OCR
RECOGNISING ACHIEVEMENT

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B623/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION
GATEWAY SCIENCE
ADDITIONAL SCIENCE B
Unit 1 Modules B3 C3 P3 (Higher Tier)

MONDAY 21 JANUARY 2008

Afternoon
Time: 1 hour

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T45739

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 60.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Section	**Max.**	**Mark**
A	**20**	
B	**20**	
C	**20**	
TOTAL	**60**	

This document consists of **23** printed pages and **1** blank page.

EQUATIONS

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

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

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2}\ mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

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

BLANK PAGE

Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module B3

1 Gary and Peter are twins. They both came from the same fertilised egg.

(a) Like all infants Gary and Peter are monitored by a health visitor to make sure they are growing normally.

Their masses are measured every three months.

The table shows their masses.

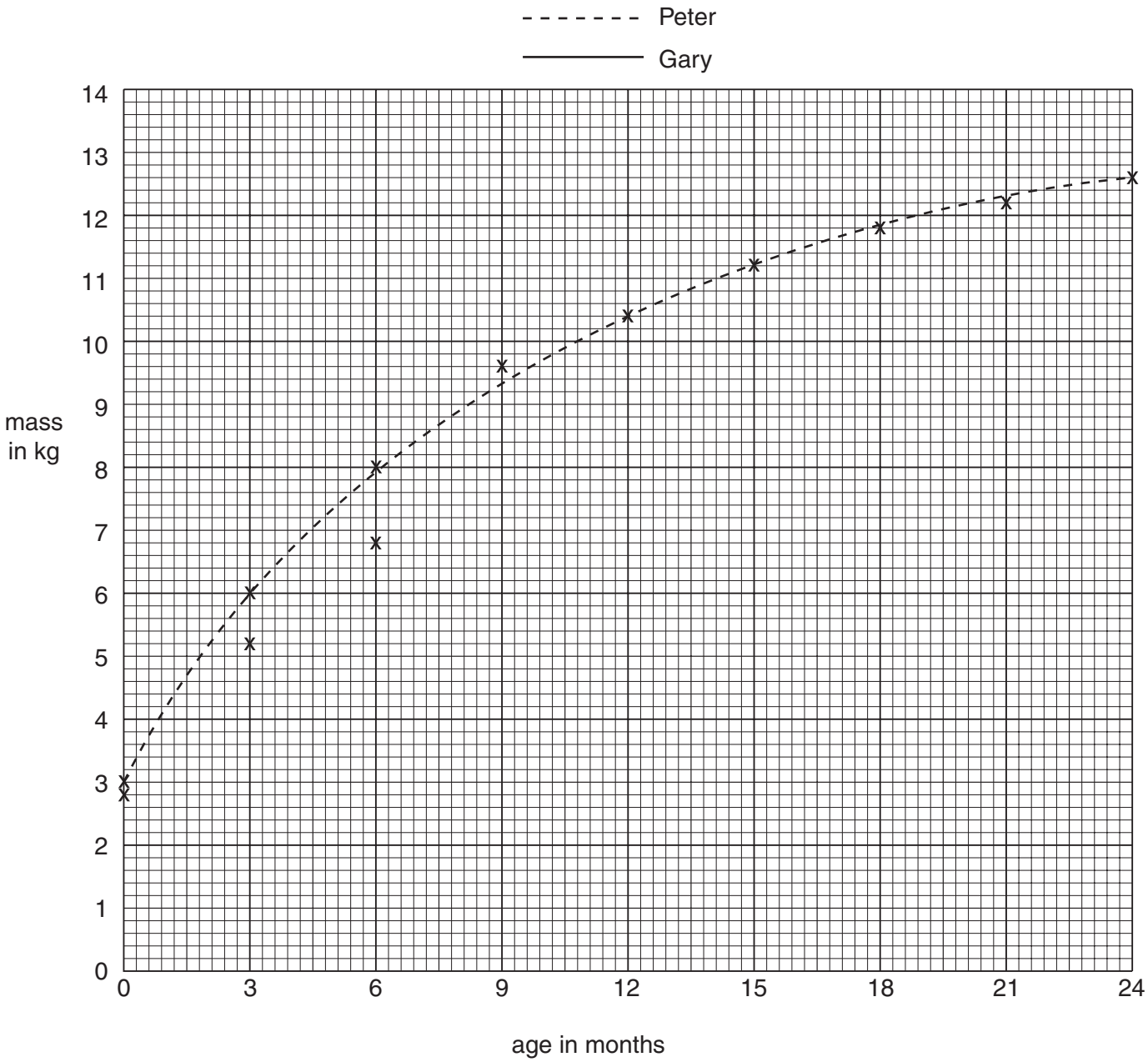
age in months	**0**	**3**	**6**	**9**	**12**	**15**	**18**	**21**	**24**
Gary's mass in kg	2.8	5.2	6.8	8.0	9.0	9.6	10.0	10.3	10.3
Peter's mass in kg	3.0	6.0	8.0	9.6	10.4	11.2	11.8	12.2	12.6

Peter's mass has been plotted on a graph.

(i) Finish the graph by plotting the mass for Gary.

The first three points have been done for you. [2]

(ii) Draw the best curve for Gary. [1]



(b) The health visitor is concerned about Gary.

Suggest why.

.....

..... [1]

[Total: 4]

2 Look at the photograph of a human foetus.

(a) The foetus is attached to the mother by the placenta.

In the placenta, oxygen diffuses from the mother's blood into the foetal blood.

The placenta is adapted to increase the rate of diffusion.

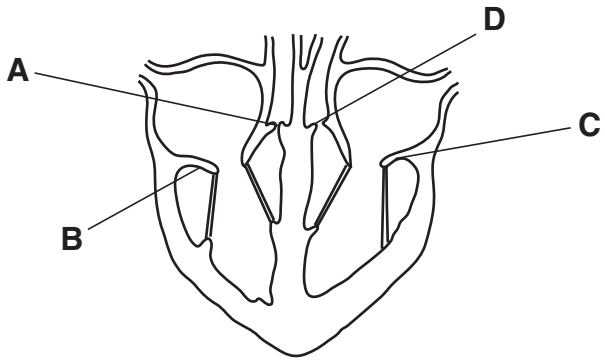
Describe **one** adaptation.

.....

..... [1]

(b) During pregnancy a midwife will check the heart of the foetus.

Look at the diagram of a heart.



(i) The diagram shows four valves.

One letter shows the tricuspid valve.

Which one?

Choose from **A**, **B**, **C** or **D**.

answer..... [1]

(ii) What is the function of the tricuspid valve?

.....

..... [1]

(c) The left ventricle has a thicker muscle wall than the right ventricle.

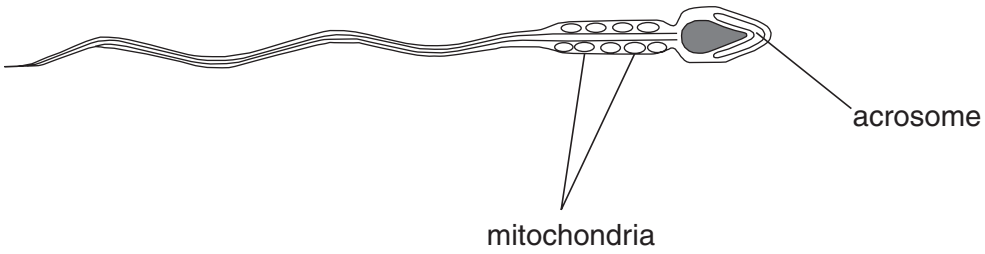
Explain why.

.....

..... [1]

[Total: 4]

3 Look at the picture of a sperm cell.



(a) **(i)** The acrosome contains a type of chemical.

Write down the name of this type of chemical.

..... [1]

(ii) Describe the job of this chemical in sexual reproduction.

..... [1]

(b) Mitochondria are found in the cytoplasm.

Write down the name of the process that occurs in the mitochondria.

..... [1]

(c) Body cells are produced by mitosis.

A type of cell division called meiosis produces sperm cells.

Describe how mitosis is different from meiosis.

.....

.....

.....

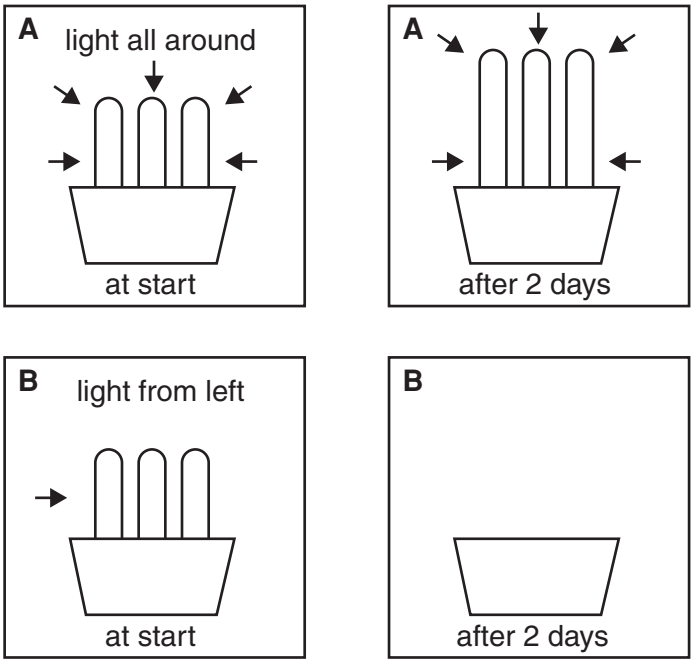
..... [2]

[Total: 5]

4 Jennifer investigates phototropism.

She grows some oat seedlings in different conditions.

Look at the diagrams of Jennifer's investigation.



(a) Finish diagram **B**.

Draw the seedlings after 2 days. [1]

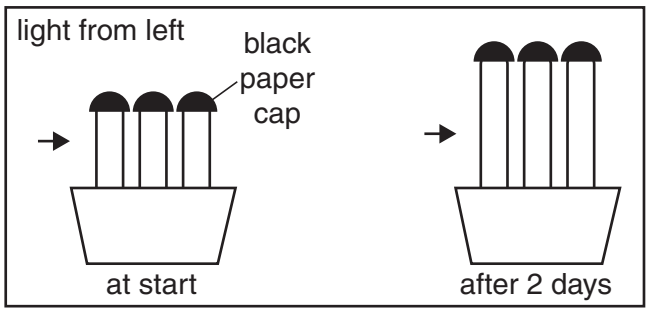
[Turn over for remainder of question 4

(b) Jennifer knows that the hormone auxin controls phototropism.

She does another investigation.

Look at the diagram.

It shows her results.



Use ideas about auxin to explain the results.

.....

.....

.....

..... [2]

[Total: 3]

5 This question is about DNA fingerprinting.

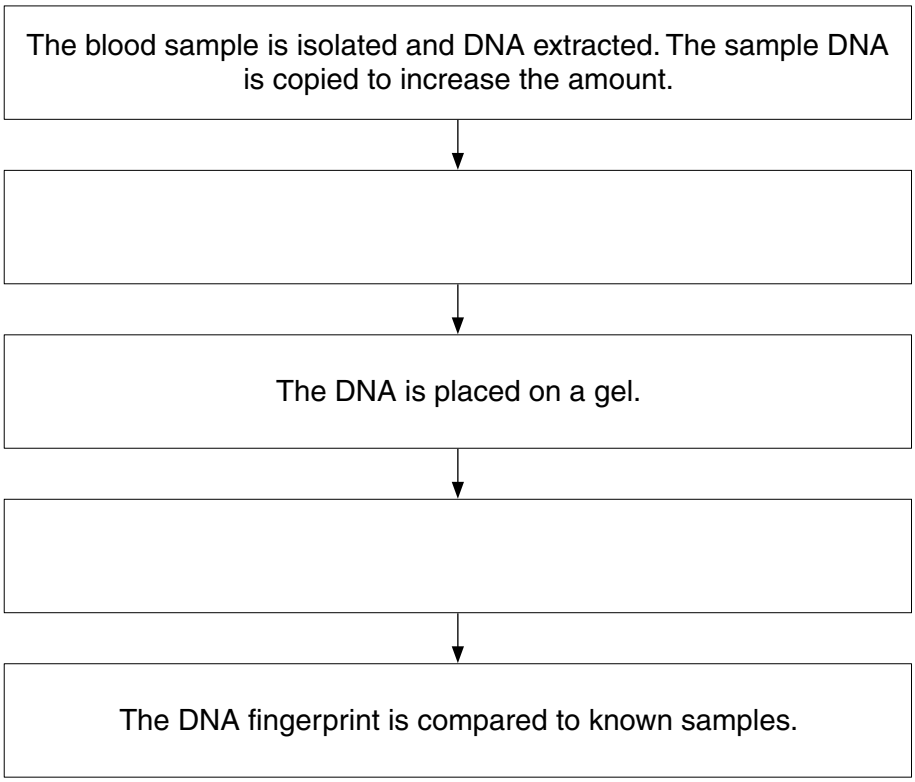
(a) Scientists use DNA fingerprinting to identify DNA left at a crime scene.

Look at the flow chart.

It shows the main stages the scientists use.

Some of the stages are missing.

Finish the flow chart by writing in the missing stages.



[2]

(b) The sequence of bases in DNA determines the order of amino acids in a protein.

Look at the sequence of bases for a section of DNA.

G T A C T C T G A

(i) How many amino acids are coded for by this section of DNA?

..... [1]

(ii) Write down the complementary DNA base code for this section of DNA.

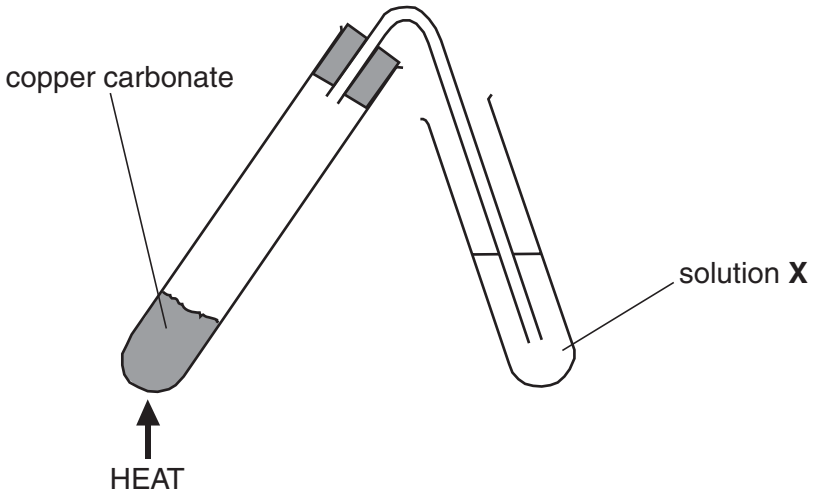
..... [1]

[Total: 4]

Section B – Module C3

6 Fred and Liz heat copper carbonate.

Look at the diagram. It shows the apparatus they use.



(a) In this reaction the copper carbonate is changed into copper oxide and carbon dioxide.

Write a **word** equation for this reaction.

..... [1]

(b) Copper is a transition element.

Transition elements make coloured compounds.

Write down the colour of most copper compounds.

Choose from the list.

blue

orange

red

yellow

answer ..... [1]

(c) Copper sulfate solution will react with sodium hydroxide solution to make an insoluble solid called copper hydroxide.

Complete the sentence.

When two solutions are mixed an insoluble solid is made.

The solid is known as a …… . [1]

[Total: 3]

7 This question is about carbon dioxide.

(a) The bonds in carbon dioxide are made up of shared electrons.

What type of bonding is this?

Choose from the list.

covalent

ionic

metallic

answer ..... [1]

(b) Carbon dioxide is a gas with a low melting point.

This is a physical property.

Write down one **other** physical property of carbon dioxide.

..... [1]

(c) The bonds in water are also made up of shared electrons.

Look at the diagrams.

They show the electronic structures of hydrogen and of oxygen.

hydrogen oxygen

Draw a 'dot and cross' diagram to show the bonding in water, H_2O.

[2]

[Total: 4]

8 John and Leah do some flame tests.

They test the chemicals in three bottles.

One bottle contains sodium chloride, another potassium chloride and a third lithium chloride.

The labels are missing from the bottles.

John and Leah want to find out which chemical each bottle contains.

(a) Describe how they do a flame test.

You may wish to draw a labelled diagram to help your answer.

.....

.....

.....

..... [2]

(b) Lithium, sodium and potassium are Group 1 metals.

Sodium reacts with water. A gas which burns with a squeaky 'pop' is made.

(i) Write down the name of this gas.

..... [1]

(ii) An alkaline solution is also made.

What is the name of the substance which makes the solution alkaline?

..... [1]

(c) The Group 1 metals all have one electron in their outer shell.

When they react they lose this outer electron.

Potassium is more reactive than sodium.

Explain why.

.....

..... [1]

[Total: 5]

9 Look at the table. It shows some properties of the Group 7 elements.

element	molecular formula	colour	state at room temperature	melting point in °C	boiling point in °C
fluorine	F_2	pale yellow	gas	–220	.....
chlorine	Cl_2	.....	gas	–101	–35
bromine	Br_2	red/brown	.....	–7	59
iodine	I_2	dark grey	solid	114	184
astatine	At_2	black	solid	.....	337

(a) Complete the table to show the **colour** of chlorine and the **state** of bromine at room temperature. [2]

(b) Complete the table to estimate the melting point of astatine and the boiling point of fluorine. Use ideas about trends down a group. [2]

(c) Sodium reacts with chlorine to make sodium chloride, NaCl.

Write a balanced **symbol** equation for this reaction.

..... [2]

[Total: 6]

10 This question is about atomic structure.

An atom of phosphorus can be represented by

$$^{31}_{15}\mathbf{P}$$

The table shows some information about this phosphorus atom.

Complete the table.

number of protons	15
number of neutrons	.....
number of electrons	.....

[2]

[Total: 2]

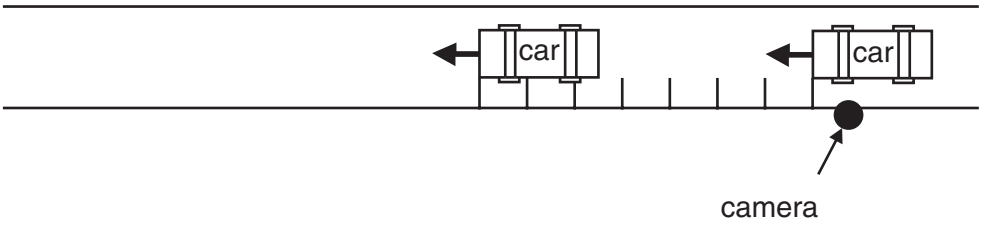
Section C – Module P3

11 This question is about road safety.

(a) There is a speed camera on the road.

There are lines painted on the road near the camera.

Look at the diagram.



The camera flashes twice.

Two photographs are taken of a speeding car.

The car travels at **28 m / s**.

The camera flashes are **0.5 s** apart.

The diagram shows the places where the car was.

Calculate the **distance** between each line on the road.

Use the equations on page 2 to help you.

.....

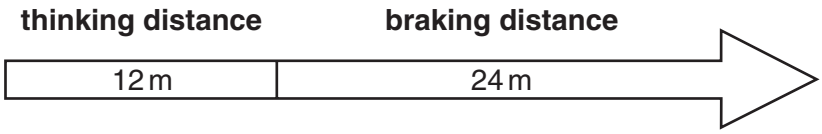
.....

.....

answer ..... m [3]

[Turn over for remainder of question 11

(b) Look at the diagram about the stopping distance for a car.



(i) Higher speed increases the **thinking** distance.

What else will **increase** the thinking distance?

Write down **two** other examples.

1 .....

2 ..... [2]

(ii) Write down one factor that can increase **braking** distance.

..... [1]

(c) Look at the information on **braking** distances for a car.

speed of car in m/s	braking distance in m
10	6
20	24
40	96

There is a **relationship** between speed and braking distance.

Explain this relationship.

In your answer

- use the equations on page 2
- write about kinetic energy.

.....

.....

.....

..... [3]

[Total: 9]

12 Cars have safety features.

In a crash, an air bag inflates and the driver hits the bag.

This reduces injuries.

Explain how this reduces injuries by completing the sentences.

Choose your answers from the list.

absorbed **increased** **reduced** **unchanged**

Each word can be used once, more than once or not at all.

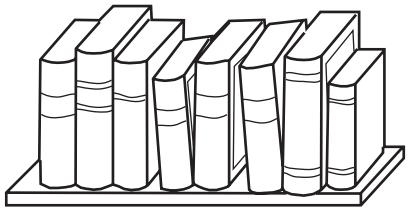
When the driver collides with the air bag

- the force is spread over an increased area of his body.
- the driver's energy is …… by the air bag.
- the driver's collision (stopping) time is …… .
- the driver's collision (stopping) distance is …… .
- the acceleration of the driver is …… in the collision. [4]

[Total: 4]

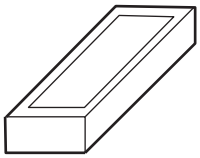
13 This question is about energy.

Look at the diagrams.

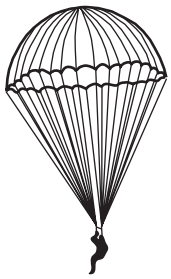


A
books on a shelf

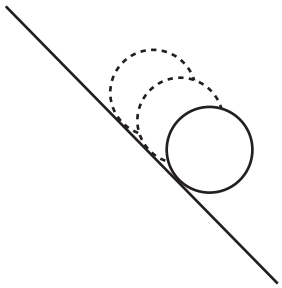
B
climbing steadily up a mountain



C
brick on floor



D
parachute falling steadily



E
ball rolling downhill

(a) (i) One of these is **gaining** kinetic energy.

Which **one**?

Choose from: **A** **B** **C** **D** **E**

..... [1]

(ii) One of these **transfers** potential energy **into** kinetic energy.

Which **one**?

Choose from: **A** **B** **C** **D** **E**

..... [1]

(b) The mountain climber does **work** when climbing the mountain.

The mountain climber does 4 000 J of work in 100 seconds.

Calculate the **power** of the mountain climber.

The equations on page 2 may help you.

.....

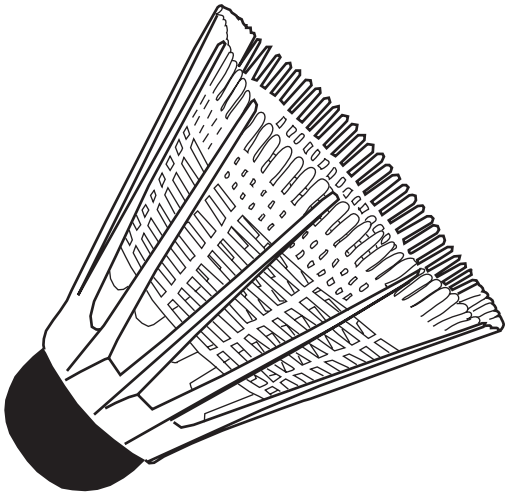
.....

answer ..... W [2]

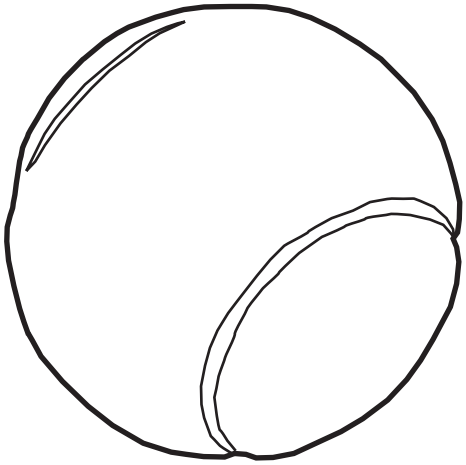
[Total: 4]

14 This question is about air resistance or drag.

Look at the diagrams.



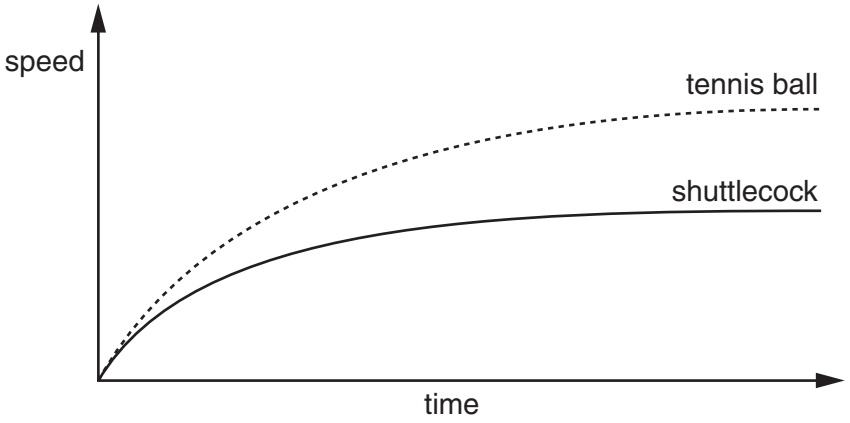
shuttlecock



tennis ball

Sally drops these two objects from a very high building.

Look at the graph of how their speeds change.



(a) Why does the shuttlecock slow down more quickly than the tennis ball?

.....

..... [1]

(b) After a short time, the shuttlecock falls at a terminal speed.

The **forces** on the shuttlecock cause it to reach terminal speed.

Explain why.

.....

..... [1]

(c) Sally cuts some feathers from the shuttlecock.

This increases its terminal speed.

Suggest why.

.....

..... [1]

[Total: 3]

END OF QUESTION PAPER

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.