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 2015

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Friday 12 June 2015 1.30 pm to 2.30 pm

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

A

Time allowed
- 1 hour

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 7(a) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

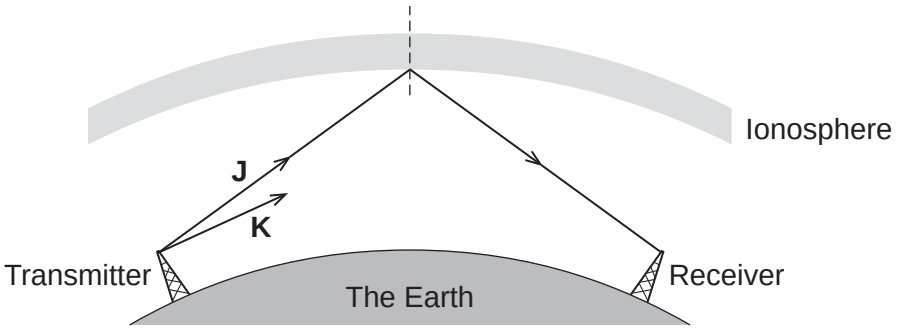
Advice
- In all calculations, show clearly how you work out your answer.

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

1 Different parts of the electromagnetic spectrum are useful for different methods of communication.

1 (a) **Figure 1** shows a transmitter emitting two electromagnetic waves, **J** and **K**.

Figure 1



Wave **J** is reflected by a layer in the atmosphere called the ionosphere.

1 (a) (i) Wave **K** will also be reflected by the ionosphere.
On **Figure 1**, draw the path of wave **K** to show that it **does not** reach the receiver.

[2 marks]

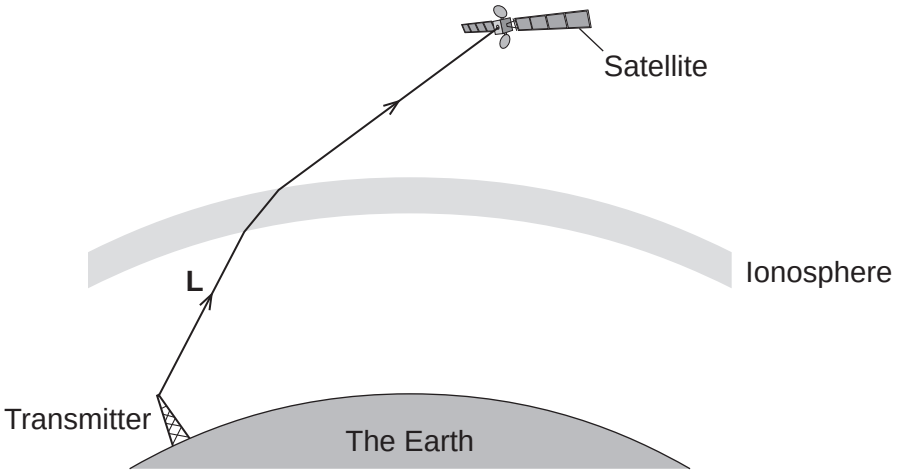
1 (a) (ii) What is the name given to the dashed line in **Figure 1**?

[1 mark]

.....

1 (b) **Figure 2** shows a transmitter sending a signal to a satellite orbiting the Earth.

Figure 2



1 (b) (i) Which type of electromagnetic wave is used to send a signal to a satellite?

[1 mark]

Draw a ring around the correct answer.

gamma **microwave** **ultraviolet**

1 (b) (ii) What name is given to the process that occurs as wave **L** passes into the ionosphere?

[1 mark]

Draw a ring around the correct answer.

diffraction **reflection** **refraction**

Question 1 continues on the next page

1 (c) Waves **J**, **K** and **L** are electromagnetic waves.

What are **two** properties of **all** electromagnetic waves?

[2 marks]

Tick (✓) **two** boxes.

Property	**Tick (✓)**
All electromagnetic waves are longitudinal.	
All electromagnetic waves are transverse.	
All electromagnetic waves are mechanical.	
All electromagnetic waves have the same speed in a vacuum.	
All electromagnetic waves have the same frequency.	

7

2 **Figure 3** shows a man using a leaf blower to move some leaves.

Figure 3

The leaf blower is powered by an electric motor connected to a battery.

2 (a) Energy transfers take place when the leaf blower is being used.

Use the correct answer from the box to complete each sentence.

[3 marks]

chemical	**electrical**	**kinetic**	**nuclear**	**sound**

The battery stores ..... energy which is transferred into electrical energy.

The electric motor transfers electrical energy usefully into ..... energy.

The motor wastes energy as ..... energy and as energy that heats the surroundings.

Question 2 continues on the next page

2 (b) The total power input to the leaf blower is 750 W.
The useful power output of the leaf blower is 360 W.

Calculate the efficiency of the leaf blower.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

.....

Efficiency = ...

5

3 **Figure 4** shows a black metal casserole dish that is put inside a hot oven. Food is cooked inside the casserole dish.

Figure 4

3 (a) Energy is transferred quickly from the inside of the hot oven, through the metal casserole dish to the food.

3 (a) (i) Why are metals good conductors of energy?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
because they contain free atoms	
because they contain free electrons	
because they contain free ions	

Question 3 continues on the next page

3 (a) (ii) Why do black surfaces become hot quickly?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
Because they are good absorbers of infrared radiation.	
Because they are good absorbers of ultraviolet radiation.	
Because they are good absorbers of visible light.	

3 (b) **Figure 5** shows a person removing a hot casserole dish from an oven, using oven gloves.

Figure 5

3 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

conductors	**insulators**	**radiators**

The oven gloves are good ..... .

3 (b) (ii) How would wearing oven gloves affect the rate of energy transfer to a person's hands compared with not wearing oven gloves?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The rate of energy transfer would be higher.	
The rate of energy transfer would be lower.	
The rate of energy transfer would stay the same.	

3 (c) What **two** factors determine the amount of energy transferred by an electric oven?

[2 marks]

1 .....

2 .....

3 (d) A company has invented an 'app' that allows householders to control the electric oven in their home using their mobile phone.
The mobile phone can be used to switch the electric oven on and off.

Suggest **one** benefit of using a mobile phone to switch an electric oven on and off.

[1 mark]

.....

.....

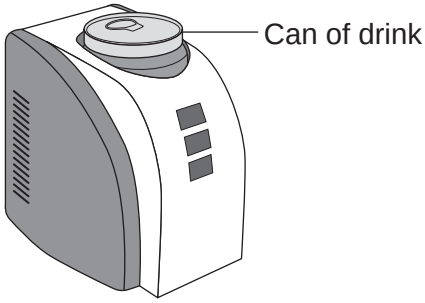
7

Turn over for the next question

4 A 'can-chiller' is used to make a can of drink colder.

Figure 6 shows a can-chiller.

Figure 6



4 (a) The can-chiller decreases the temperature of the liquid in the can by 15 °C.
The mass of liquid is 0.33 kg.
The specific heat capacity of the liquid is 4200 J/kg °C.

Calculate the energy transferred from the liquid as it cools.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... J

4 (b) Complete the following sentence.

[1 mark]

The specific heat capacity of a substance is the amount of energy required to change the ..... of one kilogram of the substance by one degree Celsius.

4 (c) To calculate the specific heat capacity of a material, the mass of the material needs to be measured.

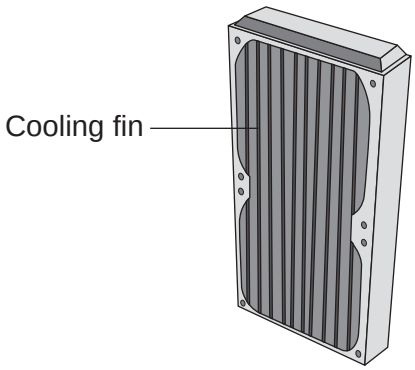
State the name of a measuring instrument used to measure mass.

[1 mark]

.....

4 (d) The back of the can-chiller has cooling fins, as shown in **Figure 7**.

Figure 7



The cooling fins increase the rate of energy transfer from the can-chiller to the surroundings.

Complete the following sentences.

[2 marks]

The cooling fins are a ..... colour because that makes them good emitters of infrared radiation.

The large surface area of the cooling fins allows the air around the can-chiller to gain energy quickly and rise, transferring energy by ..... .

Question 4 continues on the next page

4 (e) (i) The energy input to the can-chiller is the same as the energy output. This shows that energy is conserved.

Complete the following sentence.

[1 mark]

Energy can be transferred usefully, stored or dissipated, but cannot be

..... or destroyed.

4 (e) (ii) The temperature of the can of drink decreases while it is in the can-chiller.

What happens to the temperature of the air around the cooling fins?

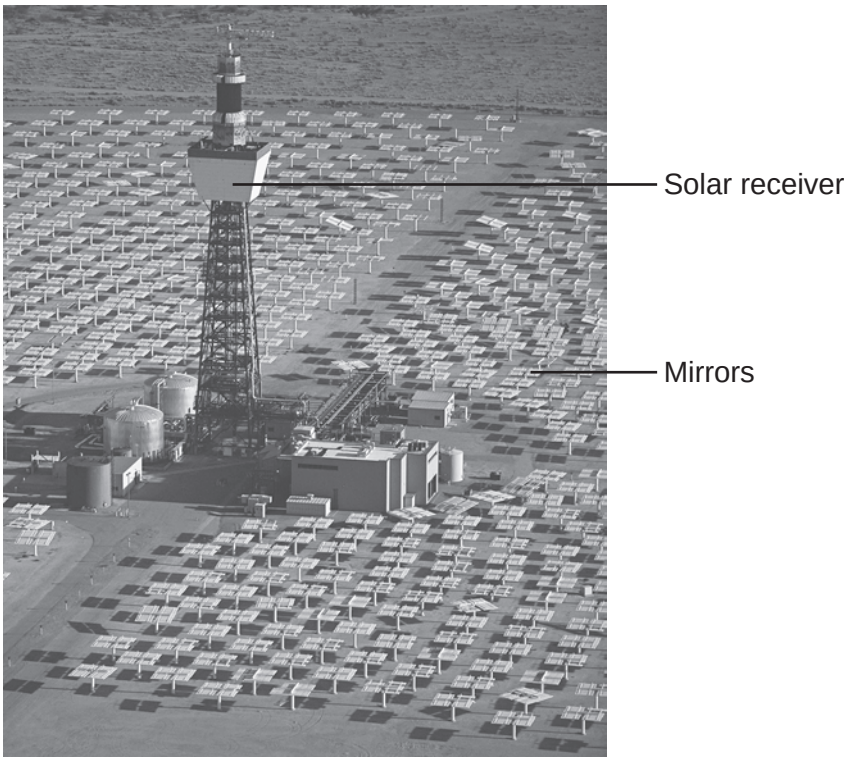
[1 mark]

.....

8

5 **Figure 8** shows a solar thermal power station.

Figure 8



Energy from the Sun is directed at the solar receiver by many mirrors.

5 (a) (i) Suggest **one** reason why a solar thermal power station is built in a hot desert.

[1 mark]

.....

.....

5 (a) (ii) Complete the following sentence to describe how the mirrors direct energy from the Sun towards the solar receiver.

[1 mark]

Energy from the Sun is ..... by the mirrors towards the solar receiver.

Question 5 continues on the next page

5 (a) (iii) Heated water is used to generate electricity in the solar thermal power station.
Choose the correct answer from the box to complete each sentence.

[3 marks]

boiler	**motor**	**transformer**	**turbine**

At the solar receiver, water is heated in a ..... which turns the water into steam. The steam turns a ..... which is connected to a generator. The generator produces electricity. A ..... is used to change the voltage for transmission along power lines.

5 (b) A solar storage power station is a new type of solar power station.
It is able to store energy from the Sun to generate electricity at night.

The solar storage power station can supply a town with a maximum electrical power of 140 000 kW for 15 hours.

Calculate the maximum energy, in kWh, stored by the solar storage power station.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... kWh

5 (c) A different method of generating electricity uses wind turbines.
A student researching a wind farm wrote the following.

> Top Hill Wind Farm has 25 wind turbines.
> Last week, one of the wind turbines generated electricity for only 42 hours out of a possible 168 hours.
> My conclusion is that all wind turbines operate for only 25% of the time.

5 (c) (i) Give **two** reasons why the student is **not** correct in reaching his conclusion.

[2 marks]

1 .....

.....

2 .....

.....

5 (c) (ii) Give **one** reason why wind turbines do not generate electricity all the time.

[1 mark]

.....

.....

5 (c) (iii) Give **one** advantage of using wind turbines to generate electricity compared with using fossil fuel power stations.

[1 mark]

.....

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11

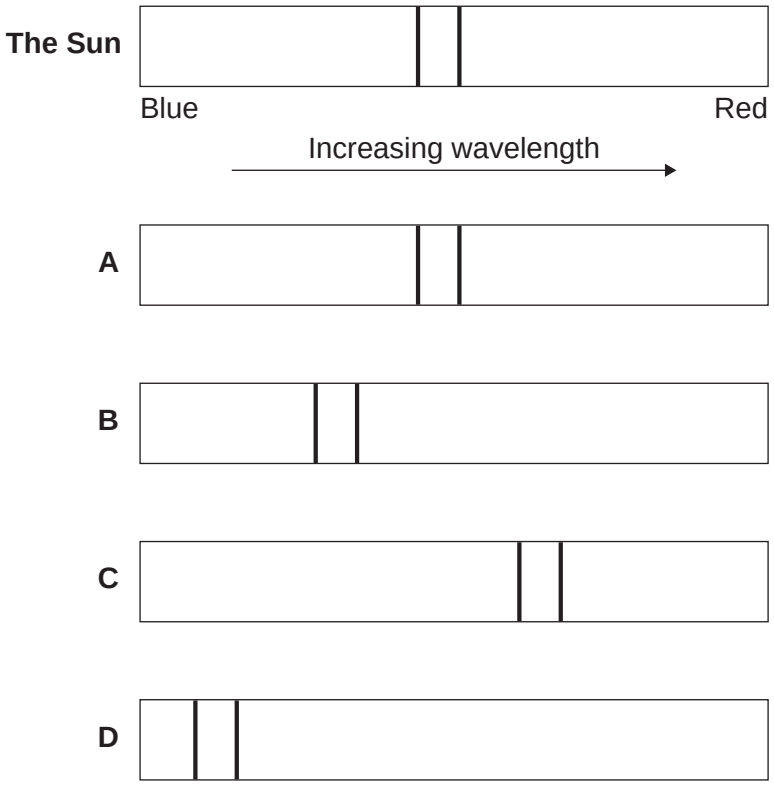
Turn over for the next question

6 Scientists can use the visible light spectrum from distant stars to determine whether the stars are moving.

The visible light spectrum from stars includes dark lines at specific wavelengths.

6 (a) **Figure 9** shows the visible light spectrum from the Sun and from four other stars, **A**, **B**, **C** and **D**.

Figure 9



6 (a) (i) Which star, **A**, **B**, **C** or **D**, is moving away from the Earth?

[1 mark]

6 (a) (ii) How does the speed of star **B** compare with the speed of star **D**?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The speed of star **B** is greater than the speed of star **D**.	
The speed of star **B** is less than the speed of star **D**.	
The speed of star **B** is the same as the speed of star **D**.	

6 (b) A radio wave is emitted by a star.
The radio wave has a wavelength of 1500 m and a frequency of 200 000 Hz.

Calculate the speed of this radio wave.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Choose the correct unit from the list below.

m **m/s** **m/s^2**

.....

.....

.....

Speed = ... unit .....

5

Turn over for the next question

7 (a) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

A householder wants to reduce her energy bills. She collected information about a number of ways of reducing energy used. The information is shown in **Table 1**.

Table 1

Ways of reducing energy used	Cost to buy and install in £	Money saved per year in £
Install an energy-efficient boiler	2 000	320
Insulate the loft	400	200
Install double-glazed windows	12 000	120
Install cavity wall insulation	415	145

Use the information in **Table 1** to compare the different ways of reducing the energy used. Your answer should include some calculations.

[6 marks]

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Extra space .....

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7 (b) Increasing the amount of insulation in a house affects the total U-value of the house.

7 (b) (i) What is meant by the term 'U-value'?

[1 mark]

.....

.....

.....

7 (b) (ii) How is the U-value affected by increasing the amount of insulation?

[1 mark]

.....

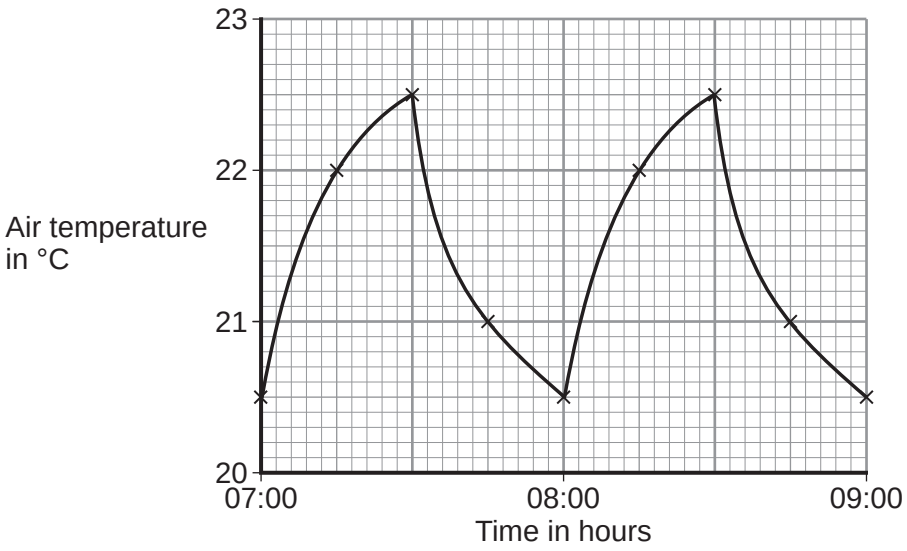
8

Turn over for the next question

8 A householder monitored how the air temperature inside his house changed over a 2-hour period. The householder measured the temperature every 15 minutes.

Figure 10 shows how the temperature changed with time.

Figure 10



8 (a) (i) The householder used a digital thermometer to measure the temperature.

What would be an appropriate resolution for the digital thermometer?

[1 mark]

Draw a ring around your answer.

0.5 °C **1 °C** **5 °C**

8 (a) (ii) The householder's results are shown on a line graph in **Figure 10**.

Why would it **not** be appropriate to use the results to plot a bar chart?

[1 mark]

.....

.....

8 (b) The householder's heating is controlled by a thermostat. The thermostat switches the heating on when the temperature decreases below a certain temperature.

8 (b) (i) At what temperature does the thermostat switch the heating on?

[1 mark]

..... °C

8 (b) (ii) Use **Figure 10** to determine the number of minutes that the householder's heating was switched on between 07:00 and 09:00.

[1 mark]

.....

.....

Time = ... minutes

Question 8 continues on the next page

8 (c) The householder read the following extract from a newspaper article about reducing energy use in the home.

> . . . decreasing the temperature setting on your thermostat by 1 °C will reduce your heating bill by 10% . . .

On Monday, the householder set his thermostat at 20.0 °C and recorded the energy, in kWh, used to heat his house.

On Tuesday, the householder set his thermostat at 19.0 °C and recorded the energy, in kWh, used to heat his house.

Table 2 shows the results of the householder's investigation.

Table 2

Thermostat setting in °C	Energy in kWh
20.0	8.0
19.0	7.2

8 (c) (i) The outside temperature was the same on both days.

Give **one** reason why this was important.

[1 mark]

.....

.....

8 (c) (ii) Explain how the results shown in **Table 2** support the extract from the newspaper article.

Justify your answer with a calculation.

[2 marks]

.....

.....

.....

.....

8 (c) (iii) The statement in the extract is **not** valid for all situations.
Suggest why.

[2 marks]

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.....

9

END OF QUESTIONS

There are no questions printed on this page

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