Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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16	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2012

Science A 1

SCA1HP

Unit 5

H

Tuesday 12 June 2012 9.00 am to 10.30 am

For this paper you must have:
- a ruler
- the Chemistry Data Sheet and Physics Equations Sheet Booklet (enclosed).

You may use a calculator.

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 8 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.

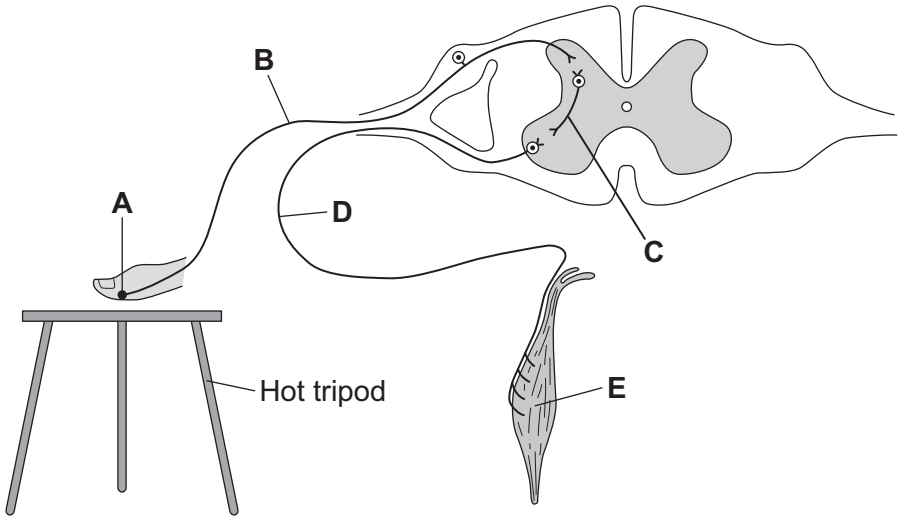
Advice
- In all calculations, show clearly how you work out your answer.

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

Biology Questions

1 If you touch a hot object you automatically pull your hand away.
This is called a reflex action.
The reflex action happens quickly and protects the body from harm.

The diagram shows the structures involved in this reflex action.



The flow diagram shows the pathway of a nerve impulse in a reflex action.

Use information from the diagram to complete the flow diagram.

Stimulus is the hot tripod.

↓

A Stimulus is detected by a ..... in the skin.

↓

B An impulse passes along a ..... neurone.

↓

C The impulse passes to a relay neurone in the ..... .

↓

D The impulse passes to a ..... neurone.

↓

E The impulse reaches the muscle. The muscle is the ..... .

↓

Response – hand pulled away from hot object.

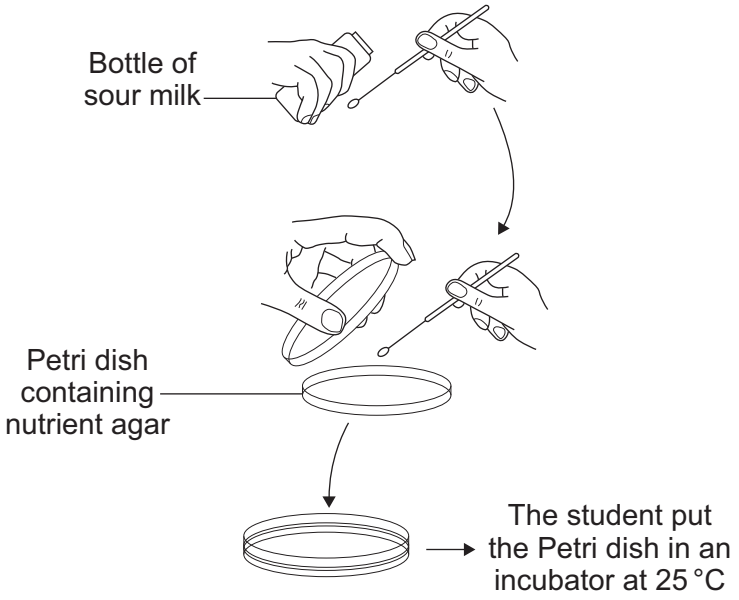
(5 marks)

5

Turn over for the next question

2 A student transferred some sour milk from a bottle to a Petri dish containing nutrient agar.

The student then incubated the Petri dish.



Describe and explain **two** precautions the student should take so that only bacteria from the milk grow on the nutrient agar.

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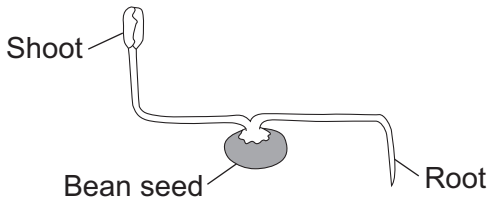
(4 marks)

4

3 A bean seedling is grown in the dark.

The shoot grows upwards and the root grows downwards.

Bean seedling growing in the dark



Explain in detail why the **root** grows downwards.

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(4 marks)

4

Turn over for the next question

Chemistry Questions

4 A burning torch is carried by a runner.

The fuel in the torch is a mixture of propane and butane.

Propane and butane are alkanes.

Alkanes have the general formula C_nH_{2n+2}

4 (a) Propane has 3 carbon atoms.

What is the formula of propane?

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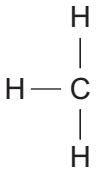
(1 mark)

4 (b) Butane has the formula C_4H_{10}

Complete the displayed (structural) formula for one molecule of butane.



(1 mark)

4 (c) Complete the word equation for the complete combustion of butane.

butane + oxygen → ..... + ...

(1 mark)

4 (d) In earlier designs of the torch, propene (C_3H_6) was used as the fuel.

Smoke is produced when propene is burned.

Explain why smoke is produced.

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(2 marks)

5

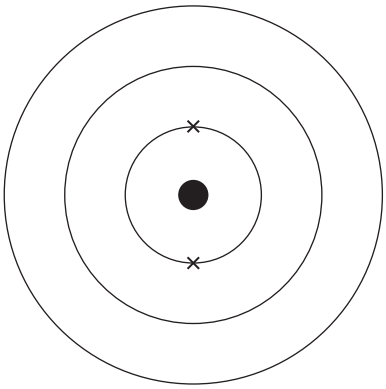
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

5 Lithium chloride can be used to colour flames dark red.

5 (a) A chlorine atom has 17 electrons.

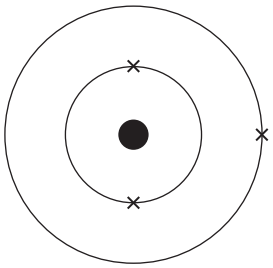
Complete the diagram to show the electronic structure of a chlorine atom.



(1 mark)

5 (b) Lithium chloride (LiCl) can be made by reacting lithium with chlorine.

The electronic structure of a lithium atom is shown below.



Describe what happens to a lithium atom when the atom reacts with chlorine.

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(3 marks)

4

Turn over for the next question

6 The picture shows a limestone quarry.

6 (a) Local residents were against the opening of a new limestone quarry. The quarry was estimated to have a 10-year operating period.

The quarry company gave reasons to show how the quarry could benefit local residents over the next 10 to 15 years.

Suggest **one** economic and **one** environmental reason the quarry company could give.

Economic reason .....

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Environmental reason .....

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(2 marks)

6 (b) What happens when limestone (calcium carbonate) is heated?

Include in your answer:

- the chemical names of the substances produced
- the name of the process.

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(2 marks)

6 (c) (i) Lime is calcium oxide. Calcium oxide reacts with water to form calcium hydroxide, $Ca(OH)_2$

Write the symbol equation for this reaction.

..... + ... → .....

(2 marks)

6 (c) (ii) Name the gas that a solution of calcium hydroxide in water is used to test for.

Give the result that you would see if the gas was present.

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(2 marks)

8

Turn over for the next question

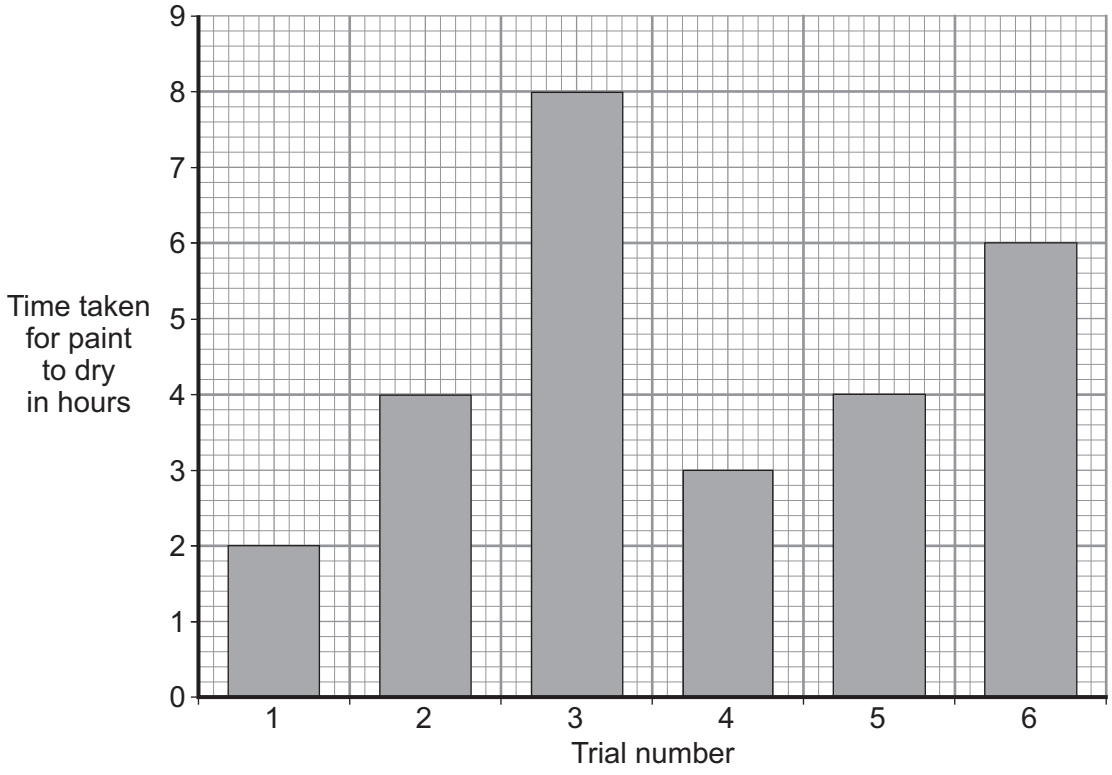
Physics Questions

7 A student investigated the factors that affect the time taken for paint on a wall to dry.

The table shows the drying conditions for each trial.

Trial number	Drying conditions	
	Temperature in °C	Humidity in %
1	25	30
2	15	30
3	5	30
4	15	10
5	15	30
6	15	60

The student's results are shown in the bar chart.



7 (a) Write **two** conclusions that can be made from this data.

Conclusion 1 .....

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Conclusion 2 .....

.....

(2 marks)

7 (b) Suggest **one** other factor that will affect the time it takes for the paint to dry.

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(1 mark)

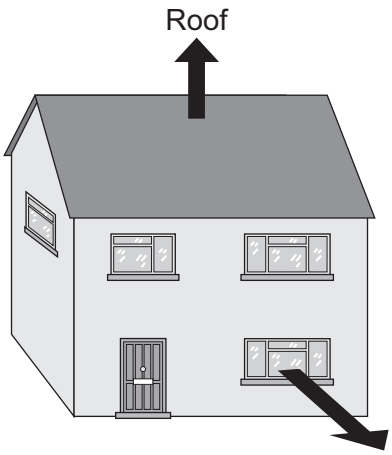
3

Turn over for the next question

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

All the energy we use to heat our houses is eventually transferred to the surroundings.

The diagram shows two places where energy is transferred from a house to the surroundings.



Describe how energy is transferred to the surroundings through the roof **and** windows.

For each place:

- name the processes involved in the energy transfer
- suggest a method of reducing the rate of energy transfer
- explain how your chosen methods reduce the rate of energy transfer.

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(6 marks)

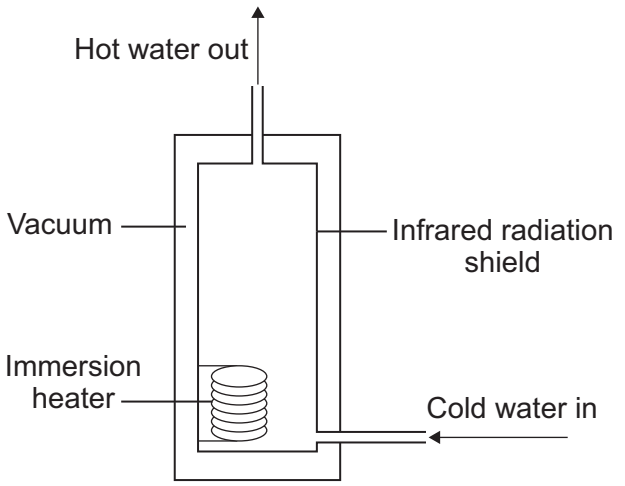
6

Turn over for the next question

9 Modern kitchens can be fitted with a device that immediately supplies water at a temperature of 93 °C.

A tank that stores very hot water is fitted under the sink so that hot water is always available.

The infrared radiation shield and the vacuum reduce the energy transfer to the surroundings.



9 (a) Which **two** methods of energy transfer does the vacuum prevent?

Method 1 .....

Method 2 .....

(2 marks)

9 (b) The infrared radiation shield is made of shiny metal.

Why does the shiny metal reduce energy transfer?

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(1 mark)

9 (c) When the hot water tank is filled with water, the immersion heater can heat the water from a temperature of 15 °C to 93 °C in 10 minutes.
The energy transferred to the water is 982 800 joules.
The specific heat capacity of water is 4200 J/kg°C.

Calculate the mass of water needed to fill the hot water tank.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Mass = ... kg

(3 marks)

9 (d) When hot water is **not** needed the immersion heater has a power input of 10 W. The energy is used to maintain the 93 °C temperature in the hot water tank.

How much energy, in joules, does the immersion heater transfer in 30 minutes when the power input is 10 W?

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Energy = ... J

(2 marks)

9 (e) The manufacturer of the device made the following claim:
'When people use conventional electric kettles, they always boil more water than they actually need. This system makes sure you only heat the water you need.'

Suggest **one** other advantage of using the device compared to using a conventional electric kettle.

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(1 mark)

9

Turn over for the next question

Biology Questions

10 Many drugs are addictive.

10 (a) People find it difficult to stop using an addictive drug.

Explain why.

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(2 marks)

10 (b) Many people claim that drinking alcohol can lead to the use of hard drugs.

Scientists investigated the use of alcohol and hard drugs by 18–24 year olds.

The table shows the results of the investigation.

	Percentage of alcohol drinkers and non-drinkers who also use the hard drug			
Hard drugs	**Binge drinkers**	**Regular drinkers**	**Occasional drinkers**	**Non-drinkers**
Cocaine	8	6	1	0
LSD	4	3	2	0
Crack	1	1	0	0
Heroin	1	1	0	0

Does the data support the claim that drinking alcohol can lead to the use of hard drugs?

Explain your answer using data from the table.

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(3 marks)

5

Turn over for the next question

11 Body mass index (BMI) helps to show if a person has a healthy mass for their height.

BMI is calculated using the following equation:

$$\text{BMI} = \frac{\text{body mass in kg}}{(\text{height in m})^2}$$

11 (a) A man is 1.8 metres tall and has a BMI of 32.

Calculate the man's mass.

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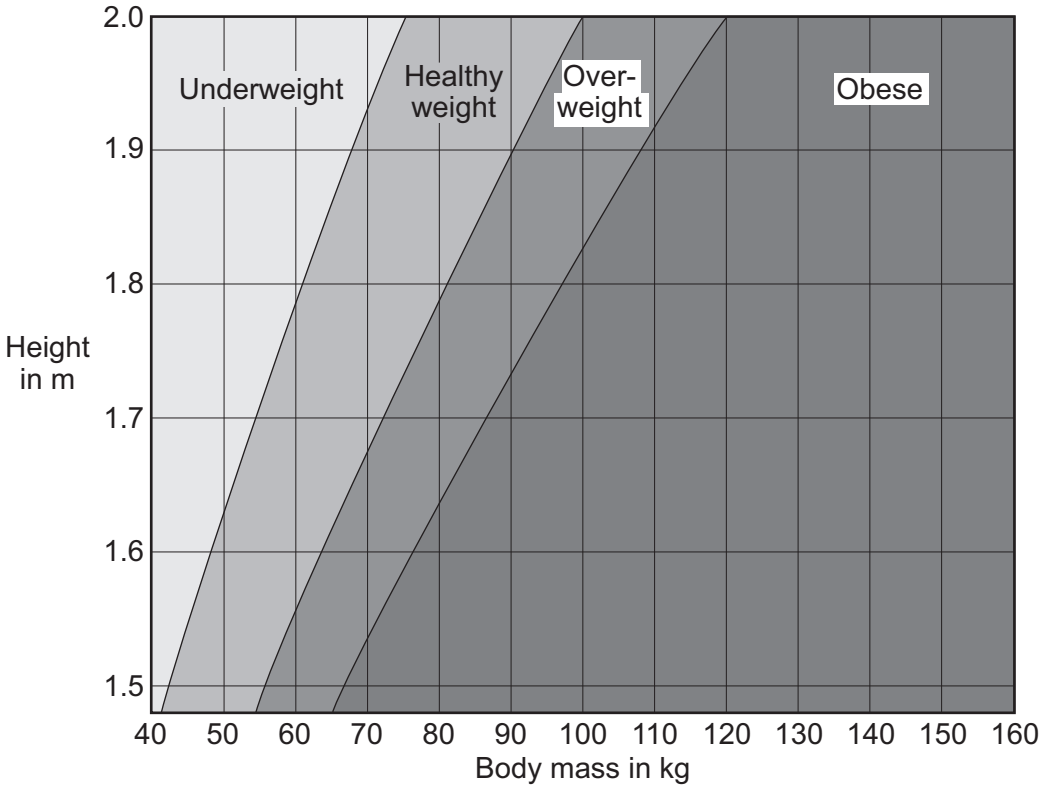
Mass = ... kg

(2 marks)

11 (b) An obesity chart is used to find if a person has a healthy weight.

Obese people are very overweight.



Use the obesity chart to suggest changes that the man in part **(a)** should make to his lifestyle.

Give reasons for your suggestions.

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(4 marks)

6

Turn over for the next question

12 Hormones can be used to control a woman's fertility.

12 (a) The first birth control pills contained only oestrogen.

Name another hormone now used in modern birth control pills.

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Give an advantage of using this hormone.

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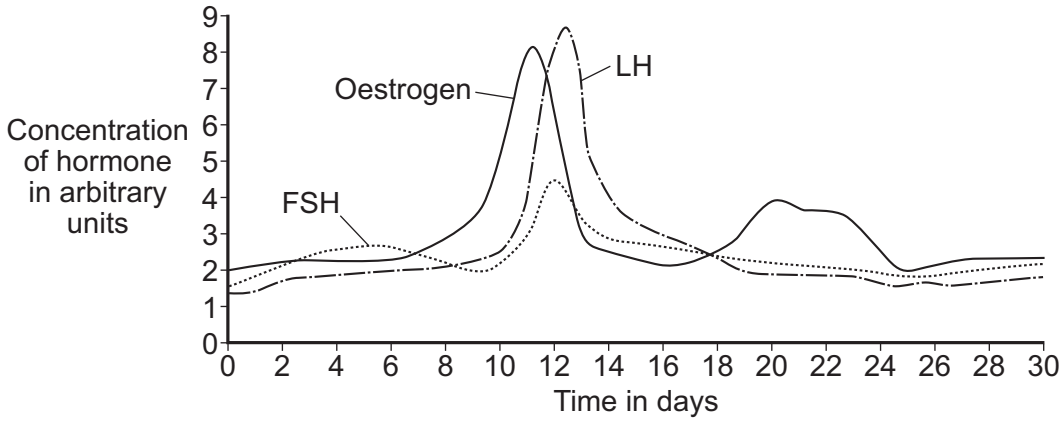
(2 marks)

12 (b) Hormones control a woman's menstrual cycle.

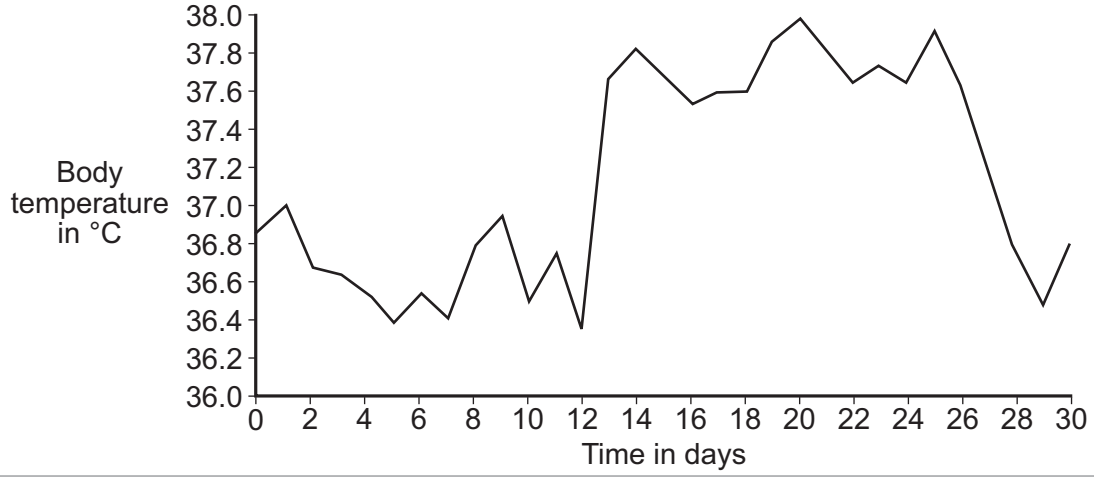
Graph 1 shows how the concentrations of hormones change during one menstrual cycle.

Graph 1



Graph 2 shows how a woman's body temperature changes during one menstrual cycle.

Graph 2



How could a woman use body temperature measurements to find the best time of the month to have sexual intercourse to get pregnant?

Use information from **Graph 1 and Graph 2** to explain your answer.

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(4 marks)

6

Turn over for the next question

Chemistry Questions

13 A gold medal was made for a competition.

13 (a) The mass number of gold is 197.

Describe the structure of a gold atom.

Use the Chemistry Data Sheet to help you answer this question.

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(4 marks)

13 (b) Bronze medals are made from an alloy of copper.

Copper can be extracted by phytomining.

13 (b) (i) Why is phytomining being used to extract copper?

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(1 mark)

13 (b) (ii) Give the main steps involved in the phytomining process.

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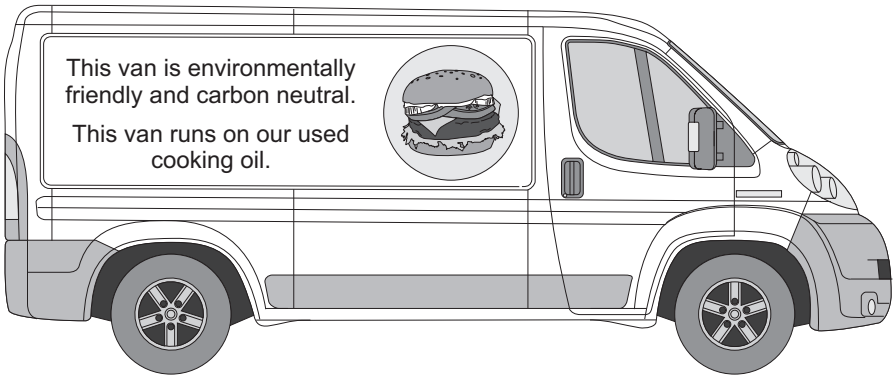
(3 marks)

8

Turn over for the next question

14 A burger van has a sign on the side.



The company that owns the van makes biodiesel from cooking oil.

A scientist investigated the emissions from biodiesel and petroleum diesel.

The scientist burned the same mass of each fuel in a diesel engine.

The scientist compared the emissions produced.

The results are shown in the table.

	Biodiesel	**Petroleum diesel**
Carbon dioxide emitted in g	3000	3000
Unburnt hydrocarbons emitted in g	7	10
Soot emitted in g	6	12
Nitrogen oxides emitted in g	5	2

Use your scientific knowledge and the data in the table to evaluate the advantages and disadvantages of using biodiesel rather than petroleum diesel as a fuel.

Remember to include a supported conclusion in your answer.

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(5 marks)

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Turn over for the next question

Physics Questions

15 A company claims to have developed a way in which the external walls of a building have a U-value that is zero.

15 (a) What does a U-value of zero mean?

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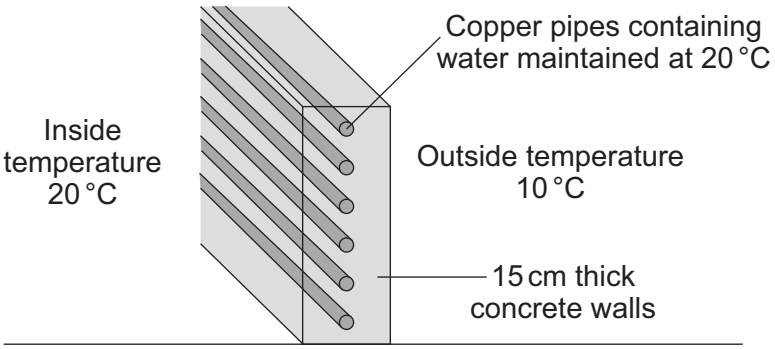
(1 mark)

15 (b) The external walls are constructed as shown in the diagram below.



15 (b) (i) Concrete has a high specific heat capacity so energy is **not** conducted quickly to the outside.

What is meant by the term *high specific heat capacity*?

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(2 marks)

15 (b) (ii) Even though the outside temperature is lower than the inside temperature there is no overall energy loss from the inside to the outside of the building.

Suggest why and explain your answer.

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(2 marks)

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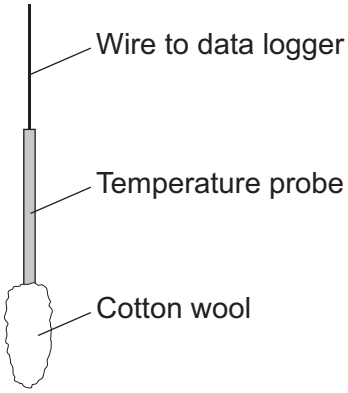
Turn over for the next question

16 A student investigated the evaporation of three different liquids using the apparatus shown.

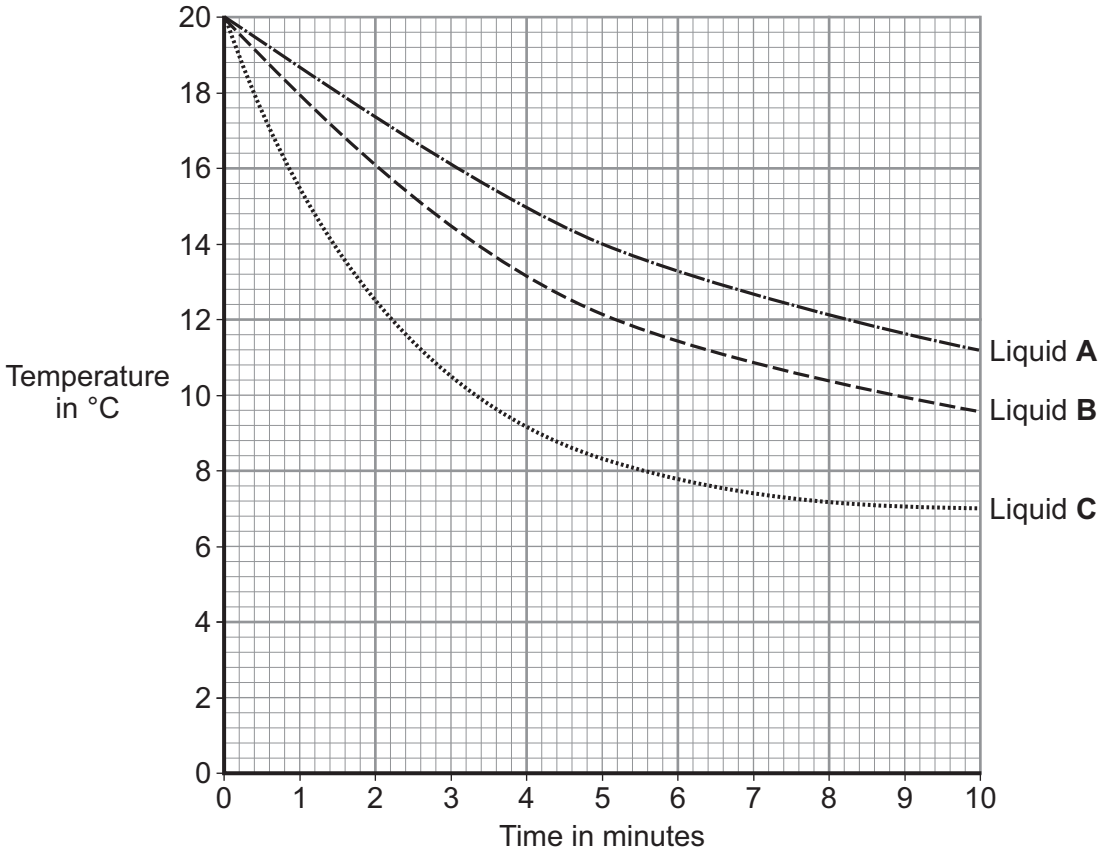


Identical pieces of cotton wool were soaked in one of three liquids, **A**, **B** or **C**, that have different boiling points. The same volume of liquid, at the same starting temperature, was used each time.

The temperature of the cotton wool was measured during a ten minute period.

The results are shown on **Graph 1.**

Graph 1



16 (a) Which liquid has the lowest boiling point?

Explain your choice.

Liquid .....

Explanation .....

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(2 marks)

16 (b) Room temperature is 20 °C.

The line for liquid **C** reached a lower limit of 7 °C.

Explain why the temperature did **not** fall below 7 °C.

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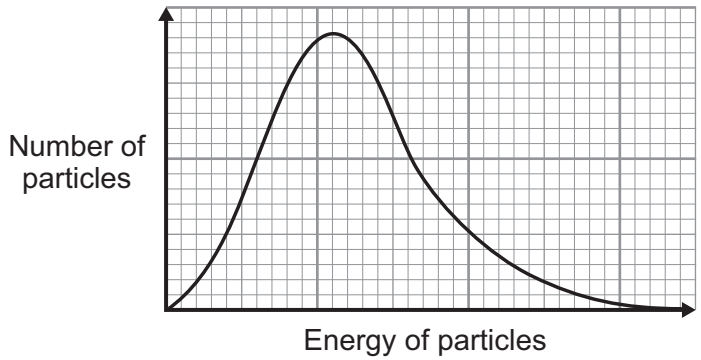
(1 mark)

Question 16 continues on the next page

16 (c) **Graph 2** shows the distribution of energy among particles in a liquid.

Graph 2



Explain, in terms of the particles in a liquid, why evaporation causes cooling.

You may use information from **Graph 2** to help you with your answer.

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(4 marks)

7

END OF QUESTIONS

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