

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Secondary Education
January 2009



SCIENCE B
Unit Physics P1

PHY1H
H

PHYSICS
Unit Physics P1

Higher Tier

Monday 19 January 2009 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.

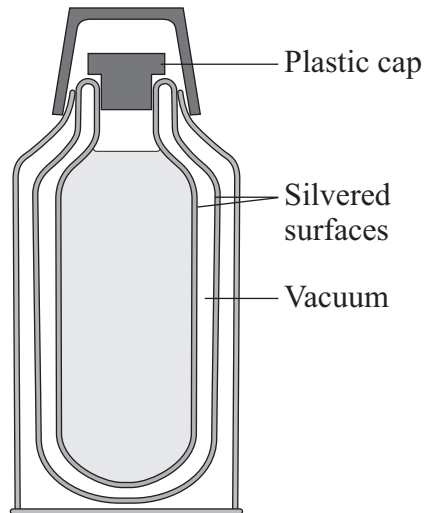
For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			



J A N O 9 P H Y 1 H O 1

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

- 1 A vacuum flask is designed to reduce the rate of heat transfer.



- 1 (a) (i) Complete the table to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

Feature	Conduction	Convection	Radiation
vacuum	✓	✓	
silvered surfaces			
plastic cap			

(2 marks)

- 1 (a) (ii) Explain why the vacuum between the glass walls of the flask reduces heat transfer by conduction and convection.

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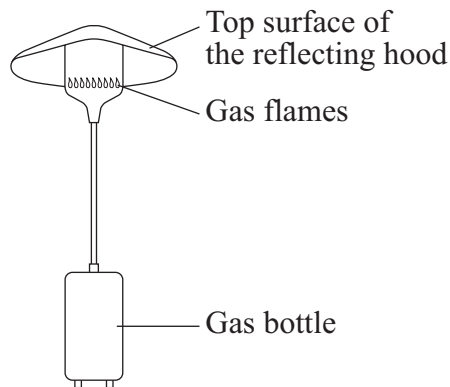
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(2 marks)



- 1 (b) The diagram shows a gas flame patio heater.



- 1 (b) (i) Explain why the top surface of the reflecting hood should be a light, shiny surface rather than a dark, matt surface.

.....

.....

.....

(2 marks)

- 1 (b) (ii) Most of the chemical energy in the gas is transformed into heat. A **small** amount of chemical energy is transformed into light.

Draw and label a Sankey diagram for the patio heater.

(2 marks)

- 1 (b) (iii) State why the total energy supplied to the patio heater must always equal the total energy transferred by the patio heater.

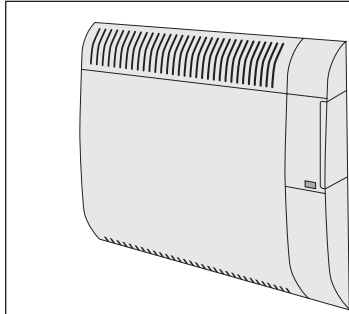
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(1 mark)

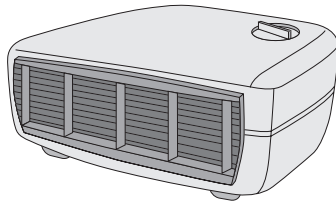


2 The pictures show three different types of electric heater.



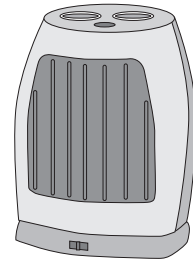
**400 W oil-filled panel heater
(wall mounted)**

- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



3 kW fan heater

- 2 heat settings
- Power indicator light
- Cool air fan setting



1800 W ceramic heater

- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out

2 (a) The ceramic heater is run on full power for 5 hours.

Use the following equation to calculate, in kilowatt-hours, the amount of energy transferred from the mains to the heater.

$$\text{energy transferred} = \text{power} \times \text{time}$$

Show clearly how you work out your answer.

.....

Energy transferred = kilowatt-hours
 (2 marks)

2 (b) Which heater will be the most expensive to run on its highest heat setting?

.....
 (1 mark)



2 (c) A heater is needed for a small office.

Comparing each type of heater with the other two, give **one** advantage of using each type of heater in the office.

oil-filled panel heater

.....

fan heater.....

.....

ceramic heater

.....

(3 marks)

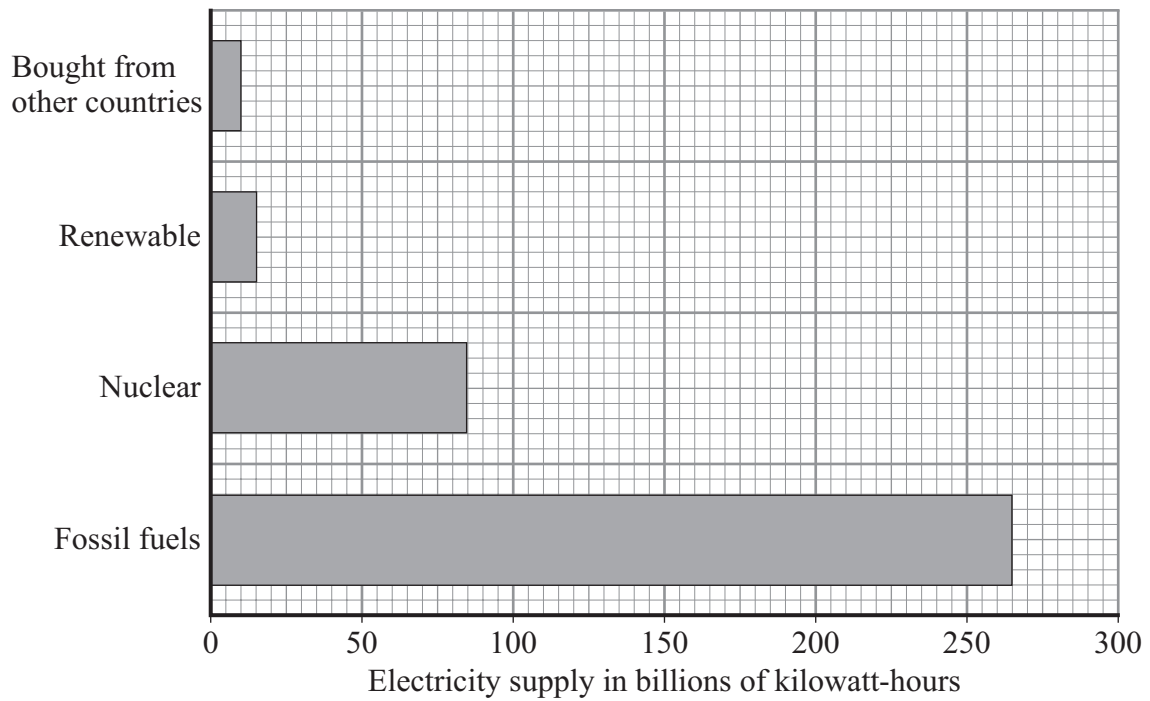
6

Turn over for the next question

Turn over ▶



3 The bar chart shows how the UK's electricity demands in 2007 were met.



3 (a) What proportion of electricity was generated using renewable energy sources?

Show clearly how you work out your answer.

.....

.....

.....

.....

(2 marks)



- 3 (b) By 2020, most of the UK's nuclear reactors and one-third of coal-fired power stations are due to close, yet the demand for electricity is expected to increase.

Four students, **A**, **B**, **C** and **D**, were asked how a demand of 380 billion kilowatt-hours could be met. They made the suggestions given in the table.

Student	Fossil fuels	Nuclear	Renewable	Bought from other countries
A	200	100	40	40
B	80	240	40	20
C	160	80	100	40
D	280	0	100	0

- 3 (b) (i) Which student has made the suggestion most likely to result in the lowest carbon dioxide emissions?

.....

Give a reason for your answer.

.....

.....

(2 marks)

- 3 (b) (ii) Suggest **one** realistic way in which a householder could help to reduce the annual electricity demand.

.....

.....

(1 mark)

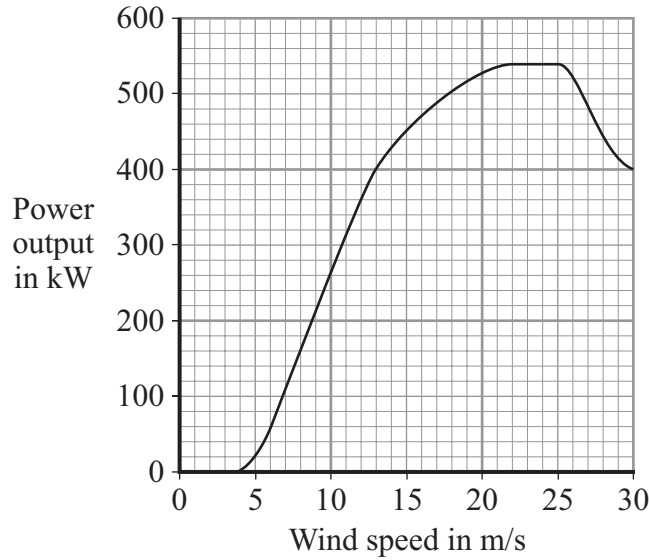
Question 3 continues on the next page

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- 3 (c) To increase the amount of electricity generated using renewable energy resources would probably involve erecting many new wind turbines.

The graph shows the power curve of a wind turbine.



- 3 (c) (i) Describe, in detail, how the power output of the turbine varies with the wind speed.

.....

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(3 marks)

- 3 (c) (ii) Give **one** disadvantage of using wind turbines to generate a high proportion of the electricity required in the UK.

.....

.....

(1 mark)



4 Most elements have some *isotopes* which are *radioactive*.

4 (a) What is meant by the terms:

4 (a) (i) *isotopes*

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

4 (a) (ii) *radioactive?*

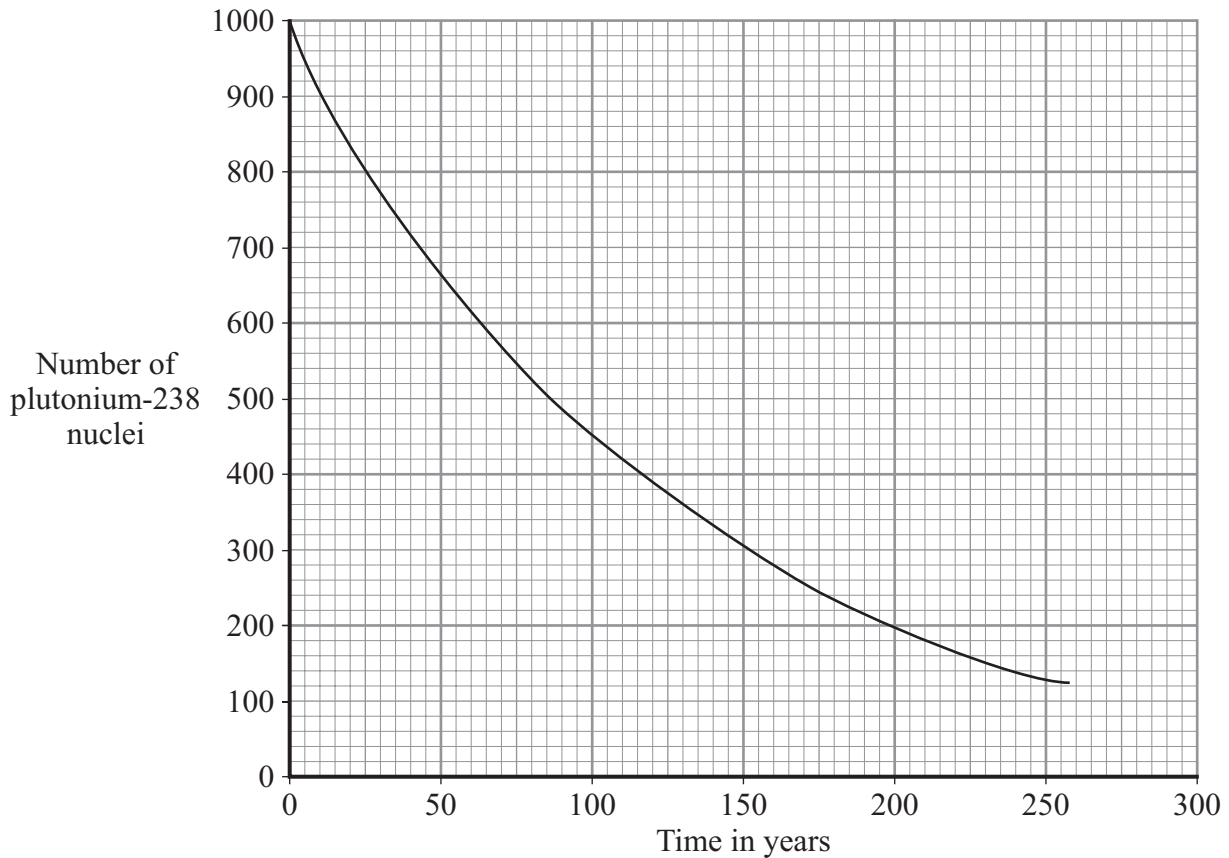
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(1 mark)

Question 4 continues on the next page

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- 4 (b) The graph shows how the number of nuclei in a sample of the radioactive isotope plutonium-238 changes with time.



Use the graph to find the half-life of plutonium-238.

Show clearly on the graph how you obtain your answer.

Half-life = years
(2 marks)

- 4 (c) The Cassini spacecraft launched in 1997 took seven years to reach Saturn. The electricity to power the instruments on board the spacecraft is generated using the heat produced from the decay of plutonium-238.

- 4 (c) (i) Plutonium-238 decays by emitting alpha particles.

What is an alpha particle?

.....
(1 mark)



4 (c) (ii) During the 11 years that Cassini will orbit Saturn, the output from the generators will decrease.

Explain why.

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(2 marks)

4 (d) Plutonium-238 is highly dangerous. A tiny amount taken into the body is enough to kill a human.

4 (d) (i) Plutonium-238 is unlikely to cause any harm if it is outside the body but is likely to kill if it is inside the body.

Explain why.

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

4 (d) (ii) In 1964, a satellite powered by plutonium-238 was destroyed, causing the release of radioactive material into the atmosphere.

Suggest why some environmental groups protested about the launch of Cassini.

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(1 mark)

10

Turn over ►



5 (a) Microwaves are one type of electromagnetic wave.

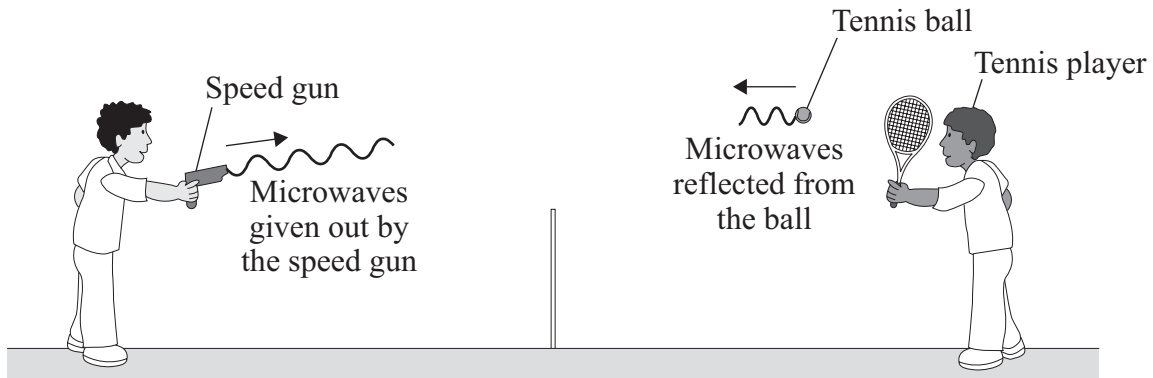
5 (a) (i) Which type of electromagnetic wave has a lower frequency than microwaves?

.....
(1 mark)

5 (a) (ii) What do all types of electromagnetic wave transfer from one place to another?

.....
(1 mark)

5 (b) The picture shows a tennis coach using a speed gun to measure how fast the player serves the ball.



5 (b) (i) The microwaves transmitted by the speed gun have a frequency of 24 000 000 000 Hz and travel through the air at 300 000 000 m/s.

Use the equation in the box to calculate the wavelength of the microwaves emitted from the speed gun.

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

Show clearly how you work out your answer.

.....
.....

Wavelength = m
(2 marks)



5 (b) (ii) Some of the microwaves transmitted by the speed gun are absorbed by the ball.

What effect will the absorbed microwaves have on the ball?

.....

.....

(1 mark)

5 (b) (iii) Some of the microwaves transmitted by the speed gun are reflected from the moving ball back towards the speed gun.

Describe how the wavelength and frequency of the microwaves change as they are reflected from the moving ball.

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(2 marks)

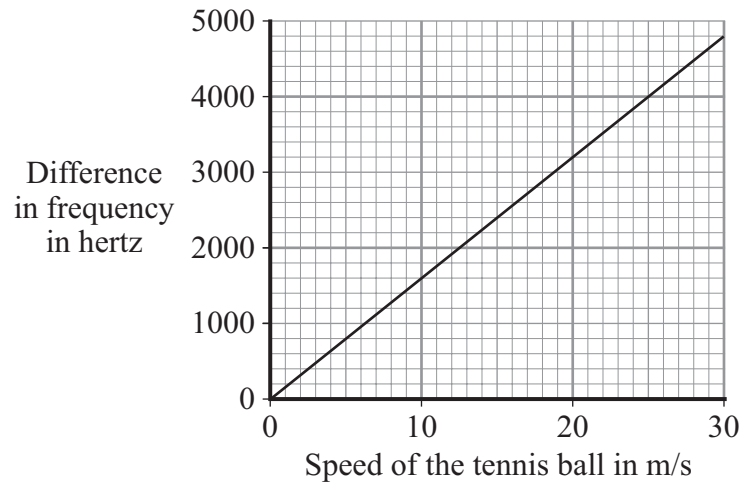
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5 (c) The difference in frequency between the transmitted and reflected waves is detected by the speed gun. This data is processed by a computer chip inside the speed gun, and then displayed as a speed.

5 (c) (i) The graph shows that the difference in frequency between the transmitted and reflected waves is directly proportional to the speed of the moving ball.



Why has a line graph been used to display the data?

.....

 (1 mark)

5 (c) (ii) Is it better to transfer the data to the computer as an analogue signal or as a digital signal?

.....
 Give a reason for your answer.

 (1 mark)



5 (c) (iii) What is the difference between an analogue signal and a digital signal?

You may draw a labelled diagram to help you with your answer.

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.....

(2 marks)

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11

END OF QUESTIONS



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ANSWER IN THE SPACES PROVIDED**

