

Surname											Other Names											
Centre Number												Candidate Number										
Candidate Signature																						

For Examiner's Use

General Certificate of Secondary Education
January 2009



APPLIED SCIENCE (DOUBLE AWARD)
Unit 2 Science for the Needs of Society
Higher Tier

APSC/2H
H

Thursday 15 January 2009 1.30 pm to 3.00 pm

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a ruler • a calculator.
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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. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 90.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

Advice

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

For Examiner's Use			
Question	Mark	Question	Mark
1		4	
2		5	
3		6	
		7	
		8	
		9	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			



J A N O 9 A P S C 2 H O 1

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

1 Agricultural scientists use genetic engineering to improve food production.

1 (a) Give **one** advantage of using genetically modified (GM) plants for farming.

.....

(1 mark)

1 (b) Give **one** reason why some shoppers prefer to buy non-GM foods.

.....

(1 mark)

1 (c) Plants produce food by photosynthesis.

1 (c) (i) Complete the word equation for photosynthesis.

..... + water → glucose +

(2 marks)

1 (c) (ii) Photosynthesis is an *endothermic* reaction.

What is an *endothermic* reaction?

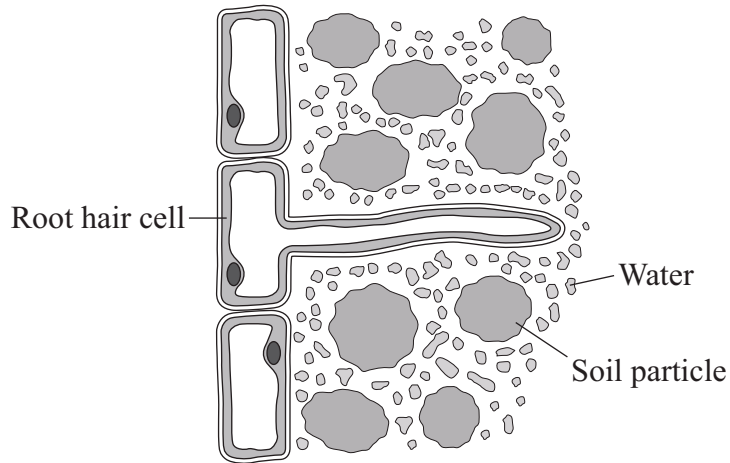
.....

(1 mark)



- 1 (d) Plants obtain water for photosynthesis from the soil.

The structure of a root hair cell enables the plant to absorb water from the soil.



- 1 (d) (i) Name **two** parts of a plant cell that are **not** found in animal cells.

1

2

(2 marks)

- 1 (d) (ii) Describe **one** feature of the structure of the root hair cell that helps it to absorb water from the soil.

.....

.....

(1 mark)

- 1 (d) (iii) Name the process for the movement of water from the soil into the root hair cell.

.....

(1 mark)

9

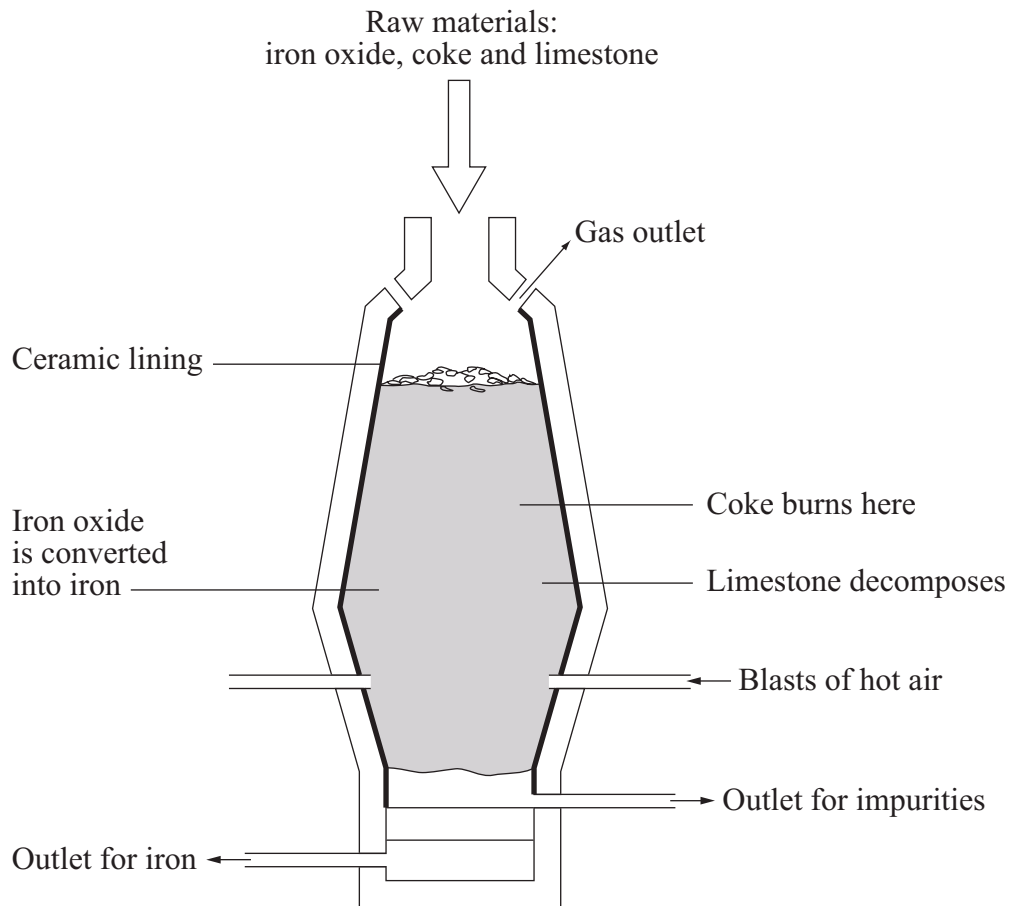
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2 Iron is extracted from iron oxide on a large scale in a blast furnace.

A mixture of iron oxide, coke and limestone is fed into the top of the furnace.

Blasts of hot air are blown into the bottom of the furnace.



2 (a) The furnace lining is made from a ceramic material.

Give **one** property of a ceramic that makes it a good choice for lining a furnace.

.....
(1 mark)

2 (b) Limestone (calcium carbonate) decomposes in the heat of the furnace.

Complete the word equation for the decomposition of limestone.

calcium carbonate → +
(2 marks)



- 2 (c) Coke (carbon) is a reducing agent.

Describe how a reducing agent converts iron oxide, Fe_2O_3 , into iron, Fe.

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(2 marks)

- 2 (d) The iron produced in the blast furnace is converted into steel.

Explain the difference between iron and steel.

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(2 marks)

- 2 (e) The production of iron and steel results in the release of large quantities of carbon dioxide, which causes environmental pollution.

- 2 (e) (i) Write a chemical equation to show the formation of carbon dioxide in the blast furnace.

.....

(1 mark)

- 2 (e) (ii) Give **one** other example of environmental pollution caused by the production of iron and steel.

.....


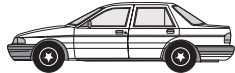


(1 mark)

9

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3 Transport engineers compare the performance of different types of vehicle.

			
Small car	Saloon car	Multi-purpose vehicle (MPV)	4 × 4

Use data from the table to help you to answer the questions.

Type of car	Miles per gallon	Acceleration time in seconds 0–100 km/h	Top speed in km/h	CO ₂ emissions in g/km
Small car	63	9.3	193	119
Saloon car	51	8.6	221	146
Multi-purpose vehicle	45	8.8	206	167
4 × 4	32	9.1	180	242

3 (a) Explain why driving a small car is better for the environment than driving a 4 × 4.

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(2 marks)

3 (b) Use the formula to calculate the distance travelled by the saloon car if it is driven at top speed for one minute.

Distance travelled (km) = speed (km/h) × time (h)

.....

.....

.....

.....

Distance = km
(2 marks)



3 (c) The multi-purpose vehicle takes 8.8 seconds to accelerate from 0 to 100 000 metres per hour.

3 (c) (i) Show that a speed of 100 000 metres per hour is the same as 27.78 metres per second.

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(2 marks)

3 (c) (ii) Calculate the acceleration of the multi-purpose vehicle in m/s^2 .

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Acceleration = m/s^2
(3 marks)

9

Turn over for the next question

Turn over ►



4 Food, materials and drugs can be made using living things.

4 (a) Microorganisms are used to produce some foods and medicines.

4 (a) (i) Name **one** food that is produced using a microorganism, and name the type of microorganism that is used.

Food

Type of microorganism

(2 marks)

4 (a) (ii) Name **one** drug that is produced using a microorganism, and name the type of microorganism that is used.

Drug

Type of microorganism

(2 marks)

4 (a) (iii) Explain how genetic engineering is used to change microorganisms to improve the production of food or medicine.

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(2 marks)

4 (b) Livestock is reared on farms in the UK to produce meat, leather and wool.

4 (b) (i) Name **three** animals reared on farms in the UK to produce meat, leather and wool.

Meat

Leather

Wool

(1 mark)



4 (b) (ii) Explain how selective breeding is used to improve animals for the production of meat, leather and wool.

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(3 marks)

10

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5 The label is from a bottle of drink manufactured in the UK.

Use the information on the label to help you to answer the questions.

Concentrated Orange Drink
with juicy bits

1 litre



INGREDIENTS
Water, orange fruit from concentrate (10%), sugar, citric acid, natural flavouring, vitamin C, preservative (sodium metabisulfite), natural colour.

SERVING GUIDE
Shake well
Dilute 1 part concentrate with 4 parts water
20 servings per bottle

5 (a) Calculate the total volume of one serving of the diluted drink.

.....

 cm³
 (2 marks)

5 (b) Explain why a preservative (sodium metabisulfite) is added to the drink.

.....

 (1 mark)

Question 5 continues on the next page

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- 5 (c) The manufacturer claims that 1000 cm^3 of Concentrated Orange Drink contains at least 1.5 g of insoluble solid.

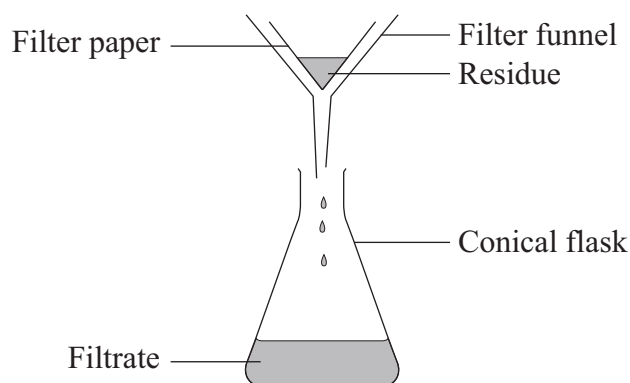
A quality control technician carried out an experiment to prove that this is true.

The method for the experiment is given below.

Method

- 1 Weigh a piece of clean filter paper.
- 2 Measure out 100 cm^3 of Concentrated Orange Drink using a measuring cylinder.
- 3 Filter the drink using filter paper and a funnel.
- 4 Allow the filter paper and residue to dry.
- 5 Weigh the dried filter paper and residue.

During the experiment, the technician filtered the drink using filter paper and a funnel.



- 5 (c) (i) Explain why Concentrated Orange Drink may be classified as a suspension.

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(2 marks)



5 (c) (ii) Explain why the filtrate may be classified as a solution.

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(2 marks)

5 (d) The technician made two errors during the experiment.

Describe and explain how each error would affect the final result.

5 (d) (i) The technician did not shake the drink before measuring out 100 cm³.

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(2 marks)

5 (d) (ii) The technician did not leave the filter paper and residue for long enough before weighing them.

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(2 marks)

11

Turn over ►



6 Bottled gas, mains gas and mains electricity provide energy for devices around the home.

6 (a) Most mains electricity is generated using fossil fuels and nuclear fuels. The UK government would like to increase the proportion of electricity generated, using renewable energy resources, to 20% by the year 2020.

6 (a) (i) Explain why the government would like to increase the proportion of electricity generated from renewable energy resources.

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(3 marks)

6 (a) (ii) Give **two** reasons why renewable energy resources will **not** be able to produce a high proportion of the electricity generated in the UK.

Reason 1

.....

Reason 2

.....

(2 marks)

6 (b) Bottled gas contains propane, C_3H_8 . Propane is a hydrocarbon. Propane can be separated from crude oil by fractional distillation.

6 (b) (i) Why is propane classified as a hydrocarbon?

.....

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(1 mark)



6 (b) (ii) Explain why propane is separated from the top of a fractional distillation column.

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(2 marks)

6 (c) Mains gas contains methane.

6 (c) (i) Write the chemical formula of methane.

.....

(1 mark)

6 (c) (ii) Methane undergoes complete combustion when it burns in a good supply of air.



Explain why is it dangerous to burn methane in the home when there is a poor supply of air.

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(2 marks)

11

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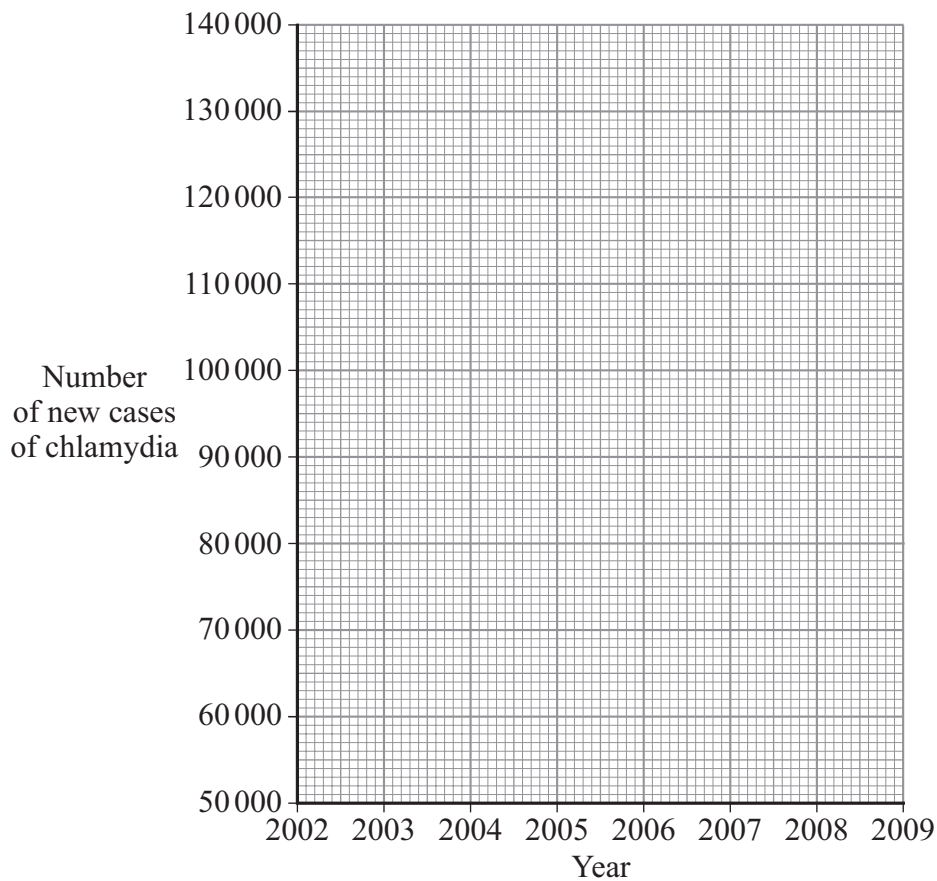


7 The number of sexually transmitted infections in the UK is increasing. Health workers are worried about the increase. One of these infections is called chlamydia.

7 (a) The table shows the number of new cases of chlamydia each year in the UK from 2002 to 2006.

Year	New cases of chlamydia
2002	87 592
2003	96 151
2004	104 733
2005	109 418
2006	113 585

7 (a) (i) Use the data in the table to draw a line graph on the axes below.



(3 marks)

7 (a) (ii) Use your graph to predict the number of new cases of chlamydia in 2009.

.....
(1 mark)



7 (b) What advice should a health worker give to young people to help them avoid catching a sexually transmitted infection?

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(2 marks)

7 (c) Sexually transmitted infections are caused by microorganisms.

Describe how white blood cells help to defend us against microorganisms.

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(2 marks)

7 (d) Antibiotics can be used to treat some sexually transmitted infections.

Give **two** reasons why not all microorganisms are killed by antibiotics.

1

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2

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(2 marks)

10

Turn over ►



8 Environmental scientists test samples of sea water to check the levels of pollution.

They do this by measuring the masses of chemicals in the water.

The table lists the masses of the positive and negative ions dissolved in a sample of sea water.

Use the data in the table to answer the questions.

Positive ions		Mass (in grams) in 1000 grams of sea water	Negative ions		Mass (in grams) in 1000 grams of sea water
Calcium	Ca ²⁺	0.4	Bromide	Br ⁻	0.07
Potassium	K ⁺	0.4	Chloride	Cl ⁻	19.0
Magnesium	Mg ²⁺	1.3	Hydrogencarbonate	HCO ₃ ⁻	0.1
Sodium	Na ⁺	11.0	Sulfate	SO ₄ ²⁻	2.5

8 (a) Sodium chloride is the most common ionic compound in sea water.

8 (a) (i) Suggest why 1000 g of the sea water contains less than 30 g of sodium chloride.

.....

 (1 mark)

8 (a) (ii) Name **one** other ionic compound that can be obtained from sea water.
Write the chemical formula for this compound.

Name

Formula

(2 marks)



8 (b) When sea water is heated, the water evaporates because it has a low boiling point. The ionic compounds are left behind.

8 (b) (i) Why does water have a low boiling point?

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(2 marks)

8 (b) (ii) Why are the ionic compounds left behind?

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(2 marks)

8 (c) Sea water is polluted by the chemicals used in intensive farming.

8 (c) (i) The table on the opposite page shows the masses of positive and negative ions in sea water. The concentration of some ions will increase when sea water is polluted by artificial fertiliser.

Name **two** ions in artificial fertiliser.

1

2

(2 marks)

8 (c) (ii) Name **one** other type of chemical used in intensive farming.

.....

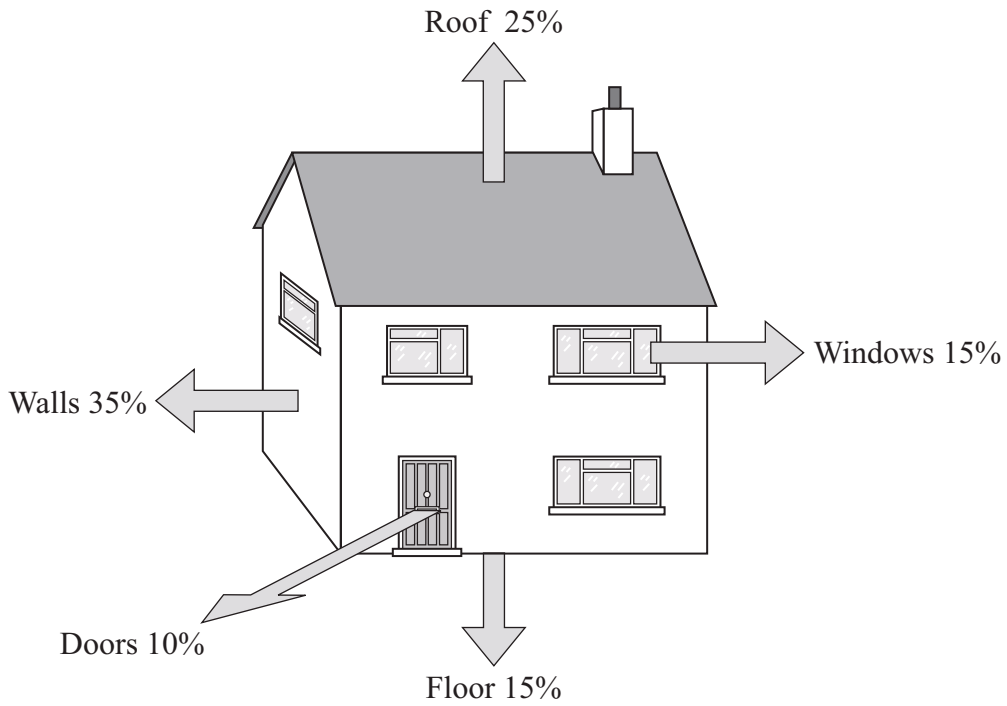
(1 mark)

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- 9 A homeowner would like to reduce the amount of heat energy lost from her home.
- 9 (a) The diagram shows how much heat energy is lost from different parts of the house.



- 9 (a) (i) Describe how heat is lost through the walls, and explain how this heat loss can be reduced.

.....

.....

.....

.....

(2 marks)

- 9 (a) (ii) Describe how heat is lost through the roof, and explain how this heat loss can be reduced.

.....

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(2 marks)



9 (b) The homeowner can also save energy by using electrical devices that are more efficient.

9 (b) (i) Calculate the energy supplied to a 0.5 kW motor when it is switched on for 3 hours.

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Energy supplied = kilowatt-hours
(3 marks)

9 (b) (ii) Calculate the percentage efficiency of the motor if it transfers 1.1 kilowatt-hours of useful energy.

.....
.....
.....

Percentage efficiency = %
(3 marks)

9 (b) (iii) The energy that is not transferred by the device is conserved but it becomes less useful.

Why does the energy become less useful?

.....
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(1 mark)

11

END OF QUESTIONS



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