

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Secondary Education
June 2008

SCIENCE B
Unit Physics P1

PHYSICS
Unit Physics P1

Higher Tier

Friday 20 June 2008 9.00 am to 9.45 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> a ruler. <p>You may use a calculator.</p>

Time allowed: 45 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 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- 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.

PHY1H
H

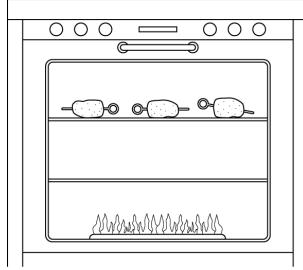


For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			



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

- 1 The diagram shows potatoes being baked in a gas oven. Each potato has a metal skewer pushed through it.



- 1 (a) Explain how heat is transferred by the process of convection from the gas flame at the bottom of the oven to the potatoes at the top of the oven.

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(3 marks)

- 1 (b) The metal skewers help the potatoes to cook by transferring heat to the inside of the potatoes.

By what method is heat transferred through a metal skewer?

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(1 mark)

- 1 (c) When the potatoes are taken from the oven, they start to cool down.

Suggest **one** factor that will affect how fast a potato cools down.

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(1 mark)

- 1 (d) If the potatoes need to be kept hot, they may be wrapped in shiny aluminium foil.

Why does this help to keep the potatoes hot?

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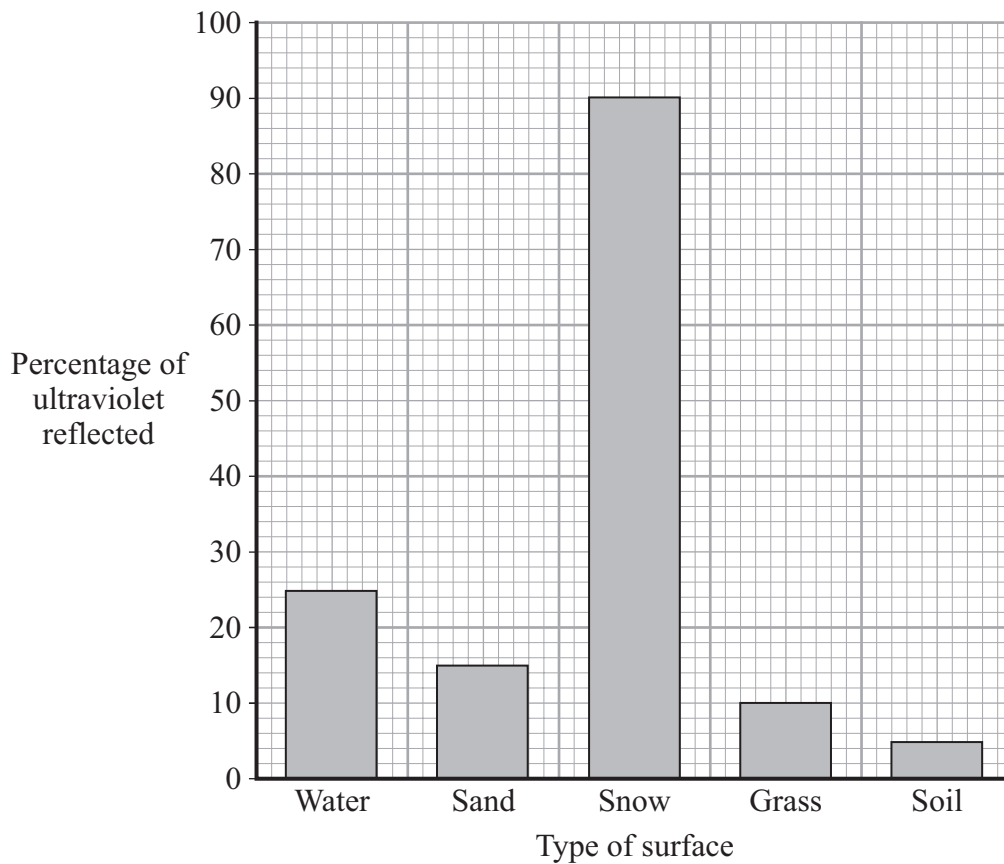
(1 mark)

6



- 2 (a) Ultraviolet (UV) radiation can be reflected or absorbed by a surface.

The percentage of ultraviolet radiation reflected by various surfaces is shown in the bar chart.



- 2 (a) (i) Which of these surfaces is the best **absorber** of ultraviolet radiation?

.....
(1 mark)

- 2 (a) (ii) Why has the data been shown as a bar chart rather than a line graph?

.....
.....
(1 mark)

- 2 (a) (iii) Who is likely to be exposed to more ultraviolet radiation, a skier or a golfer?

Draw a ring around your answer. **skier** **golfer**

Give a reason for your answer.

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(1 mark)

Question 2 continues on the next page

Turn over ►



2 (a) (iv) State **one** harmful effect that ultraviolet radiation has on skin.

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(1 mark)

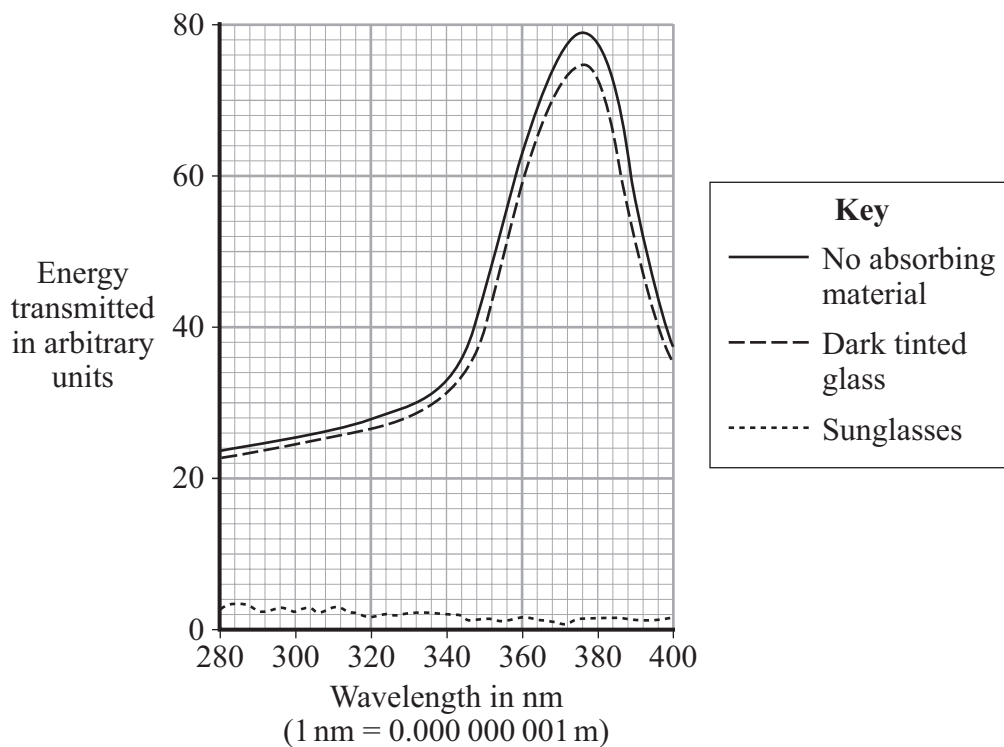
2 (b) This is a label from a pair of sunglasses.

Sportswear Budget	£5
<ul style="list-style-type: none"> • plastic lenses • blocks 95% of ultraviolet rays • UV absorbing up to wavelengths of 400 nm 	

A student tested the sunglasses by measuring the energy transmitted by the lenses for ultraviolet waves with a range of different wavelengths.

For comparison, the student also measured the transmission of ultraviolet waves through a piece of dark tinted glass.

The results of the tests are shown in the graph.



- 2 (b) (i) Explain how the student's results support the claims made on the label.

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(2 marks)

- 2 (b) (ii) Ultraviolet radiation can cause permanent eye damage.

Why should the lenses for sunglasses **not** be made from the dark tinted glass used in the student's tests?

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(1 mark)

- 2 (c) An eye care charity predicts that within 10 years, everyone, when outside, will wear UV protection sunglasses most of the time. This is because the potential damage from ultraviolet radiation is so serious.

- 2 (c) (i) Which **one** of the following statements is the most likely reason for the prediction made by the eye care charity?

Put a tick (✓) in the box next to your answer.

Publicity and education will make people aware of the dangers.

The price of UV blocking sunglasses will fall dramatically.

The level of UV in the atmosphere will increase.

(1 mark)

- 2 (c) (ii) Several manufacturers of sunglasses have said that the research they have carried out supports the view of the eye care charity.

Suggest why the research conducted by the manufacturers could be biased.

.....

.....

(1 mark)

9

Turn over ►



- 3 The table gives data about two space telescopes. The Hubble telescope is already in space, but the James Webb telescope is still being built.

Name of telescope	Mirror diameter in metres	Launch Year	Orbit distance from the Earth in kilometres
Hubble	2.4	1990	575
James Webb	6.5	2013	1 500 000

- 3 (a) Explain why the Hubble telescope produces clearer images than optical telescopes positioned on the Earth.

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(2 marks)

- 3 (b) After the Hubble telescope was launched into space, scientists found that it was not able to focus properly. Astronauts sent into space were able to repair the fault.

The James Webb telescope is to be fully assembled and tested before it is launched into space. Suggest why.

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(2 marks)

- 3 (c) To get the large mirror for the James Webb telescope into space, it will be folded in segments, launched into space and then opened out. This is a complicated process so a working scale model of the optical system has been built.

Suggest **one** reason why building a scale model is a good idea.

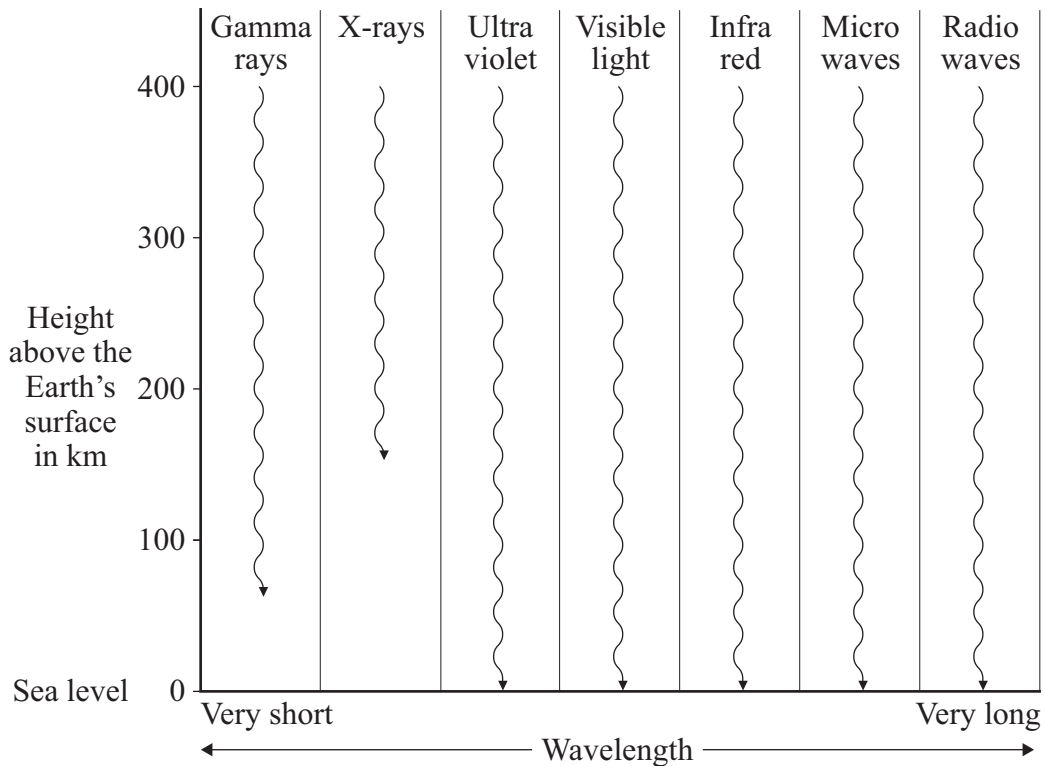
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(1 mark)



- 3 (d) The diagram shows how far different types of electromagnetic wave can travel through the Earth's atmosphere before being absorbed.



Explain why an optical telescope can be positioned on the Earth but an X-ray telescope must be in space.

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(2 marks)

7

Turn over for the next question

Turn over ▶



4 (a) Solar energy is a *renewable* energy source that can be used to generate electricity.

4 (a) (i) What is meant by an energy source being *renewable*?

.....
(1 mark)

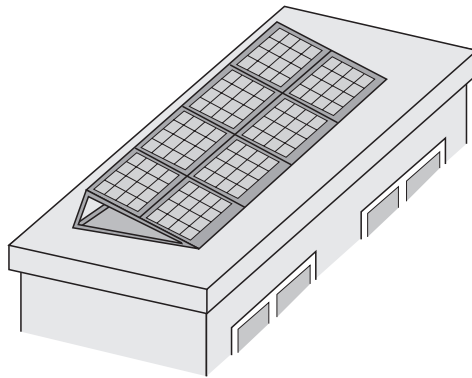
4 (a) (ii) Name **two** further renewable energy sources used to generate electricity.

1

2

(1 mark)

4 (b) A householder uses a bank of solar cells to generate electricity for his home.
The solar cells are tilted to receive the maximum energy input from the Sun.



The data in the table gives the average energy input each second (in J/s), to a 1 m^2 area of solar cells for different angles of tilt and different months of the year.

Month	Angle of tilt			
	20°	30°	40°	50°
February	460	500	480	440
April	600	620	610	600
June	710	720	680	640
August	640	660	640	580
October	480	520	500	460
December	400	440	420	410

- 4 (b) (i) Use the data in the table to describe how the average energy input to the solar cells depends on the angle of tilt.

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(2 marks)

- 4 (b) (ii) The bank of solar cells used by the householder has an area of 8 m^2 .

The efficiency of the solar cells is 0.15

Use the equation in the box to calculate the average **maximum** electrical energy available from the bank of solar cells each second in June.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

.....

.....

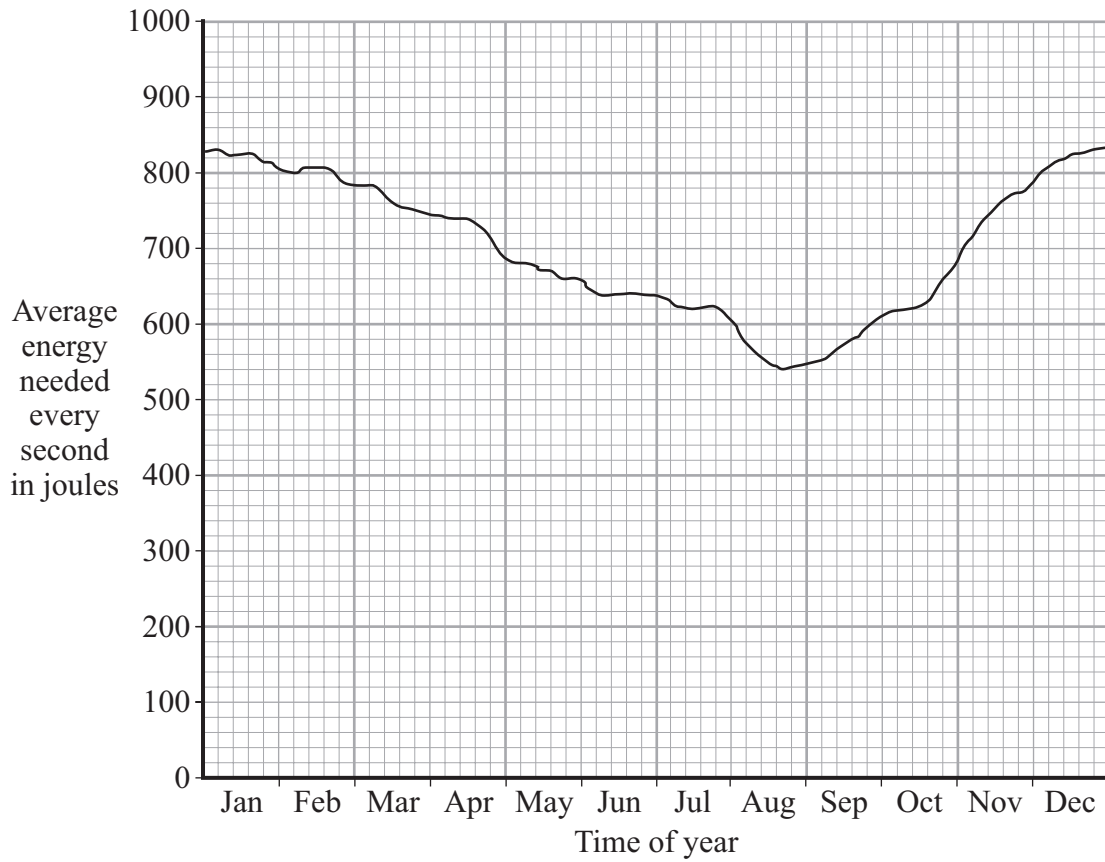
Maximum energy = joules/second
(3 marks)

Question 4 continues on the next page

Turn over ►



4 (c) The graph shows how the householder's electrical energy needs change over one year.



Why would it be advisable for the householder to remain connected to the National Grid?

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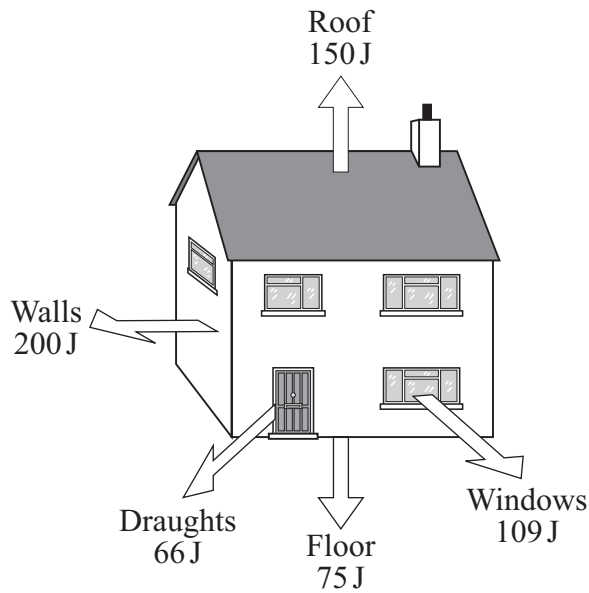
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(1 mark)

8



- 5 (a) The diagram shows how much heat is lost each second from different parts of an uninsulated house.



- 5 (a) (i) Each year, the house costs £760 to heat.

How much money is being wasted because of heat lost through the roof?

Show clearly how you work out your answer.

.....

(2 marks)

- 5 (a) (ii) Insulating the loft would cut the heat lost through the roof by 50%.

The loft insulation has a payback time of $1\frac{1}{2}$ years.

How much did the loft insulation cost to buy?

.....

Cost of loft insulation = £

(1 mark)

- 5 (b) What happens to the wasted energy?

.....

(1 mark)

4

Turn over ►



6 In 1986, a nuclear reactor exploded in a power station at Chernobyl in the Ukraine.

6 (a) The table gives information about some of the radioactive substances released into the air by the explosion.

Radioactive substance	Half-life	Type of radiation emitted
Iodine-131	8 days	beta and gamma
Caesium-134	2 years	beta
Caesium-137	30 years	beta

6 (a) (i) How is the structure of a caesium-134 atom different from the structure of a caesium-137 atom?

.....
 (1 mark)

6 (a) (ii) What is a beta particle and from which part of an atom is a beta particle emitted?

.....

 (1 mark)

6 (a) (iii) Once a radioactive substance is dissolved in rainwater, it can enter the food chain.

Following the Chernobyl explosion, some milk supplies were found to be radioactive.

If one litre of milk contaminated with iodine-131 gives a count rate of 400 counts/second, how long will it take for the count rate to fall to 25 counts/second?

Show clearly how you work out your answer.

.....

Time taken = days
 (2 marks)



- 6 (a) (iv) After 20 years, the caesium-137 emitted into the atmosphere is a more serious problem than the iodine-131.

Explain why.

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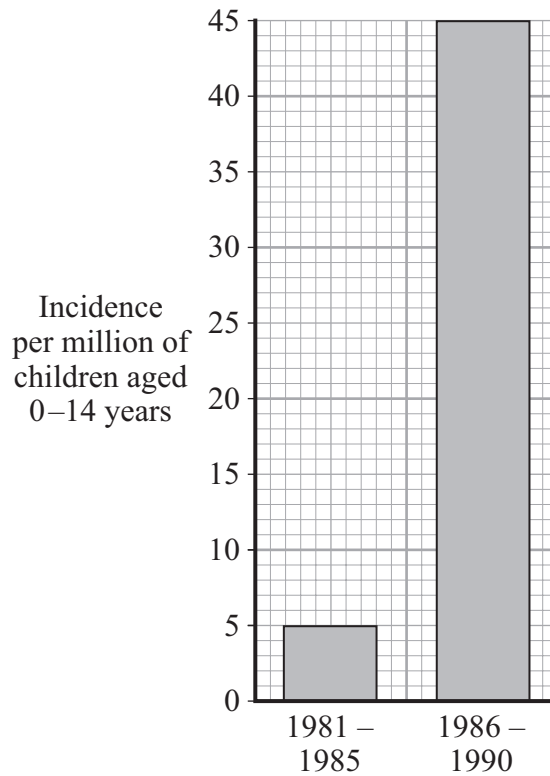
(2 marks)

Question 6 continues on the next page

Turn over ►



- 6 (b) The bar chart compares the incidence of thyroid cancer in Ukrainian children, aged 0–14 years, before and after the Chernobyl explosion.



Of the children that developed thyroid cancer, 64% lived in the areas most contaminated by the radiation.

Considering this data, can you be certain that a child who developed thyroid cancer between 1986 and 1990 did so because of the Chernobyl explosion?

Explain the reason for your answer.

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(2 marks)



- 6 (c) In 1991, some scientists compared the health of two groups of people: a *control* group and a group that had been exposed to the radiation from Chernobyl.

What people would have been in the *control* group?

.....
(1 mark)

- 6 (d) Although there are some risks associated with nuclear power stations, it is likely that new ones will be built.

Give **two** reasons to justify the use of nuclear power.

1

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2

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(2 marks)

11

END OF QUESTIONS



There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

