OCR RECOGNISING ACHIEVEMENT

H

A215/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

Unit 1 Modules B4 C4 P4 (Higher Tier)

TUESDAY 17 JUNE 2008

Morning

Time: 40 minutes

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

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

CUP/T46091

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.
- 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 **42**.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**4**	
2	**5**	
3	**1**	
4	**4**	
5	**4**	
6	**5**	
7	**5**	
8	**4**	
9	**5**	
10	**5**	
TOTAL	**42**	

This document consists of **20** printed pages.

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

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

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

energy transferred = power × time

power = potential difference × current

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

The Wave Model of Radiation

wave speed = frequency × wavelength

Answer **all** the questions.

1 A doctor tells Johnny that he should use 'low-salt' instead of normal salt.

(a) In 'low-salt', some of the sodium chloride is replaced with potassium chloride.

Why is it possible to replace sodium chloride with potassium chloride in salt?

Choose the statement which is the most likely explanation.

A Sodium is more reactive than potassium.

B When salt dissolves, its ions split apart.

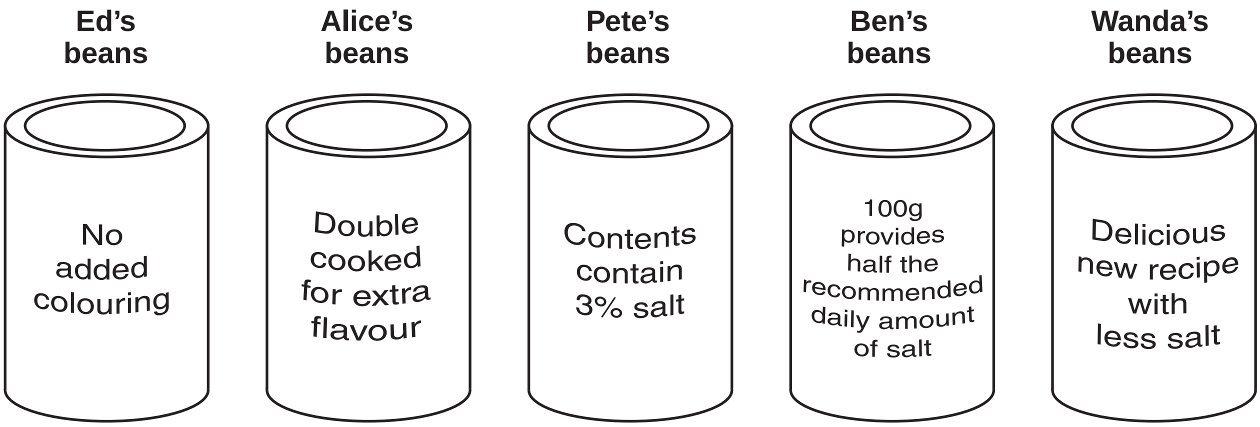
C Potassium chloride flows more easily than sodium chloride.

D Sodium and potassium are both in Group I.

answer .... [1]

(b) Johnny checks the amount of **salt** in different tins of baked beans.

The labels have different amounts of useful information.



Fill in the boxes below to show the order of **increasing** useful information in the labels.

The first one has been done for you.

order ⟶

Alice				

[3]

[Total: 4]

2 The European Smart-1 spacecraft was deliberately crashed onto the Moon's surface.

This threw up a cloud of dust and produced a flash of light.

Astronomers on Earth saw the flash of light and measured it with spectroscopes.

(a) What was the flash used to find out about?

A the far side of the Moon

B elements in the rocks of the Moon's core

C elements in the dust from the Moon's surface

D elements in the Sun

answer .... [1]

(b) The spacecraft used a new type of rocket motor called an ion-engine to drive it through space. The engine ionises xenon gas, then it fires the ions through an exhaust nozzle.

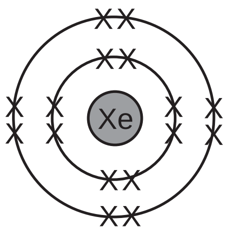
Xenon melts at –120 °C, and it boils at –108 °C.

Put a ring around the best temperature inside the engine when it is working in space.

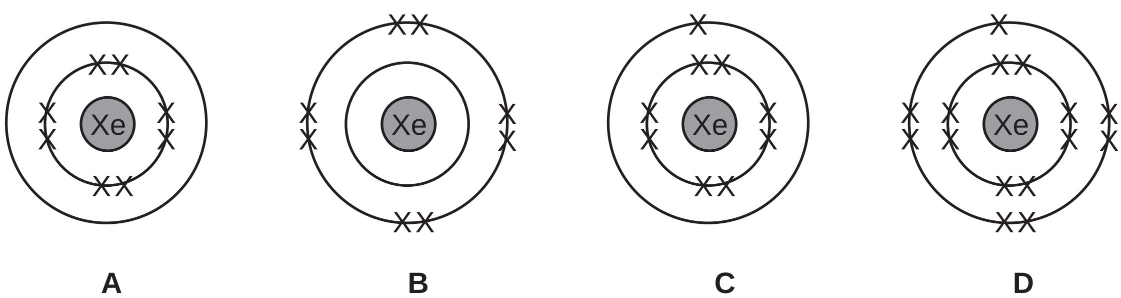
–273 °C **–173 °C** **–110 °C** **+273 °C**

[1]

(c) The outer two electron shells for an atom of xenon are:



Which of the following shows a xenon ion, Xe^{+}?



answer .... [1]

(d) Xenon, which is in Group 0 of the Periodic Table on page 20, does not normally form ions.

In which group of the Periodic Table do elements form ions with a single positive charge?

Put a ring around the best answer.

Group 1 **Group 2** **Group 4** **Group 6** **Group 7**

[1]

(e) Lithium azide contains the Li^+ and the N_3^- ions.

Put a ring around the formula of lithium azide.

$\mathbf{LiN_3}$ $\mathbf{Li_3N_3}$ $\mathbf{Li_3N}$ $\mathbf{LiNO_3}$

[1]

[Total: 5]

3 Sodium and calcium are both metals.

Sodium compounds make flames turn orange.

Calcium compounds make flames turn red.

When you look at each flame through a spectrometer, what do you notice?

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

The lines in the calcium spectrum are all red.
The lines in the two spectra come in different places. ☐

The lines in the sodium spectrum are all red.
The lines in the two spectra come in the same places. ☐

In both spectra, each line is a different colour.
The lines in the two spectra come in the same places. ☐

In both spectra, each line is a different colour.
The lines in the two spectra come in different places. ☐

[1]

[Total: 1]

4 We often need to show the state symbols, such as [aq], in chemical equations.

(a) Fill in the boxes to show the state symbol for each of these chemicals at room temperature.

chemical	**melting point in °C**	**boiling point in °C**	**state symbol**
A	114	184	
B	42	713	
C	–7	58	
D	–101	–34	

[2]

(b) When some compounds are melted they will then conduct electricity.

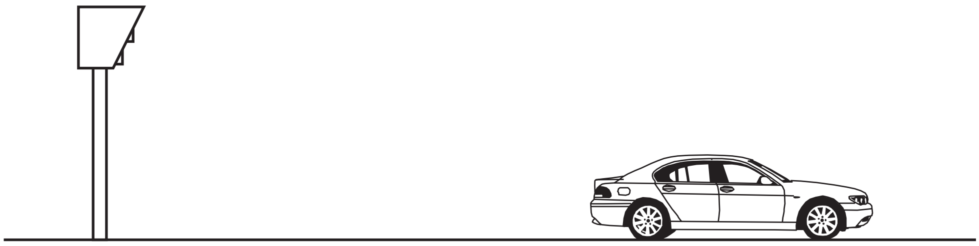
Draw **one** straight line to join the two statements which **best** explain why this is so.

particles (choose one)	**behaviour** (choose one)
The particles in each element are ions.	In a melted compound, electrons are passed from ion to ion.
The particles in the compound make up a regular lattice.	In the melted compound, the ions can move.
The particles in the compound are ions.	Particles in a lattice vibrate more at higher temperatures.

[2]

[Total: 4]

5 Jake drives his car past a speed camera.



(a) The camera takes a photograph of the car.

It takes another photograph 0.50 s later.

The photographs show that the car moves a distance of 9.0 m between the two photographs.

What is the average speed of the car?

Put a ring around the correct answer.

0.056 m / s   **4.5 m / s**   **18 m / s**   **450 m / s**

[1]

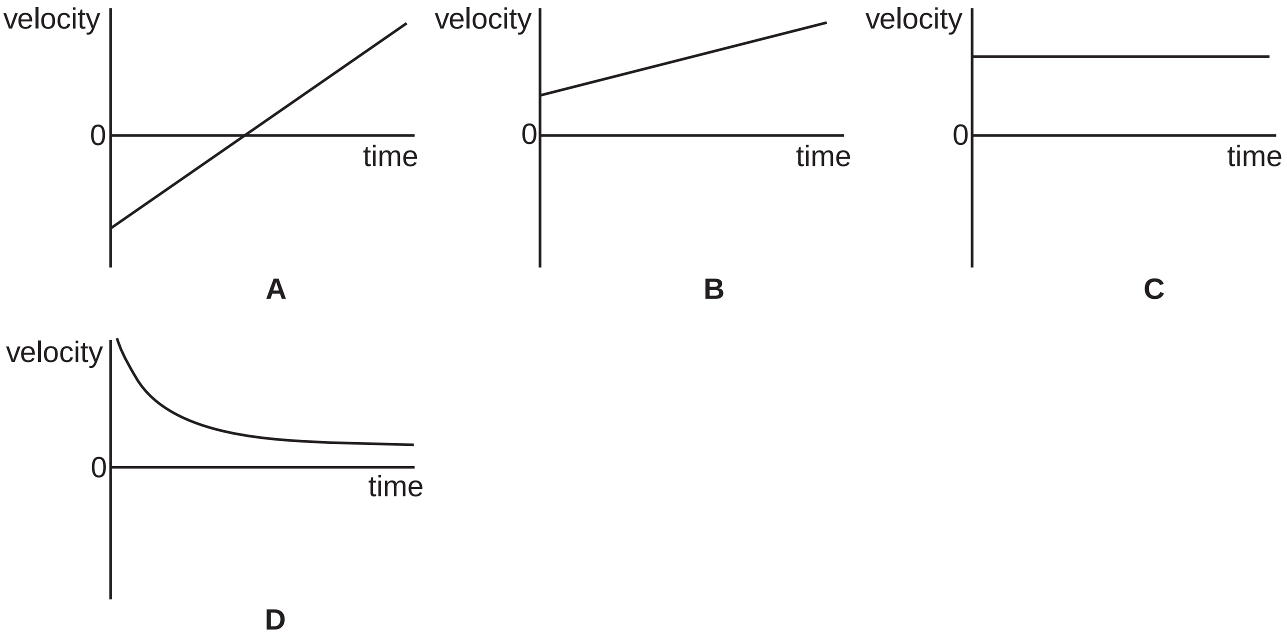
(b) The car is speeding up as the photographs are being taken.

(i) Complete the table with **true** or **false** for a car which is speeding up.

The counter force on the car is …	**true** or **false**
… equal to the driving force.	
… less than the driving force.	
… getting smaller all the time.	
… greater than the driving force.	
… in the same direction as the driving force.	
… in the opposite direction to the driving force.	

[2]

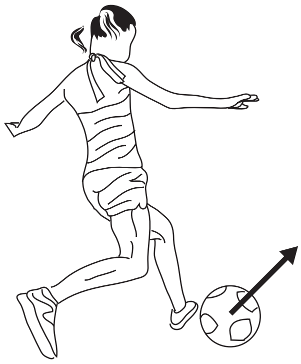
(ii) Which of these velocity-time graphs, **A**, **B**, **C** or **D**, shows the motion of the car as it passes the speed camera?



answer .... [1]

[Total: 4]

6 Sally plays football.



(a) She kicks a football with a force of 100 N.

The momentum of the football changes by 50 kg m / s.

How should she calculate the **time** for which her force acts?

Put a ring around the correct calculation.

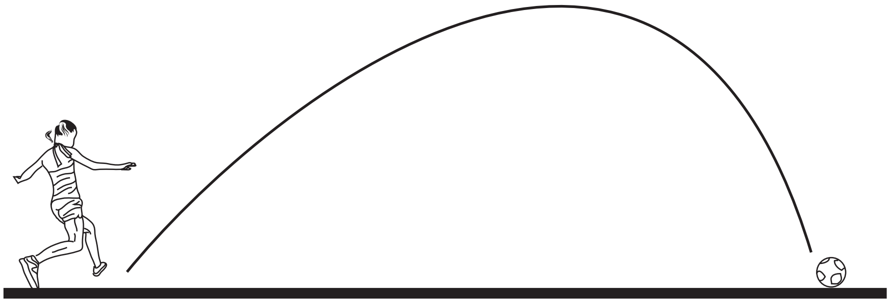
$\mathbf{\frac{100}{50}}$ **100 + 50** **100 × 50** **100 – 50** $\mathbf{\frac{50}{100}}$ [1]

(b) Complete the table with **true** or **false**.

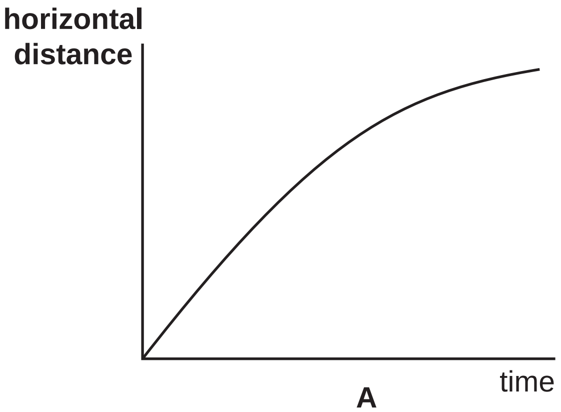
The force from Sally's foot …	**true** or **false**
… is equal to the weight of the ball.	
… reduces the momentum of the ball.	
… is greater than the reaction force from the ball.	
… does work increasing the kinetic energy of the ball.	
… has the same size as the reaction force from the ball.	
… is in the same direction as the reaction force from the ball.	

[3]

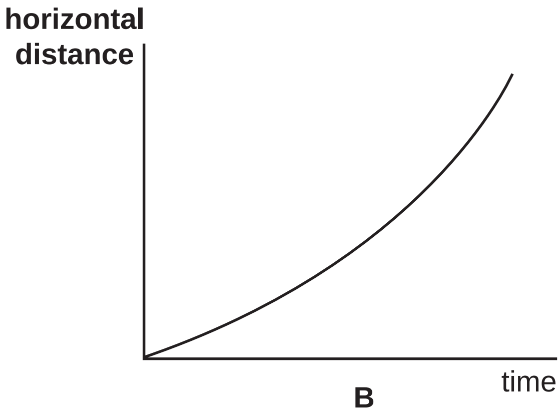
(c) The diagram shows the path followed by the ball once it has left Sally's foot.



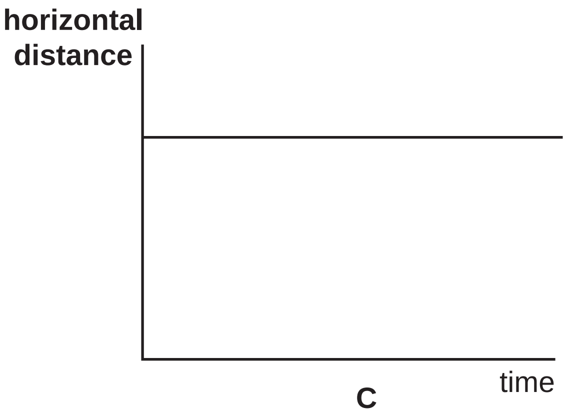
Which **one** of these graphs shows how the **horizontal distance** of the ball changes with time between leaving Sally's foot and hitting the ground?



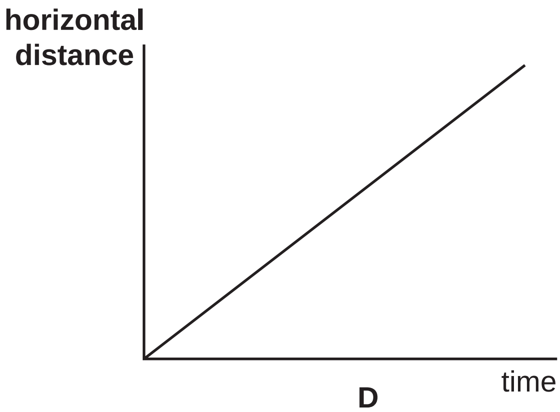
A



B



C



D

answer .... [1]

[Total: 5]

7 Byron goes for a walk in the park.

(a) (i) Which of these arrows shows the direction of the reaction force from the ground on Byron's feet when he stands still?

Put a (ring) around the correct arrow.

↑ → ↓ ←

[1]

(ii) The reaction force is part of an interaction pair.

Which of these forces is the **other** force in the interaction pair?

Put a (ring) around the correct answer.

counter force **driving force** **friction** **weight**

[1]

(b) Byron walks at a steady speed across the ground.

Draw a straight line from the **start** of each sentence to its correct **end**.

start	**end**
The friction force is …	… dissipated by heating.
The total reaction force is …	… equal to Byron's weight.
The work done by Byron is …	… enough to stop the feet slipping.

[2]

(c) Byron does 500 J of work as he walks a distance of 100 m across the park.

This takes 50 s.

Calculate the average counter force.

Put a ring around the correct answer.

1 N **5 N** **10 N** **50 000 N** **2 500 000 N**

[1]

[Total: 5]

8 Dan is carrying out vigorous exercise.

He is using equipment in a gym.

(a) Sweating is one aspect of homeostasis.

What is homeostasis?

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

the decrease in activity within the internal environment	☐
the increase in activity within the internal environment	☐
the maintenance of a constant internal environment	☐
the maintenance of a constant external environment	☐

[1]

(b) Any changes in Dan's core body temperature are detected and processed.

Different parts of the body are involved.

Complete the sentences. Choose the **best** words from this list.

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

blood **brain** **heart** **liver** **skin**

Changes in the external temperature are detected by temperature receptors

in the ……………………………… .

Changes in the temperature of the blood are detected by temperature receptors

in the ……………………………… .

Information received from the temperature receptors is processed

by the ……………………………… . [2]

(c) Dan loses water as he sweats.

How else can Dan lose water?

Put a ring around each of the **two** correct answers.

breathing **digesting** **eating** **excreting** **respiring**

[1]

[Total: 4]

9 This question is about kidneys.

(a) Which of the following is totally reabsorbed into the blood in the kidneys?

Put a ring around the correct answer.

sugar **proteins** **salt** **urea** **water**

[1]

(b) The hormone ADH is involved in regulating the balance of water and salt in the body.

Draw a straight line from the **amount of ADH** released to the correct **blood content**.

Draw a straight line from the **amount of ADH** released to the correct **concentration of urine** produced.

blood content	**amount of ADH**	**concentration of urine**
correct balance of water and salt		high
too much salt	less ADH released	medium
too much water		low

[2]

(c) The pituitary gland produces the ADH.

Drinking alcoholic drinks, like beer and wine, can cause people to become dehydrated.

What does the alcohol do to the production of ADH?

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

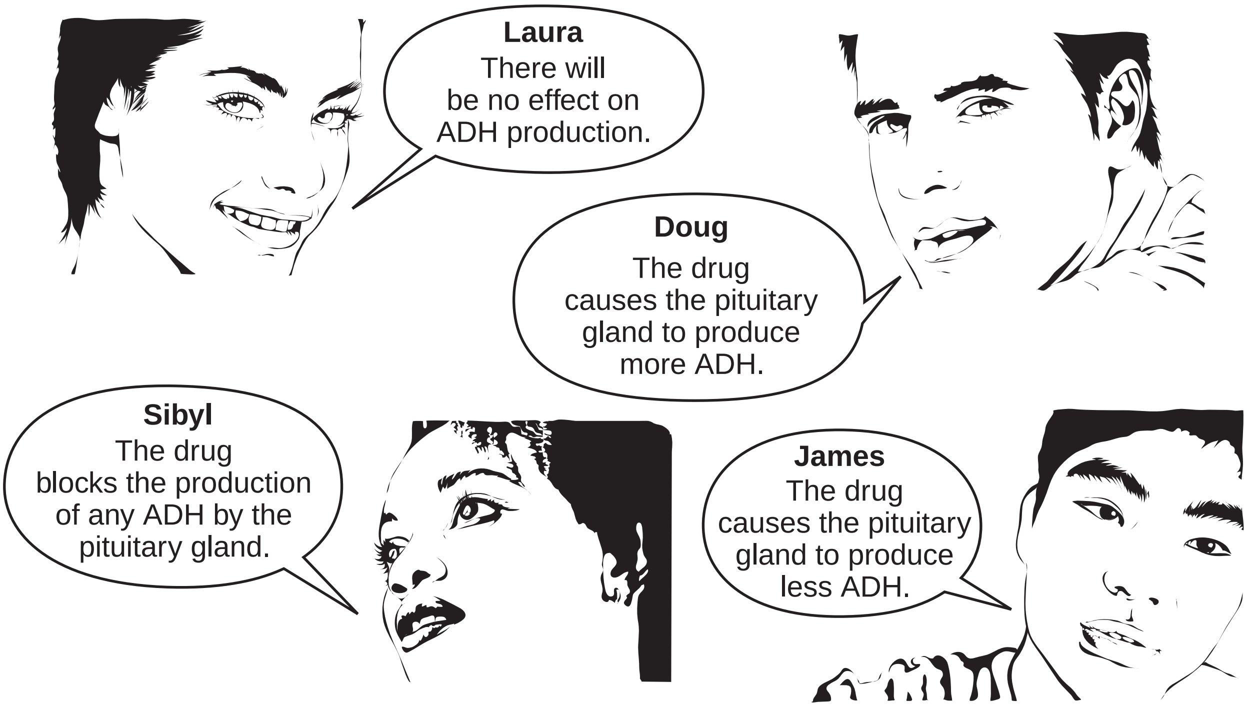
It allows the same amount of ADH to be produced by the pituitary gland. ☐

It causes the pituitary gland to produce less ADH. ☐

It causes the pituitary gland to produce more ADH. ☐

[1]

(d) Four people were asked to describe the effect of the drug Ecstasy on the activity of the pituitary gland.



Who gave the **correct** answer?

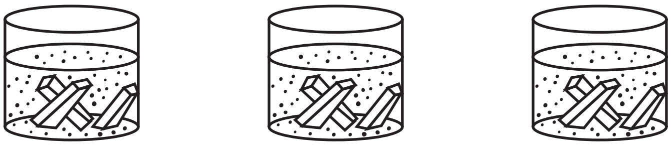
answer .... [1]

[Total: 5]

10 Liz uses an experiment to show the effect of different solutions on potato tissue.

She cuts up pieces of potato, measures their length, and puts them in different beakers.

After an hour, Liz measures the length of the potato pieces again.



A **B** **C**

(a) Complete the following table.

Put ticks (✓) in the correct boxes to show the **contents** of each beaker.

		contents of each beaker		
beaker	**length of potato pieces**	**dilute sugar solution**	**highly concentrated sugar solution**	**pure water**
A	much shorter			
B	much longer			
C	little or no change			

[2]

(b) Liz tries to return the length of the potato pieces in beaker **B** to the original size.

What should she do?

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

put the potato pieces into pure water ☐

dry the potato pieces with a paper towel ☐

put the potato pieces into a less concentrated sugar solution ☐

put the potato pieces into a more concentrated sugar solution ☐

[1]

(c) Liz knows that the process involved in her experiment is osmosis.

She asks some of her friends to say what happens in osmosis.

Which **two** of Liz's friends give the **best** answers?

Write their names below.

.... and .... [2]

[Total: 5]

END OF QUESTION PAPER

The Periodic Table of the Elements

Key

relative atomic mass **atomic symbol** name atomic (proton) number

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						

** 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.