OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A
Unit 1 Modules B4 C4 P4
HIGHER TIER
THURSDAY 14 JUNE 2007

H **A215/02**

Afternoon
Time: 40 minutes

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

CUP/T45562

Candidate Name

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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.

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

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

[Turn over

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

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

$$\frac{V_\text{p}}{V_\text{s}} = \frac{N_\text{p}}{N_\text{s}}$$

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

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

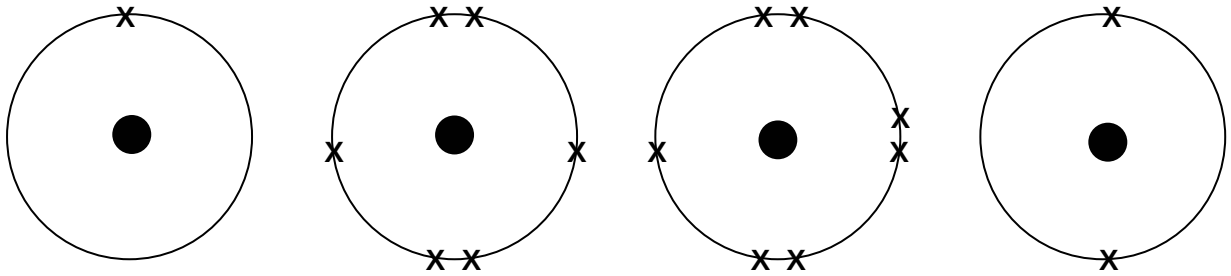
$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Motion of Radiation

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

Answer **all** the questions.

1 These diagrams show the arrangement of electrons in four atoms, **A, B, C** and **D**.
Only the electrons in the outer shell are shown.



X = an electron

A **B** **C** **D**

Use the letters **A, B, C** and **D** to answer the following questions.

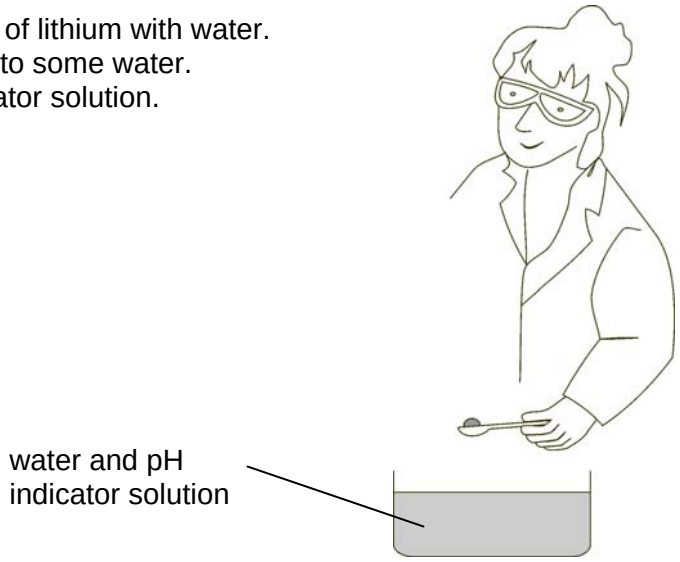
(a) Which atom is a Group 6 element? **……** [1]

(b) Which atom could be a chlorine atom? **……** [1]

(c) Which atom forms ions by losing one electron? **……** [1]

[Total: 3]

2 This question is about the reaction of lithium with water.
Eve puts a small piece of lithium into some water.
The water contains some pH indicator solution.



(a) This chart shows the colours of a pH indicator in acidic, neutral and alkaline solutions.

	acidic solution	**neutral solution**	**alkaline solution**
colour of indicator	red	green	blue

When lithium reacts with water, the colour of the pH indicator changes.

What are the colours of the pH indicator before and after the experiment?

colour **before** lithium is added **……**

colour **after** lithium reacts**……** [1]

(b) Eve sees bubbles of gas on the lithium.

(i) What is the name of the gas?

Put a (ring) around the correct answer.

carbon dioxide **chlorine** **hydrogen** **oxygen**

[1]

(ii) Give the name of the **other** product of the reaction between lithium and water.

..... [1]

(c) **(i)** The table shows some information about elements that are similar to lithium.

Complete the table.
Use the Periodic Table (on page 20) to help you.

name	symbol
potassium	
sodium	
	Rb

[1]

(ii) Use the Periodic Table to help you arrange the **three** elements in the table above, in order of reactivity.

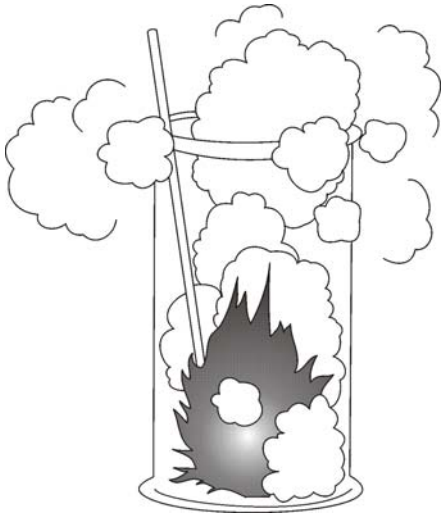
most reactive **……**

……

least reactive **……** [1]

[Total: 5]

3 Liz puts a piece of hot lithium into a gas jar of chlorine.



(a) Liz writes equations for the reaction.

Complete the word equation **and** balance the symbol equation by filling in the boxes.

lithium + chlorine → ☐

☐ Li + Cl_2 → ☐ LiCl

[2]

(b) During the reaction, chlorine atoms become chloride ions.

(i) Give the formula of a chloride ion. **……** [1]

(ii) What happens to the electron arrangement of a chlorine atom when it changes into a chloride ion?

Put ticks (✓) in the correct boxes.

it gains one electron	☐
it loses one electron	☐
it loses seven electrons	☐
it gains a full outer shell	☐
it shares an electron with lithium	☐

[2]

(c) At the end of the reaction, Liz notices that the gas jar contains a white solid.

How can Liz test the solid to show that it is a lithium compound?

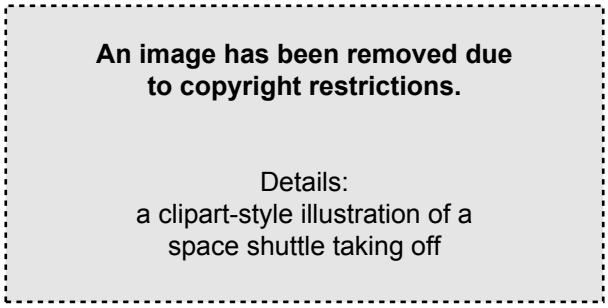
Put a tick (✓) in the box which shows the **best test** for a lithium compound.

do a flame test	☐
test solubility in water	☐
see if it tarnishes in air	☐
test electrical conductivity	☐

[1]

[Total: 6]

4 This question is about a space shuttle taking off.



(a) Complete the sentences.
Choose words from this list.

constant

downwards

energy

upwards

weight

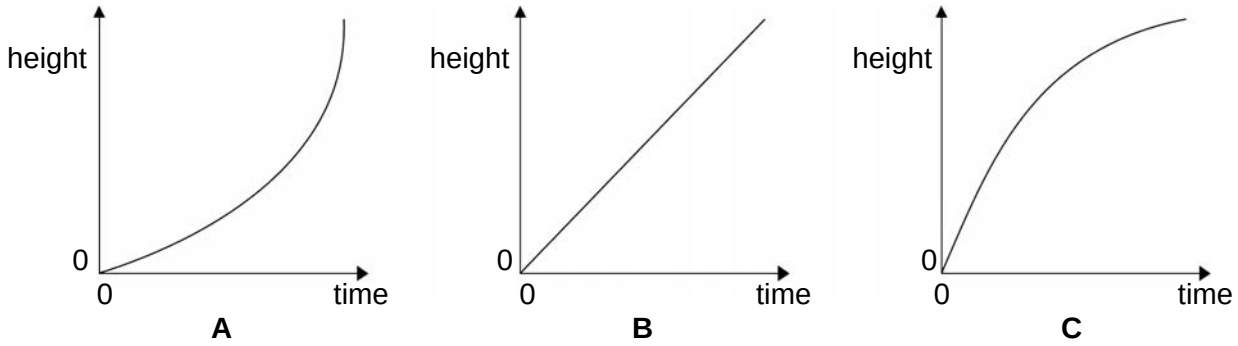
The direction of the exhaust gas momentum is ..... .

So the force it exerts on the shuttle is ..... .

The shuttle speeds up when this force is greater than its ..... .

[3]

(b) Here are three height-time graphs.



Which **one** shows the shuttle getting faster?

answer ..... [1]

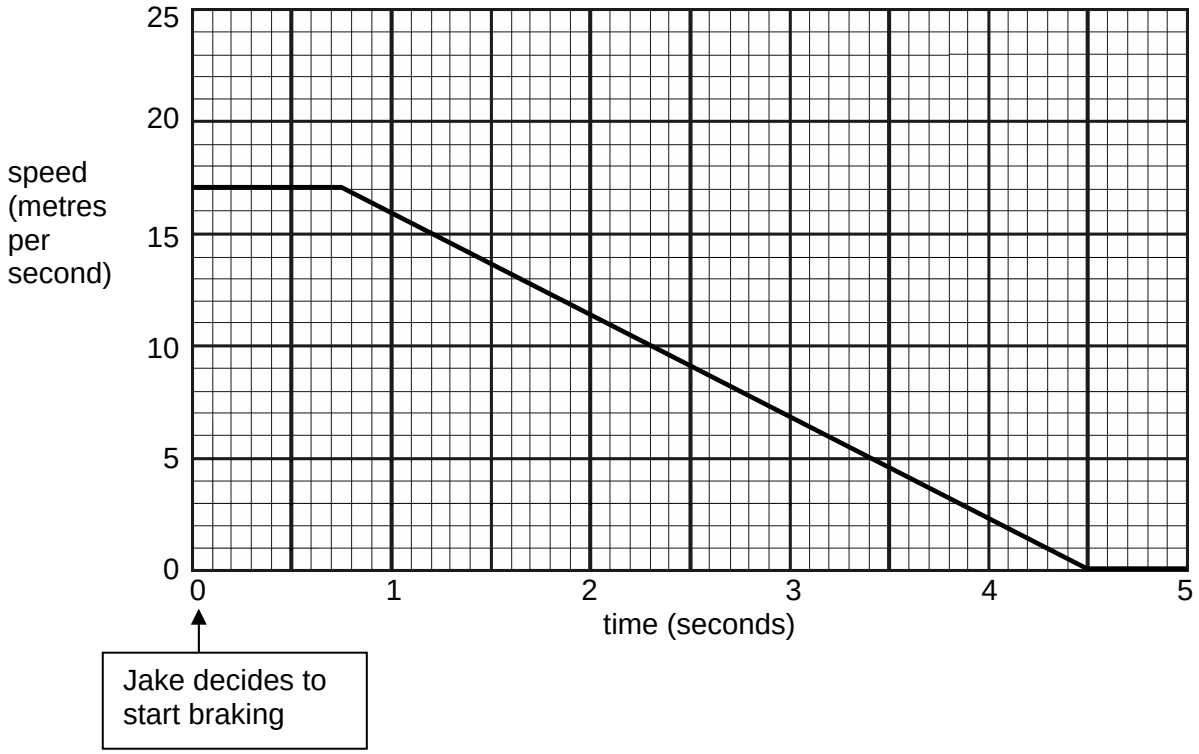
[Total: 4]

5 Jake tests the brakes of his car on a long stretch of straight, flat road.

An image has been removed due to copyright restrictions.

Details:
a clipart-style illustration of a car

The graph shows how his velocity changes with time as Jake slows down the car.



(a) The graph starts at the moment that Jake decides to stop the car.

(i) Here are some statements about the motion of the car shown in the graph.

Put a tick (✓) in the box if it is true.
Put a cross (**x**) in the box if it is false.

the brakes apply a force on the car throughout	
the kinetic energy lost by the car is transferred by heating	
work is done by the car brakes to slow the car down	
the velocity of the car decreases steadily throughout	

[2]

(ii) For how long were the brakes **applied**? Choose from the list.

0.75 s

3.75 s

4.50 s

5.00 s

answer ..... s [1]

(iii) The car has a mass of 800 kg.

How much momentum does the car lose as it stops?

momentum lost = **.....** kg m/s [1]

(b) Jake does the test again going up a hill.
He finds that, for the same initial velocity, the car stops in less time.

Which statement is the **best** explanation for this?

A Gravity pulls the car onto the road, giving the tyres a better grip.

B The kinetic energy of the car decreases as it does work against gravity.

C The car does not need to lose as much momentum when going up the hill.

answer ..... [1]

[Total: 5]

6 Sammi enjoys making parachute jumps.

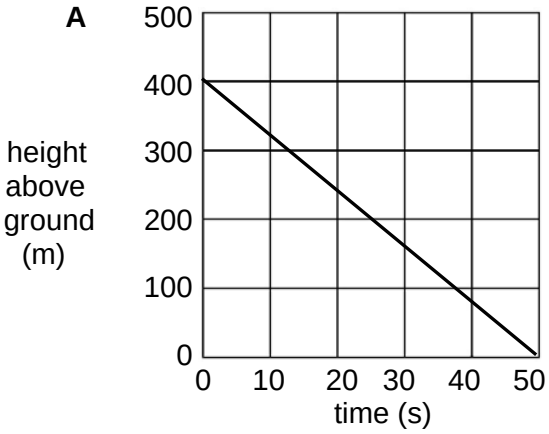
An image has been removed due to copyright restrictions.

Details:
a clipart-style illustration of a parachutist with open parachute

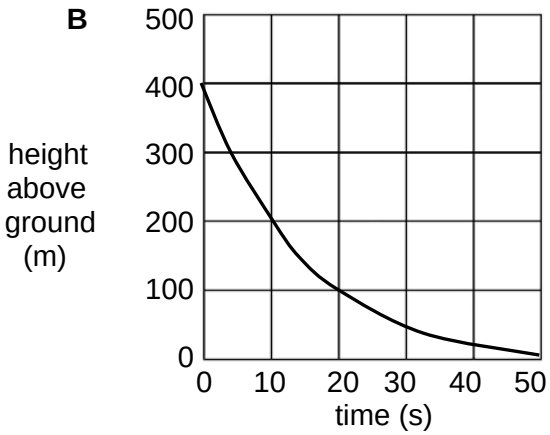
(a) When the parachute is open, Sammi has a constant velocity of 8 m/s in a downwards direction.

(i) Choose the **one** graph, **A**, **B**, **C** or **D**, which correctly shows her motion.

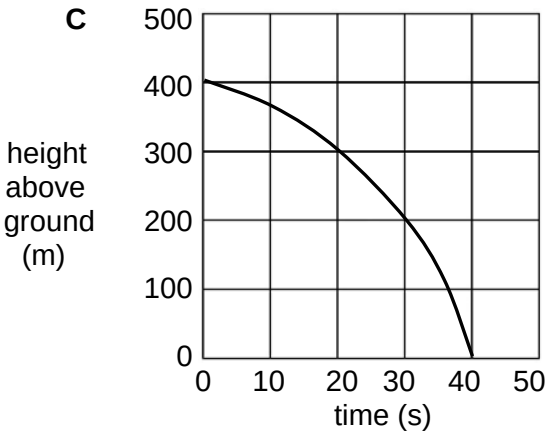
A



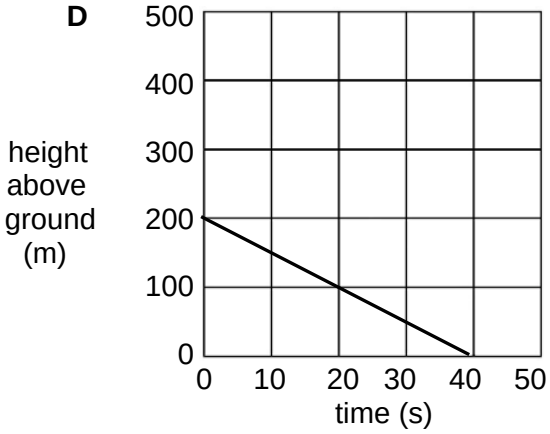
B



C



D



answer ..... [2]

(ii) Sammi has a mass of 60 kg. What is her kinetic energy as she falls at 8 m/s?

Put a (ring) around the correct answer.

240 J **480 J** **1920 J** **38 400 J**

[1]

(b) Sammi and her parachute have a total weight of 800 N.

Calculate the change of gravitational potential energy (GPE) when she drops through a height of 300 m.

change of GPE = ... J [1]

(c) A loss of gravitational potential energy usually results in a gain of kinetic energy. This does not happen when Sammi falls by parachute.

Who has the **best** explanation for this?

Bert

Energy is always conserved.

Patel

No work is done on Sammi as she falls.

Suzy

The parachute has a constant velocity.

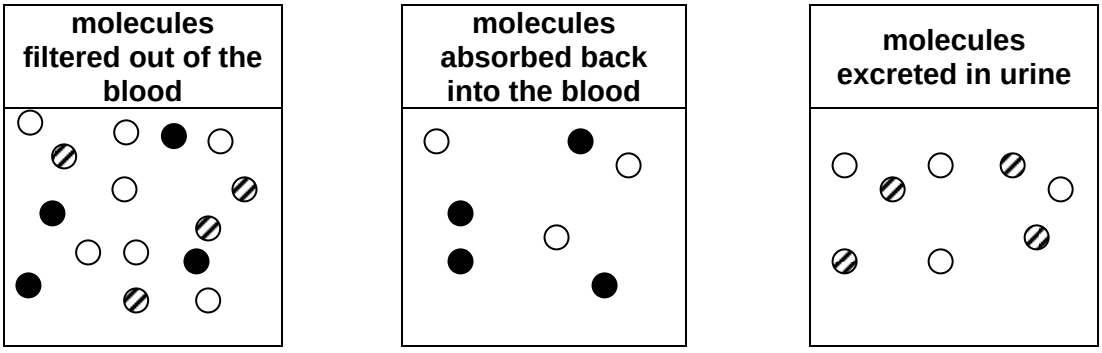
Cheryl

Energy is dissipated through heating.

answer ..... [1]

[Total: 5]

7 David draws three diagrams to show how kidneys work.



Some of the molecules are absorbed back into the blood and others are excreted in the urine.

(a) Complete the key for David's diagrams.

Choose from the list.

sugar

urea

water

key

● = ...

○ = ...

⊘ = ...

[2]

(b) Where is urine stored in the human body?

Put a ring around the correct answer.

bladder **kidney** **liver**

[1]

(c) **(i)** Drugs can have a harmful effect on kidneys.

Complete the diagram to show the link between two different types of drug, ADH production and urine production.

Draw straight lines from each **type of drug** to its effect on **ADH production** and then to the effect on **urine production**.

type of drug	**ADH production**	**urine production**
	reduced	smaller volume and less dilute
ecstasy		
	increased	greater volume and more dilute
alcohol		
	stays the same	same volume and same dilution

[2]

(ii) Which structure secretes ADH into the blood stream?

Put a (ring) around the correct structure.

hypothalamus **kidney** **liver** **pituitary gland**

[1]

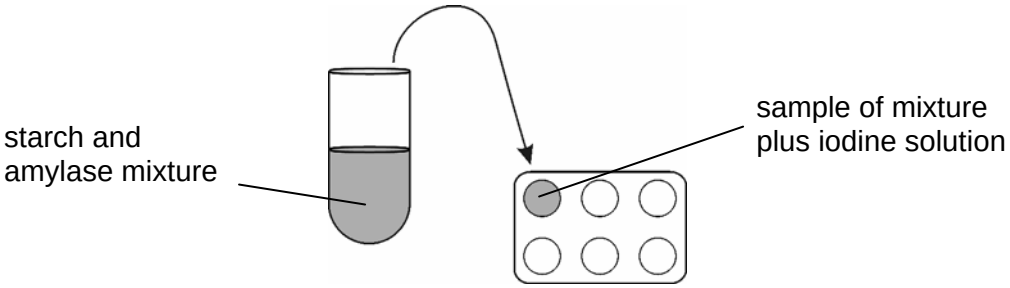
[Total: 6]

8 Jenny carries out an experiment to show the effect of temperature on the activity of the enzyme amylase.

She puts the same amounts of **starch** and **amylase** into three test tubes at three different temperatures.

The three temperatures are **20 °C**, **40 °C** and **60 °C**.

After 5 minutes, Jenny takes a small sample of each mixture and adds a drop of iodine solution to test for starch.



Result of the experiment:

temperature °C	starch present	starch absent
20		✓
40		✓
60	✓	

(a) Jenny writes four different statements about her results.

Which of her statements are **correct**?

Put tick(s) (✓) next to the correct box or boxes.

amylase works best at 60 °C ☐

amylase was denatured at 20 °C ☐

amylase was working at 20 °C and 40 °C ☐

the active site of amylase changes shape at 60 °C ☐

[2]

(b) At which temperature is the rate of collisions between amylase and starch molecules the highest?

answer ..... °C [1]

[Total: 3]

9 The automatic control of internal body temperature is important in humans.

Finish the sentences by choosing the **best** words from the list. You may use words more than once.

decreases
hypothalamus
increases
pituitary gland
skin
stay the same
move
vasodilate
vasoconstrict

Changes in the blood temperature are detected by receptors in the **……**.

If the body core temperature is too high, the amount of sweat produced by the sweat glands **……**.

Such high temperatures also cause the blood vessels in the skin to **……**.

As a result of these processes, the body temperature lowers because the rate of heat loss **……**.

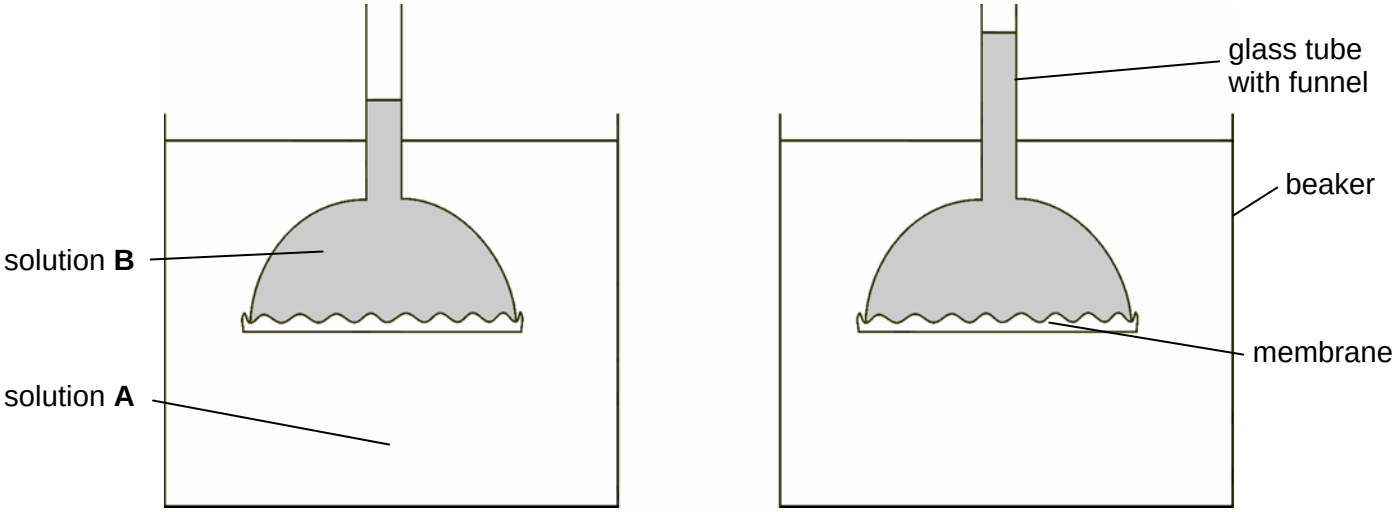
[3]

[Total: 3]

10 Joe is doing an experiment to find out about the movement of **water molecules** across a membrane. He uses two solutions, **A** and **B**.

They contain different concentrations of sugar molecules and water molecules.

Joe draws two diagrams of the apparatus.
They show the heights of the two solutions at the start of the experiment and after 1 hour.



level at the start **level after 1 hour**

(a) Here are statements about the difference in concentration of sugar in solutions **A** and **B**, at the **start** of the experiment.

Put a (ring) around the correct statement.

A greater than **B** **B** greater than **A** **A** the same as **B**

[1]

(b) Joe wanted to get the height of sugar solution **B** down to its original level.

What should he do to solution **A**?

Put a tick (✓) in the correct box.

add more sugar ☐

add more water ☐

add more solution ☐

remove some solution ☐

[1]

[Total: 2]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

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.