

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Higher Tier
January 2013

Science A 1

SCA1HP

Unit 5

H

Wednesday 9 January 2013 9.00 am to 10.30 am

For this paper you must have:

- a ruler
- a calculator
- the Chemistry Data Sheet and Physics Equations Sheet Booklet (enclosed).

Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 4 should be answered in continuous prose. In this question you will be marked on your ability to:
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.

Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Question	Mark
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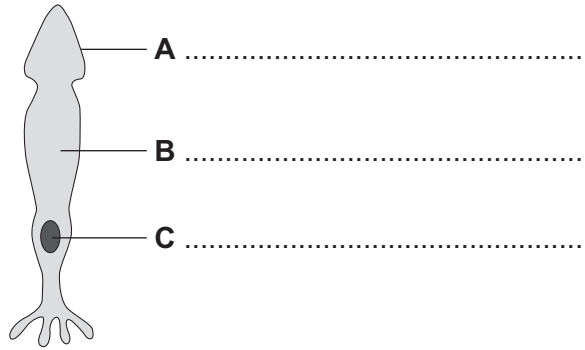


J A N 1 3 S C A 1 H P O 1

Answer **all** questions in the spaces provided.

Biology Questions

1 (a) The diagram shows a light receptor cell.



Label structures **A**, **B** and **C** on the diagram.

(3 marks)

1 (b) It is important that the nervous system can detect stimuli.

Give **two** reasons why.

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(2 marks)

5



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ANSWER IN THE SPACES PROVIDED**

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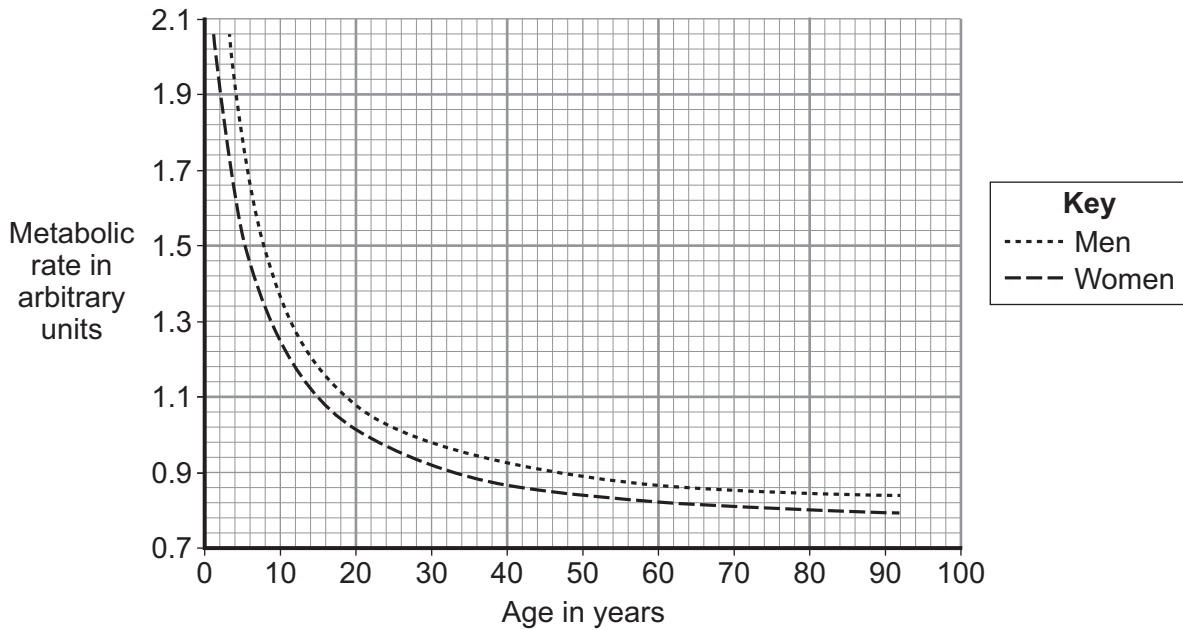
2 This question is about metabolic rate.

2 (a) Describe what *metabolic rate* is.

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(1 mark)

2 (b) The graph shows the metabolic rate in people of different ages.



2 (b) (i) Use the graph to describe how metabolic rate changes with age.

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(2 marks)

2 (b) (ii) Suggest how the change in metabolic rate might affect older people.

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(1 mark)



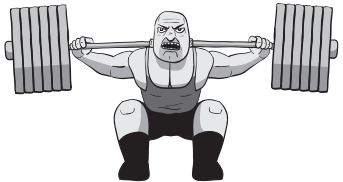


2 (b) (iii) Use the graph to give **one** conclusion about the effect of gender on metabolic rate.

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(1 mark)

2 (c) The table gives information about three different people, **A**, **B** and **C**.

	Person A	Person B	Person C
			
Age in years	30	30	30
Body mass in kg	70	70	70
Amount of physical activity	Moderate	Low	High

Person **C** has the highest metabolic rate.

Suggest **two** reasons why.

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(2 marks)

7

Turn over ►



Chemistry Questions

3 (a) Iron is produced in a blast furnace.

Explain why most of the iron produced in a blast furnace is converted into steels.

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(2 marks)

3 (b) Three types of steel are low-carbon steel, high-carbon steel and stainless steel.



Which type of steel is used to make cutlery?

Give a reason why this steel is used.

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(2 marks)

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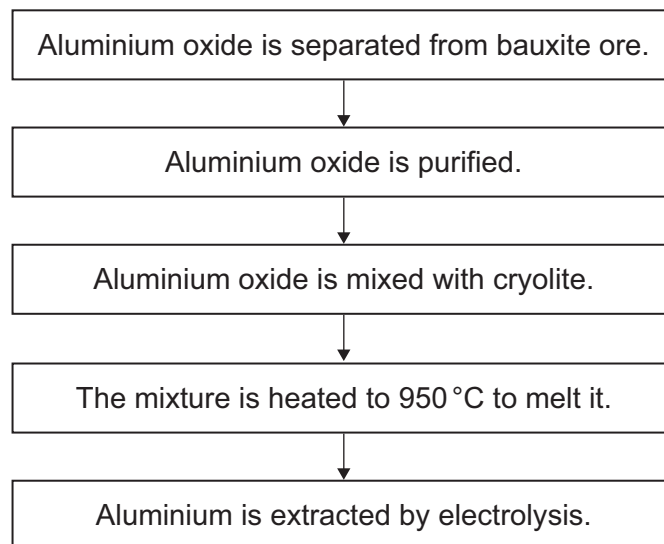
- 4 *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Aluminium is used to make many items.



Aluminium is extracted from aluminium ore. Aluminium ore is called bauxite, which is impure aluminium oxide.

The flow chart shows the main steps in the extraction of aluminium from aluminium ore.



Most aluminium is recycled.

Aluminium is recycled by melting scrap aluminium at 700 °C.



Use your own knowledge and the information given to answer the question.
Suggest why most aluminium is recycled.

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(6 marks)

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Turn over for the next question

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5 Fire dancers use firesticks to make flame patterns.



One end of the firestick is soaked in kerosene.
The kerosene is lit and burns with a yellow flame.

5 (a) Kerosene is a mixture of hydrocarbons.

Which elements are present in a hydrocarbon?

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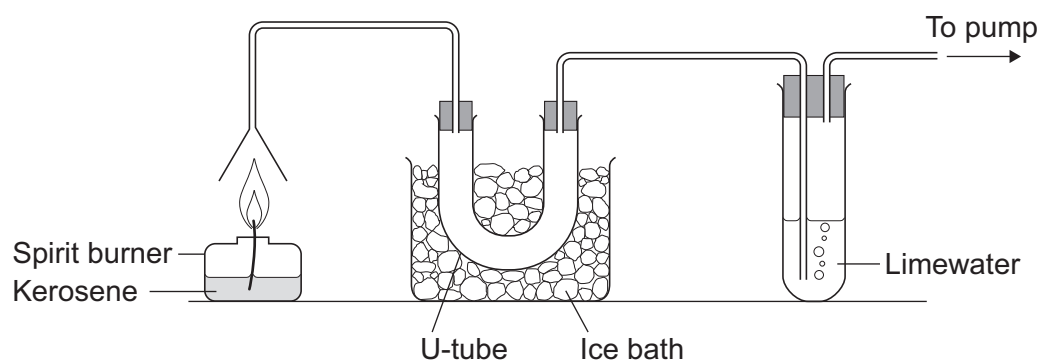
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(1 mark)



5 (b) A student investigated the products formed when kerosene burned.

The diagram shows the apparatus the student used.



Describe and explain the observations you would expect the student to make.

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(4 marks)

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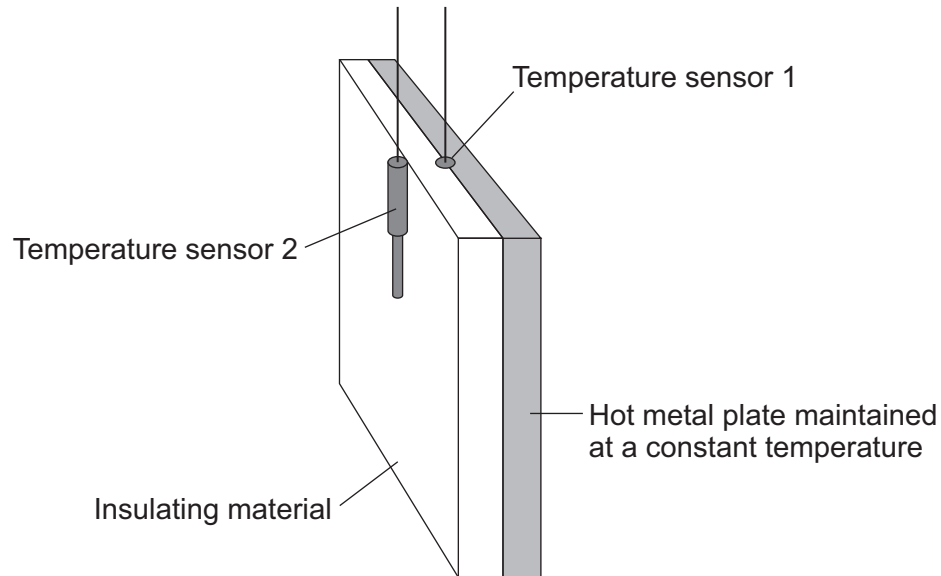
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Physics Questions

6 (a) A student investigated the insulating properties of three materials.

The diagram shows the apparatus the student used.

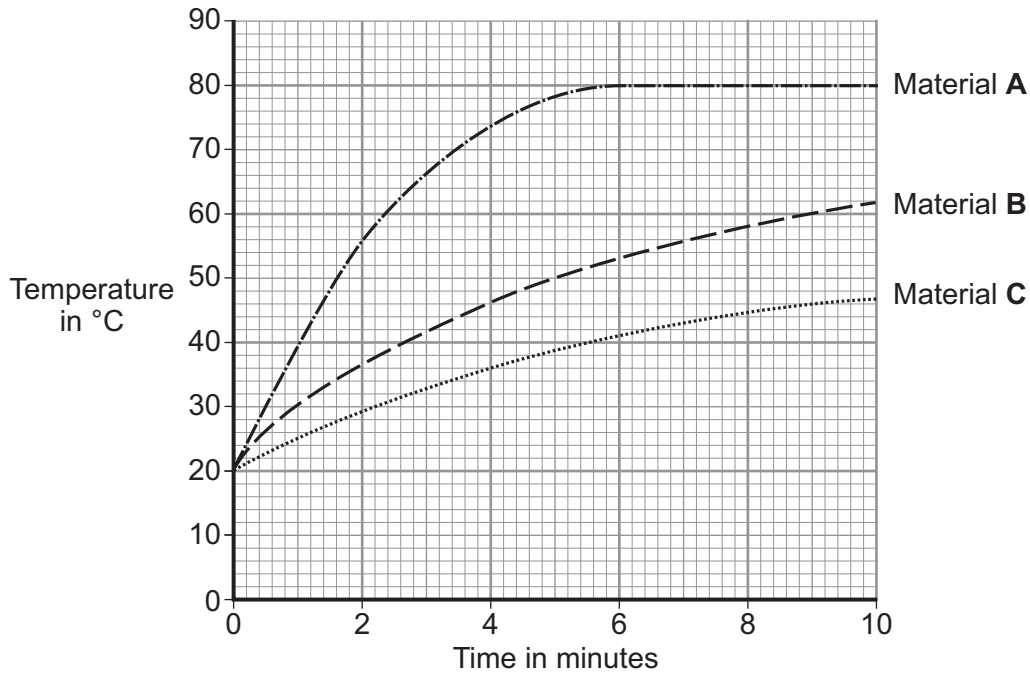


In the investigation:

- different insulating materials, **A**, **B** and **C**, were placed in contact with the hot metal plate
- temperature sensors measured the temperature on each side of the material
- the difference in temperature across the insulating material was then calculated
- the differences in temperature were compared to measure the effectiveness of each insulating material.



The graph shows how the temperature measured by temperature sensor 2 changed over 10 minutes for each of the materials.



6 (a) (i) What was the temperature of the hot metal plate?

..... °C
(1 mark)

6 (a) (ii) Which material, **A**, **B** or **C**, is the best insulator?

Material:

Give a reason for your answer.

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(2 marks)

6 (a) (iii) Which material, **A**, **B** or **C**, has the highest U-value?

Material:

Give a reason for your answer.

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(2 marks)

Question 6 continues on the next page

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6 (b) The table shows information about three home insulation methods for an average sized home.

Insulation method	Cost of insulation in £	Savings per year in £
Double glazing	5000	60
Draught excluders	90	30
Loft insulation	350	150

Which method of home insulation is the most cost-effective over 10 years?

You must include calculations in your answer.

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(4 marks)

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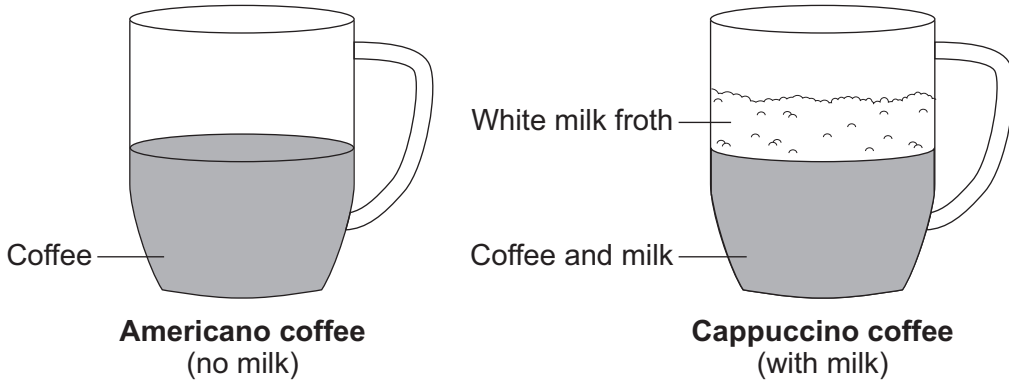


7 A student drinks two different types of coffee.

- Americano coffee is coffee and water.
- Cappuccino coffee is coffee with milk and milk froth.

The student observed that a cup of Americano coffee cools down faster than a cup of Cappuccino coffee. Both the Americano and Cappuccino coffees are served at the same temperature.

The diagrams show the differences between Americano coffee and Cappuccino coffee.



7 (a) The milk froth is white and contains lots of air bubbles.

Suggest why the Cappuccino coffee cools down more slowly than the Americano coffee.

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(2 marks)

Question 7 continues on the next page

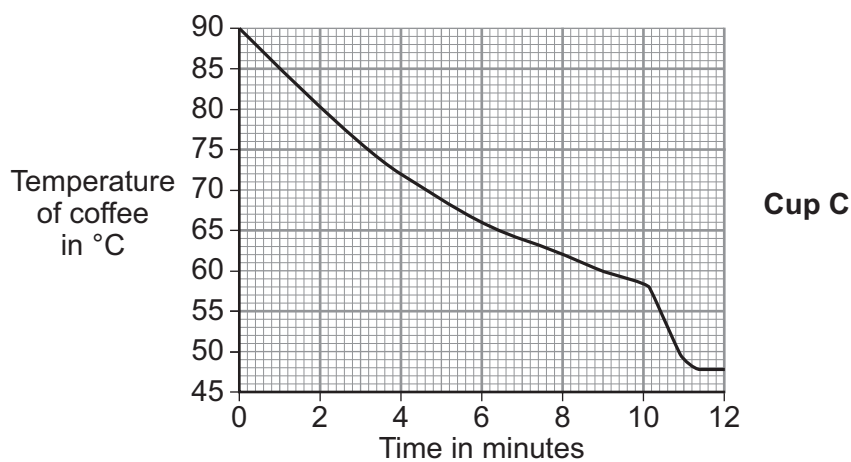
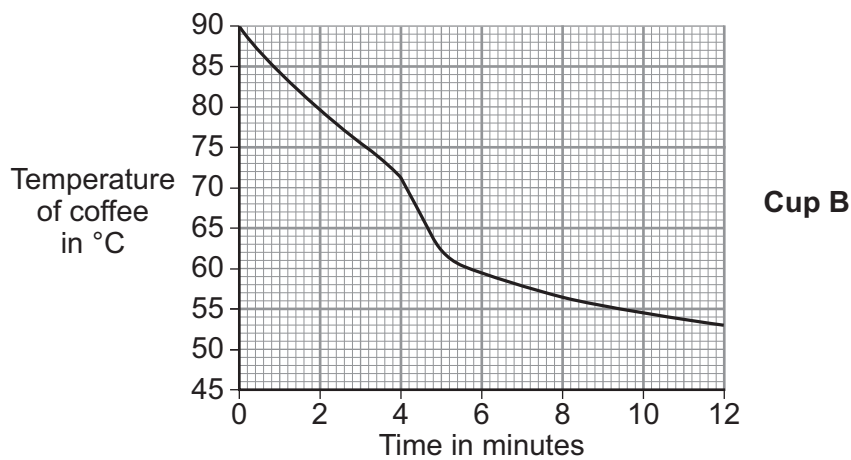
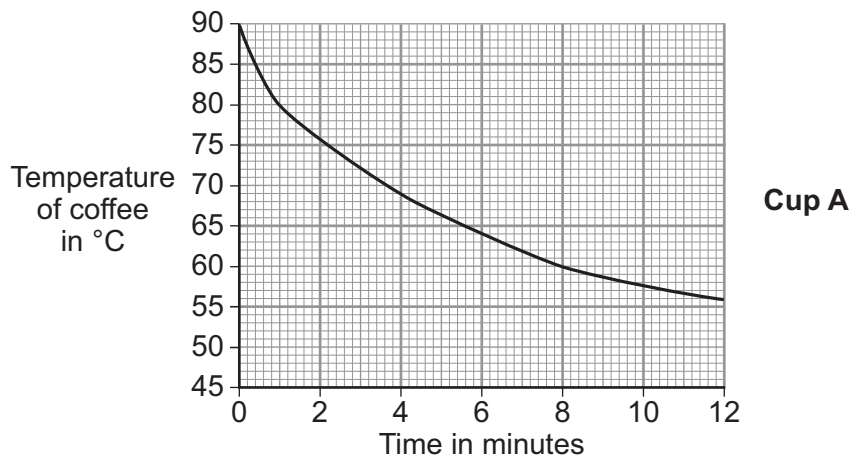
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7 (b) The student investigated how adding milk to coffee at different times affected the temperature of the coffee.

- The student poured the same volume of coffee into three identical cups, **A**, **B** and **C**.
- The coffee started at a temperature of 90°C .
- The student poured the milk into the cups.
- The milk had a temperature of 5°C .
- The milk was added to the three cups after different periods of time.

The graphs show the results.



7 (b) (i) What was the independent variable in the investigation?

.....
(1 mark)

7 (b) (ii) Use the graph to identify the time when cold milk was added to cup B.

Give a reason for your answer.

Time:

Reason:

.....
(2 marks)

7 (b) (iii) Which cup of coffee transfers energy to the surroundings at the slowest rate over 12 minutes?

Give a reason for your answer.

Cup:

Reason:

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(2 marks)

7

Turn over for the next question

Turn over ►



Biology Questions

8 It has been suggested that about 7% of the UK adult population smoke cannabis regularly.

Smoking cannabis is illegal.

Give other reasons why young people should **not** start smoking cannabis.

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(4 marks)

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9 MRSA is a strain of bacterium that developed due to a mutation.
MRSA is difficult to treat so has led to high numbers of infections in hospital patients.
Explain why.

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(4 marks)

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Turn over for the next question

Turn over ►



10

An investigation was done to compare the rate of water loss in the sweat of builders in summer and winter.

On one day in summer, 29 healthy male builders did the same amount of hard physical work for 1 hour.

The volume of sweat produced and the concentration of sodium ions in their sweat were measured.

The same men repeated the activity in winter.

The results of the investigation are shown in the table.

	Summer	Winter
Mean rate of water loss per person in litres per hour	0.47	0.42
Mean concentration of sodium ions in milligrams per litre of sweat	0.48	0.62

10 (a)

Explain these results.

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(4 marks)



10 (b) During hard physical work the body loses a lot of sodium ions in sweat.

If a builder worked for 8 hours during one day in winter he would lose 2.08 mg of sodium ions on average.

Use data from the table to calculate the mean amount of sodium ions a builder would lose if he worked for 8 hours during one day in summer.

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Mean amount of sodium ions lost during
8 hours work on one day in summer = mg
(2 marks)

10 (c) Long periods of hard physical work affect the composition of the blood and kidney function.

Describe how the composition of the builder's blood **and** how his kidney function would be affected if he did not eat and drink frequently.

Use information from the table and your own knowledge to help you to answer the question.

Blood composition:
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Kidney function:
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(4 marks)

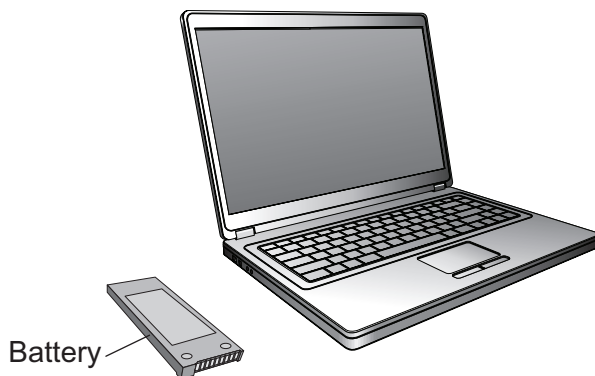
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Chemistry Questions

- 11** Lithium batteries are used in laptops.
- The batteries contain a lithium compound, LiCoO_2
- The batteries are sealed to stop water and air entering them.



- 11 (a)** Some laptops have caught fire.

Scientists concluded sparks caused the fires. The sparks caused small particles of lithium in the batteries to react with oxygen. Lithium oxide (Li_2O) was produced.

- 11 (a) (i)** Write a balanced symbol equation for the reaction between lithium and oxygen.

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(2 marks)

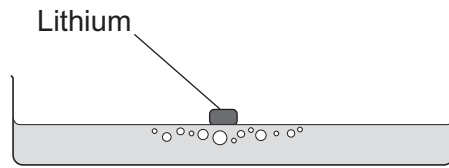
- 11 (a) (ii)** The batteries were sealed.

Suggest where the oxygen that reacted with the lithium came from.

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(1 mark)



11 (b) A teacher demonstrated how lithium reacts with water.



The students observed:

- the lithium reacting on the surface of the water
- bubbles of gas where lithium was in contact with the water.

The solution remaining in the trough was tested and found to be alkaline.

11 (b) (i) Explain the students' observations, naming the substances produced.

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(3 marks)

11 (b) (ii) The teacher then investigated the reaction of sodium with water.

Suggest how sodium would react with water.

Explain why.

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(2 marks)

8

Turn over ►



12 This article appeared in a local newspaper.

Acid Rain Attack on Greenhouse!

A gardener used polycarbonate instead of glass in his greenhouse. Polycarbonate is a polymer, which contains carbonate groups.

The gardener noticed small holes appearing in the polycarbonate. There were more holes on the side where there was most wind and rain.

The gardener thought the holes were caused by acid rain.

The gardener also said the amount of road traffic had increased, the air had become more polluted and black soot had fallen on the greenhouse.



12 (a) (i) Name the environmental effect caused by solid particulates such as soot.

.....
(1 mark)

12 (a) (ii) Why is soot produced by cars?

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(1 mark)

12 (b) (i) Acid rain damages limestone buildings.

Describe the chemical reaction causing this damage.

State what happens to the products of the reaction.

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(3 marks)



12 (b) (ii) Suggest why the gardener thought acid rain was causing the damage to his greenhouse.

Use your answer to part **(b)(i)** and information from the article to help you to answer this question.

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(2 marks)

7

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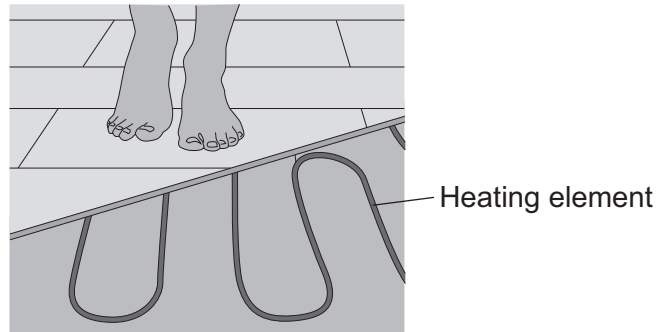
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Physics Questions

13 Rooms can be heated using under-floor heating.

The under-floor heating system has wires that use an electric current to heat elements under the floor which then heat the floor and the room.



13 (a) Energy is transferred to the air particles in contact with the floor.

Explain how the air particles transfer energy throughout the room by convection.

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(4 marks)

13 (b) Why are heaters the **only** appliances that can be 100 % efficient?

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(2 marks)

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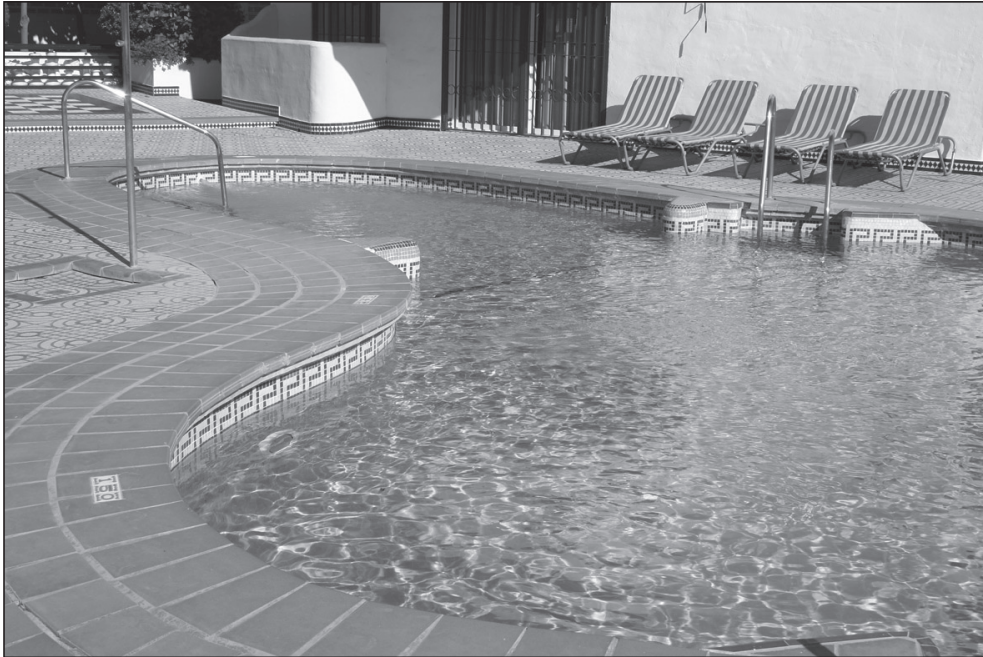
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- 14** During the day, the Sun transfers energy to an outdoor swimming pool.



- 14 (a)** By which method of energy transfer does the pool receive energy from the Sun?

.....
(1 mark)

- 14 (b) (i)** The mass of water in the pool is 5000 kg. The specific heat capacity of water is 4200 J/kg °C.

Calculate how much energy needs to be supplied to increase the water temperature by 5 °C and state the correct unit.

Use the correct equation from the Physics Equations Sheet.

Give the unit.

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Energy =
(3 marks)



14 (b) (ii) The Sun supplies energy to the water in the pool at a rate of 16 kJ every second.

Calculate how much time it would take for energy from the Sun to raise the water temperature by 5 °C.

You will need to use your answer to **(b)(i)** and the correct equation from the Physics Equations Sheet.

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Time = seconds
(3 marks)

14 (b) (iii) On one day, the temperature of the pool is 7 °C lower than the air temperature.

The time it takes for the pool temperature to rise by 5 °C is less than the answer to part **(b)(ii)**.

Suggest a reason why.

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(1 mark)

8

END OF QUESTIONS



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