Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

AQA

General Certificate of Secondary Education
Foundation Tier
January 2012

Science B
Unit Physics P1

PHY1F

F

Physics
Unit Physics P1

Monday 30 January 2012 1.30 pm to 2.15 pm

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.

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

1 (a) **List A** gives names of four types of wave. **List B** gives information about different types of wave.

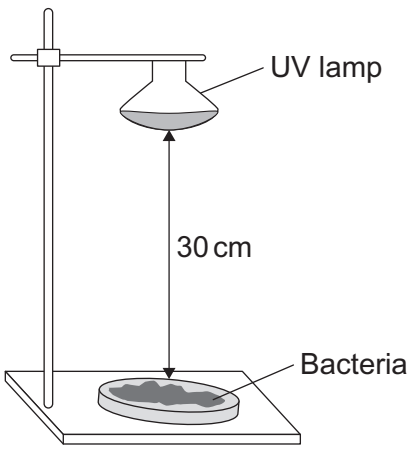
Draw a line to link each type of wave in **List A** to the information about that type of wave in **List B**.

Draw only **four** lines.

List A **Type of wave**	**List B** **Information about waves**
	is **not** part of the electromagnetic spectrum
infrared	
	used to produce images of broken bones
light	
	can cause sunburn
sound	
	can be used to cook food
X-rays	
	used by our eyes to see

(4 marks)

1 (b) A scientist investigated the use of ultraviolet (UV) radiation for killing one particular type of bacteria.



The scientist exposed the bacteria to the UV radiation for different amounts of time. She then measured the amount of bacteria still living.

1 (b) (i) Which of the following was a control variable in this investigation?

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

the distance between the UV lamp and the bacteria ☐

the time the bacteria were exposed to the UV radiation ☐

the amount of bacteria still living after exposure to the UV radiation ☐

(1 mark)

1 (b) (ii) The results obtained by the scientist are given in the table.

Time of exposure to UV radiation in minutes	Percentage (%) of bacteria still living after exposure to UV radiation
1	100
5	95
20	40
30	15
45	0

What is the pattern linking the time of exposure to UV radiation and the percentage of bacteria still living after exposure?

.....

.....

(1 mark)

1 (b) (iii) The scientist concluded that:
'Exposure to UV radiation for 45 minutes will kill **all** types of bacteria.'

It is wrong to conclude that 45 minutes of exposure to UV radiation will kill **all** bacteria.

Why is it wrong to conclude this?

.....

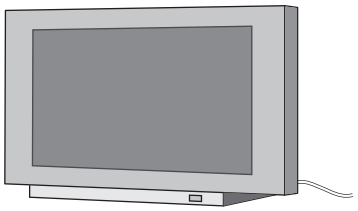
.....

(1 mark)

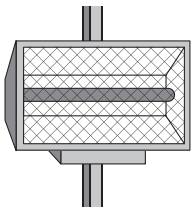
7

Turn over ▶

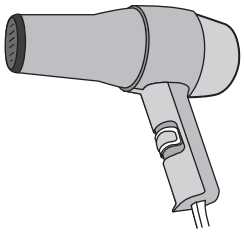
2 The data included in the diagrams gives the power of the electrical appliances.



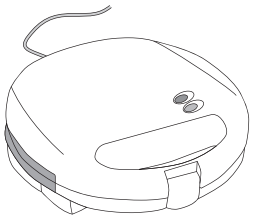
TV
160 W



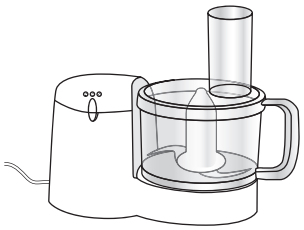
Radiant heater
1.0 kW



Hairdryer
1100 W



Sandwich toaster
1.1 kW



Food processor
0.4 kW

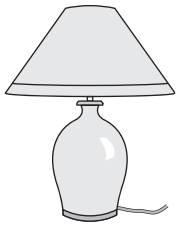


Table lamp
40 W

2 (a) (i) Which appliance is designed to transform electrical energy to light and sound?

.....

(1 mark)

2 (a) (ii) Which **two** appliances transform energy at the same rate?

..... and .....

(1 mark)

2 (b) During one week, the food processor is used for a total of 3 hours.

2 (b) (i) Use the equation in the box to calculate the energy transferred, in kilowatt-hours, by the food processor in 3 hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

Show clearly how you work out your answer.

.....

.....

.....

.....

Energy transferred = ... kWh

(2 marks)

2 (b) (ii) Electricity costs 15 pence per kilowatt-hour.

Use the equation in the box to calculate the cost of using the food processor for 3 hours.

total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour

Show clearly how you work out your answer.

.....

.....

.....

.....

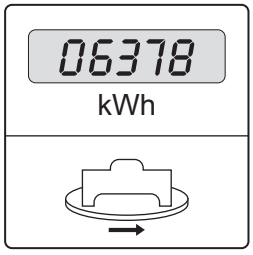
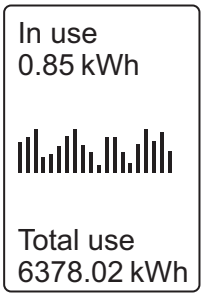
Cost = ... pence

(2 marks)

Question 2 continues on the next page

2 (c) A homeowner decides to monitor the amount of electrical energy used in his home.

He can do this by using an electricity meter or by using a separate electronic device.

Electricity meter	Electronic device
Records to the nearest kilowatt-hour	Records to the nearest 1/100th kilowatt-hour
	

2 (c) (i) Use one word from the box to complete the following sentence.

precise	**reliable**	**valid**

The reading given by the electronic device is more ..... than the reading given by the electricity meter.

(1 mark)

2 (c) (ii) Monitoring the electrical energy used in a home may help people to save money by encouraging them to use less electricity.

Explain why, apart from saving money, it is important for people to use less electricity.

.....

.....

.....

.....

(2 marks)

9

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

3 The world's biggest offshore wind farm, built off the Kent coast, started generating electricity in September 2010.

3 (a) One advantage of using the wind to generate electricity is that it is a renewable energy source.

3 (a) (i) Give **one** other advantage of using the wind to generate electricity.

.....

.....

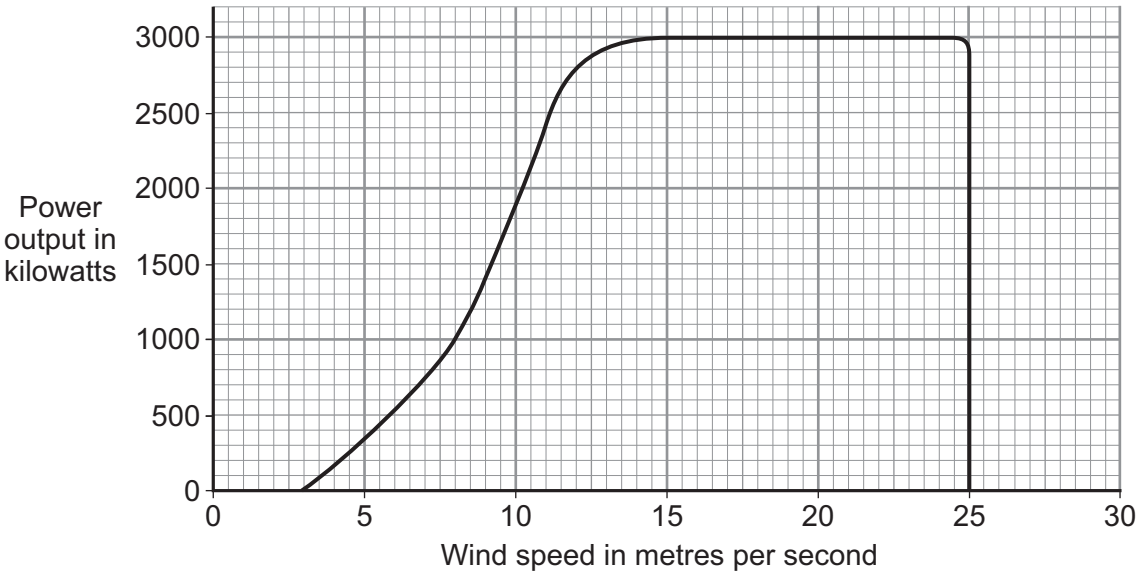
(1 mark)

3 (a) (ii) Name **one** other renewable energy source used to generate electricity.

.....

(1 mark)

3 (b) The graph shows how wind speed affects the power output from a large wind turbine.



3 (b) (i) What is the maximum possible power output from this wind turbine?

.....

(1 mark)

3 (b) (ii) Read this part of a newspaper article.

Cold weather stops wind turbines

For the past two weeks, most of the UK's wind turbines have been generating less than one sixth of their maximum power output. To avoid major power cuts in the future, some experts have said that more nuclear power stations need to be built to provide a reliable source of energy.

Use the graph to explain why the power output from the wind turbines was less than one sixth of the maximum.

.....

.....

.....

.....

(2 marks)

3 (b) (iii) Having more nuclear power stations will help to avoid power cuts in the future.

Which **two** of these reasons explain why?

Put a tick (✓) in the boxes next to your answers.

A small amount of nuclear fuel generates a large amount of electricity. ☐

The radioactive waste produced must be stored for many years. ☐

Nuclear power stations do not depend on the weather to generate electricity. ☐

(1 mark)

6

4 Certain types of atom emit alpha, beta or gamma radiation. The radiation is emitted from the centre of the atom.

4 (a) What name is given to the centre of an atom?

.....

(1 mark)

4 (b) The sign below is used to warn people that a radiation source is being used in a laboratory.

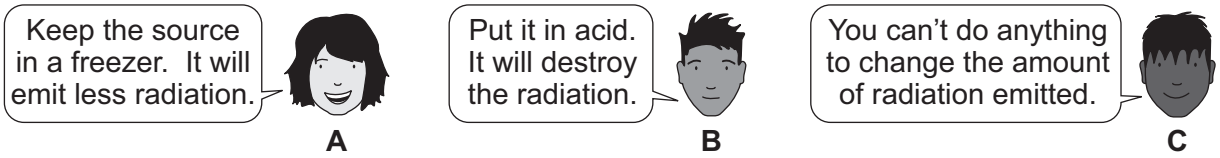
Why is it important to warn people that a radiation source is being used?

.....

.....

(1 mark)

4 (c) Before using a radiation source, a teacher asked her class whether there was any way that she could reduce the amount of radiation that the source emitted. Three students each gave an answer to the teacher.

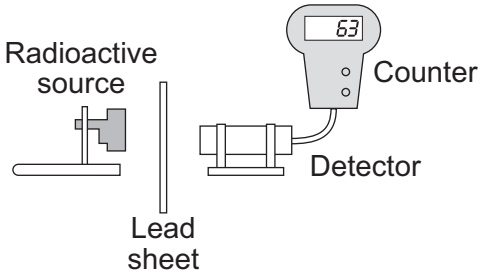


Which **one** of the students, **A**, **B** or **C**, is correct?

Write your answer in the box. ☐

(1 mark)

4 (d) The diagram shows the apparatus used by the teacher to demonstrate how one type of radiation is able to pass through lead.



One lead sheet, 2 mm thick, was placed between the source and the detector and a count rate was taken. Extra lead sheets were added. For each extra lead sheet, a new count rate was taken and recorded in the table.

Number of lead sheets	Count rate in counts per minute
1	226
2	220
3	210
4	190
5	185

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

.....

Give the reason for your answer.

.....

.....

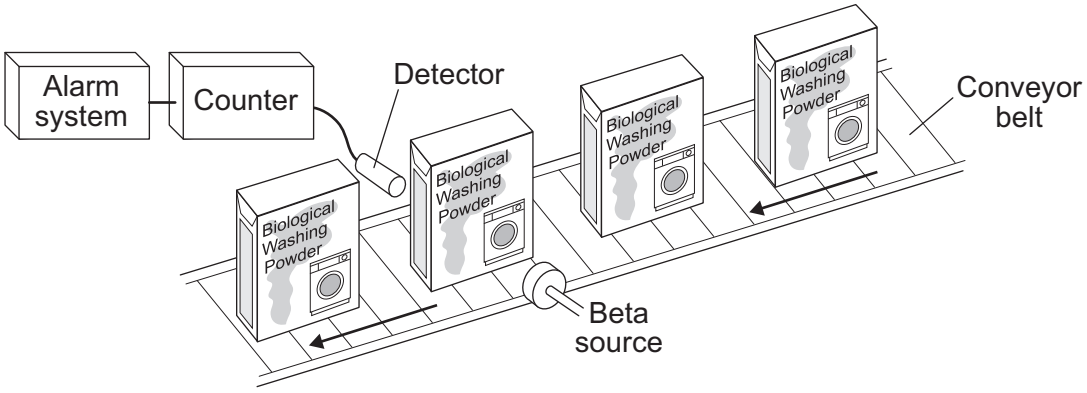
.....

(2 marks)

Question 4 continues on the next page

4 (e) The diagram shows how a company detects any boxes left empty by an automatic filler.

When an empty box passes between the beta source and the detector, a buzzer sounds. A worker then removes the box from the conveyor belt.



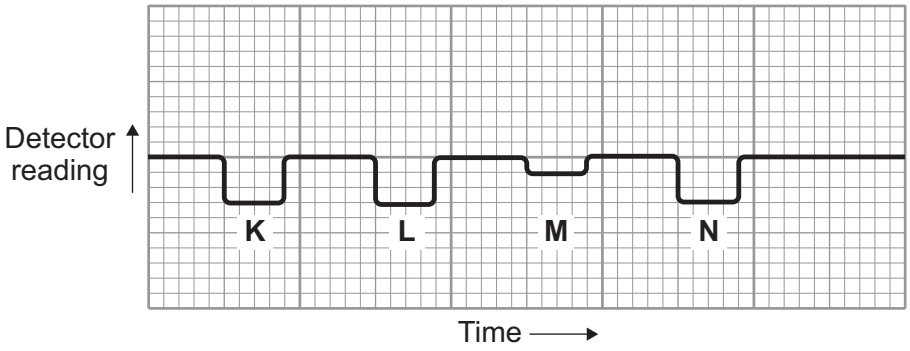
4 (e) (i) Why would this system **not** work if an alpha source were used instead of the beta source?

.....

.....

(1 mark)

4 (e) (ii) The chart shows how the detector reading changes as boxes pass along the conveyor belt.



Which part of the chart, **K**, **L**, **M** or **N**, shows that an empty box is passing between the beta source and the detector?

.....

Give a reason for your answer.

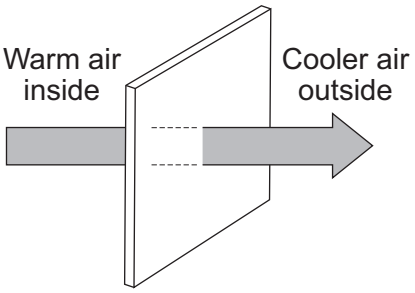
.....

.....

(2 marks)

8

5 The diagram shows the direction of heat transfer through a single-glazed window.



5 (a) (i) Name the process by which heat is transferred **through** the glass.

.....

(1 mark)

5 (a) (ii) Explain how heat is transferred **through** the glass.

.....

.....

.....

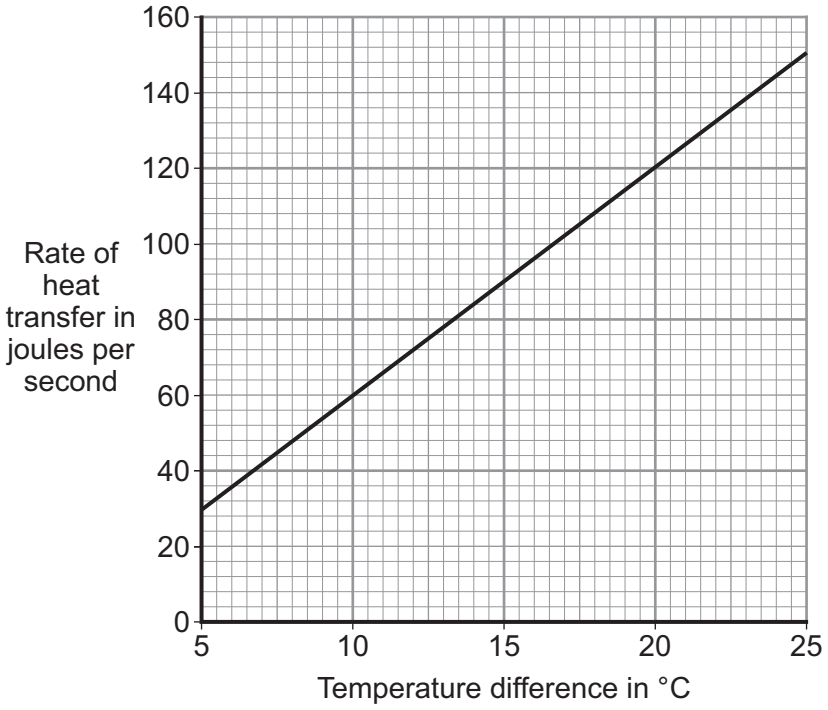
.....

(2 marks)

Question 5 continues on the next page

5 (b) The rate of heat transfer through a window depends on the difference between the inside and outside temperatures.

The graph shows the rate of heat transfer through a $1m^2$ single-glazed window for a range of temperature differences.



5 (b) (i) What is the range of temperature differences shown in the graph?

From ..... to .....

(1 mark)

5 (b) (ii) A student looks at the graph and concludes:

'Doubling the temperature difference doubles the rate of heat transfer.'

Use data from the graph to justify the student's conclusion.

.....

.....

.....

.....

(2 marks)

5 (b) (iii) A house has single-glazed windows. The total area of the windows in the house is 15 m^2.

On one particular day, the difference between the inside and outside temperatures is 20 °C.

Use the graph to calculate the total rate of heat transfer through all of the windows on this particular day.

Show clearly how you work out your answer.

.....

.....

.....

.....

Rate of heat transfer = ... J/s

(2 marks)

5 (c) A homeowner plans to replace the single-glazed windows in his home with double-glazed windows. He knows that double-glazed windows will reduce his annual energy bills.

The table gives information about the double glazing to be installed by the homeowner.

Cost to buy and install	Estimated yearly savings on energy bills	Estimated lifetime of the double-glazed windows
£5280	£160	30 years

Explain, in terms of energy savings, why replacing the single-glazed windows with these double-glazed windows is not cost effective.

To gain full marks you must complete a calculation.

.....

.....

.....

.....

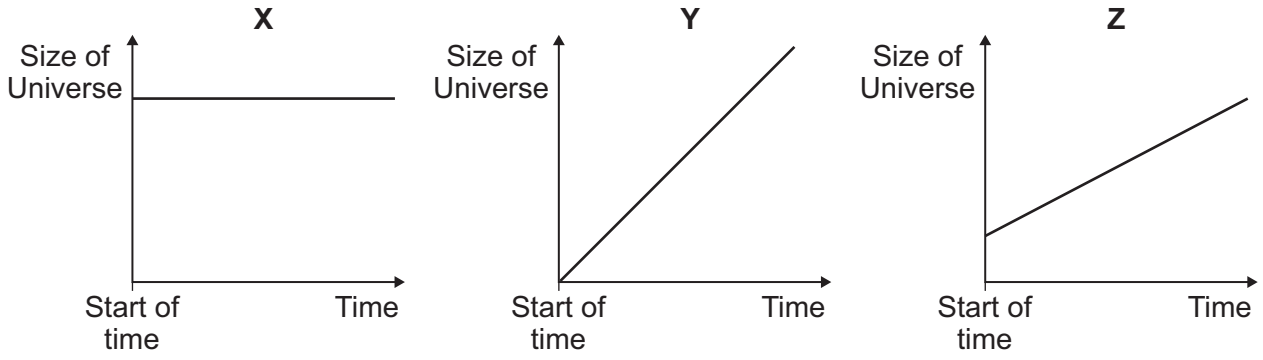
(2 marks)

10

Turn over ▶

6 The 'big bang' theory is one theory explaining the origin of the Universe.

6 (a) The graphs **X**, **Y** and **Z**, show how the size of the Universe may have changed with time.



Which graph would the 'big bang' theory suggest is correct?

Write your answer, **X**, **Y** or **Z**, in the box. ☐

Explain the reason for your answer.

.....

.....

.....

.....

(3 marks)

6 (b) In 1948, an alternative to the 'big bang' theory, called the 'steady state' theory, was developed.
The 'steady state' theory suggested that the Universe, although expanding, has always existed without a beginning in time.

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

The measurement of red-shift in the light from distant galaxies provides evidence

to support

only the 'big bang' theory.
only the 'steady state' theory.
both the 'big bang' and 'steady state' theories.

(1 mark)

6 (b) (ii) In 1965, scientists rejected the 'steady state' theory in favour of the 'big bang' theory.

Suggest what might cause scientists to stop supporting one theory and to start supporting an alternative theory.

.....

.....

.....

(1 mark)

5

END OF QUESTIONS

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