

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Higher Tier
June 2013

Science A

Unit Physics P1

Physics

Unit Physics P1

Thursday 13 June 2013 9.00 am to 10.00 am

For this paper you must have:

- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

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 4(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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



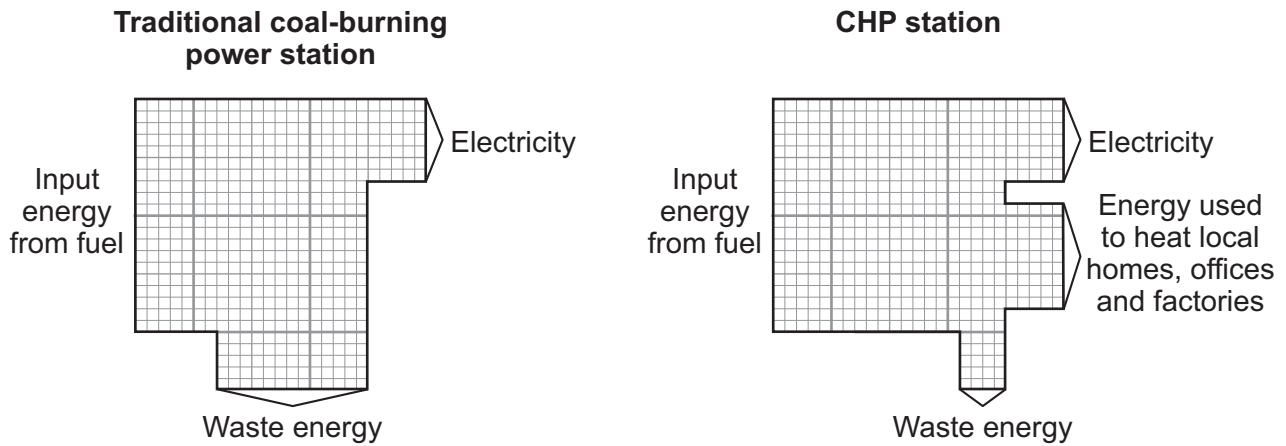
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PH1HP

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

- 1** The Sankey diagrams show the energy transfers in a traditional coal-burning power station and a combined heat and power (CHP) station.



- 1 (a)** What effect does the waste energy from a power station have on the surroundings?

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(1 mark)

- 1 (b)** Calculate the efficiency of the CHP station.

Use the correct equation from the Physics Equations Sheet.

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Efficiency = ...

(2 marks)



- 1 (c)** Why is a CHP station more efficient than a traditional coal-burning power station?

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(2 marks)

- 1 (d)** A CHP station is usually used to meet the demand for electricity within the local area. The electricity is not transmitted and distributed through the National Grid.

- 1 (d) (i)** What is the National Grid?

Tick (✓) **one** box.

A system of cables and pylons.

☐

A system of cables and transformers.

☐

A system of cables, transformers and power stations.

☐

(1 mark)

- 1 (d) (ii)** Using the electricity locally and not transmitting it through the National Grid increases the overall efficiency of a CHP station by 7%.

Give **one** reason why.

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(1 mark)

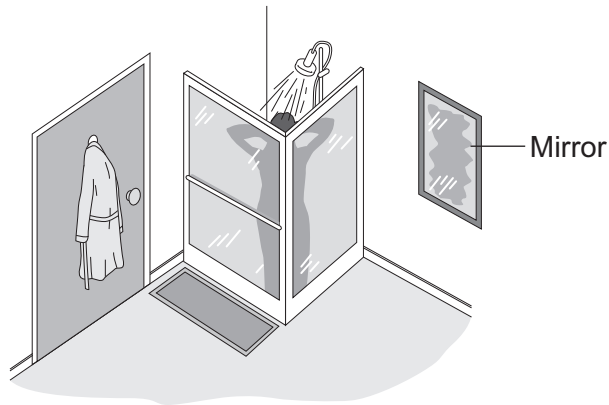
7

Turn over for the next question

Turn over ►



- 2** The picture shows a person taking a hot shower.



- 2 (a)** When a person uses the shower the mirror gets misty.

Why?

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(3 marks)



2 (b) The homeowner installs an electrically heated mirror into the shower room.

When a person has a shower, the heated mirror does **not** become misty but stays clear.

Why does the mirror stay clear?

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(2 marks)

5

Turn over for the next question

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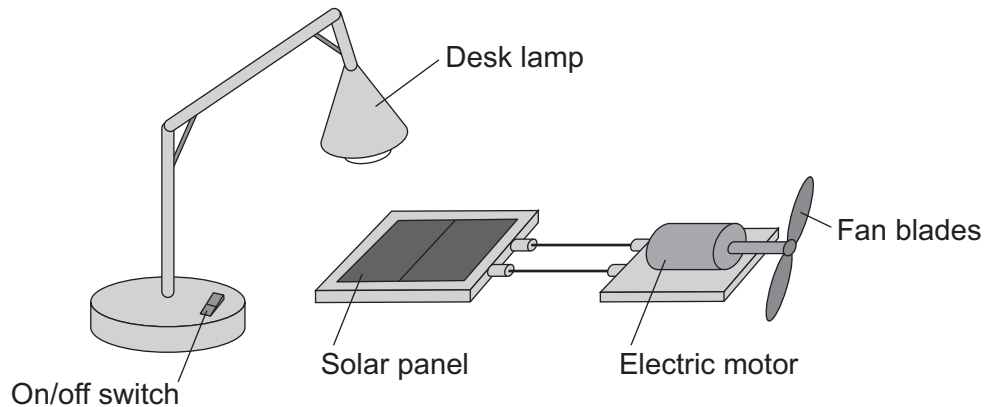
3 (a) Light waves transfer energy.

3 (a) (i) Complete the following sentence.

The oscillations producing a light wave are to
the direction of the energy transfer by the light wave.

(1 mark)

3 (a) (ii) The apparatus in the diagram shows that light waves transfer energy.



Describe how switching the desk lamp on and off shows that light waves transfer energy.

You do **not** need to describe the energy transfers.

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(2 marks)



- 3 (b)** A student holds a wrist watch in front of a plane mirror. The student can see an image of the wrist watch in the mirror.

The diagram shows the position of the wrist watch and the mirror.

Plane mirror



Wrist watch



Draw a ray diagram showing how the image of the wrist watch is formed.

Mark the position of the image.

(4 marks)

- 3 (c)** The image of the wrist watch seen by the student is virtual.

What is a virtual image?

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(1 mark)

8

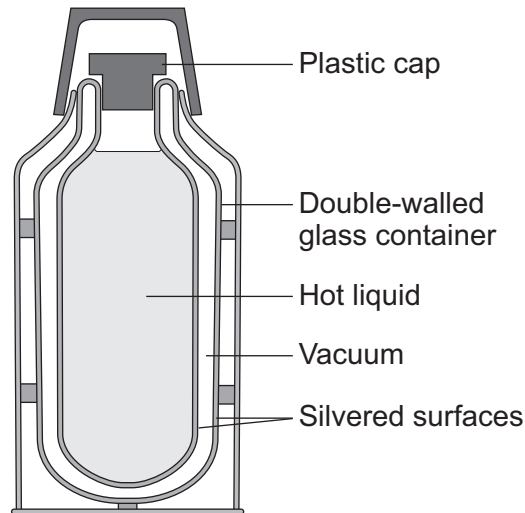
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- 4 (a)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The diagram shows the structure of a vacuum flask.



A vacuum flask is designed to reduce the rate of energy transfer by heating processes.

Describe how the design of a vacuum flask keeps the liquid inside hot.

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(6 marks)

4 (b) Arctic foxes live in a very cold environment.



Arctic foxes have small ears.

How does the size of the ears help to keep the fox warm in a cold environment?

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(2 marks)

8

Turn over ►

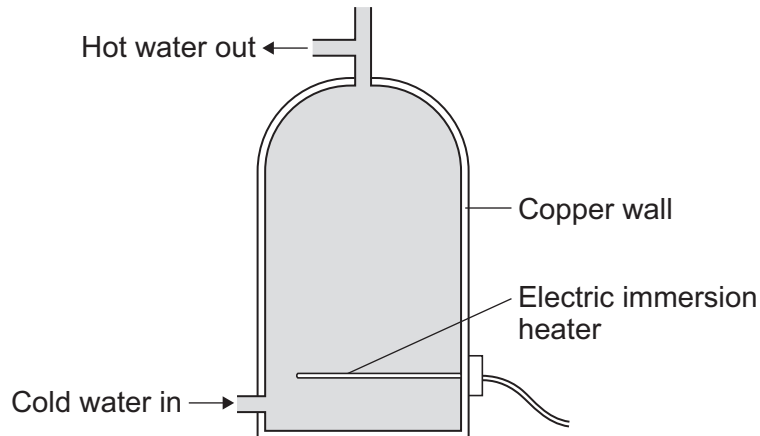


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ANSWER IN THE SPACES PROVIDED**



- 5** An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.



- 5 (a)** Energy is transferred by the process of convection from the hot water at the bottom of the tank to the cooler water at the top.

Explain how.

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(4 marks)

- 5 (b)** Complete the following sentence.

The main way the energy is transferred through the copper wall of the water tank is by the process of

(1 mark)

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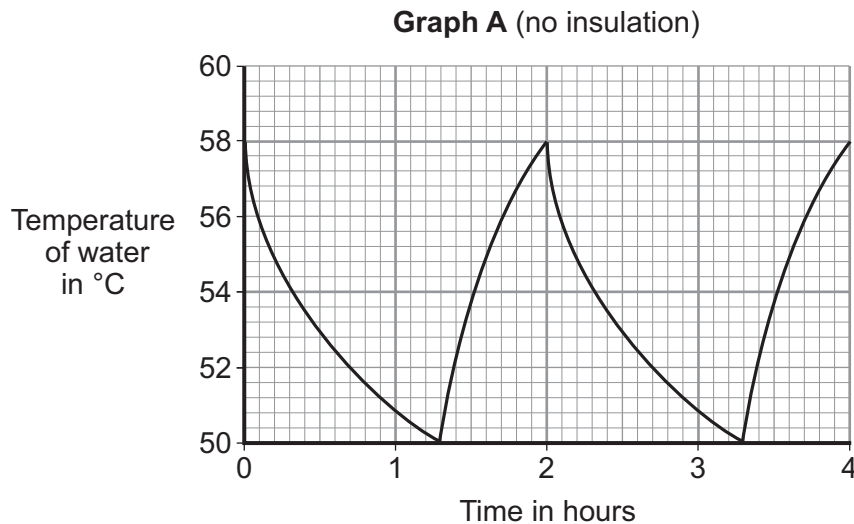
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- 5 (c)** The immersion heater has a thermostat to control the water temperature.

When the temperature of the water inside the tank reaches 58°C the thermostat switches the heater off. The thermostat switches the heater back on when the temperature of the water falls to 50°C .

Graph A shows how the temperature of the water inside a hot water tank changes with time. The tank is **not** insulated.



- 5 (c) (i)** The temperature of the water falls at the fastest rate just after the heater switches off.

Explain why.

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(2 marks)

- 5 (c) (ii)** To heat the water in the tank from 50°C to 58°C the immersion heater transfers 4032 kJ of energy to the water.

Calculate the mass of water in the tank.

Specific heat capacity of water = $4200 \text{ J/kg}^{\circ}\text{C}$

Use the correct equation from the Physics Equations Sheet.

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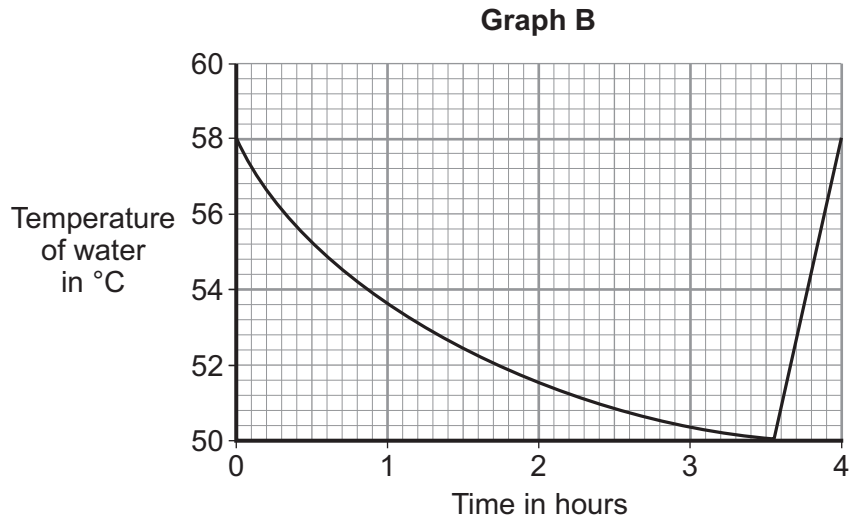
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Mass = ... kg
(3 marks)



5 (c) (iii) An insulating jacket is fitted to the hot water tank.

Graph B shows how the temperature of the water inside the insulated hot water tank changes with time.



An insulating jacket only costs £12.

By comparing **Graph A** with **Graph B**, explain why fitting an insulating jacket to a hot water tank saves money.

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(3 marks)



6 (a) In the UK, over 70% of the electricity is generated in power stations that burn fossil fuels.

6 (a) (i) Explain **one** effect that burning fossil fuels has on the environment.

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(2 marks)

6 (a) (ii) Give **one** way the effect on the environment described in part **(a)(i)** could be reduced.

Assume the amount of fossil fuels burnt stays the same.

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(1 mark)

6 (b) Electricity can also be generated in a pumped storage hydroelectric power station.

An advantage of pumped storage hydroelectric power stations is the short start-up time they have.

6 (b) (i) What is the importance of the short start-up time?

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(1 mark)

6 (b) (ii) Give **one** other advantage of a pumped storage hydroelectric power station.

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(1 mark)



- 6 (c)** Read the extract below from a newspaper article.

In the future it may not be possible to have constant electricity. Families will have to get used to using power when it is available.

- 6 (c) (i)** In the UK, the proportion of electricity generated using wind turbines is due to increase a lot. Some opponents of wind turbines think this increase will cause big fluctuations in the electricity supply.

Suggest **one** reason why this may be true.

.....
.....

(1 mark)

- 6 (c) (ii)** Between 2002 and 2008 the amount of electricity used for lighting in homes in the UK decreased.

Suggest **one** reason why.

.....
.....

(1 mark)

7

Turn over for the next question

Turn over ►



7 (a) Electromagnetic waves form a continuous spectrum with a range of wavelengths.

What is the approximate range of wavelengths of electromagnetic waves?

Tick (✓) **one** box.

10^{-15} metres to 10^4 metres

☐

10^{-4} metres to 10^{15} metres

☐

10^{-6} metres to 10^6 metres

☐

(1 mark)

7 (b) Infrared waves and microwaves are used for communications.

7 (b) (i) Give **one** example of infrared waves being used for communication.

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.....

(1 mark)

7 (b) (ii) A mobile phone network uses microwaves to transmit signals through the air. The microwaves have a frequency of 1.8×10^9 Hz and travel at a speed of 3.0×10^8 m/s.

Calculate the wavelength of the microwaves.

Use the correct equation from the Physics Equations Sheet.

Give your answer to **two** significant figures.

.....

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Wavelength = ... m

(3 marks)



- 7 (c)** Some scientists suggest there is a possible link between using a mobile phone and male fertility.

The results of their study are given in the table.

Mobile phone use in hours per day	Sperm count in millions of sperm cells per cm ³ of semen
0	86
less than 2	69
2–4	59
more than 4	50

The results show a negative correlation: the more hours a mobile phone is used each day, the lower the sperm count. However, the results do **not** necessarily mean using a mobile phone causes the reduced sperm count.

Suggest **one** reason why.

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(1 mark)

6

Turn over for the next question

Turn over ►



8 (a) Observation of the spectra from distant galaxies provides evidence to support the 'Big Bang' theory.

8 (a) (i) Complete the following sentence.

Many scientists think that the 'Big Bang' theory describes the

.....
(1 mark)

8 (a) (ii) Tick (✓) **one** box to complete the sentence.

The discovery of cosmic microwave background radiation was important
because it ...

proved the 'Big Bang' theory to be correct.

☐

provided more evidence to support the 'Big Bang' theory.

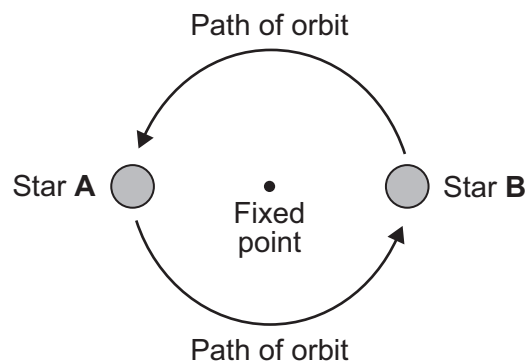
☐

proved the Universe will continue to expand forever.

☐

(1 mark)

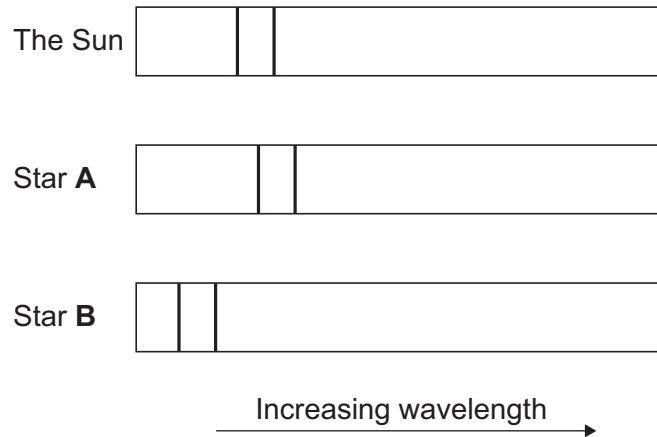
8 (b) Many stars are part of a binary star system. Binary star systems have two stars.



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



The diagram shows the position of two dark lines in the spectrum from the Sun. It also shows the same lines in the spectra from two stars **A** and **B** in a binary star system at the same point in time.



- 8 (b) (i)** What name is given to the effect shown in the spectrum from star **A**?

.....
(1 mark)

- 8 (b) (ii)** Scientists have concluded that the two stars in a binary star system orbit around a fixed point between the two stars.

A comparison of the spectra from the two stars in a binary star system provides evidence to support this conclusion.

Explain how.

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(3 marks)

END OF QUESTIONS



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