

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



General Certificate of Secondary Education
Foundation Tier
June 2012

Science B
Unit Physics P1

PHY1F
F

Physics
Unit Physics P1

Wednesday 20 June 2012 9.00 am to 9.45 am

For this paper you must have:

- a ruler.

You may use a calculator.

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. 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 45.
- 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.



J U N 1 2 P H Y 1 F 0 1

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

1 Each letter, **A**, **B**, **C**, **D** and **E**, represents an energy transformation.

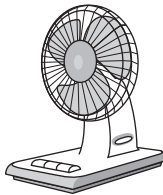
- A** electrical to chemical
- B** electrical to heat
- C** electrical to kinetic
- D** electrical to light
- E** electrical to sound

Match each of the following devices to the useful energy transformation that the device is designed to make.

Write the correct letter, **A**, **B**, **C**, **D** or **E**, in the box below each device.

Use each letter no more than once.

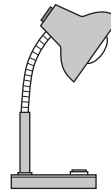
Fan



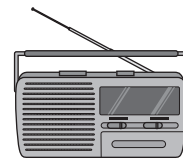
Kettle



Lamp



Radio

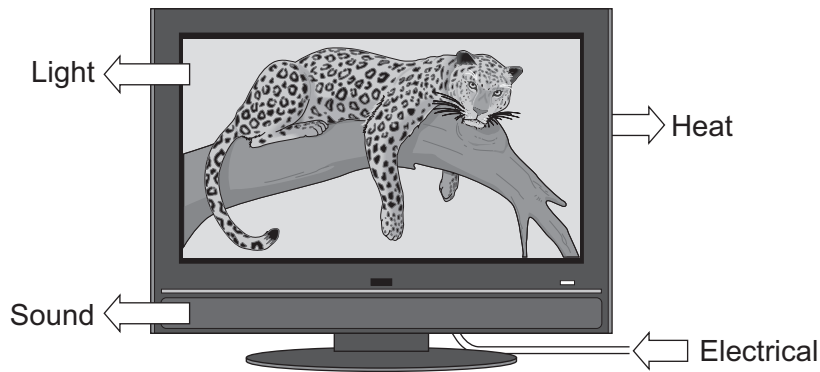


(4 marks)

4



- 2 (a) The diagram shows the energy transformations produced by a television.



When the television is working, 1200 joules of energy are supplied to the television every second. The useful energy transferred by the television is 720 joules every second.

- 2 (a) (i) Use the equation in the box to calculate the efficiency of the television.

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

Show clearly how you work out your answer.

.....

Efficiency =
 (2 marks)

- 2 (a) (ii) Use **one** word from the diagram to complete the following sentence.

The electrical energy that is **not** usefully transformed by the television is wasted as

.....

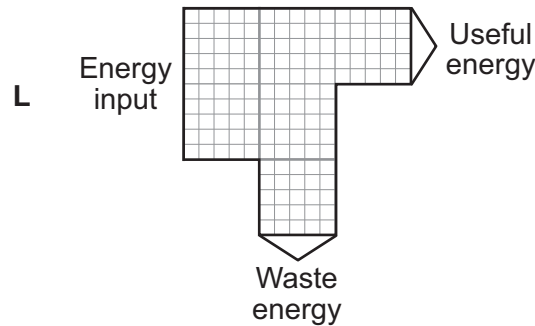
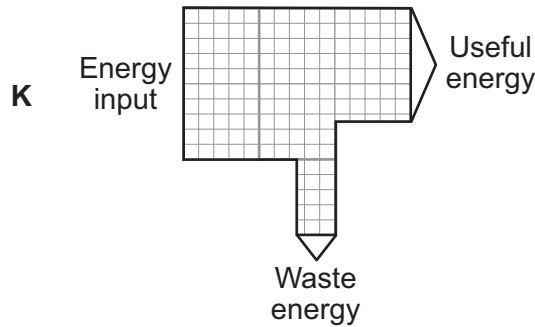
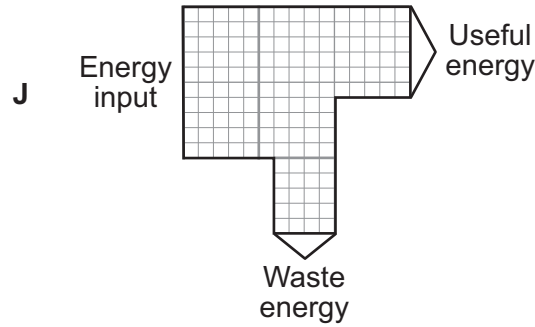
(1 mark)

Question 2 continues on the next page

Turn over ►



2 (b) Drawn below are the Sankey diagrams for three televisions, J, K and L. The diagrams are drawn to the same scale.



Which **one** of the televisions, J, K or L, is the most efficient?

Write your answer in the box.

Give a reason for your answer.

.....

.....

(2 marks)



- 2 (c)** A homeowner is sent an electricity bill every 3 months. The total amount of electrical energy used during one 3-month period was 800 kilowatt-hours. Electrical energy costs 15p per kilowatt-hour.

Use the equation in the box to calculate the cost of the energy transferred from the mains electricity supply.

$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Show clearly how you work out your answer and give the unit.

.....
.....

Cost =
(2 marks)

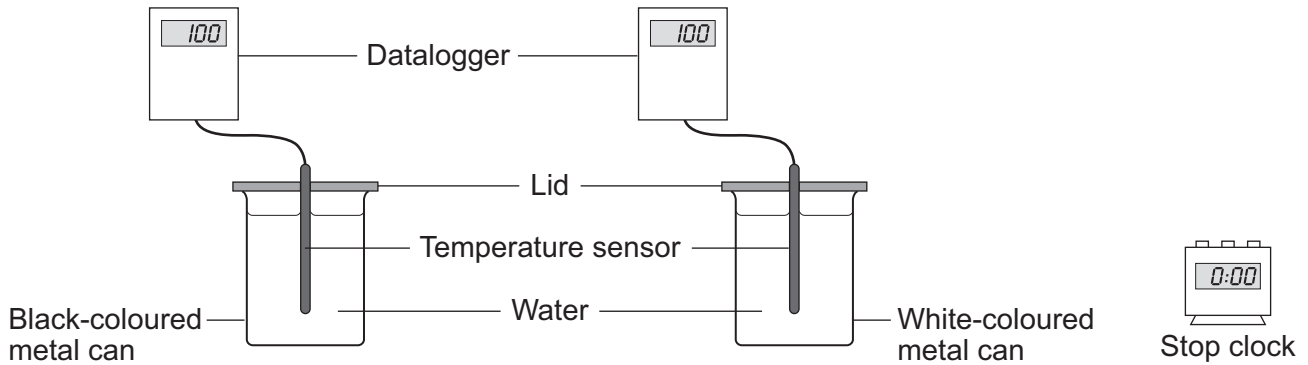
7

Turn over for the next question

Turn over ►



- 3 The diagram shows the equipment a student used to investigate how the colour of a surface affects how fast it emits (gives out) heat.



An equal volume of boiling water was poured into each metal can. The student then recorded the temperature of the water in each can every minute for ten minutes.

- 3 (a) (i) Which of the following was a control variable in this investigation?

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

The volume of boiling water.

The decrease in temperature of the water.

The outside colour of the metal can.

(1 mark)

- 3 (a) (ii) Give **one** advantage of using a temperature sensor and datalogger rather than a thermometer to measure the temperature of the water.

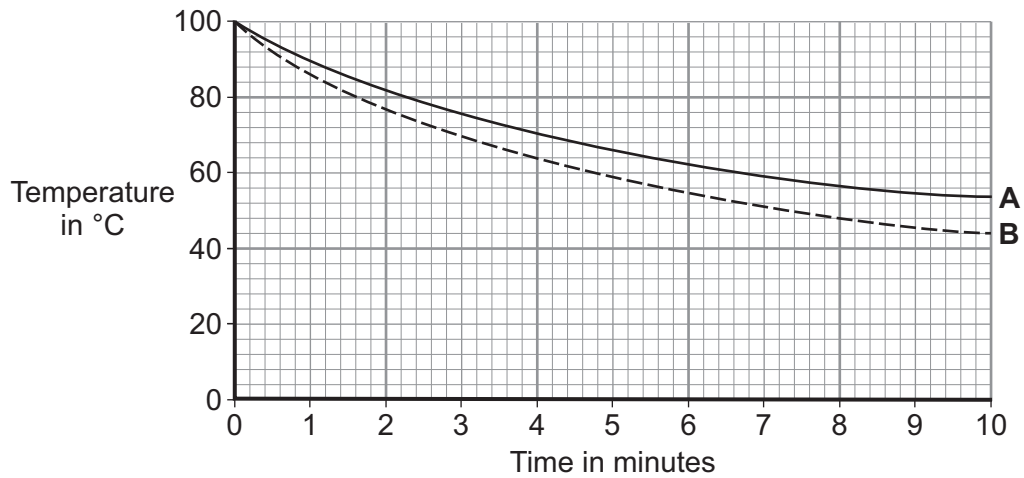
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.....

(1 mark)



3 (b) The student's results for both cans are plotted on the graph.



Which line, **A** or **B**, shows how the temperature of the water inside the black-coloured metal can changed?

Draw a ring around your answer. **A** **B**

Explain the reason for your answer.

.....

.....

.....

.....

(2 marks)

Question 3 continues on the next page

Turn over ►



3 (c) Some gardeners make soil darker by digging black soot into the soil. Other gardeners use straw to protect plants from the cold.

3 (c) (i) Complete the following sentence by drawing a ring around the correct line in the box.

On a warm day, the temperature of darker coloured soil will increase

slower than
as fast as
faster than

the temperature of lighter coloured soil.

(1 mark)

3 (c) (ii) Give a reason for your answer to part (c)(i).

.....

.....

(1 mark)

3 (c) (iii) The statement in the box is **false**.

Straw keeps plants warm by trapping air.

This is because air is a good conductor.
--

Change **one** word in the statement to make the statement **true**.

Write down your **new** statement. The answer has been started for you.

This is because air is a

(1 mark)

7



4 Mobile phone networks send digital signals from one phone mast to another phone mast using microwaves.

4 (a) What type of radiation are microwaves?

Draw a ring around your answer.

electromagnetic

nuclear

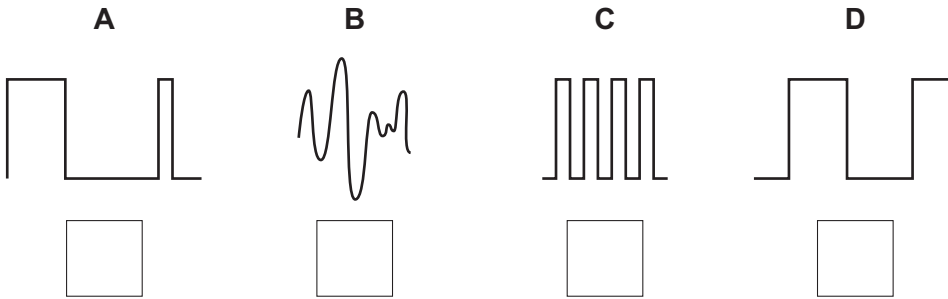
thermal

(1 mark)

4 (b) A mobile phone converts an analogue signal into a digital signal.

The diagrams show four signals, A, B, C and D.

Put a tick (✓) in the box below the analogue signal.



Give a reason for your choice.

.....

.....

(2 marks)

4 (c) Some schools are paid for allowing a mobile phone mast to be built in the school grounds.

Complete the following sentence by drawing a ring around the correct word in the box.

Accepting payment for allowing a mobile phone mast in school grounds raises ethical

and

economic
environmental
scientific

 issues.

(1 mark)

4

Turn over ►



5 (a) Optical telescopes may be used to observe galaxies. Some optical telescopes are on the Earth and some are on satellites in space.

5 (a) (i) Give **one** advantage of having the telescope on the Earth rather than on a satellite in space.

.....
.....

(1 mark)

5 (a) (ii) Scientists have observed that the wavelengths of the light from galaxies moving away from the Earth are longer than expected.

What name is given to this observation?

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

blue-shift

orange-shift

red-shift

(1 mark)

5 (b) The Earth's atmosphere absorbs X-rays from space.

Where should a telescope designed to detect X-rays be positioned?

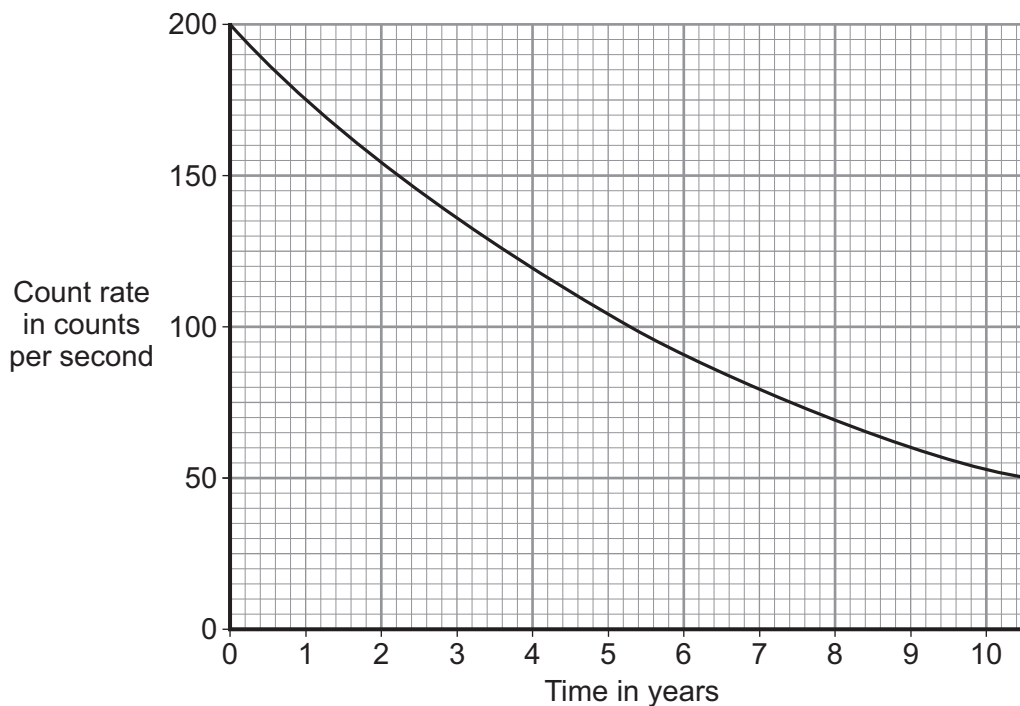
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(1 mark)

3



- 6 (a)** The graph shows how the count rate from a sample containing the radioactive substance cobalt-60 changes with time.



- 6 (a) (i)** What is the range of the count rate shown on the graph?

From counts per second to counts per second.
(1 mark)

- 6 (a) (ii)** How many years does it take for the count rate to fall from 200 counts per second to 100 counts per second?

Time = years
(1 mark)

- 6 (a) (iii)** What is the half-life of cobalt-60?

Half-life = years
(1 mark)

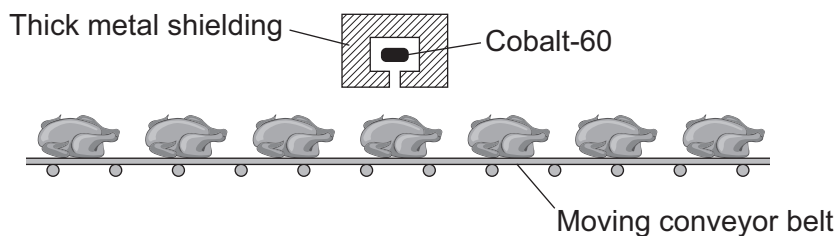
Question 6 continues on the next page

Turn over ►



- 6 (b)** The gamma radiation emitted from a source of cobalt-60 can be used to kill the bacteria on fresh, cooked and frozen foods. Killing the bacteria reduces the risk of food poisoning.

The diagram shows how a conveyor belt can be used to move food past a cobalt-60 source.



- 6 (b) (i)** Which **one** of the following gives a way of increasing the amount of gamma radiation the food receives?

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

Increase the temperature of the cobalt-60 source.

Make the conveyor belt move more slowly.

Move the cobalt-60 source away from the conveyor belt.

(1 mark)

- 6 (b) (ii)** To protect people from the harmful effects of the gamma radiation, the cobalt-60 source has thick metal shielding.

Which **one** of the following metals should be used?

Draw a ring around your answer.

aluminium

copper

lead

(1 mark)



- 6 (c)** A scientist has compared the vitamin content of food exposed to gamma radiation with food that has not been exposed.

The table gives the data the scientist obtained when she tested 1 kg of cooked chicken.

Vitamin	Food not exposed to gamma radiation	Food exposed to gamma radiation
	Mass in milligrams	Mass in milligrams
B6	1.22	1.35
B12	21.00	28.00
E	3.30	2.15
Niacin	58.00	55.50
Riboflavin	2.10	2.25

Considering only this data, which **one** of the following is a correct conclusion?

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

Vitamin content is not affected by gamma radiation.

Gamma radiation completely destroys some types of vitamin.

Exposure increased the content of some types of vitamin.

(1 mark)

6

Turn over for the next question

Turn over ►



7 A farmer has installed a biogas electricity generator on his farm. This device generates electricity by burning the methane gas produced from rotting animal waste. Methane is a greenhouse gas. When methane burns, carbon dioxide and water are produced.

The animal waste rots in an anaerobic digester. The digester and the generator are kept inside a farm building and cannot be seen from the outside.

7 (a) The animal waste used in the anaerobic digester is a *renewable* energy source.

What is meant by an energy source being *renewable*?

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

7 (b) Suggest **one** reason why farmers have been encouraged to install their own biogas generators.

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

7 (c) The farmer's monthly electricity bill using the mains electricity supply was £300. The biogas generator cost the farmer £18 000 to buy and install.

Assuming the biogas generator provides all of the farmer's electricity, what is the pay-back time for the generator?

.....
Pay-back time =
(1 mark)

7 (d) It would have been cheaper for the farmer to have bought and installed a small wind turbine.

Give **two** advantages of using the biogas generator rather than a wind turbine, to generate the electricity used on the farm.

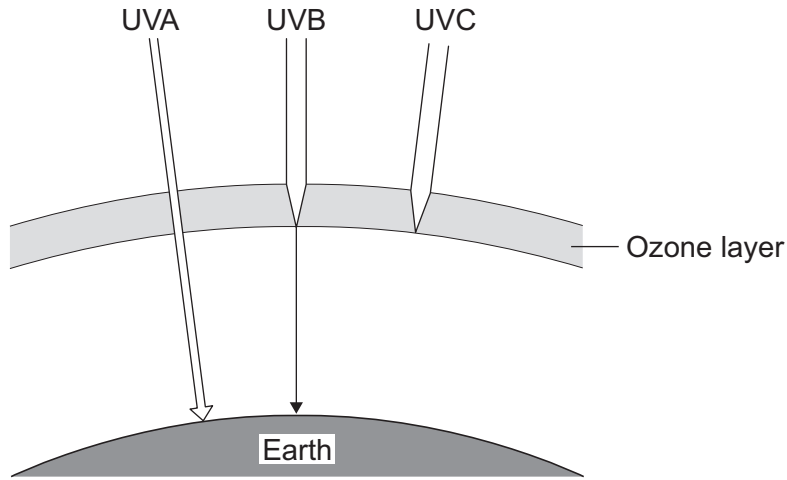
1
.....
2
.....
(2 marks)

5



8 When outside, we need to protect our skin and eyes from the harmful effects of ultraviolet (UV) radiation. There are three types of UV radiation.

8 (a) The diagram shows the effect of the ozone layer on each of the three types of UV radiation. The width of the arrow represents the amount of UV radiation.



8 (a) (i) Which type of UV radiation will **not** have a harmful effect on our skin or eyes?

Draw a ring around your answer.

UVA

UVB

UVC

Give a reason for your answer.

.....

.....

(2 marks)

8 (a) (ii) The ozone layer above some places on the Earth's surface is very thin.

Explain the effect of a decrease in the thickness of the ozone layer on the risk to health from UV radiation, for people living at these places.

.....

.....

.....

.....

(2 marks)

Question 8 continues on the next page

Turn over ►



- 8 (b)** Scientists have investigated the effect that the type of ground surface has on the amount of UV radiation entering the eye.

Two dummies, each fitted with UV sensors in the eyes, were used to measure the intensity of the UV radiation over the same period of time. The measurements were taken with one dummy facing the Sun, and the other dummy facing away from the Sun.

Measurements were taken in two places, one on a snow-covered area, the other on a sandy beach.

The results of their investigation are given in the table.

Position of the dummy head	Intensity of UV radiation in the snow-covered area in arbitrary units	Intensity of UV radiation in the sandy beach area in arbitrary units
Facing the Sun	650	250
Facing away from the Sun	520	50

- 8 (b) (i)** What was the independent variable in this investigation?

.....
(1 mark)

- 8 (b) (ii)** How could the reliability of the data collected in this investigation have been improved?

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

- 8 (b) (iii)** Some of the UV radiation measured by the sensors has been reflected from the surface of the ground.

Which surface is the best reflector of UV radiation, sand or snow?

Draw a ring around your answer. **sand** **snow**

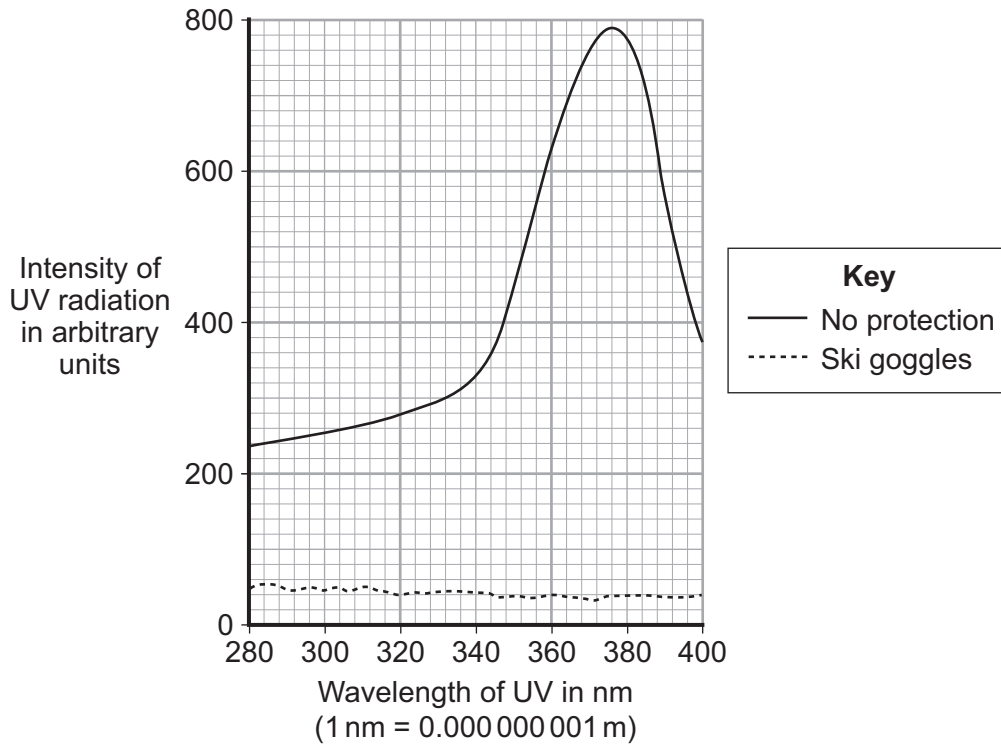
Give **one** reason for your answer.

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



8 (c) Ski goggles are designed to block UV radiation. The manufacturer of one brand of ski goggles claims that the goggles block 100% of all UV radiation. These goggles were tested using UV radiation with a range of different wavelengths.

The results of the test are shown in the graph.



Do the results of the test support the claim made by the manufacturer?

Draw a ring around your answer. **Yes** **No**

Explain the reason for your answer.

.....

.....

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.....

(2 marks)

9

END OF QUESTIONS



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