

**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)

**Friday 19 June 2009  
Morning**

**Duration: 40 minutes**



Candidate Forename		Candidate Surname	
-----------------------	--	----------------------	--

Centre Number						Candidate Number				
---------------	--	--	--	--	--	------------------	--	--	--	--

**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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.
- Do **not** write in the bar codes.
- 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 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

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

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

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

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

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

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

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

#### Electric Circuits

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

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

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

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

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

#### The Wave Model of Radiation

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

**3**

**BLANK PAGE**

**Question 1 starts on page 4.**


**PLEASE DO NOT WRITE ON THIS PAGE**

Answer **all** the questions.

- 1 Ben hurts his foot playing football. The hospital takes an X-ray image of his foot to see if any bones are broken.



- (a) Ben asks his friends why X-rays can be used to make an image of his bones.

<p><b>Alan</b> X-rays can pass through empty space.</p>		<p><b>Bess</b> Bone absorbs more X-rays than muscle.</p>
<p><b>Carlo</b> Muscle absorbs X-rays but bone does not.</p>		<p><b>Davina</b> Nothing can stop X-rays.</p>

Who gives the **best** answer?

answer ..... [1]

- (b) Ben knows that exposure to X-rays can be dangerous.  
This is because X-ray photons carry a lot of energy and can damage cells.

Why do X-ray photons carry a lot of energy?

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

X-rays are invisible.

☐

X-rays have a high frequency.

☐

X-rays can travel through a vacuum.

☐

[1]

5

(c) Here is an incomplete diagram of the electromagnetic spectrum.

Write **X-ray** in the correct place.

radio		infrared		ultraviolet		gamma
-------	--	----------	--	-------------	--	-------

[1]

(d) Complete the sentences. Choose words from the list.

**amplitude****sound****speed****wavelength**

Infrared and ultraviolet waves have the same ..... through empty space.

Infrared and ultraviolet waves must have a different .....

[2]

[Total: 5]

- 2 Jake is a security guard. He uses radio waves to communicate with his boss.



- (a) The **amplitude** of the radio waves carries information about Jake's voice. Which other wave property can be used instead?

Put a (ring) around the answer.

frequency

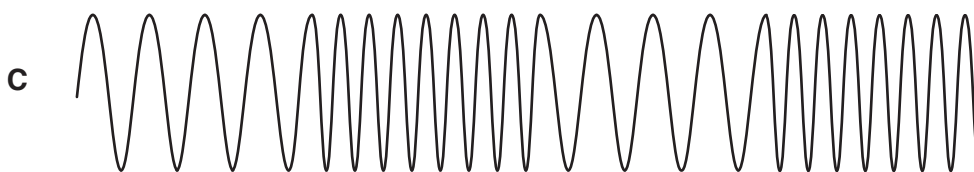
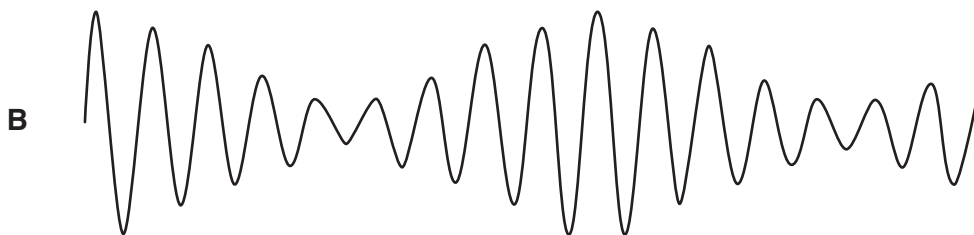
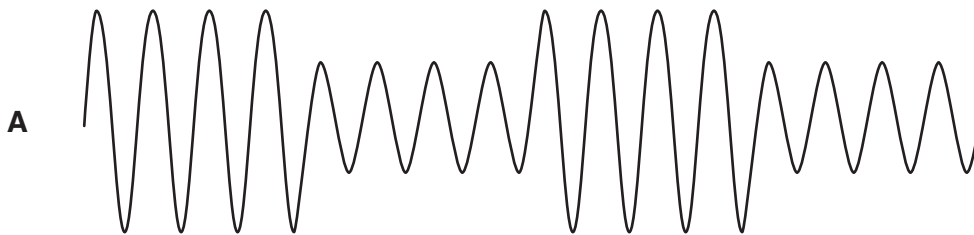
transverse

speed

[1]

- (b) The radio waves carry digital information.

Which of these wave patterns, **A**, **B** or **C**, shows **digital** information which has been **amplitude modulated** onto a wave?



wave pattern ..... [1]

7

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

Jake uses his radio to call his boss.

The waves travel away from the radio to the **receiver** **transmitter**.

As the waves travel, their amplitude **decreases** **increases** **stays the same**.

The quality of the radio waves gets worse as **information** **noise** is added to them. [2]

- (d) Radio waves are **transverse**. What does this mean?

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

The disturbance of the wave is ...

... in the same direction as the wave energy flow.

☐

... in the opposite direction to the wave energy flow.

☐

... at right angles to the direction of the wave energy flow.

☐

[1]

[Total: 5]

- 3 (a) Micky plays dominoes in a lesson about waves.

Each domino has a **word** at the top and a **meaning** at the bottom. The meaning explains the word at the top of the next domino.

Each word must be placed below its correct meaning, as shown below.

<b>A</b>	<b>longitudinal</b>	
	number of waves per second from the source	meaning
<b>B</b>	<b>frequency</b>	word
	distance from one crest to the next	

Here are the other three dominoes.

<b>C</b>	<b>amplitude</b>	<b>D</b>	<b>wavelength</b>	<b>E</b>	<b>speed</b>
	how far a wave goes in a second		height of a crest		energy flow parallel to wave disturbance

Write **C**, **D** or **E** in each blank domino so that each word is below its correct meaning. You may fill in the blank dominoes if it helps you work out the answers.

[2]



9

(b) Which one of these actions could change the speed of a wave?

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

change the intensity of the wave

☐

change the amplitude of the wave

☐

change the frequency of the wave source

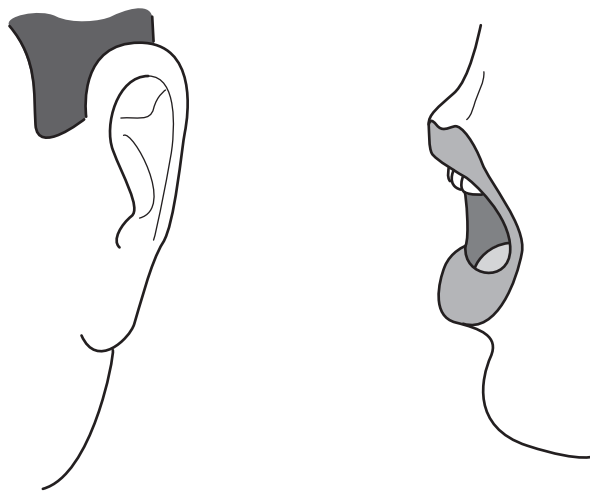
☐

change the medium that the wave passes through

☐

[1]

(c) Alice talks to Micky about their work.



What do the sound waves transfer from Alice to Micky?

Put a (ring) around the correct answer.

atoms

energy

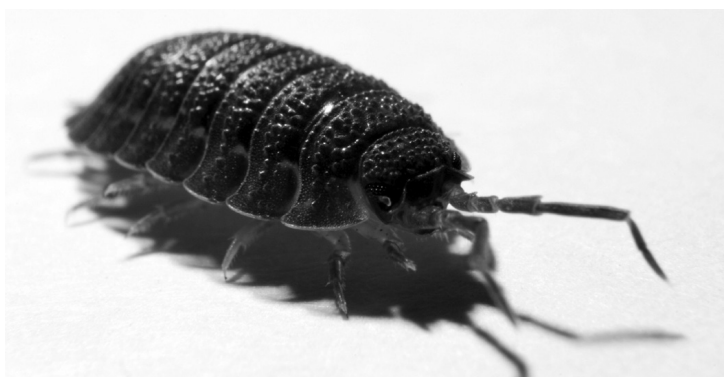
rays

wavelengths

[1]

[Total: 4]

- 4 Animals such as woodlice respond to changes in their environment.



This process follows a series of steps.

- (a) Complete the sentences to explain these steps.

Choose words from the list.

**an action**

**an effector**

**a hormone**

**a motor neuron**

**a receptor**

**a sensory neuron**

**a stimulus**

**a synapse**

The change in the environment is .....

The change is detected by .....

Information is carried to the central nervous system by .....

Information is carried from the central nervous system by .....

The response is carried out by .....

[4]

- (b) Woodlice move away from light.

Which of these sentences explains the reason for this response?

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

They prefer dry conditions.

☐

They are afraid of the light.

☐

Their food source is always in the dark.

☐

Dark conditions are more favourable for their survival.

☐

[1]

11

(c) Which of these terms describes the behaviour of simple animals such as woodlice?

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

a complex response

☐

a simple reflex

☐

a learned response

☐

a learned reflex

☐

[1]

[Total: 6]

12

5 (a) Label this diagram of a motor neuron.

Choose words from the list.

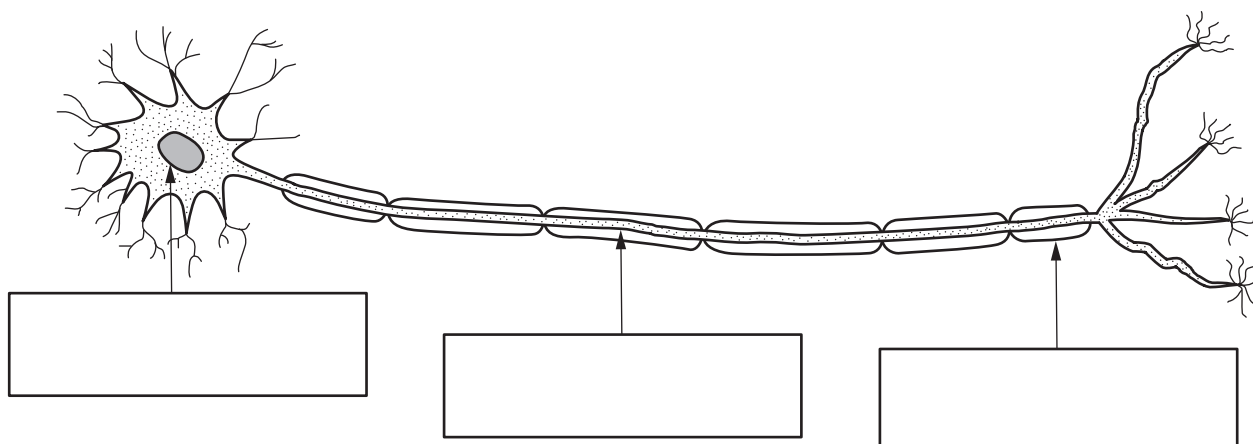
axon

chloroplast

fatty sheath

nucleus

ribosome



[3]

(b) What happens when a motor neuron is stimulated?

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

It gets shorter.

☐

It moves to where it is needed.

☐

It transmits an electrical impulse.

☐

[1]

[Total: 4]

## 6 Baby Sam is learning to crawl.



The brain is responsible for memory and for learning.

(a) Draw a straight line from each **function** to its correct **description**.

function	description
	the result of experience or repetition
memory	an involuntary response to a stimulus
learning	the storage and retrieval of information
	a voluntary response to a stimulus

[2]

(b) Babies learn new skills as they develop.

The sentences explain how this happens.  
They are in the wrong order.

- A** If the experience is repeated the link becomes stronger.
- B** It is easier for impulses to pass along the link.
- C** When a baby tries something new, links between neurons are made in the brain.
- D** The response gets easier to make.

Fill in the boxes to show the correct order. The first one has been done for you.

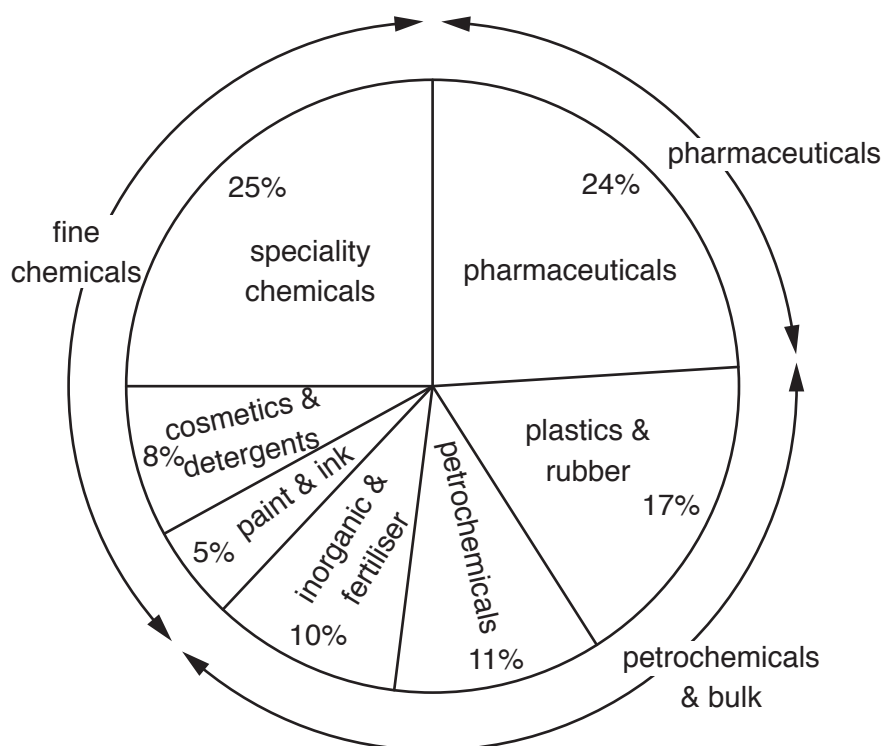
<b>C</b>			
----------	--	--	--

[2]

[Total: 4]

Turn over

- 7 The pie chart shows the EU chemical industry sales for 2003.



Mary combines these sectors to show the sales of the three main areas of the chemical industry.

- (a) Complete the table to show the total size of the three main areas.

area	total % sales
pharmaceuticals	
petrochemicals & bulk	
fine chemicals	

[2]

- (b) The total sales of the industry are about 450 billion euros.

Using the information in the pie chart, put a (ring) around the total sales of the pharmaceuticals in billions of euros.

$$450 \times \frac{24}{100}$$

$$450 \times \frac{100}{24}$$

$$450 \times \frac{38}{100}$$

$$450 \times \frac{100}{38}$$

[1]

[Total: 3]

- 8 Foods such as fruit taste pleasant because they contain small amounts of acid.



- (a) Sometimes, extra acid is added to foods.

Acids which can be added to food are given E numbers.

acid	E number
ethanoic acid	E260
citric acid	E330
tartaric acid	E334
hydrogen chloride	E507
sulfuric acid	E513

Give one E number for an acid which is solid when pure.

answer .....

Give one E number for an acid which is a liquid when pure.

answer .....

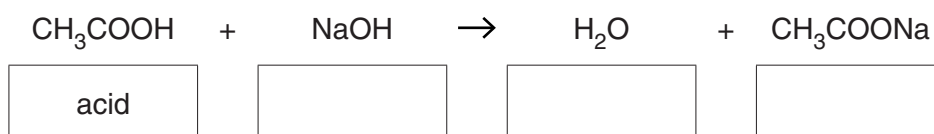
Give one E number for an acid which is a gas when pure.

answer .....

[2]

- (b) Acids in food show the normal reactions of an acid.

Write the labels **acid**, **alkali**, **salt** and **water** in the boxes. One has been done for you.

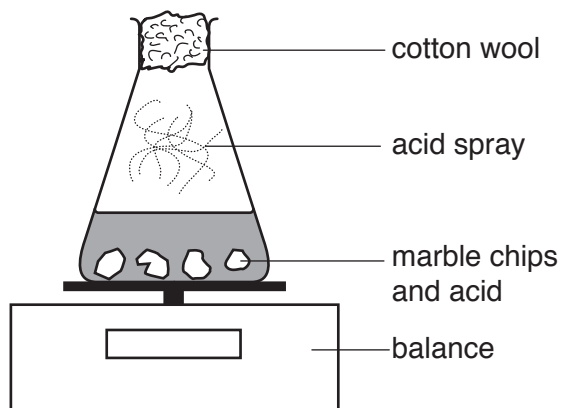


[1]

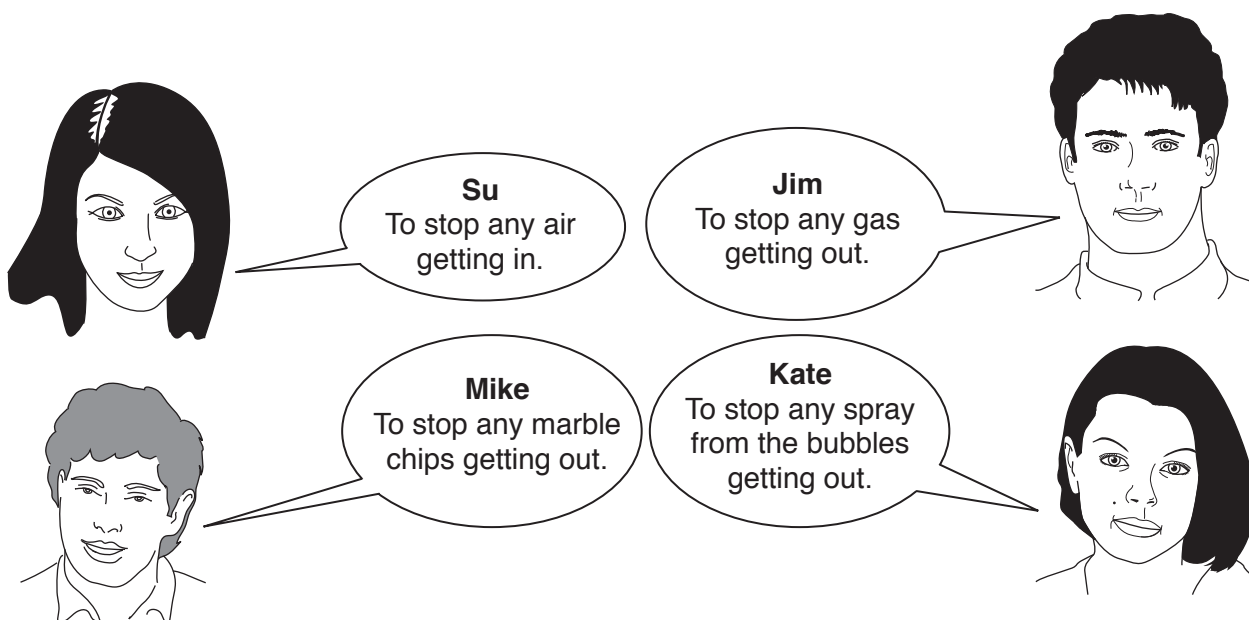
[Total: 3]

9 Bobby reacts marble chips (calcium carbonate) with acid.

He measures the change in mass as the acid reacts.



(a) Why does he put cotton wool in the top of the flask?



Who gives the **best** answer?

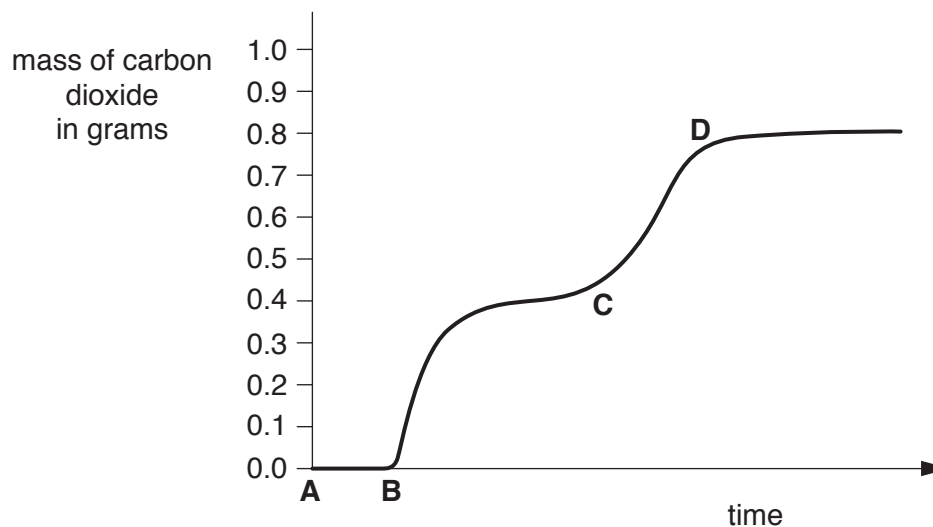
answer ..... [1]



17

(b) Bobby starts the reaction by adding some acid.

He adds extra acid part way through.



(i) Put a ring around the letter below that shows where he added the acid to **start** the reaction.

**A                  B                  C                  D** [1]

(ii) Put a ring around the letter below that shows where he added the extra acid.

**A                  B                  C                  D** [1]

(iii) Put a ring around the mass of carbon dioxide given off by the end of the experiment.

**0.4 g                  0.5 g                  0.6 g                  0.8 g                  1.0 g** [1]

[Total: 4]

10 Benzoic acid is added to foods as a preservative.

Benzoic acid forms solid crystals which must be purified before the acid is used.

- (a) The table shows different methods of purifying chemicals, and information about when you would use each method.

Draw lines to link each **method** to the correct piece of **information**.

One has been done for you.

method	information
crystallisation	The solid substance is coated with a solution containing impurities.
evaporation	The impurities are more soluble than the substance.
filtration	The substance is in a very dilute solution.
washing	The impurities do not dissolve.

[2]

- (b) Terry does a titration to check the purity of some benzoic acid.

He wants to use an indicator which changes colour when the solution becomes slightly alkaline.

	indicator	pH range for colour change
<b>A</b>	gentian violet	0 to 2
<b>B</b>	methyl red	4 to 6
<b>C</b>	litmus	5 to 8
<b>D</b>	phenolphthalein	8 to 10
<b>E</b>	nitramine	11 to 13

- (i) Which indicator, **A**, **B**, **C**, **D**, or **E**, should he use?

answer ..... [1]

- (ii) Terry does the titration five times.

He writes down his titration results.

titration number	1	2	3	4	5
volume of alkali in cm <sup>3</sup>	25.9	25.1	25.0	25.0	25.0

Put a tick (✓) in the box next to the result that he should use for his calculations.

25.0	<input type="checkbox"/>
25.1	<input type="checkbox"/>
25.2	<input type="checkbox"/>
25.9	<input type="checkbox"/>

[1]

[Total: 4]

**END OF QUESTION PAPER**

**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1PB.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© OCR 2009

\* 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.