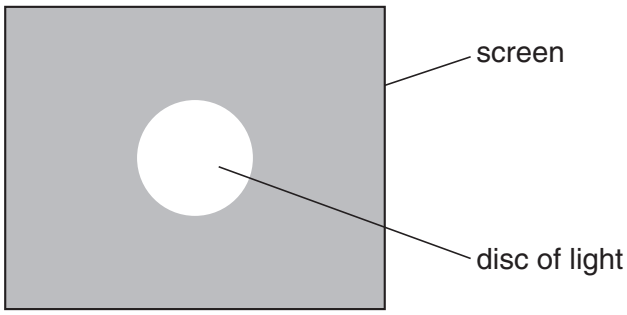
..... **[2]**

[Total: 4]

3 Thomas passes light from a laser through a small hole in a metal sheet.



(a) Thomas sees a disc of light when he looks at the screen.



The disc is much larger than the hole.

Light that passes through the hole spreads out before it hits the screen.

(i) What is the name of this effect?

answer ..... **[1]**

(ii) What does this observation suggest about light?

Put a tick (✓) in the box next to each of the **two** correct explanations.

Light has a wave nature. ☐

Light is a longitudinal wave. ☐

Light from the source has only one wavelength. ☐

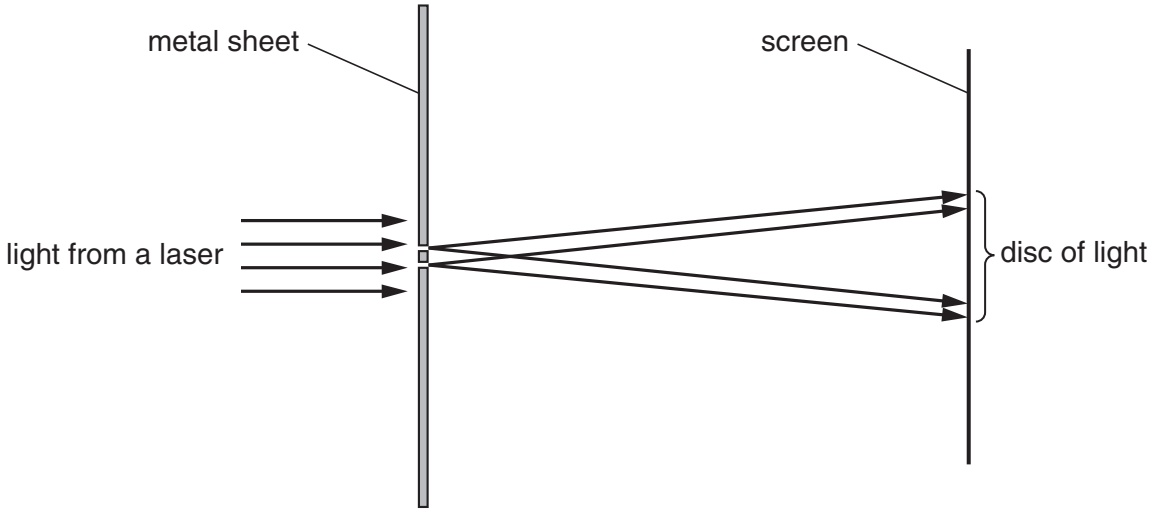
The size of the hole is similar to the wavelength of the light. ☐

Photons carry the energy of the light from the source to the screen. ☐

The amplitude of the light is much smaller than the size of the pinhole. ☐

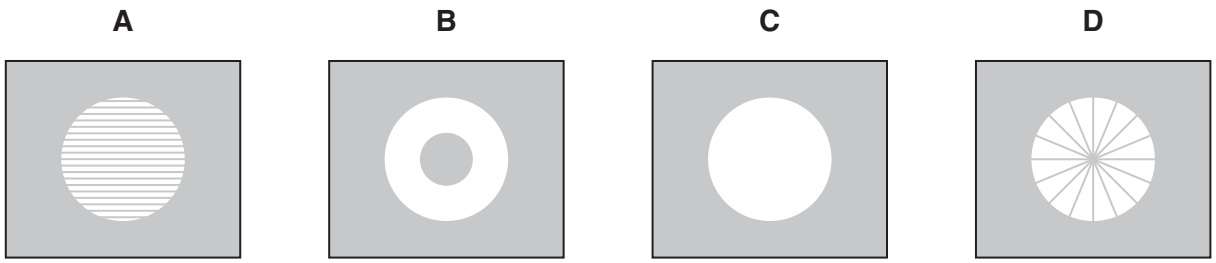
[2]

(b) Thomas makes a second hole in the metal sheet just above the first hole.



Thomas looks at the screen for an interference pattern.

Here are four possible patterns.



Which pattern, **A**, **B**, **C** or **D**, will Thomas see?

answer ..... **[1]**

[Total: 4]

4 Many animals rely on simple reflexes.

(a) (i) Put a (ring) around the correct word from each **bold** pair to complete the sentence.

Simple reflexes produce **slow** / **rapid** and

involuntary / **voluntary** responses.

[1]

(ii) A reflex starts with a stimulus.

Put a tick (✓) in the box next to the correct description of a stimulus.

A stimulus is a change in an organism's …

… effectors. ☐

… receptors. ☐

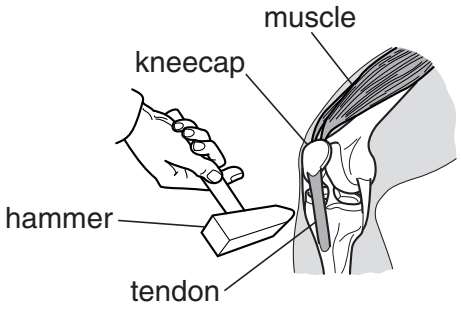
… behaviour. ☐

… environment. ☐

[1]

(b) Joe is having a check up at his doctor's.

The doctor tests Joe's knee jerk reflex.



The hammer taps the tendon.

This stretches the muscle.

The muscle then contracts.

The knee jerk reflex is described by statements **A**, **B**, **C**, **D** and **E** below.

Put the statements in the correct order.

The first one has been done for you.

A The impulse goes to the spinal cord.

B There is an impulse in the sensory neuron.

C There is a change in the receptor.

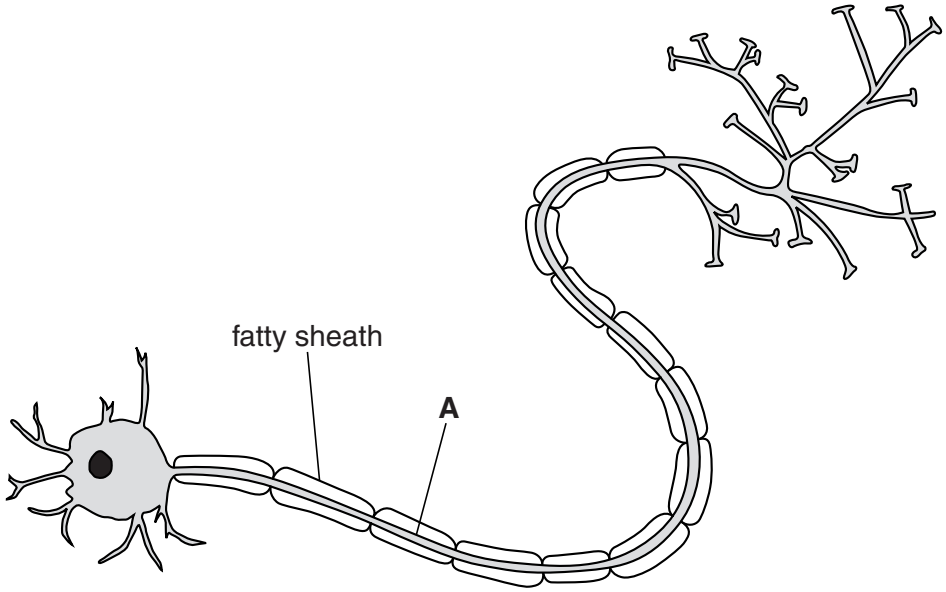
D The effector gives a response.

E There is an impulse in the motor neuron.

C				

[2]

(c) Part of Joe's reflex arc is made up of a motor neuron like this one.



(i) Put a (ring) around the correct name for the part of the motor neuron labelled **A**.

axon **synapse** **nucleus** **[1]**

(ii) Part **A** is wrapped in a fatty sheath that insulates it from other neurons.

What other benefit is there from the fatty sheath?

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

It slows the impulse. ☐

It keeps the nerve warm. ☐

It speeds up the impulse. ☐

It makes the impulse last longer. ☐ **[1]**

(d) Reflexes such as the knee jerk reflex help an animal to survive.

Give **another** example of a reflex response and explain how it helps an animal's chances of survival.

reflex response .....

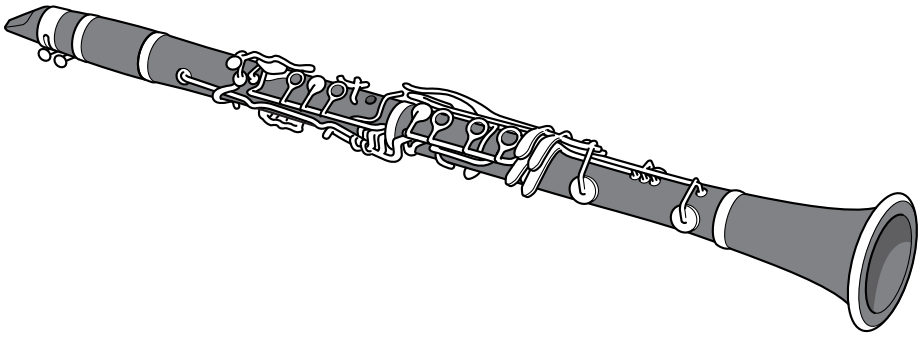
.....

how it helps survival .....

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

[Total: 8]

5 Colin plays his clarinet in a school concert.



(a) He has to practise playing to be able to perform.

Put ticks (✓) in the boxes next to the **two** statements that best explain what is happening in Colin's brain as he learns some new music.

Repetition causes neuron pathways to wear out.	☐
New experiences cause new neuron pathways to form.	☐
Repetition makes new pathways more likely to transmit impulses.	☐
Repetition makes all new neurons more likely to transmit impulses.	☐
New experiences cause neurons to make bigger electrical impulses.	☐

[2]

(b) The cerebral cortex of Colin's brain is concerned with memory.

(i) Put a (ring) around **two** other things that the cerebral cortex is concerned with.

consciousness **hormone release** **language**

temperature control **water balance**

[2]

(ii) Scientists use different methods to map the cerebral cortex.

Write down **two** of these methods.

1. .....

2. .....

[2]

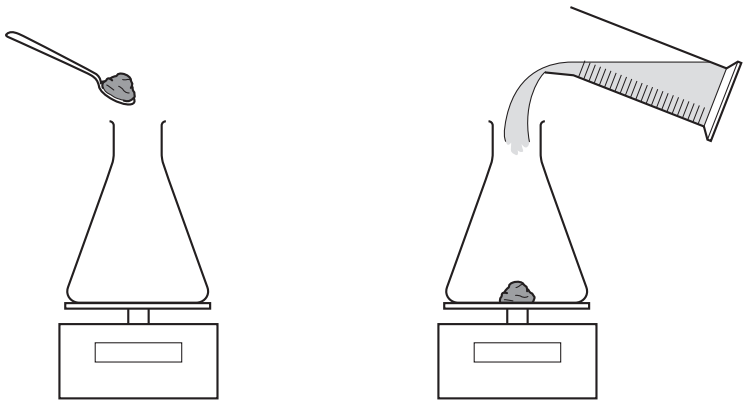
[Total: 6]

6 Ann has some alkali.

It is a solid and she wants to know how pure it is.

(a) She places a conical flask on a balance and adds some of the alkali.

She adds water to the flask to dissolve the alkali.



Ann makes four measurements, **A**, **B**, **C** and **D**.

A mass of conical flask

B mass of conical flask + alkali

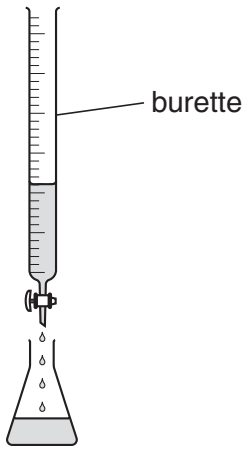
C mass of conical flask + solution

D volume of water poured into the conical flask

Which **two** of these measurements could be used to work out the mass of the alkali that she put into the flask?

measurements ..... and ..... **[1]**

(b) Ann carries out an accurate titration to find out how much acid reacts with 25.0 cm^3 of the alkali solution.



She puts 25.0 cm^3 of the alkali solution into a conical flask.

She then adds a few drops of indicator solution.

She puts the acid into a burette.

Describe how Ann should carry out the rest of the titration.

Include any measurements that she should make.

.....

.....

.....

.....

..... **[4]**

(c) Ann's titration uses sulfuric acid and sodium hydroxide.

She knows that they react to make sodium sulfate and water.

Fill in the two boxes to write a word equation for the reaction.

sulfuric acid	+		→		+	water

[1]

(d) Ann knows that sodium hydroxide is an alkali.

Two of the following chemicals are also alkalis.

Put a tick (✓) in the box next to each of the **two** alkalis.

potassium hydroxide ☐

calcium hydroxide ☐

potassium chloride ☐

calcium chloride ☐

[1]

[Total: 7]

7 Bernie buys stomach powder from his supermarket.

The powder contains solid sodium hydrogencarbonate and a solid acid.

(a) Put a (ring) around the acid that is a solid at room temperature.

citric acid **ethanoic acid** **hydrogen chloride** **sulfuric acid** **[1]**

(b) What do we call the reaction between an acid and sodium hydrogencarbonate?

Put a (ring) around the best answer.

neutralisation **oxidation** **reduction** **titration** **[1]**

(c) A drug company measures the amount of impurities in the stomach powder.

They do not need to remove all of the impurities.

Explain why drug companies do not need to remove all of the impurities.

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

The remaining impurities do not do any harm. ☐

No one will know that impurities are there. ☐

Medicines often contain more than one ingredient. ☐

So they can charge more for medicines. ☐ **[1]**

(d) The drug company rejects one sample of the stomach powder because it is not pure enough.

100 g of the sample contains 98 g of stomach powder and 2 g of impurity.

Put a (ring) around the percentage purity of this stomach powder.

0.02% **2%** **50%** **98%** **[1]**

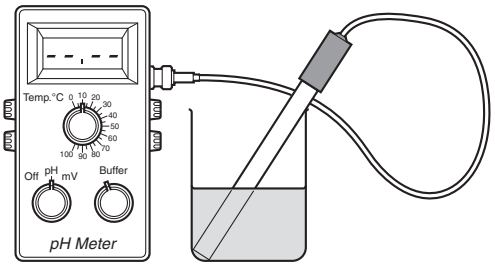
[Total: 4]

8 Carina has to dispose of a solution of a dangerous chemical.

She knows that she can dispose of it by adding hydrochloric acid.

Carina must add exactly the right amount of acid.

She uses a pH meter while she adds the acid.



(a) Carina adds the acid until the solution is neutral.

(i) What do pH meters measure?

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

whether a solution is neutral	☐
how much acid to add	☐
whether a solution is dangerous	☐
how acidic or alkaline the solution is	☐

[1]

(ii) Put a ring around the pH of a neutral solution.

1 **6** **7** **14**

[1]

(b) Carina needs to know the relative formula mass of the hydrochloric acid, HCl.

The relative **atomic** mass of hydrogen = 1
The relative **atomic** mass of chlorine = 35.5

Put a ring around the calculation for the relative **formula** mass of HCl.

$\frac{\mathbf{1}}{\mathbf{35.5}}$ $\frac{\mathbf{35.5}}{\mathbf{1}}$ **35.5 – 1** **35.5 + 1**

[1]

[Total: 3]

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.