Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2009

SCIENCE B **PHY1F**
Unit Physics P1 **F**

PHYSICS
Unit Physics P1

Foundation Tier

Monday 19 January 2009 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. 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		6	
2		7	
3			
4			
5			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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ANSWER IN THE SPACES PROVIDED

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

1 The table shows the electromagnetic spectrum.
Three types of wave have been missed out.

Gamma rays		Ultraviolet rays	Visible light		Micro-waves	

Shortest wavelength ⟷ Longest wavelength

1 (a) (i) Use words from the box to complete the table.

infra red rays	**radio waves**	**X-rays**

(2 marks)

1 (a) (ii) Which **one** of the following gives a use of gamma rays?

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

to communicate with satellites ☐

to see objects ☐

to kill cancer cells ☐

(1 mark)

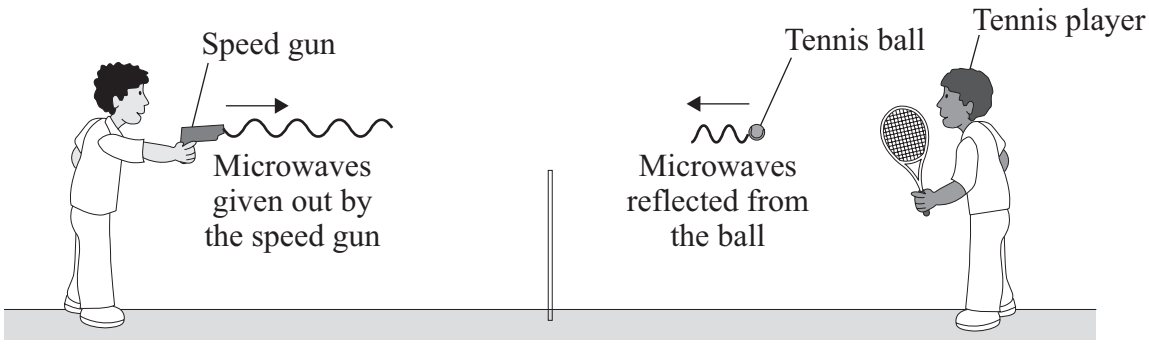
1 (a) (iii) Complete the following sentence by drawing a ring around the correct word in the box.

All electromagnetic waves move [energy / gases / particles] from one place to another.

(1 mark)

4

2 (a) The picture shows a speed gun being used to measure how fast a tennis player hits the ball.



Some of the microwaves from the speed gun are absorbed by the ball and some are reflected by the ball.

2 (a) (i) Complete the following sentence by choosing **one** of the phrases from the box.

longer than	**the same as**	**shorter than**

The wavelength of the microwaves reflected from the ball are

..... the wavelength of the microwaves from the speed gun.

(1 mark)

2 (a) (ii) Complete the following sentence by drawing a ring around the correct line in the box.

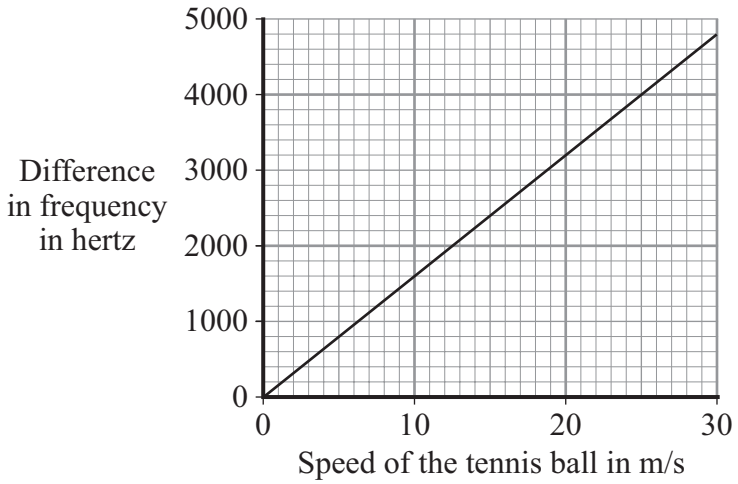
When the ball absorbs microwaves, its temperature will

decrease slightly
not change
increase slightly

.

(1 mark)

2 (b) The microwaves reflected from the ball have a higher frequency than the microwaves from the speed gun.
The graph shows how the difference between the two frequencies depends on the speed of the ball.



2 (b) (i) Describe the pattern that links the difference between the two frequencies and the speed of the ball.

.....

.....

(1 mark)

2 (b) (ii) The speed gun measures the difference between the two frequencies as 3200 Hz.

Use the graph to find the speed of the tennis ball.
Show clearly on the graph how you obtain your answer.

Speed of the tennis ball = ... m/s

(2 marks)

2 (b) (iii) Which **one** of the following gives the reason why the data has been shown as a line graph and **not** as a bar chart?

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

Frequency and speed are both categoric variables. ☐

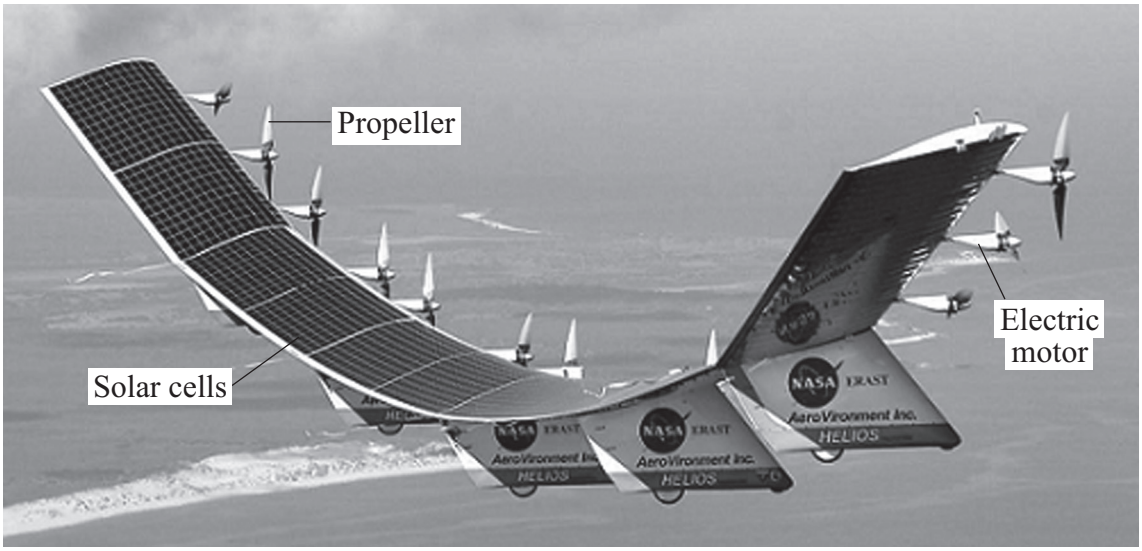
Frequency and speed are both continuous variables. ☐

Speed is a continuous variable and frequency is a categoric variable. ☐

(1 mark)

6

3 The picture shows a solar-powered aircraft. The aircraft has no pilot.



3 (a) Use words from the box to complete the following sentence.

electrical	**heat**	**light**	**sound**

Solar cells are designed to transform ..... energy into

..... energy.

(2 marks)

3 (b) On a summer day, 175 000 joules of energy are supplied to the aircraft's solar cells every second. The useful energy transferred by the solar cells is 35 000 joules every second.

3 (b) (i) Use the equation in the box to calculate the efficiency of the solar cells.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

3 (b) (ii) What happens to the energy that is **not** usefully transferred by the solar cells?

.....

(1 mark)

3 (c) The aircraft propellers are driven by electric motors. As well as the solar cells, there are fuel cells that provide additional power to the electric motors.

3 (c) (i) Suggest **one** advantage of the aircraft having fuel cells as well as the solar cells.

.....

.....

(1 mark)

3 (c) (ii) Give **one** environmental advantage of using electric motors to drive the aircraft propellers rather than motors that burn a fuel.

.....

.....

(1 mark)

3 (c) (iii) Eventually, the designers want to produce an unmanned aircraft that can fly at twice the height of a passenger jet for up to six months.

Suggest **one** possible use for an aircraft such as this.

.....

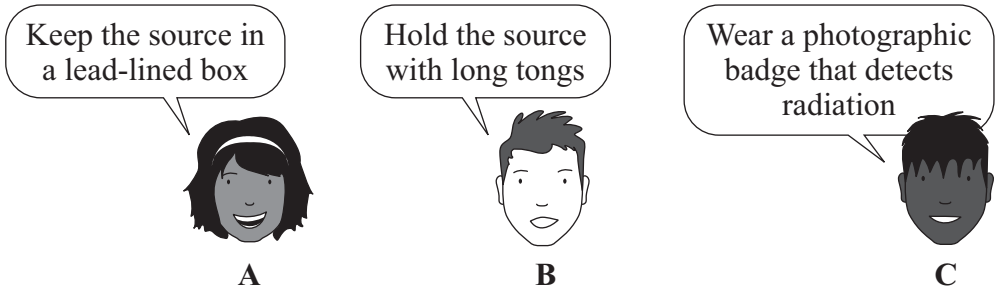
.....

(1 mark)

8

Turn over for the next question

4 Before using a radioactive source, a teacher asked her students to suggest safety procedures that would reduce her exposure to the radiation. The students made the following suggestions.



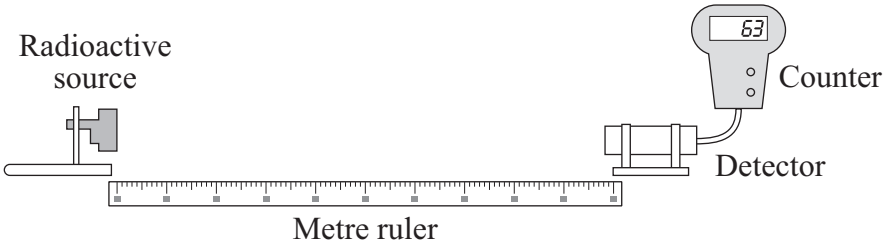
A **B** **C**

4 (a) Which suggestion, **A**, **B** or **C**, would **not** reduce the exposure of the teacher to radiation?

.....

(1 mark)

4 (b) The diagram shows how the teacher measured the distance that the radiation travelled from the source. The count-rate at different distances from the source was measured and recorded in the table.



Distance from source to detector in cm	Count-rate in counts per minute
20	85
40	81
60	58
80	53
100	23

What type of radiation was the source emitting, alpha, beta or gamma?

.....

Explain the reasons for your choice.

.....

.....

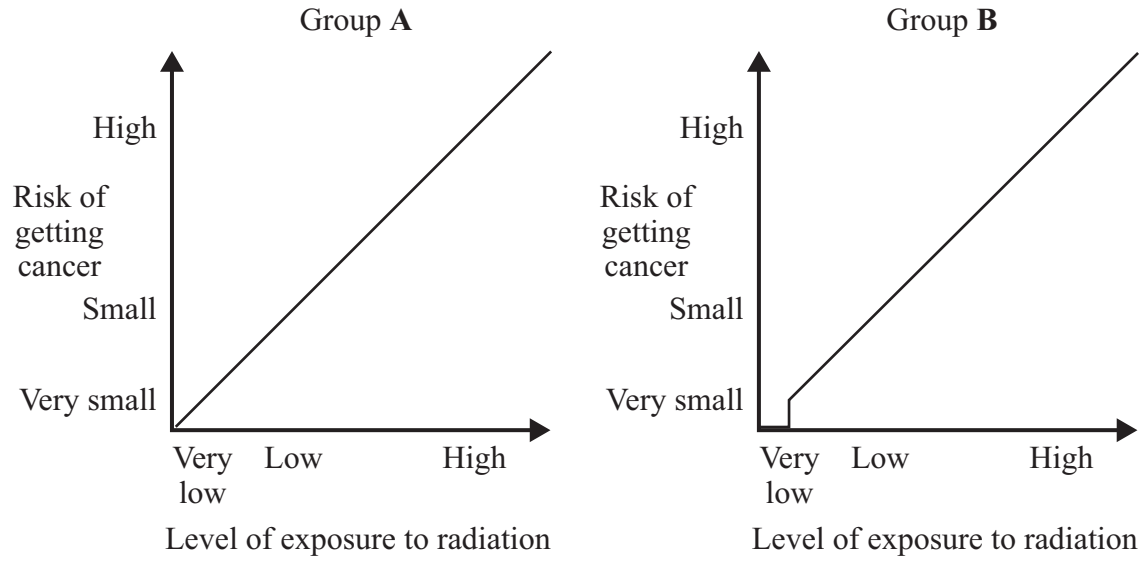
.....

.....

(3 marks)

Question 4 continues on the next page

4 (c) The graphs show how two groups of scientists, **A** and **B**, link exposure to radiation and the risk of getting cancer.



4 (c) (i) Complete the following sentence using a word or phrase from the box.

decreases	**has no effect on**	**increases**

Both groups of scientists agree that a high level of exposure to radiation

..... the risk of getting cancer.

(1 mark)

4 (c) (ii) Use the graphs to describe carefully how the two groups of scientists disagree when the level of exposure to radiation is very low.

.....

.....

.....

.....

(2 marks)

7

Turn over for the next question

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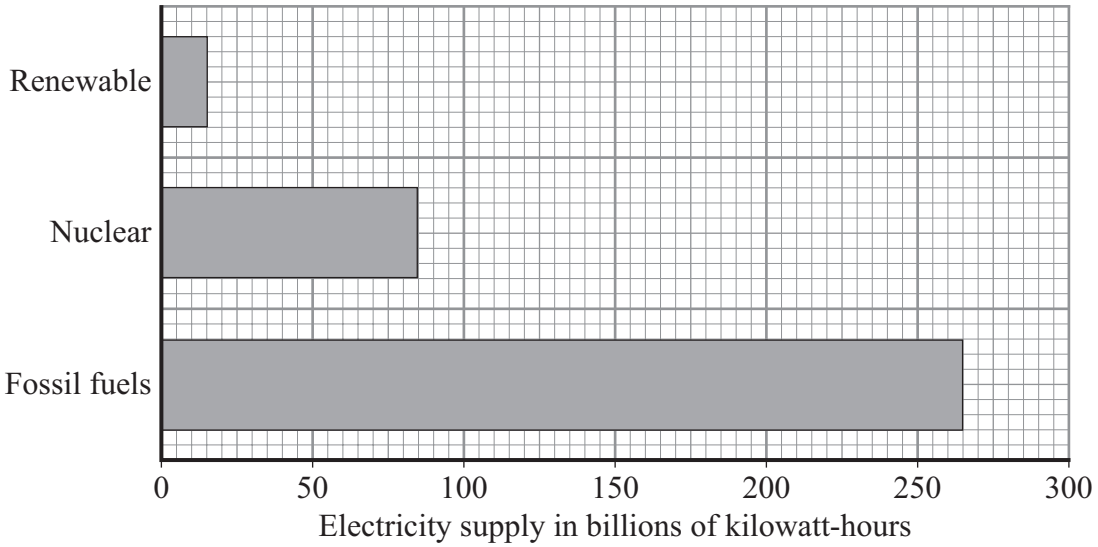
5 The bar chart shows the different energy sources used to generate the UK's electricity in 2007.



5 (a) (i) The wind is a renewable energy source.

Name **one** more renewable energy source used to generate electricity.

.....

(1 mark)

5 (a) (ii) Complete the following sentence by drawing a ring around the correct line in the box.

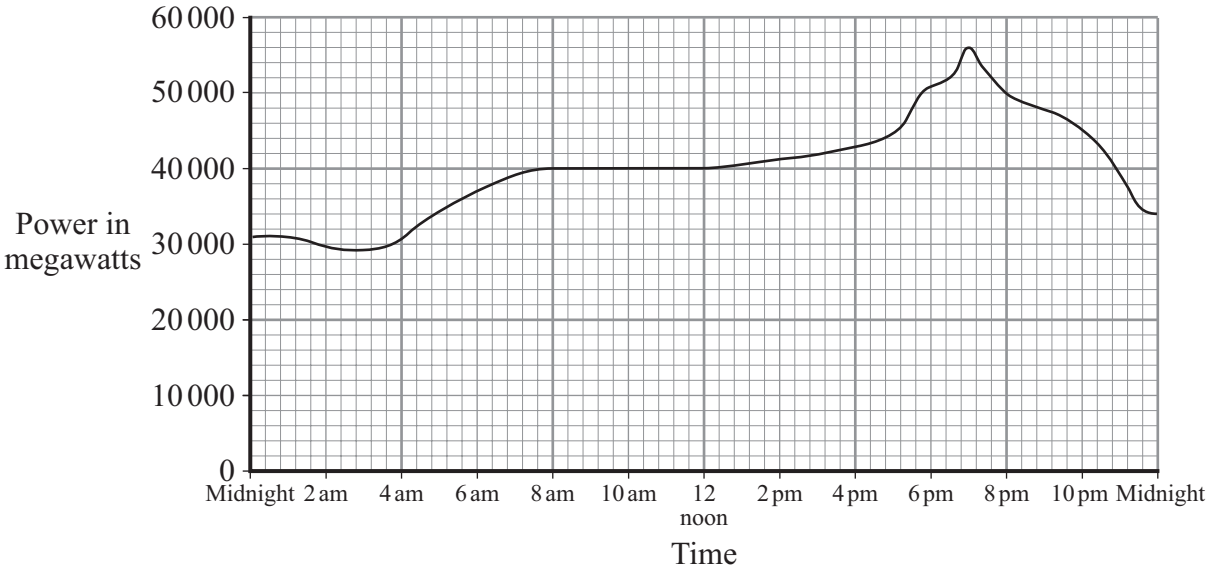
Using less fossil fuels to generate electricity will

decrease
not change
increase

the amount of carbon dioxide emitted into the atmosphere.

(1 mark)

5 (b) The graph shows how the demand for electricity in the UK varied over one day in the winter.



5 (b) (i) Describe how the demand for electricity varied between 4.00 am and 10.00 am.

.....

.....

.....

.....

(2 marks)

5 (b) (ii) Which type of power station has the fastest start-up time?

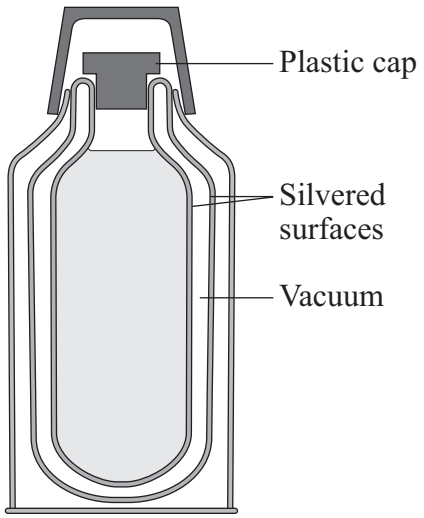
Draw a ring around your answer.

coal **natural gas** **nuclear** **oil**

(1 mark)

5

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



6 (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)

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

.....

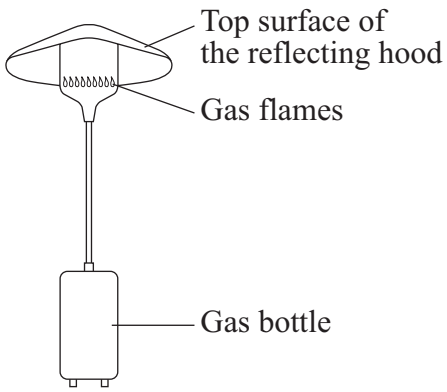
.....

.....

.....

(2 marks)

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



6 (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)

6 (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)

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

.....

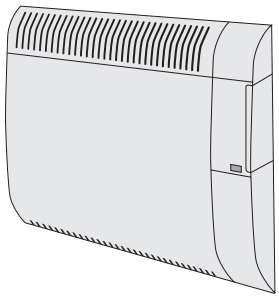
.....

(1 mark)

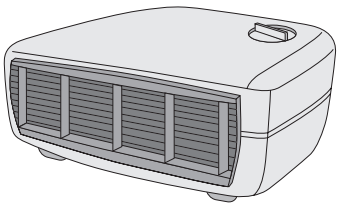
9

Turn over ▶

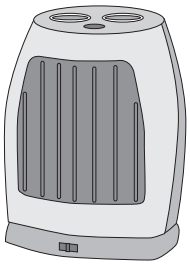
7 The pictures show three different types of electric heater.



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

7 (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.

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kilowatt-hours

(2 marks)

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

.....

(1 mark)

7 (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

END OF QUESTIONS

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