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| Centre Number | | Candidate Number | |
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| For Examiner's Use |
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General Certificate of Secondary Education
June 2007



SCIENCE B
Unit Physics P1

PHY1H
H

PHYSICS
Unit Physics P1

Higher Tier

Monday 25 June 2007 9.00 am to 9.45 am

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|---|
| <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 blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- 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.

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



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

1 Some types of food are treated with *gamma* radiation. Low doses of radiation slow down the ripening of fresh fruit and vegetables while higher doses of radiation kill the bacteria that make the food go off.

(a) (i) What is *gamma* radiation?

.....
(1 mark)

(ii) Food packed in crates or boxes can be treated using this method.

Why must a source that emits *gamma* radiation be used?

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

(iii) A suitable source of gamma radiation is the isotope caesium 137.

Complete the following sentence by choosing the correct word from the box.

| | | |
|------------------|-----------------|----------------|
| electrons | neutrons | protons |
|------------------|-----------------|----------------|

An atom of caesium 137 has two more than an atom of caesium 135.

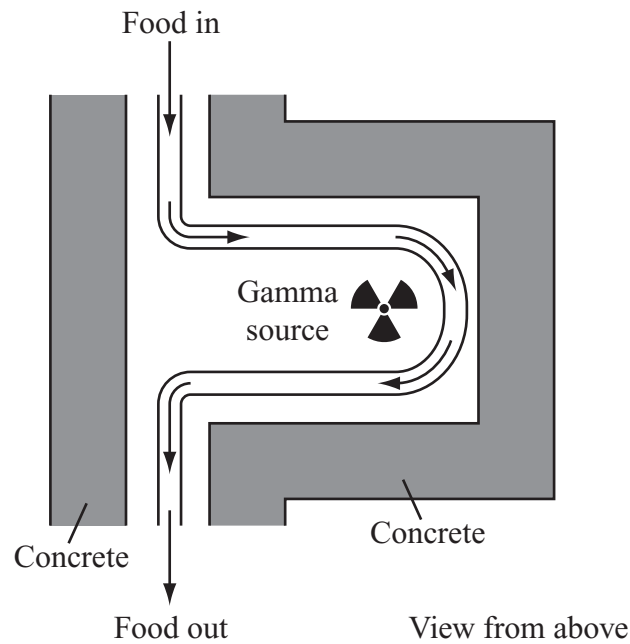
(1 mark)

Question 1 continues on the next page

Turn over ►



- (b) The diagram shows how a conveyor belt can be used to move food past the radioactive source.



- (i) How do the concrete walls reduce the radiation hazard to workers outside the food treatment area?

.....

 (1 mark)

- (ii) Suggest **one** way that the dose of radiation received by the food could be increased other than by changing the radioactive source.

.....

 (1 mark)



(c) Some people may not like the idea of eating food treated with radiation.

(i) What evidence could a food scientist produce to show that food treated with radiation is safe to eat?

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

(2 marks)

(ii) The diagram shows the sign displayed on food treated with radiation.



Why is it important for people to know which foods have been treated with radiation?

.....
.....

(1 mark)

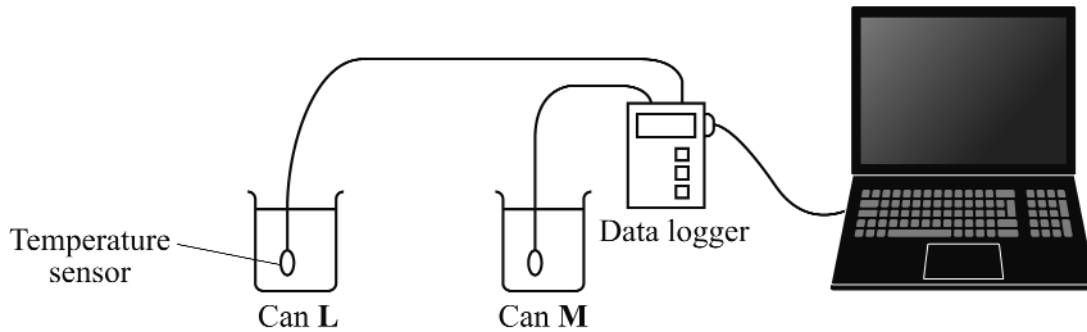
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Turn over for the next question

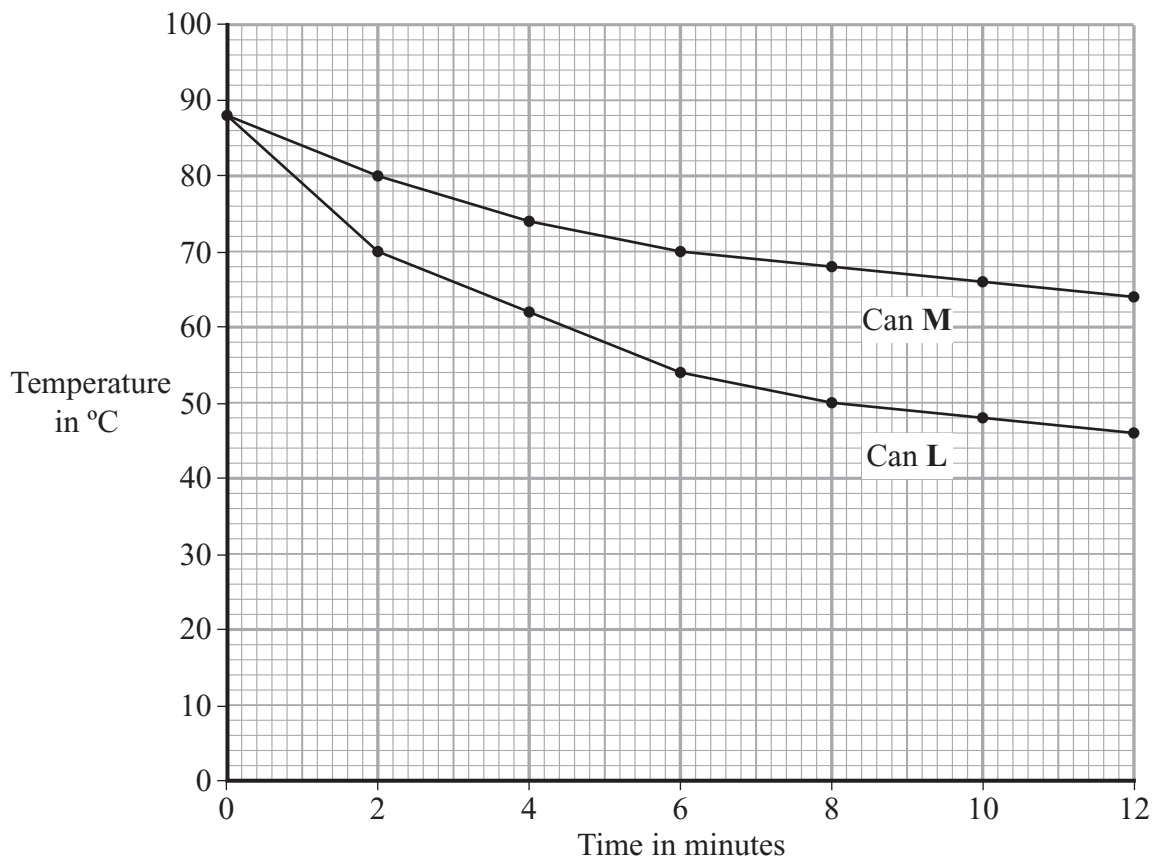
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- 2 A student was asked to investigate the heat loss from two metal cans, **L** and **M**. The cans were identical except for the outside colour.



The student filled the two cans with equal volumes of hot water. He then placed the temperature sensors in the water and started the data logger. The computer used the data to draw the graph below.



(a) Which **one** of the following is a categoric variable?

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

the outside colour of the cans

the starting temperature of the hot water

the time

the volume of hot water

(1 mark)

(b) For can **L**, state the temperature drop of the water:

(i) in the **first** two-minute interval

.....

(1 mark)

(ii) in the **second** two-minute interval.

.....

(1 mark)

(c) In both cans the water cooled faster at the start of the investigation than at the end of the investigation. Why?

.....

.....

(1 mark)

(d) One can was black on the outside and the other can was white on the outside.

What colour was can **L**?

Explain the reason for your answer.

.....

.....

.....

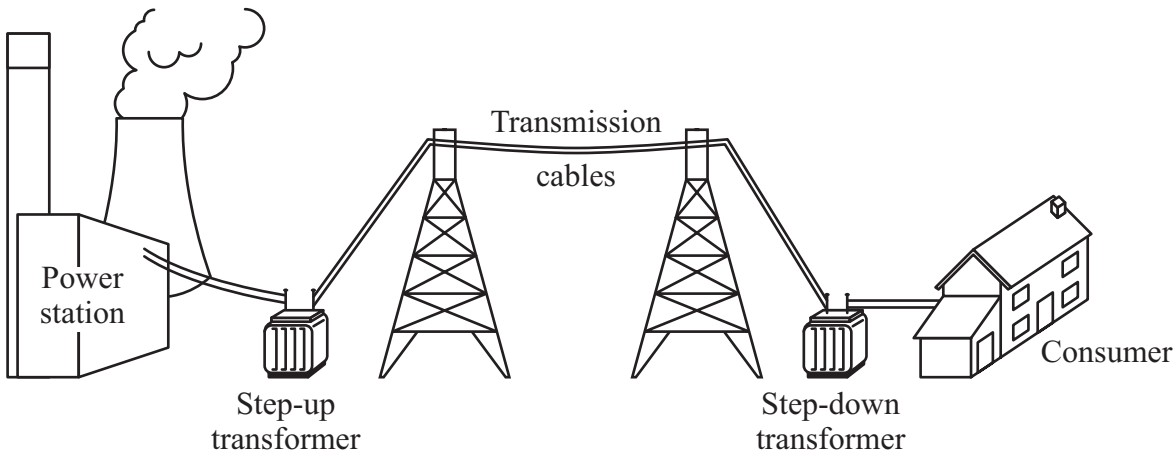
(3 marks)

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Turn over ►



3 The diagram shows how electricity is distributed from power stations to consumers.



- (a) (i) What name is given to the network of cables and transformers that links power stations to consumers?

.....
(1 mark)

- (ii) What does a step-up transformer do?

.....
(1 mark)

- (iii) Explain why step-up transformers are used in the electricity distribution system.

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

- (b) Most of the world's electricity is generated in power stations that burn fossil fuels.

State **one** environmental problem that burning fossil fuels produces.

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



- (c) Electricity can be generated using energy from the wind. A company wants to build a new wind farm. Not everyone thinks that this is a good idea.



- (i) What arguments could the company give to persuade people that a wind farm is a good idea?

.....

.....

.....

.....

(2 marks)

- (ii) What reasons may be given by the people who think that wind farms are **not** a good idea?

.....

.....

.....

.....

(2 marks)

Turn over ►



- 4 (a) A student listens to the sound waves produced by a car siren. When the car is stationary, the student hears a constant frequency sound.

Describe how the wavelength and frequency of the sound waves heard by the student change when the car is driven away from the student.

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

(2 marks)

- (b) Satellites fitted with various telescopes orbit the Earth. These telescopes detect different types of electromagnetic radiation.

Why are telescopes that detect different types of electromagnetic waves used to observe the Universe?

.....
.....

(1 mark)

- (c) In 2005 a space telescope detected a star that exploded 13 billion years ago. The light from the star shows the biggest *red-shift* ever measured.

- (i) What is *red-shift*?

.....
.....

(1 mark)

- (ii) What does the measurement of its red-shift tell scientists about this star?

.....
.....

(1 mark)



(d) Red-shift provides evidence for the ‘big bang’ theory.

(i) Describe the ‘big bang’ theory.

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

(2 marks)

(ii) Suggest what scientists should do if new evidence were found that did not support the ‘big bang’ theory.

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

(1 mark)

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Turn over for the next question

Turn over ►



5 (a) The new Tetra communications system to be used by the police transmits *digital signals* using microwaves of wavelength 75 cm. The signals travel through the air at 300 000 000 m/s.

(i) What is a *digital signal*?

.....
(1 mark)

(ii) Use the following equation to calculate the frequency of the microwaves used by the Tetra system. Show clearly how you work out your answer.

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

.....
.....

Frequency = hertz
(2 marks)

(b) Read the following extract from a newspaper and then answer the questions that follow.

Residents of Stag Hill Court, a luxury block of flats, are shocked at the plans to site a mobile phone mast on the roof of the flats. They oppose the mast on health grounds, quoting research in Germany that has found a possible increase in cases of cancer around mobile phone masts.

A spokesperson for the telecoms company said, ‘The residents should not worry. The research carried out by our own scientists has found no link between ill health and mobile phone masts’.

This has not reassured the residents, who argue that new independent research is urgently needed.

(i) Explain why living near a mobile phone mast could cause ill health.

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

(3 marks)



(ii) Suggest **two** reasons why the residents have **not** been reassured by the research carried out by the telecoms company.

1.....

.....

2.....

.....

(2 marks)

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- 6 (a) The table gives information about some ways of reducing the energy consumption in a house.

| Method of reducing energy consumption | Installation cost in £ | Annual saving on energy bills in £ |
|---------------------------------------|------------------------|------------------------------------|
| Fit a new hot water boiler | 1800 | 200 |
| Fit a solar water heater | 2400 | 100 |
| Fit underfloor heating | 600 | 50 |
| Fit thermostatic radiator valves | 75 | 20 |

Which way of reducing energy consumption is most cost effective over a 10-year period?

To obtain full marks you must support your answer with calculations.

.....

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.....

(3 marks)

- (b) Explain why using an energy-efficient light bulb instead of an ordinary light bulb reduces the amount of carbon dioxide emitted into the atmosphere.

.....

.....

.....

.....

(2 marks)

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| 5 |
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END OF QUESTIONS



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