

Wednesday 5 June 2013 – Afternoon

**GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A**

A151/01 Modules B4 C4 P4 (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)

Duration: 1 hour

MODIFIED LANGUAGE



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. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- 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).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets [] at the end of each question or part question.
- A list of physics equations is printed on page 2.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.



TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

$$\text{distance} = \text{wave speed} \times \text{time}$$

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

Sustainable energy

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

$$\text{power} = \text{voltage} \times \text{current}$$

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

Explaining motion

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

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

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

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

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

$$\text{amount of energy transferred} = \text{work done}$$

$$\text{change in gravitational potential energy} = \text{weight} \times \text{vertical height difference}$$

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

Electric circuits

$$\text{power} = \text{voltage} \times \text{current}$$

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

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

Radioactive materials

$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

Answer **all** the questions.

- 1 Chloe is a sprinter.
Her muscles respire **anaerobically**.

(a) Complete the word equation for anaerobic respiration.

Use words from this list.

carbon dioxide glucose lactic acid oxygen water

..... → (+energy) [2]

(b) In which part of Chloe's muscle cells does **anaerobic** respiration take place?

Put a ring around the correct answer.

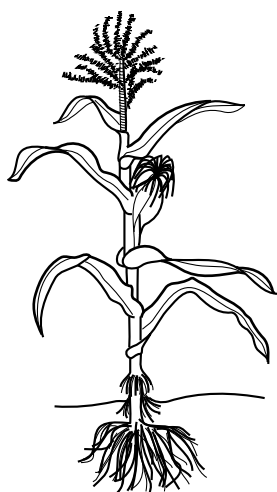
cell membrane cytoplasm mitochondria nucleus

[1]

[Total: 3]

Question 2 begins on page 4

2 Photosynthesis takes place in the leaves of a plant.



The gases carbon dioxide and oxygen diffuse in and out of the leaf.

The concentration of oxygen in the air is 21%.

The concentration of carbon dioxide in the air is 0.04%.

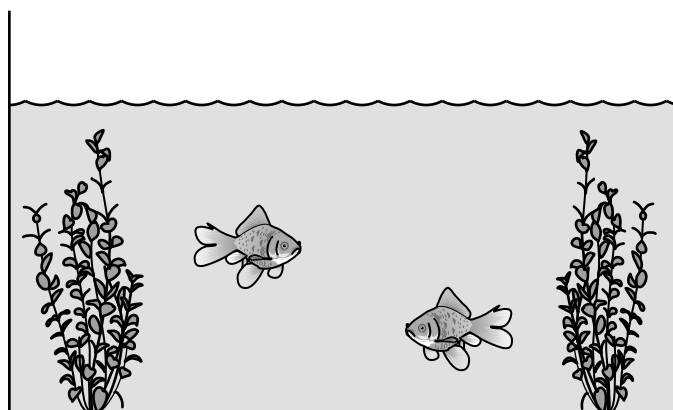
(a) Put ticks (✓) in the table to show the concentrations of oxygen and carbon dioxide **inside** the leaf at midday.

Put **one** tick in each row.

	Concentration inside the leaf		
	less than 0.04%	between 0.04% and 21%	greater than 21%
oxygen			
carbon dioxide			

[2]

(b) Kevin has a tank containing plants and fish.



He knows that both plants and fish use certain gases for chemical processes.

He also knows that these processes make other gases.

His teacher tells him that the plants and the fish need each other to survive.

Explain why.



The quality of written communication will be assessed in your answer.

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..... [6]

[Total: 8]

3 Yeast uses an enzyme to make carbon dioxide from sugar.

(a) Put a tick (✓) in the box next to the correct word to complete each sentence.

The enzyme is made of	fat.	
	sugar.	
	protein.	

The instructions to make the enzyme are found in the	genes.	
	cytoplasm.	
	membrane.	

The sugar has to be the correct shape to fit into the	closed		site of the enzyme.
	active		
	genetic		

[2]

(b) Yeast makes carbon dioxide during **anaerobic** respiration.

Write down **one** other substance that yeast makes during anaerobic respiration.

.....

[1]

[Total: 3]

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Question 4 begins on page 8

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- 4 Karen investigates osmosis using potato cylinders.

She cuts six potato cylinders, each 50 mm long.

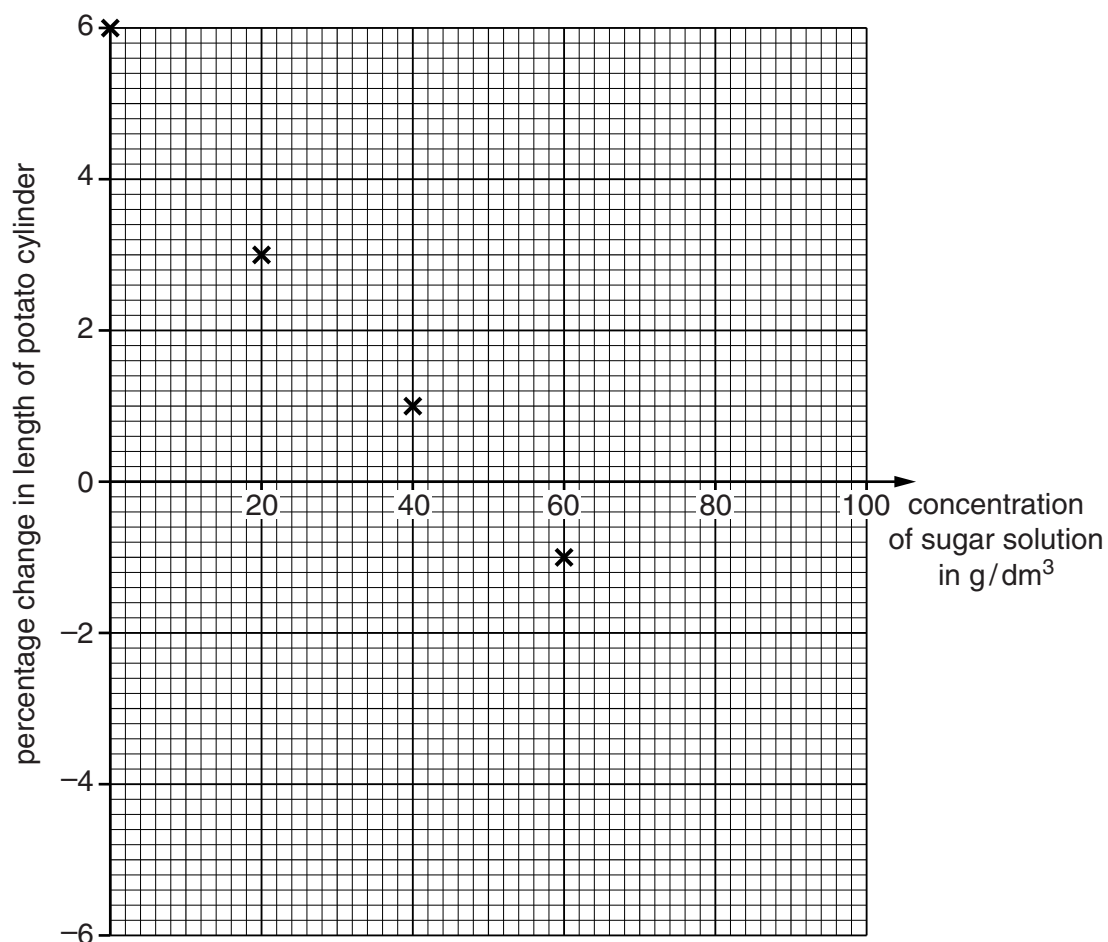
She places each potato cylinder in a different concentration of sugar solution.

After 60 minutes, she removes the potato cylinders and measures the length of each one.

Concentration of sugar solution in g/dm^3	% change in length of potato cylinder
0	+6
20	+3
40	+1
60	-1
80	-4
100	-6

- (a) Plot a graph of these results on the axes and draw a straight line of best fit.

Four points have been done for you.



[2]

- (b) What is the concentration inside the potato cells at the start of the experiment?

Justify your answer.

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..... [2]

- (c) Explain how Karen could improve her experiment to increase confidence in the conclusion.

.....

.....

..... [2]

[Total: 6]

Question 5 begins on page 10

5 James is studying the halogens.

(a) A website tells James that chlorine boils at -35°C and that iodine boils at 184°C .

What is the boiling point of bromine?

Put a **ring** around the correct answer.

-184°C

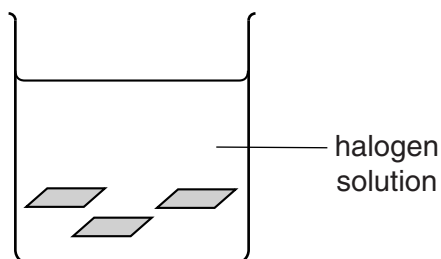
-37°C

59°C

219°C

[1]

(b) James tries to bleach small pieces of coloured cloth with solutions of different halogens.



(i) Which halogen is likely to make the best bleach?

Put a **ring** around the correct answer.

chlorine

bromine

iodine

[1]

(ii) Why is this halogen the best bleach?

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

It has the greatest reactivity.

☐

It has the highest boiling point.

☐

It has the highest melting point.

☐

It is a liquid at room temperature.

☐

[1]

(c) James knows that chlorine, bromine and iodine are halogens.

(i) Find the halogens in the Periodic Table at the back of this paper.

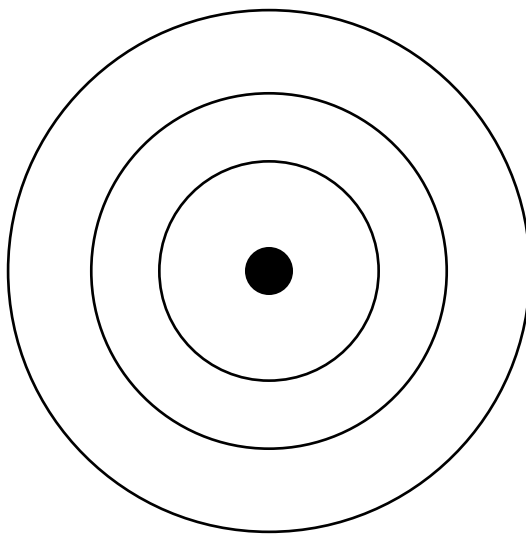
The relative atomic mass of one halogen is 80. Which halogen? [1]

(ii) How many protons does a **chlorine** atom have? [1]

(iii) Each chlorine atom has 17 electrons.

The electron arrangement is 2.8.7 for a chlorine atom.

Put crosses on the diagram to show all the electrons in an atom of chlorine.



[2]

(iv) When a chlorine atom reacts with a metal the chlorine atom becomes charged.

Use ideas about electrons to explain:

- what sort of charged particle is formed
- how the atom turns into a charged particle.

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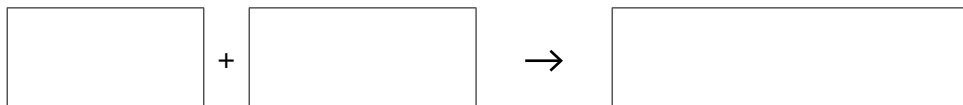
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..... [2]

- (v) Chlorine reacts with sodium to make sodium chloride.

Fill in the boxes to show a word equation for this reaction.



[1]

- (vi) Chlorine also reacts with potassium.

What substance is made when chlorine reacts with potassium?

.....

[1]

[Total: 11]

6 In 1869, Mendeleev arranged the elements into his Periodic Table.

- He put the elements into groups.
- He left empty places in some parts of his table.

Explain why these were good ideas, and why other scientists started to agree with Mendeleev after a few years.



The quality of written communication will be assessed in your answer.

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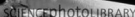
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[Total: 6]

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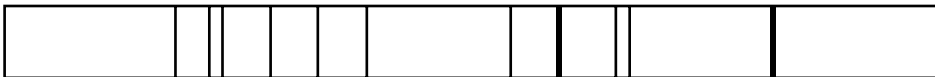
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7



She photographs its spectrum.

sample

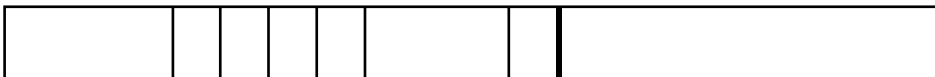


Nigella thinks that the substance contains sodium compounds and potassium compounds.

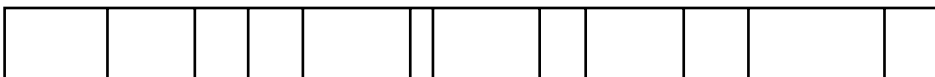
Jo thinks the substance contains sodium compounds, but no potassium compounds.

They look up some spectra in a book.

sodium



potassium

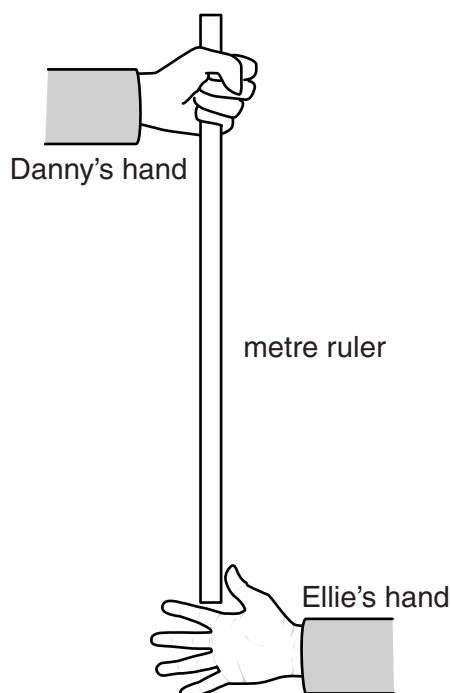


Who is correct? Explain your answer.

..... [3]

[Total: 3]

- 8 Danny holds a metre ruler above Ellie's open hand. Danny lets go of the ruler without warning. Ellie catches the ruler. They use the distance that the ruler falls to work out her reaction time.



(a) Here are their results.

Test	Reaction time in seconds
one	0.21
two	0.18
three	0.22
four	0.19

- (i) What is the best estimate of the true value of her reaction time?
Put a ring around the correct answer.

0.18 s 0.19 s 0.20 s 0.21 s 0.22 s [1]

- (ii) What is the range of the results?
Put a ring around the correct answer.

0.18 s to 0.22 s 0.19 s to 0.21 s 0.20 s to 0.22 s 0.21 s to 0.22 s [1]

- (b) Ellie drinks an energy drink.
Half an hour later Danny measures Ellie's reaction time again.
Here are their results.

Test	Distance fallen by ruler in cm	Reaction time in seconds
five	17	0.17
six	13	0.15
seven	15	0.16

What can you conclude about the effect of the energy drink?
Justify your answer. Use your answers to part (a) to help.

.....

.....

.....

..... [3]

- (c) The ruler speeds up as it falls.
Why does the ruler speed up?
Put a tick (✓) in the box next to the correct explanation.

Gravitational potential energy transfers to kinetic energy.

☐

The kinetic energy remains constant.

☐

Kinetic energy transfers to gravitational potential energy.

☐

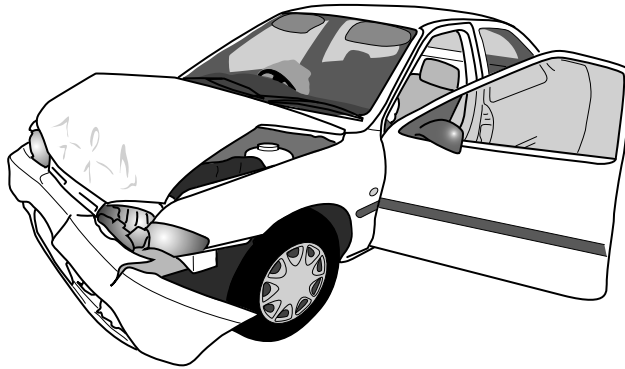
The gravitational potential energy remains constant.

☐

[1]

[Total: 6]

- 9 Modern cars are built with larger crumple zones than older cars.



Explain why larger crumple zones are more effective than small ones.



The quality of written communication will be assessed in your answer.

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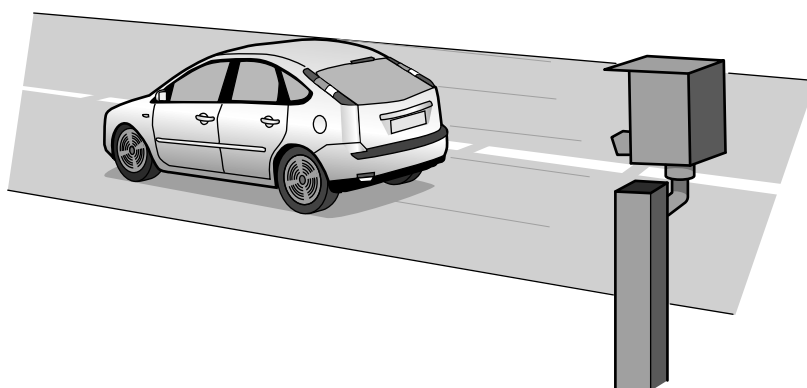
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[Total: 6]

- 10 A speeding car sets off a speed camera.

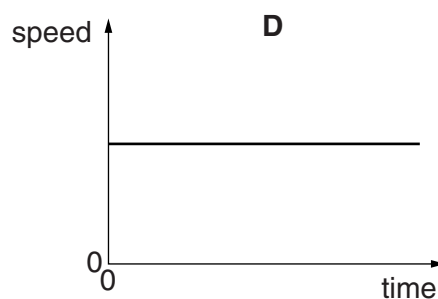
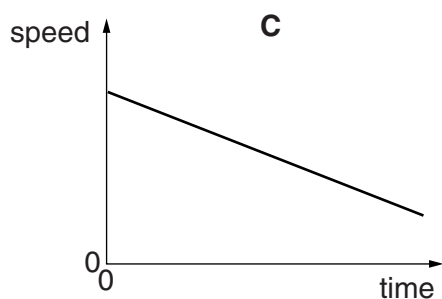
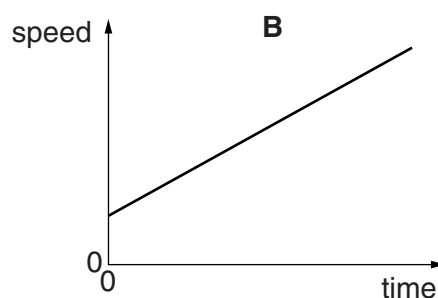
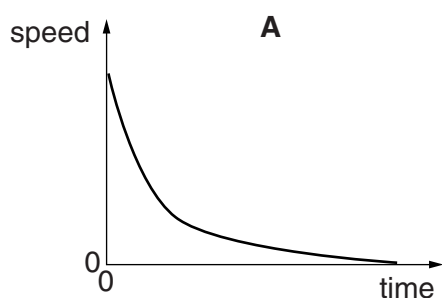


- (a) The camera takes two photos of the car.

The photos are taken 0.40 s apart.
The car moves 8.0 m in this time.
Calculate the speed of the car.
Show your working.

speed = m/s [2]

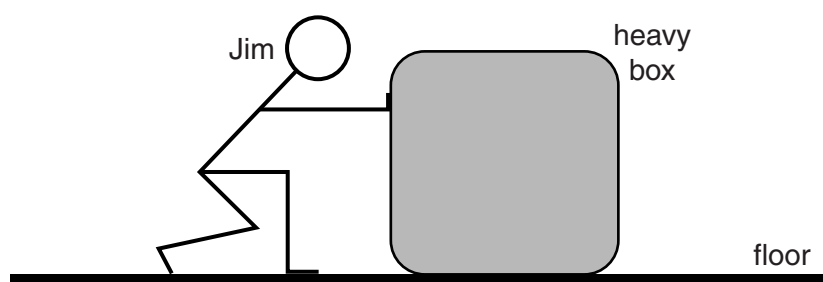
- (b) The car accelerates away from the camera.
Which speed-time graph, **A**, **B**, **C** or **D**, shows this acceleration?



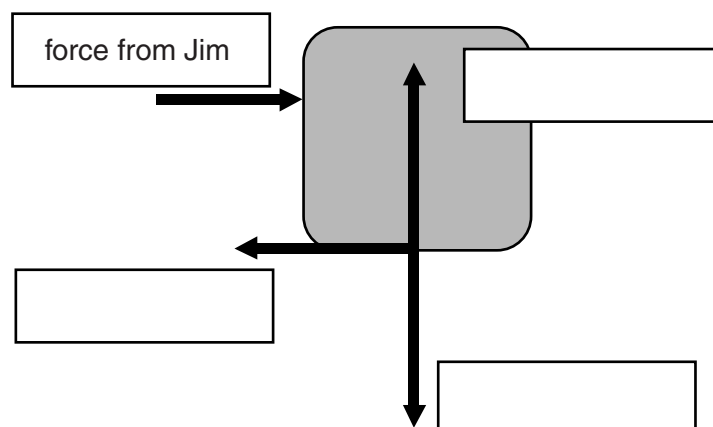
answer [1]

[Total: 3]

11 Jim pushes a heavy box across a level floor.



(a) Four different forces act on the heavy box, as shown below.



Add these labels to the diagram.

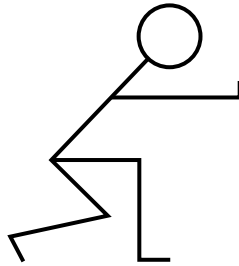
friction

reaction

weight

[2]

- (b) Jim pushes on the box with a force of 200 N.
Jim's weight is 800 N.
State and explain the size and direction of the force **on** Jim **from** the box.
You may draw on the diagram if you wish.



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..... [3]

[Total: 5]

END OF QUESTION PAPER

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* 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.