SEVENOAKS SCHOOL

YEAR 9 (13+) SCHOLARSHIP

May 2018
for entry September 2018

SCIENCE 1

Your Name: .....

Your School: .....

Time allowed: 1 hour

Equipment needed: Pen, pencil, and ruler. You may use an eraser and a calculator if needed.

Information for Candidates:

1. Write your name and school on this page.
2. Write all of your answers in the spaces provided. If you need additional paper then please ask the invigilator.
3. The marks for each question are indicated at the end of the question.
4. Answer **all** questions in Section A and **one** question only in Section B.
5. The total mark for this paper is 70.

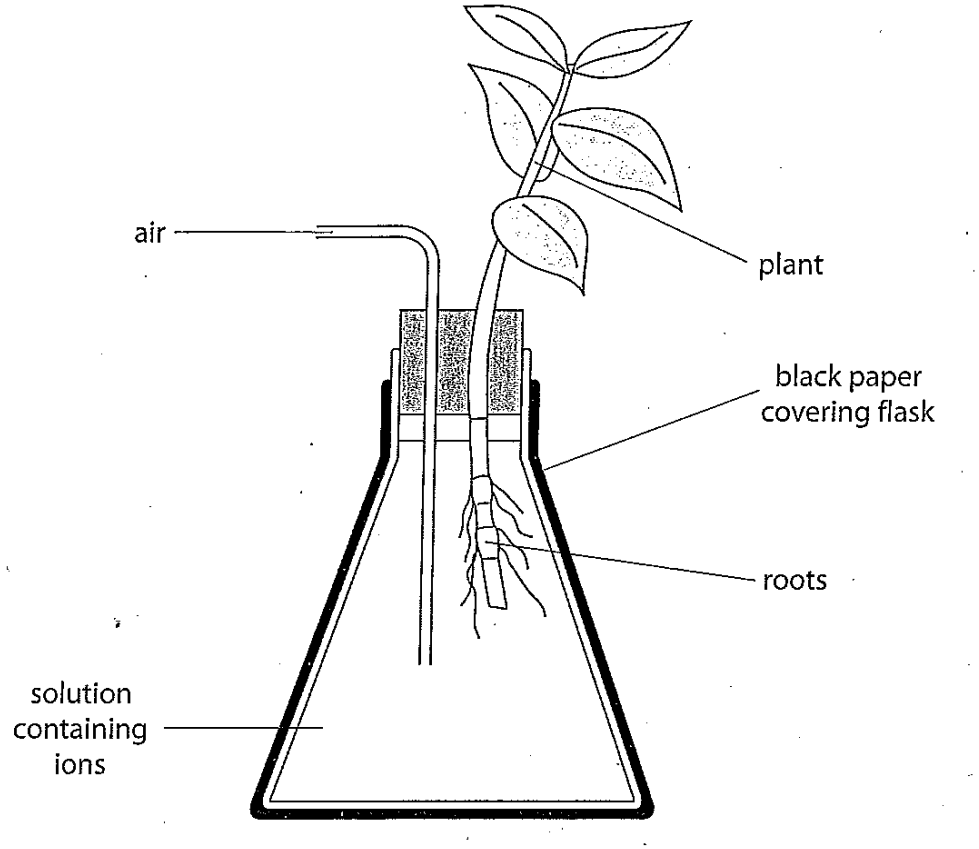
Paper 1

Section A

ANSWER ALL QUESTIONS

Biology

1 A student used this apparatus to find out if nitrate ions helped plants to grow.



A young plant was grown in a solution that contained all the mineral ions needed for growth.

A different young plant was grown in a solution that also contained all the ions needed for growth except nitrate.

(a) Can you suggest why the solutions have air bubbled through into them?

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..... **(2)**

(b) Can you suggest why the apparatus was covered in black paper?

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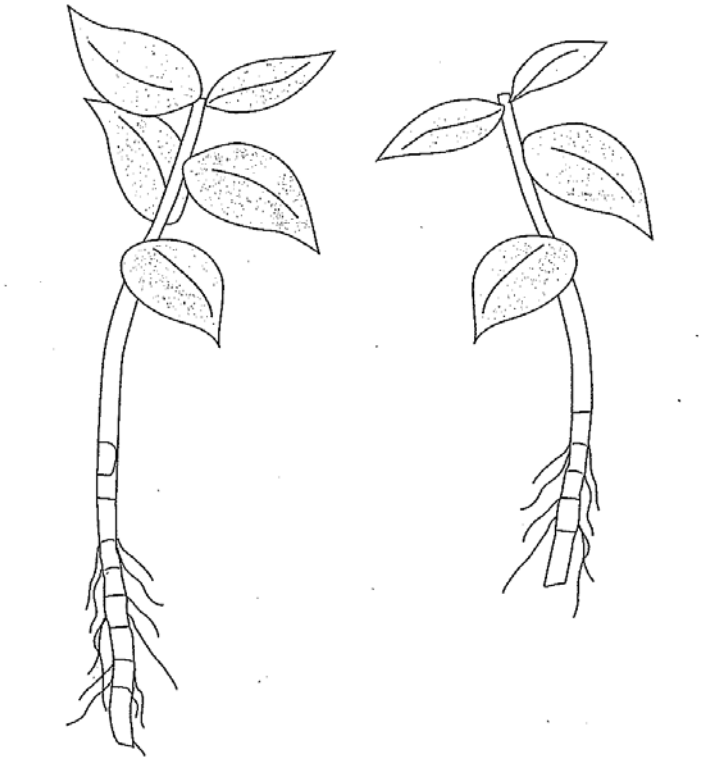
..... **(2)**

(c) The diagram shows the young plants after 55 days of growth.



(i) Measure the length of the plants in mm and write your answers below.

Plant grown in the solution containing all the ions ……. mm

Plant grown in the solution without nitrate ions ……. mm **(2)**

(ii) Suggest how the student could make the results of the investigation more reliable

.....

..... **(1)**

(iii) Suggest **two** factors not seen in the diagram that the student should keep the same for both plants while they are growing?

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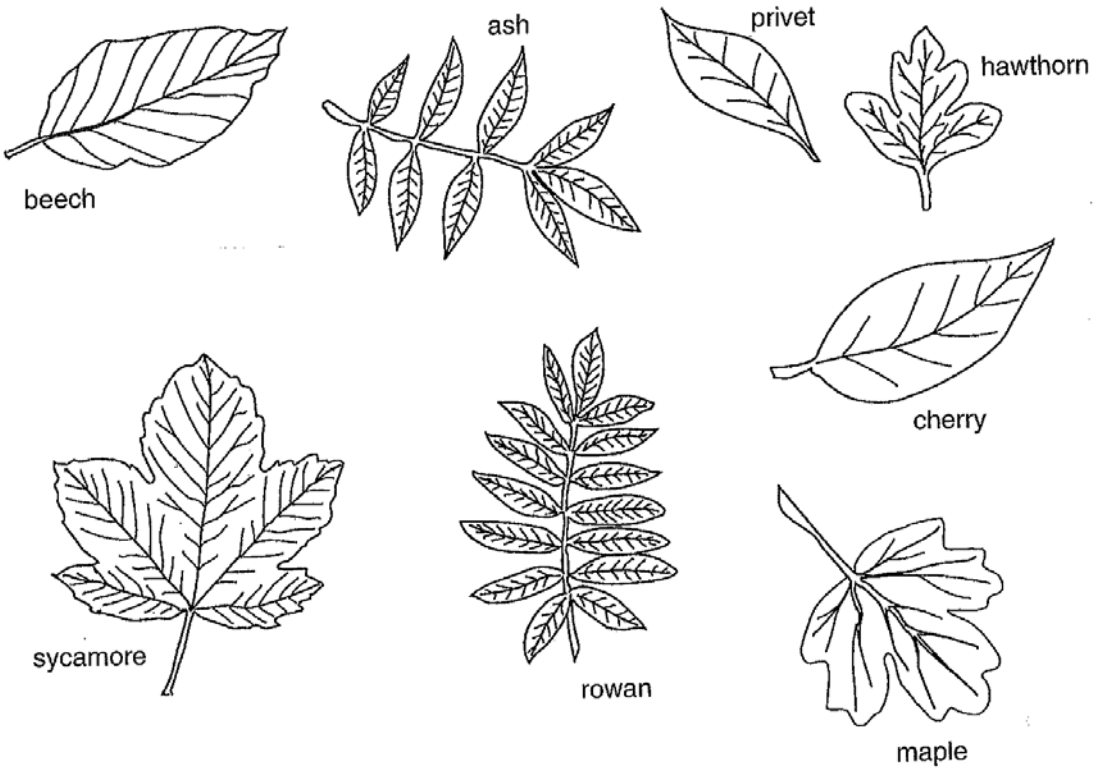
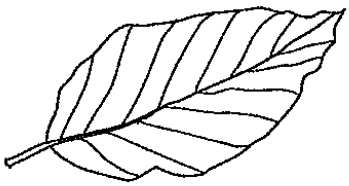
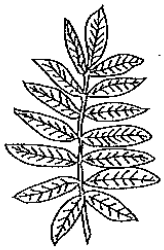
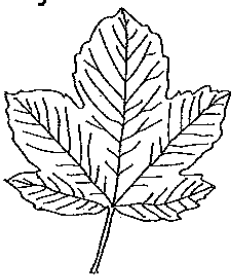
..... **(2)**

2 The diagrams below show leaves from different trees and bushes.



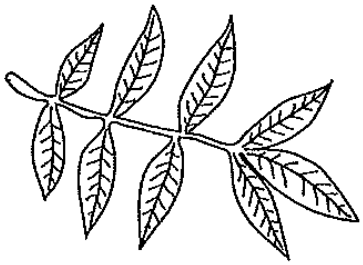
The leaves can be put into 3 groups by shape.

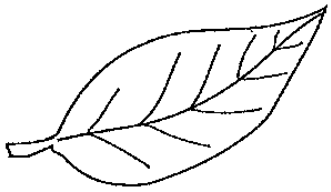
The table shows which groups beech, rowan and sycamore leaves below to.

group 1	group 2	group 3
beech 	rowan 	sycamore 

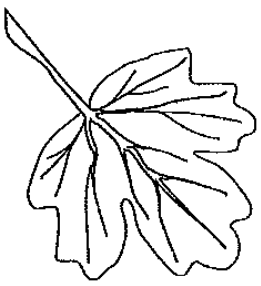
Look at the shapes of the other leaves and put each one into the correct group.

hawthorn  group _____

ash  group _____

cherry  group _____

privet  group _____

maple  group _____

(5)

3 (a) In the spaces below draw a diagram of a general animal cell and a general plant cell.

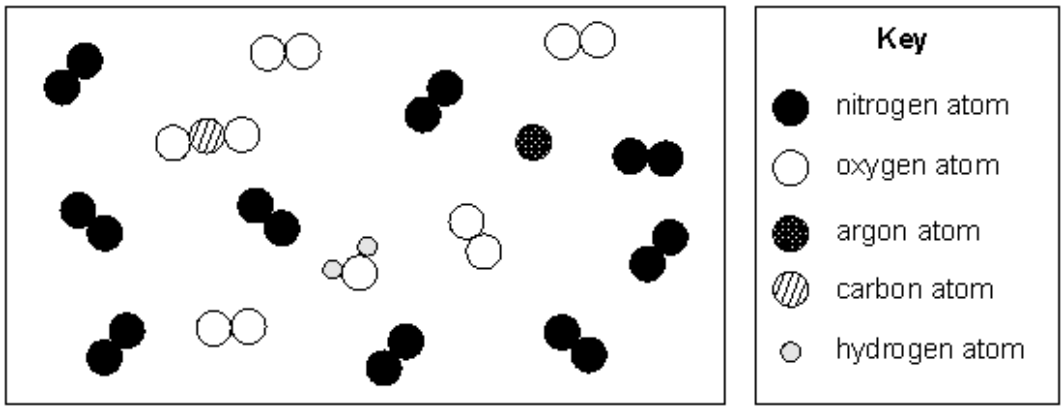
Animal Cell

Plant Cell

(3)

(b) On the plant cell label three structures found in a plant cell but **not** in an animal cell. **(3)**

4 The diagram below represents the particles found in a sample of air.



(a) Nitrogen is used in the electronics industry during the production of transistors and diodes. Give the property of nitrogen that makes it suitable to use as an atmosphere during these processes.

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..... **(1)**

(b) State the names and give the molecular formulas of two **compounds** present in the sample of air.

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..... **(2)**

(c) Write a word equation for the combustion of hydrogen in air.

..... **(2)**

(d) A sample of air in a balloon is cooled. Complete the sentences below using appropriate words or phrases.

When the air is cooled, the volume of the air ..... and the mass of the air ..... When the air is cooled, the density of the air ..... **(2)**

(e) In 1902, the scientist Carl von Linde cooled air to produce **liquid oxygen**. The table below shows the melting points and boiling points of four substances that are found in air.

substance	melting point (°C)	boiling point (°C)
argon	–189	–186
oxygen	–218	–183
nitrogen	–210	–196
water	0	100

Before Linde, scientists tried to produce **liquid air** by cooling it to –190 °C. Give a reason why liquid air was not produced.

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.....

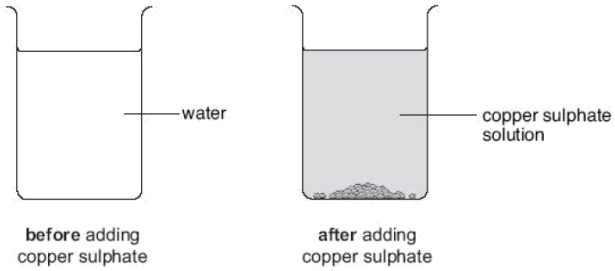
..... **(1)**

(f) Give the state of matter in which the four substances in the table exist at -190 °C.

substance	State at -190 °C
argon	
oxygen	
nitrogen	
water	

(2)

5 Owen added some blue copper sulphate crystals to a beaker of water.



(a)

(i) Describe **two** ways in which Owen could **see** that some of the copper sulphate crystals had dissolved in the water?

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..... **(2)**

(ii) Suggest **two** ways in which Owen could make the copper sulphate crystals dissolve more quickly?

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.....

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..... **(2)**

(b) Owen poured some of the copper sulphate solution into a dish. He left it in on a window sill for five days. All the water evaporated from the solution in the dish.

Owen took the remaining residue and heated it strongly in a Bunsen burner flame.

Describe and explain the appearance of the residue after it had been heated?

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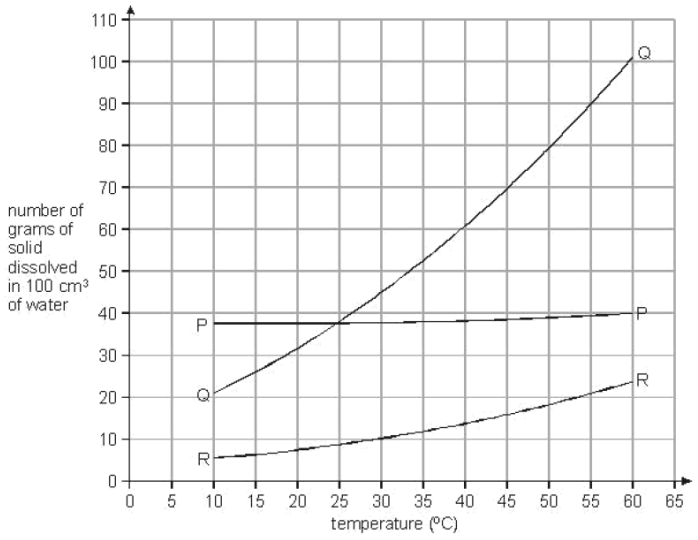
..... **(3)**

(c) Owen did an experiment to see how much of three solids, P, Q and R, will dissolve in 100 cm^3 of water at different temperatures.

He plotted his results on graph paper as shown below.



Use the graph above to answer the questions below.

(i) At 30 °C how many grams of solid R dissolved in the 100 cm^3 of water?

Answer …….. g **(1)**

(ii) At 60°C which solid dissolved the most in 100 cm^3 of water? State the letter.

Answer …… **(1)**

(iii) Which **two** solids were equally soluble at 25°C? State the two letters.

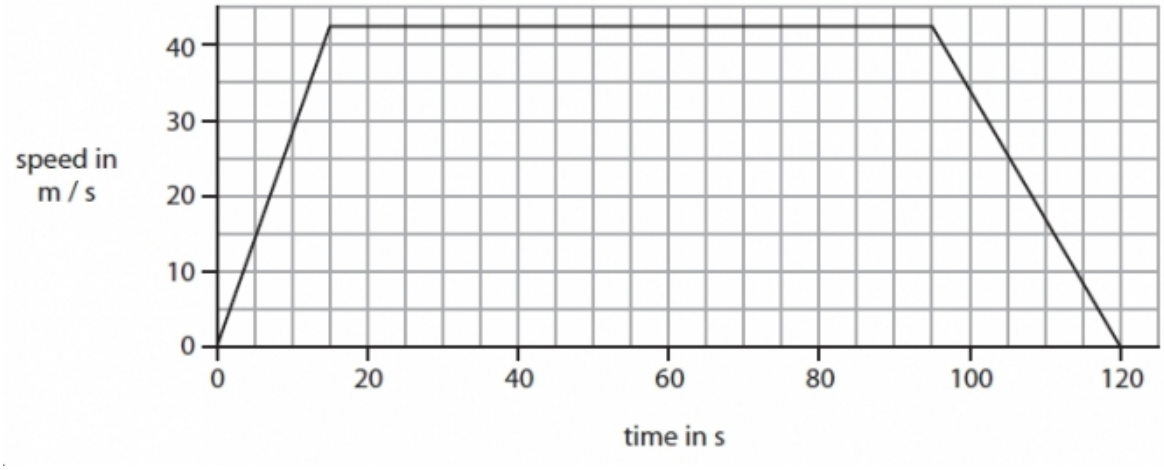
Answer …… and …… **(1)**

6 An aeroplane takes two minutes to travel the short distance between airports on two islands.

The graph shows how the speed of the aeroplane changes as it

- takes off
- flies across the sea
- lands on the other island

When it is flying across the sea, the aeroplane travels at a constant speed.



(a) Use the graph to answer the following questions.

(i) State the value of the constant speed.

Speed = …… m/s **(1)**

(ii) Calculate the acceleration of the aeroplane at the start of the journey and give the unit.

Acceleration = …… Unit …… **(3)**

(iii) Calculate the total distance that the aeroplane travels.

Distance = …… m **(3)**

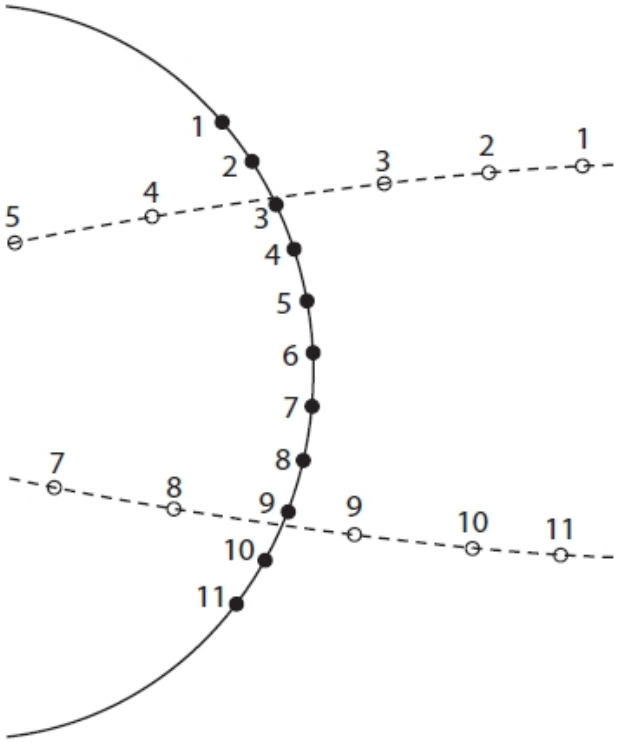
(b) Each airport has a runway that is about 500 m long. When it lands, the speed of the aeroplane is 40 m/s. Explain why the airline should not use an aeroplane that has more mass and needs a higher speed for landing.

(3)

7 A comet passes close to the Earth.

An astronomer observes the position of the comet and the Earth on the same day each week for several weeks.

(a) The diagram shows her observations for weeks 1 to 11.



Path of Earth	———
Path of comet	- - - - - - - - -
Position of Earth week 1	1●
Position of comet week 1	1○

(i) Complete the path for the comet between week 5 and week 7. **(1)**

(ii) Mark an × on the diagram to show the position of the Sun. **(1)**

(iii) Suggest why the astronomer did not observe the comet during week 6.

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(1)

(iv) The observation showing the comet nearest to the Earth was made during

- ☒ **A** week 7
- ☒ **B** week 8
- ☒ **C** week 9
- ☒ **D** week 10

(1)

(v) Explain how the diagram shows that the speed of the comet changes as it moves from position 1 to position 5.

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..... **(2)**

(vi) Suggest why the speed of the comet changes.

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..... **(1)**

(b) The Earth orbits the Sun once in 365 days.
The radius of the Earth's orbit is 150 000 000 km.

Calculate the orbital speed of the Earth in kilometres per hour.

Orbital speed = ... kilometres per hour **(3)**

SECTION B

ANSWER ONE QUESTION ONLY

Biology

8 Give the equations for aerobic and anaerobic respiration and explain the differences between them, including when they would occur in an organism.

(10)

9 Chloe is investigating the relationship between the reactivity of different metals. The metals Chloe wishes to order are zinc, iron, magnesium and copper. She places a same-sized strip of each metal in the four metal sulphate solutions, in turn, and records her observations.

(a) State **two** observations Chloe might expect to note when she reacts magnesium with copper sulphate solution.

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..... **(2)**

(b) Write a word equation for the reaction between iron(II) sulphate and magnesium.

..... **(1)**

(c) Explain why Chloe uses same-sized strips of metal for her experiments?

..... **(1)**

(d) State and explain what Chloe would expect to see when a strip of iron was added to zinc sulphate solution.

.....

.....

..... **(2)**

(e) Rank the four metals according to their reactivity series.

Most Reactive .....

.....

.....

Least Reactive ..... **(1)**

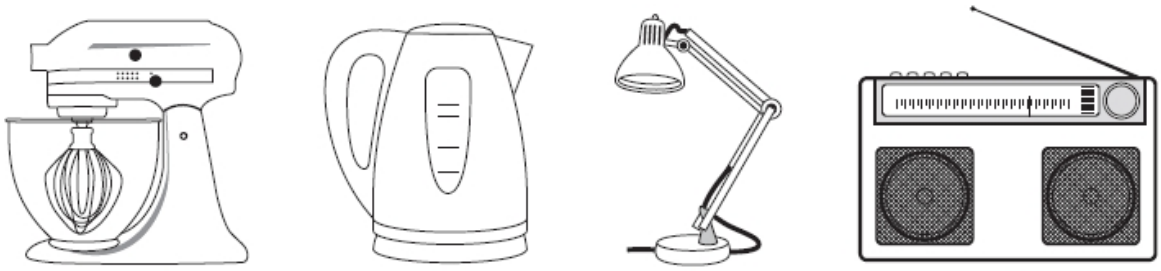
(f) An alternative method for determining the relative reactivity of the four metals is to use hydrochloric acid. Describe how Chloe could investigate the reactivities of zinc, iron, magnesium and copper using hydrochloric acid.

Your answer should include:

- Names of appropriate apparatus
- A step-by-step method
- The likely results

(3)

10 The diagram shows some electrical appliances.



A B C D

(a)

(i) Which appliance is designed to transfer electrical energy to thermal energy?

- ☒ **A** food mixer
- ☒ **B** kettle
- ☒ **C** lamp
- ☒ **D** radio

(1)

(ii) Which appliance is designed to transfer electrical energy to kinetic energy?

- ☒ **A** food mixer
- ☒ **B** kettle
- ☒ **C** lamp
- ☒ **D** radio

(1)

(b) In all the appliances, energy is conserved.

What is meant by the phrase **energy is conserved**?

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(2)

(c) The lamp has an efficiency of 20%.
Explain what this means.

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(2)

(d) The photograph shows two cups of coffee.

The cups are the same size.

One cup is full of coffee, the other cup is half full.

Compare the pressures in the coffee at the bottom of each cup.

(4)