Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE

SCIENCE A
PHYSICS

F

Foundation Tier Unit Physics P1

Wednesday 25 May 2016 Afternoon Time allowed: 1 hour

Materials

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

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(b) 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.

Do not write outside the box

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

1 Different energy sources are used to generate electricity.

1 (a) Use words from the box to match the correct energy source to each of the descriptions given in **Table 1**.

[3 marks]

biofuel	**coal**	**geothermal**	**nuclear**	**waves**

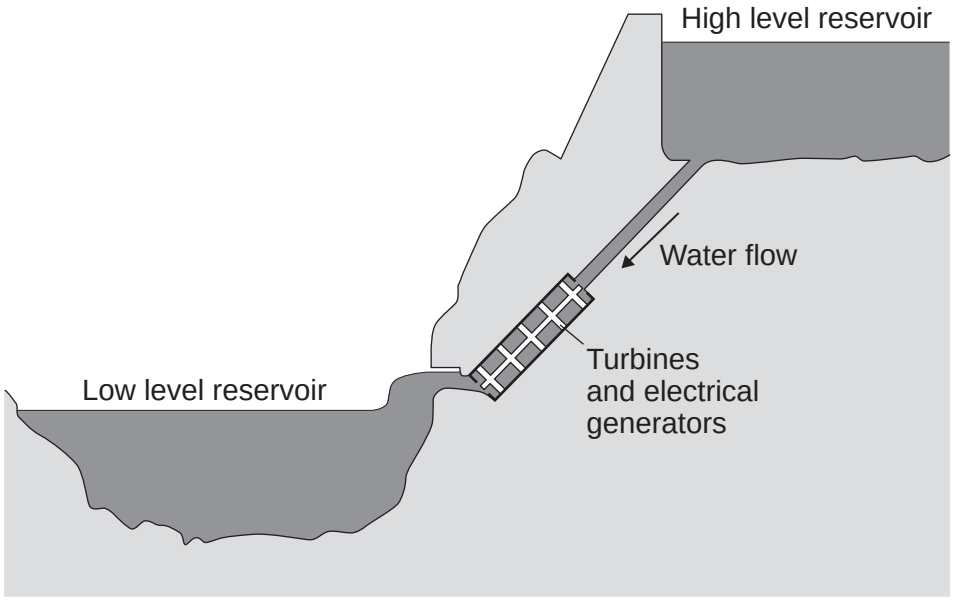
Table 1

Description	**Energy source**
Energy from the Earth's core is used to heat water.	
Fission of uranium nuclei is used to heat water.	
Gases from rotting plant material are burned to heat water.	

1 (b) Energy can be stored in a pumped storage power station.

Figure 1 shows a pumped storage power station.

Figure 1



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When electricity is needed, the water in the high level reservoir is allowed to flow to the low level reservoir. The flowing water generates electricity.

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

[3 marks]

electrical	**gravitational potential**	**kinetic**	**nuclear**	**sound**

The water in the high level reservoir stores _____ energy.

The flowing water has _____ energy.

The water turns the turbine which is connected to the generator.

The generator produces some _____, this is wasted energy.

1 (c) The total power input to a pumped storage power station is 600 MW.

The useful power output is 540 MW.

1 (c) (i) Calculate the efficiency of this pumped storage power station.
Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Efficiency = _____

1 (c) (ii) Calculate how much power is wasted by the pumped storage power station.

[1 mark]

_____

Power = _____ MW

1 (c) (iii) How is the temperature of the surroundings affected by the energy wasted by the pumped storage power station?

[1 mark]

_____

10

Do not write outside the box

2 The electric kettle shown in **Figure 2** is used to boil water.

Figure 2

2 (a) After the water has boiled, the temperature of the water decreases by 22 °C.
The mass of water in the kettle is 0.50 kg.
The specific heat capacity of water is 4200 J/kg °C.

Calculate the energy transferred to the surroundings from the water.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Energy = _____ joules

2 (b) Why is the total energy input to the kettle higher than the energy used to heat the water?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
Energy is absorbed from the surroundings.	
Energy is used to heat the kettle.	
The kettle is more than 100% efficient.	

Do not write outside the box

2 (c) In one day, 0.6 kWh of energy is transferred from the mains electricity supply to the kettle.

The energy costs 15 pence per kWh.

Calculate the cost of using the kettle for one day.

[2 marks]

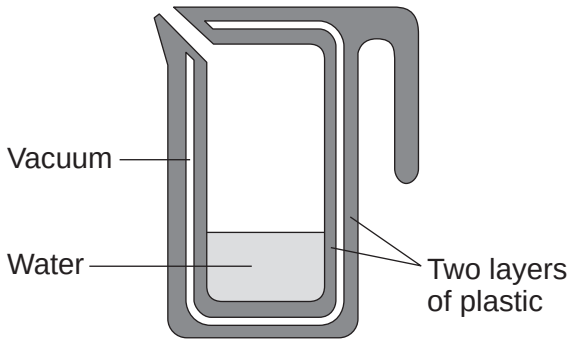
_____

_____

Cost = _____ pence

2 (d) A new type of electric kettle is made from two layers of plastic separated by a vacuum. After the water in the kettle has boiled, the water stays hot for at least 2 hours. The new kettle is shown in **Figure 3**.

Figure 3



2 (d) (i) Which energy transfers does a vacuum reduce?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
conduction and radiation	
conduction and convection	
convection and radiation	

2 (d) (ii) Using the new kettle may reduce the householder's energy bill. Suggest **one** reason why.

[1 mark]

_____

_____

7

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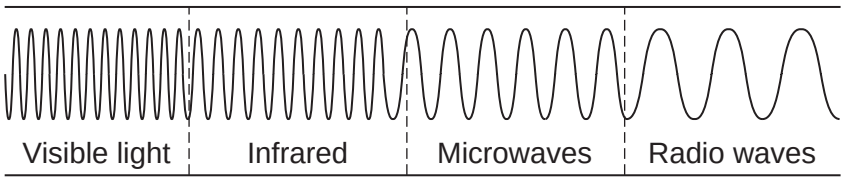
3 Infrared and microwaves are two types of electromagnetic radiation.

Figure 4 shows the positions of the two types of radiation within part of the electromagnetic spectrum.

Figure 4



3 (a) (i) Name **one** type of electromagnetic radiation which has more energy than infrared.

[1 mark]

_____

3 (a) (ii) Use the correct answer from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

[3 marks]

greater than	**less than**	**the same as**

The wavelength of infrared is _____ the wavelength of microwaves.

The frequency of microwaves is _____ the frequency of infrared.

The speed of microwaves in a vacuum is _____ the speed of infrared in a vacuum.

Do not write outside the box

3 (b) Cosmic Microwave Background Radiation (CMBR) is electromagnetic radiation that fills the universe.

Only one theory about the origin of the universe can explain the presence of CMBR.

3 (b) (i) Give the name of this theory.

[1 mark]

_____

3 (b) (ii) Which other piece of evidence supports this theory?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
the diffraction of sound waves	
the electromagnetic spectrum	
the red-shift of light from distant galaxies	

6

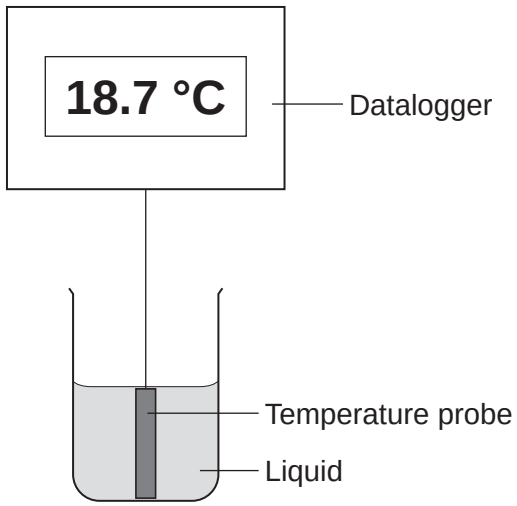
Turn over for the next question

Do not write outside the box

4 A student investigated the cooling effect of evaporation.

She used the equipment (datalogger and probe) in **Figure 5** to measure how the temperature of a liquid changed as the liquid evaporated.

Figure 5



4 (a) Which type of variable was the temperature in this investigation?

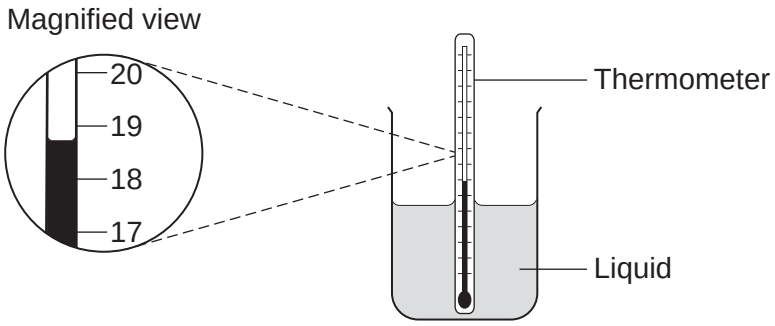
[1 mark]

Tick (✓) **one** box.

	Tick (✓)
control	
dependent	
independent	

4 (b) The student could have used the thermometer shown in **Figure 6**.

Figure 6



How does the resolution of the equipment in **Figure 5** compare with the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The equipment has a better resolution.	
The equipment has a worse resolution.	
The equipment has the same resolution.	

4 (c) Before the investigation started, the student checked the accuracy of three different temperature probes. The student put the probes in a beaker of boiling water that had a temperature of 100.0 °C.
Figure 7 shows the readings from the three temperature probes.

Figure 7

Probe A	**Probe B**	**Probe C**
99.8	**100.1**	**103.2**

Which **one** of the temperature probes, **A**, **B** or **C**, was **least** accurate?

[2 marks]

Write the correct answer in the box.

Give a reason for your answer.

_____

_____

Question 4 continues on the next page

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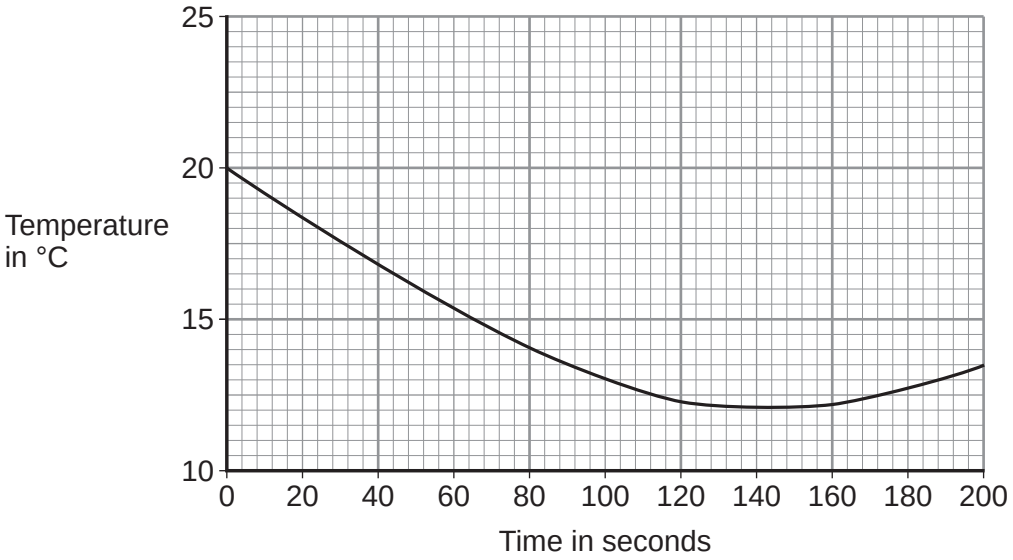
4 (d) **Figure 8** shows how the temperature recorded changed during the investigation.

Figure 8



4 (d) (i) Use **Figure 8** to determine the lowest temperature recorded as the liquid evaporated.

[1 mark]

Temperature = _____ °C

4 (d) (ii) Use **Figure 8** to determine how long it took for all the liquid to evaporate.
Give a reason for your answer.

[2 marks]

Time = _____ seconds

Reason: _____

_____

4 (d) (iii) How would increasing the starting temperature of the liquid above 20 °C affect the rate of evaporation of the liquid?

[1 mark]

_____

_____

8

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Turn over for the next question

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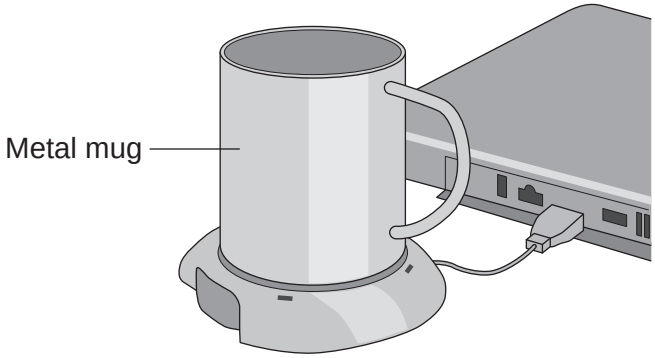
5 A heater uses energy from a laptop computer to keep a drink hot.

Figure 9 shows a metal mug on the heater.

Figure 9



5 (a) The laptop computer is operating on battery power.
How would connecting the heater affect the amount of time the laptop computer would operate for, before needing to be recharged?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
it would decrease the time	
it would not affect the time	
it would increase the time	

5 (b) The power output from the heater is 12 W.

Calculate the energy transferred to the metal mug in 60 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Energy = _____ joules

Do not write outside the box

5 (c) The heater causes a convection current in the liquid inside the mug.

Complete the sentences to explain how.

[3 marks]

The liquid at the bottom of the mug heats up and becomes less _____ .

The hot liquid _____ and the cooler liquid at the top of the mug _____ .

5 (d) **Table 2** lists changes that may affect the energy transfer per second from the heater to the liquid.

Tick (✓) **one** box to show the effect of **each** change.

[3 marks]

Table 2

Change	Energy transfer per second to the liquid		
	increases	**decreases**	**does not change**
use a mug with a smaller base			
use a lower power heater			
use a plastic mug instead of a metal mug			

9

Turn over for the next question

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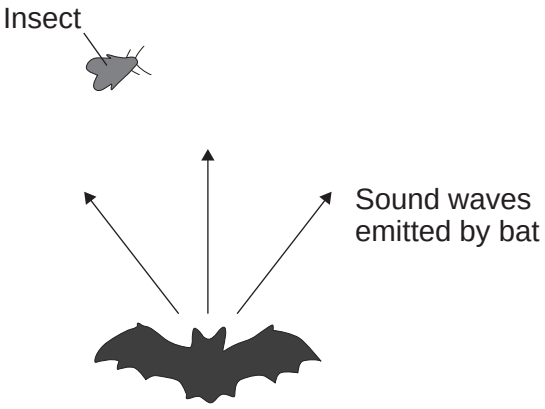
6 Bats use the reflection of high pitched sound waves to determine the position of objects. **Figure 10** shows a bat and an insect flying in front of the bat.

Figure 10



6 (a) What determines the pitch of a sound wave?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
amplitude	
frequency	
speed	

6 (b) State the name given to reflected sound waves.

[1 mark]

_____

Do not write outside the box

6 (c) The bat emits sound waves with a range of wavelengths.

Some of the sound waves will be diffracted by the insect.

Complete the following sentences to explain why.

[2 marks]

Diffraction is caused by the sound waves _____ as they pass the insect.

The most diffraction happens when the wavelength of the sound wave is

_____ the size of the insect.

6 (d) The bat emits a sound wave with a frequency of 25.0 kHz and a wavelength of 0.0136 metres.

Calculate the speed of this sound wave.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Speed = _____ m/s

6 (e) Sound waves are longitudinal. Describe a longitudinal sound wave.

[2 marks]

_____

_____

_____

_____

8

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7 A small community of people live in an area in the mountains.
The houses are not connected to the National Grid.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

Figure 11 shows where these people live.

Figure 11

7 (a) It would not be economical to connect the houses to the National Grid.
Give **one** reason why.

[1 mark]

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

Information about the two electricity generation systems is given in **Figure 12**.

Figure 12

The wind turbine costs £50 000 to buy and install.
The hydroelectric generator costs £20 000 to buy and install.
The average power output from the wind turbine is 10 kW.
The hydroelectric generator will produce a constant power output of 8 kW.

Do not write outside the box

Compare the advantages and disadvantages of the two methods of generating electricity.

Use your knowledge of energy sources as well as information from **Figure 12**.

[6 marks]

Extra space

7

Turn over for the next question

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8 (a) Heating food in a saucepan over a gas flame is inefficient.
Suggest why.

[2 marks]

_____

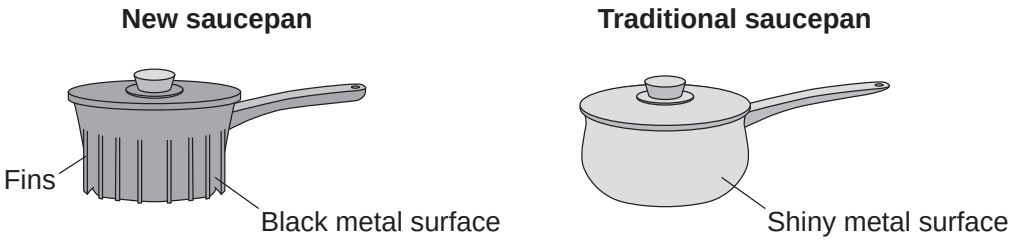
_____

_____

_____

8 (b) A new saucepan has been designed that heats up food much faster than a traditional saucepan. **Figure 13** shows the two saucepans.

Figure 13



Describe how the features of the new saucepan cause the food to heat up faster than when the food is heated in the traditional saucepan.

[2 marks]

Fins _____

_____

Black metal surface _____

_____

8 (c) State the relationship between the temperature of the saucepan and the rate at which the saucepan emits infrared radiation.

[1 mark]

_____

_____

5

END OF QUESTIONS

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