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
January 2012

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Friday 20 January 2012 9.00 am to 10.00 am

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

You may use a calculator.

Time allowed
- 1 hour

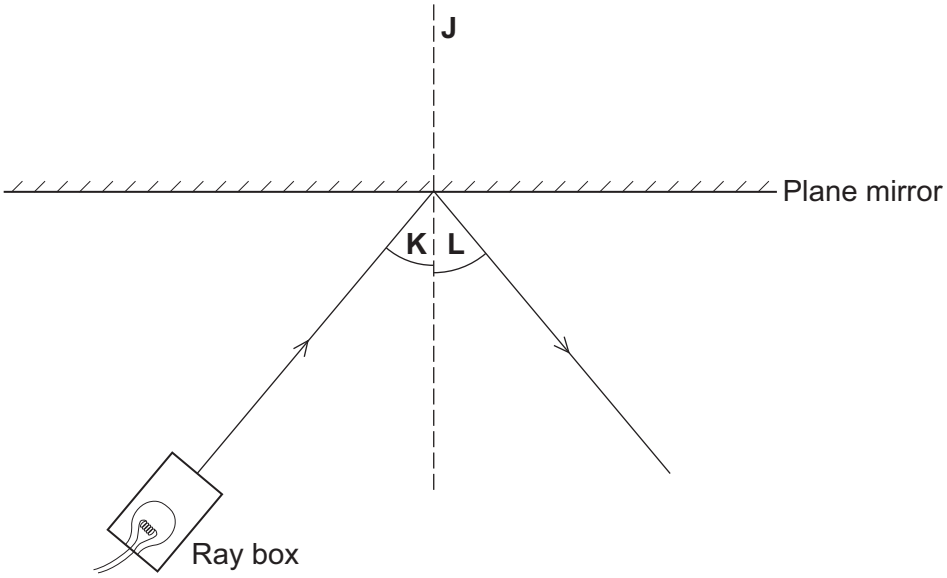
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work 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 8(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.

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

1 The diagram shows a ray of light from a ray box that is reflected by a plane mirror.



1 (a) What name is given to the dashed line labelled **J**?

Draw a ring around the correct answer.

incident **normal** **reflection**

(1 mark)

1 (b) Draw a ring around the correct answer in the box to complete the sentence.

If the angle marked **K** is halved, then the angle marked **L** will

be doubled.

not change.

be halved.

(1 mark)

1 (c) A student looking into the mirror can see an image of the ray box.

Which **two** words can be used to describe the image that the student sees?

Draw a ring around the **two** correct answers.

inverted **magnified** **real** **upright** **virtual**

(2 marks)

4

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

2 (a) The diagram below shows six of the seven types of wave that make up the electromagnetic spectrum.

Gamma rays		Ultraviolet	Visible light	Infrared	Microwaves	Radio waves

2 (a) (i) What type of electromagnetic wave is missing from the diagram?

.....

(1 mark)

2 (a) (ii) Which of the following electromagnetic waves has the most energy?

Draw a ring around the correct answer.

gamma rays **radio waves** **visible light**

(1 mark)

2 (a) (iii) Which of the following electromagnetic waves is given out by a TV remote control?

Draw a ring around the correct answer.

infrared **microwaves** **ultraviolet**

(1 mark)

2 (b) Draw a ring around the correct answer in the box to complete the sentence.

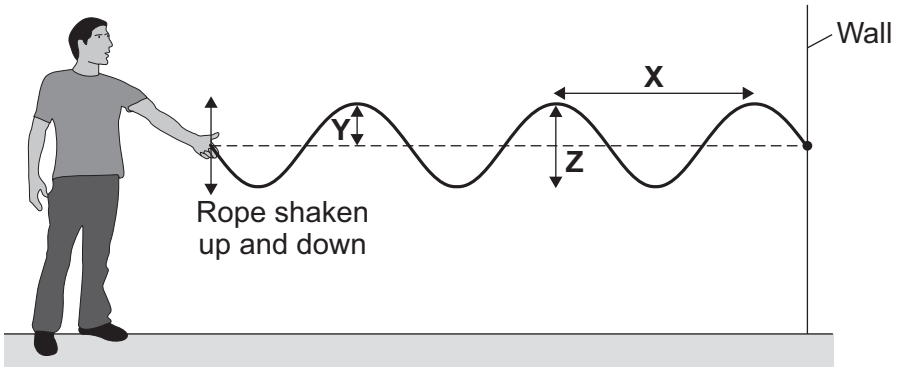
Microwaves travel through a vacuum at

a slower speed than
the same speed as
a faster speed than

radio waves.

(1 mark)

2 (c) The diagram shows waves being produced on a rope.
The waves are **not** reflected by the wall.



2 (c) (i) Draw an arrow on the diagram to show the direction in which the waves transfer energy.
(1 mark)

2 (c) (ii) Which **one** of the arrows, labelled, **X**, **Y** or **Z**, shows the amplitude of a wave?

Write the correct answer in the box. ☐

(1 mark)

2 (c) (iii) The waves produced on the rope are transverse.

Name **one** other type of transverse wave.

.....
(1 mark)

2 (d) The rope is shaken up and down, producing 3 waves every second.
The waves have a wavelength of 1.2 metres.

2 (d) (i) State the frequency of the waves.

..... Hz
(1 mark)

2 (d) (ii) Calculate the speed of the waves.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

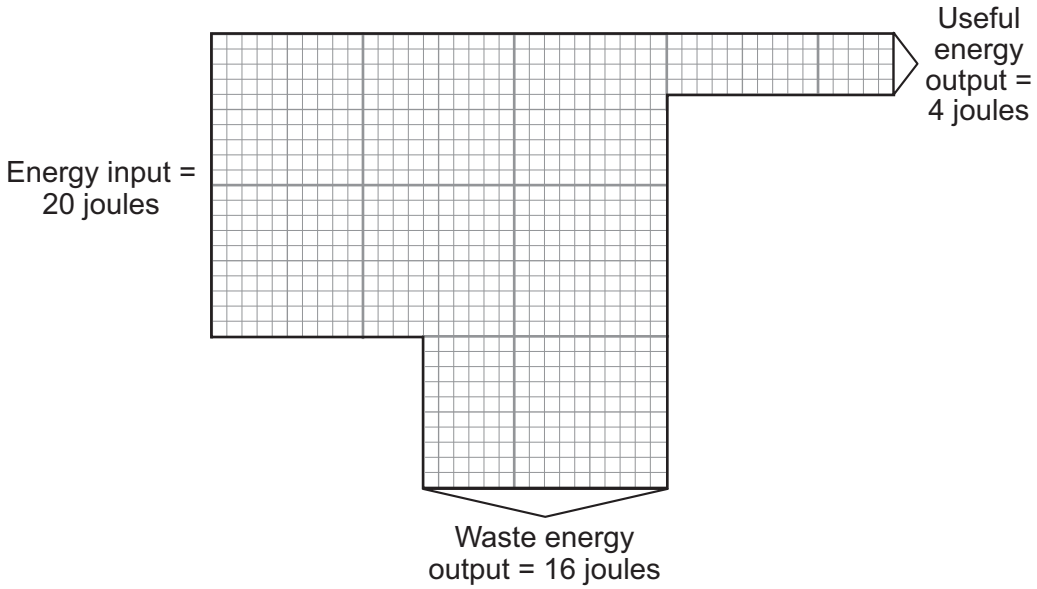
.....

.....

Wave speed = ... m/s
(2 marks)

10

3 (a) The Sankey diagram for a low energy light bulb, known as a CFL, is shown below.



3 (a) (i) What is the useful energy output that the CFL is designed to produce?

.....

(1 mark)

3 (a) (ii) What effect does the waste energy output have on the surrounding air?

.....

.....

(1 mark)

3 (a) (iii) Use the information in the diagram to calculate the efficiency of the CFL.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

.....

Efficiency = ...

(2 marks)

3 (a) (iv) CFLs contain mercury. Mercury is a poisonous substance.

It is important that old CFLs are sent for recycling and not thrown into a rubbish bin.

Suggest **one** reason why.

.....

.....

(1 mark)

3 (b) A new type of low energy bulb uses light emitting diodes (LEDs).

Draw a ring around the correct answer in the box to complete the sentence.

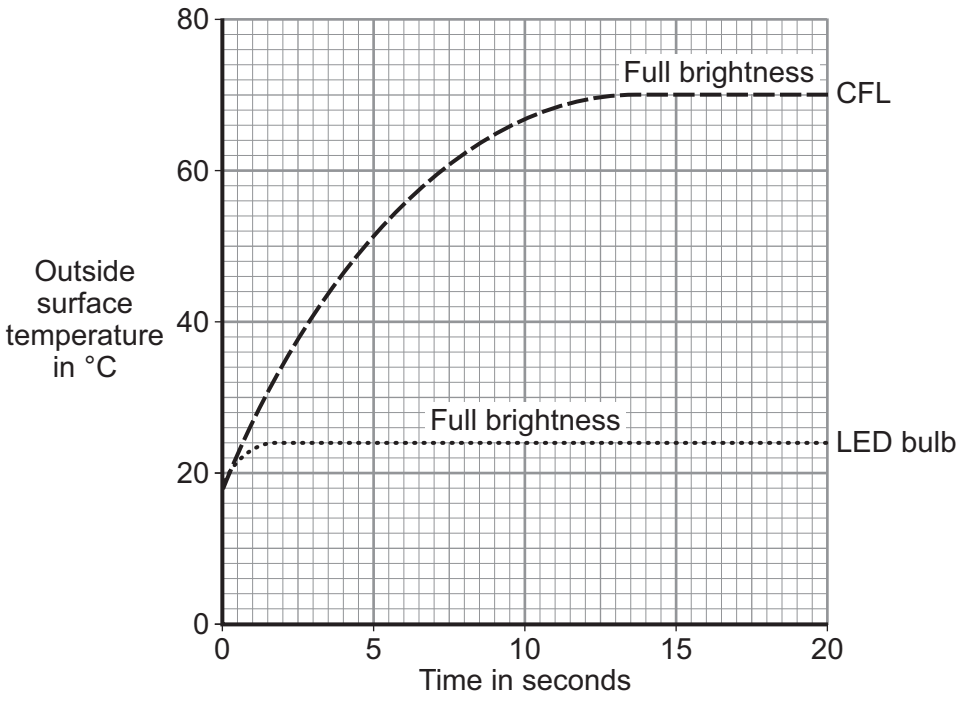
LED bulbs are more efficient than CFLs. This means that LED bulbs

waste | a smaller / the same / a bigger | proportion of the input energy compared to CFLs.

(1 mark)

Question 3 continues on the next page

3 (c) The graph shows how the outside surface temperatures of a CFL and an LED bulb change after they are switched on.



Apart from a higher efficiency, suggest **one** advantage of using an LED bulb rather than a CFL.

.....

.....

(1 mark)

3 (d) At the moment, LED bulbs are much more expensive to buy than CFLs.

Which **two** of the following would a homeowner need to know to decide whether it would be cost-effective to replace a CFL with an equally bright LED bulb?

Tick (✓) **two** boxes.

The number of hours each bulb lasts before needing to be replaced ☐

The power of each bulb in watts ☐

The voltage of the mains electricity supply ☐

(1 mark)

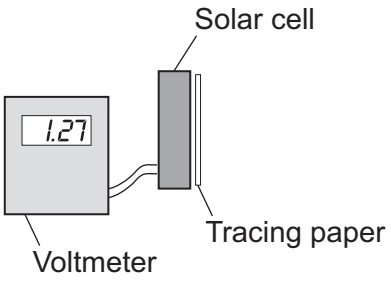
8

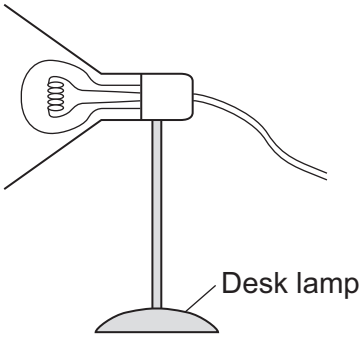
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

4 A student has read that a solar cell with a dirty surface will not work as well as a solar cell with a clean surface.

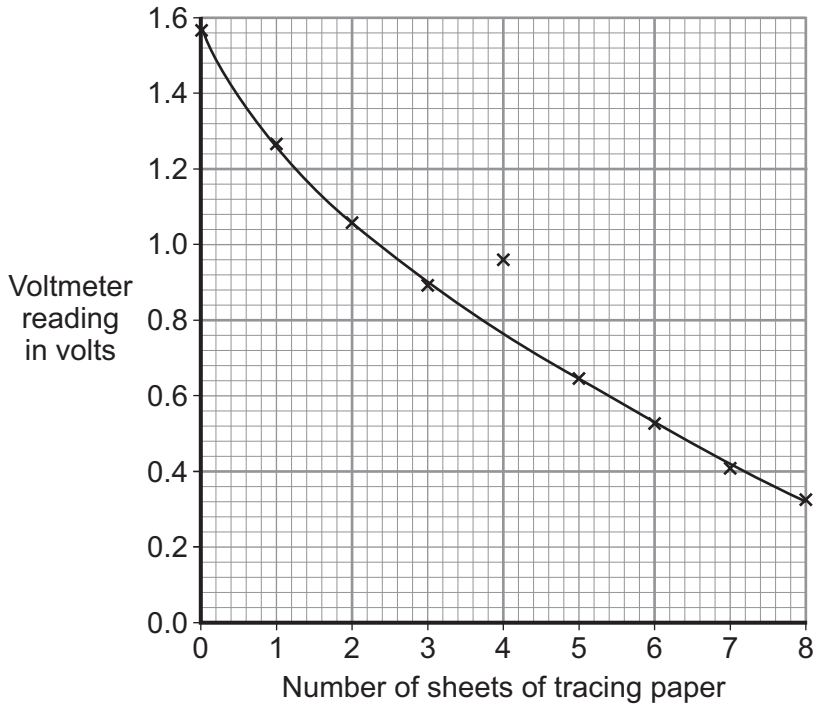
To test the effect of a dirty surface on a solar cell, the student set up the following equipment.





The student put the desk lamp a fixed distance from the solar cell. To represent the effect of a dirty surface, the student covered the surface of the solar cell with pieces of tracing paper. Each time the student added a piece of paper, she measured the output voltage of the solar cell.

4 (a) The results taken by the student have been used to draw the graph below.



4 (a) (i) One of the results seems to be anomalous.

Draw a ring around the anomalous data point on the graph.

(1 mark)

4 (a) (ii) The larger the number of sheets of tracing paper used, the lower the intensity of the light reaching the solar cell.

Draw a ring around the correct answer in the box to complete the sentence.

A decrease in the intensity of the light reaching the solar cell causes

a decrease in
no change to
an increase in

the output voltage from the solar cell.

(1 mark)

4 (b) People can buy panels of solar cells to generate electricity for their homes. Any surplus electricity can be sold to the electricity supply company.

4 (b) (i) Give **one** environmental advantage of generating electricity using solar cells rather than generating electricity in a coal-burning power station.

.....

.....

(1 mark)

4 (b) (ii) A homeowner pays £7600 to have solar panels fitted on the roof of their house. The homeowner expects to save £950 each year from reduced energy bills and from selling the electricity.

Assuming these figures to be correct, calculate the pay-back time for the solar panels.

Show clearly how you work out your answer.

.....

.....

.....

Pay-back time = ... years

(2 marks)

Question 4 continues on the next page

4 (b) (iii) Draw a ring around the correct answer in the box to complete the sentence.

Allowing the surface of the solar panels to become very dirty will

decrease
not change
increase

the pay-back time.

(1 mark)

4 (b) (iv) Explain your answer to part **(b)(iii)**.

.....

.....

.....

.....

(2 marks)

8

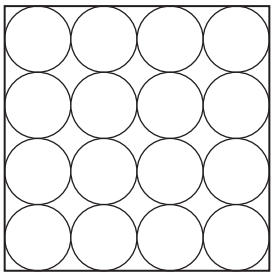
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

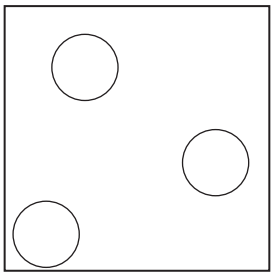
5 (a) The diagrams show the arrangement of the particles in a solid and in a gas.

Each circle represents one particle.

Solid

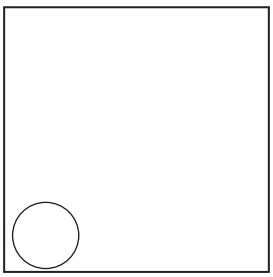


Gas



5 (a) (i) Complete the diagram below to show the arrangement of the particles in a liquid.

Liquid



(2 marks)

5 (a) (ii) Explain, in terms of the particles, why gases are easy to compress.

.....

.....

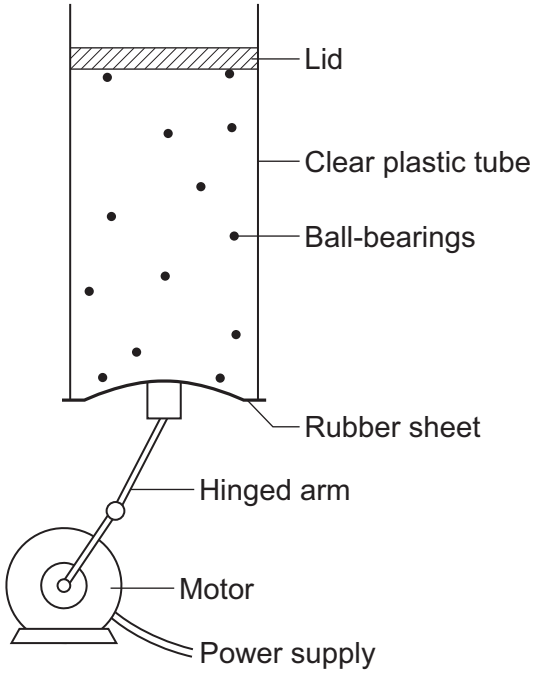
.....

.....

(2 marks)

5 (b) The diagram below shows the model that a science teacher used to show her students that there is a link between the temperature of a gas and the speed of the gas particles.

The ball-bearings represent the gas particles. Switching the motor on makes the ball-bearings move around in all directions.



5 (b) (i) How is the motion of the ball-bearings similar to the motion of the gas particles?

.....

.....

(1 mark)

5 (b) (ii) The faster the motor runs, the faster the ball-bearings move. Increasing the speed of the motor is like increasing the temperature of a gas.

Use the model to predict what happens to the speed of the gas particles when the temperature of a gas is increased.

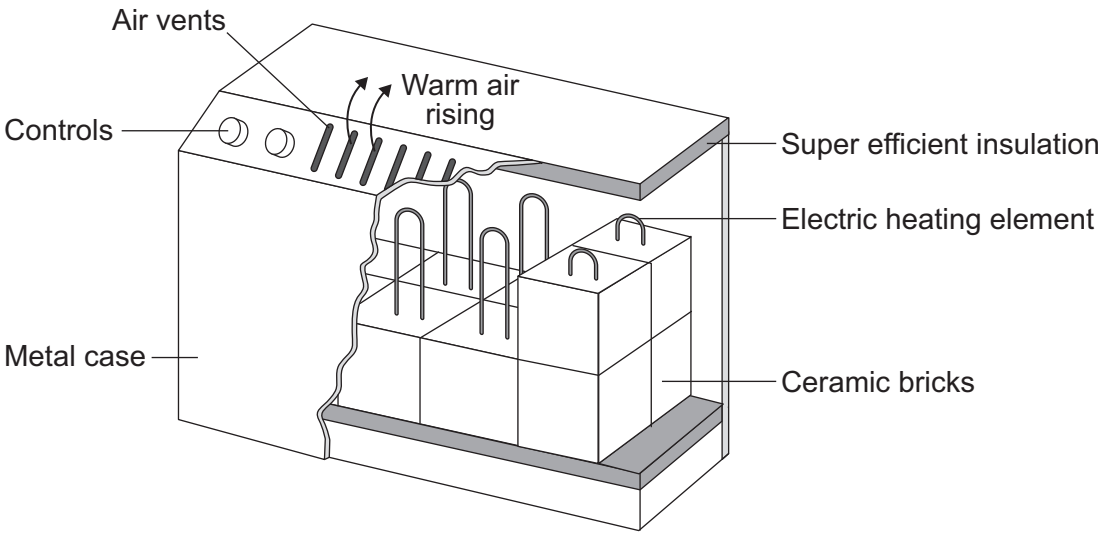
.....

.....

(1 mark)

6

6 The diagram shows how one type of electric storage heater is constructed. The heater has ceramic bricks inside. The electric elements heat the ceramic bricks during the night. Later, during the daytime, the ceramic bricks transfer the stored energy to the room.



6 (a) (i) Complete the following sentences using words from the box.

conduction	**convection**	**evaporation**

Energy is transferred through the metal casing by ..... .

The warm air rising from the heater transfers energy to the

room by ..... .

(2 marks)

6 (a) (ii) The inside of the metal case is insulated.

Which **one** of the following gives the reason why?

Tick (✓) **one** box.

To transfer energy from the ceramic bricks to the room faster ☐

To stop energy from the room transferring into the heater ☐

To keep the ceramic bricks hot for a longer time ☐

(1 mark)

6 (b) In winter, the electricity supply to a 2.6 kW storage heater is switched on for seven hours each day.

6 (b) (i) Calculate the energy transferred, in kilowatt-hours, from the electricity supply to the heater in seven hours.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

6 (b) (ii) The electricity supply to the heater is always switched on between midnight and 7 am. Between these hours, electricity costs 5 p per kilowatt-hour.

Calculate how much it costs to have the heater switched on between midnight and 7 am.

.....

.....

Cost = ... p

(1 mark)

6 (c) Between 7 am and 8 am, after the electricity supply is switched off, the temperature of the ceramic bricks falls by 25 °C.

Calculate the energy transferred from the ceramic bricks between 7 am and 8 am.

Total mass of ceramic bricks = 120 kg.
Specific heat capacity of the ceramic bricks = 750 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

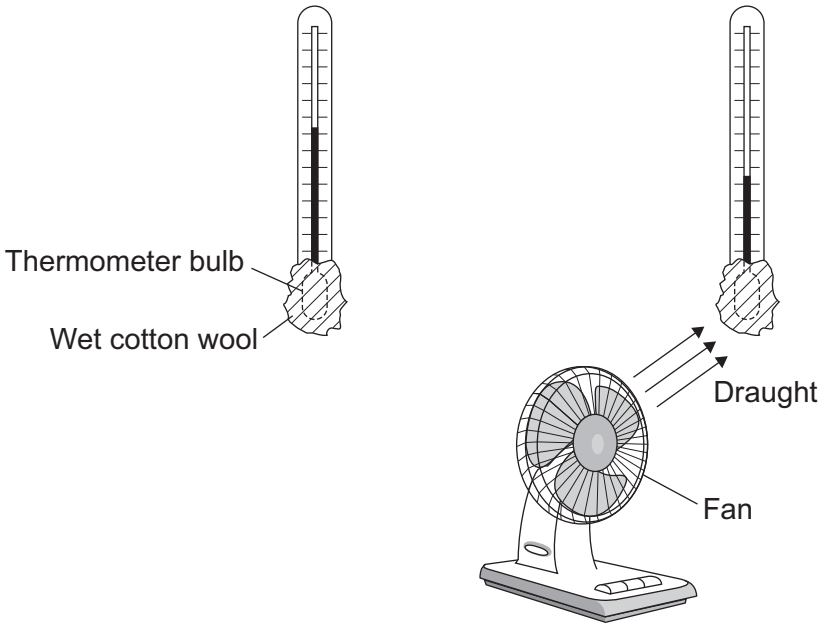
.....

Energy transferred = ... J

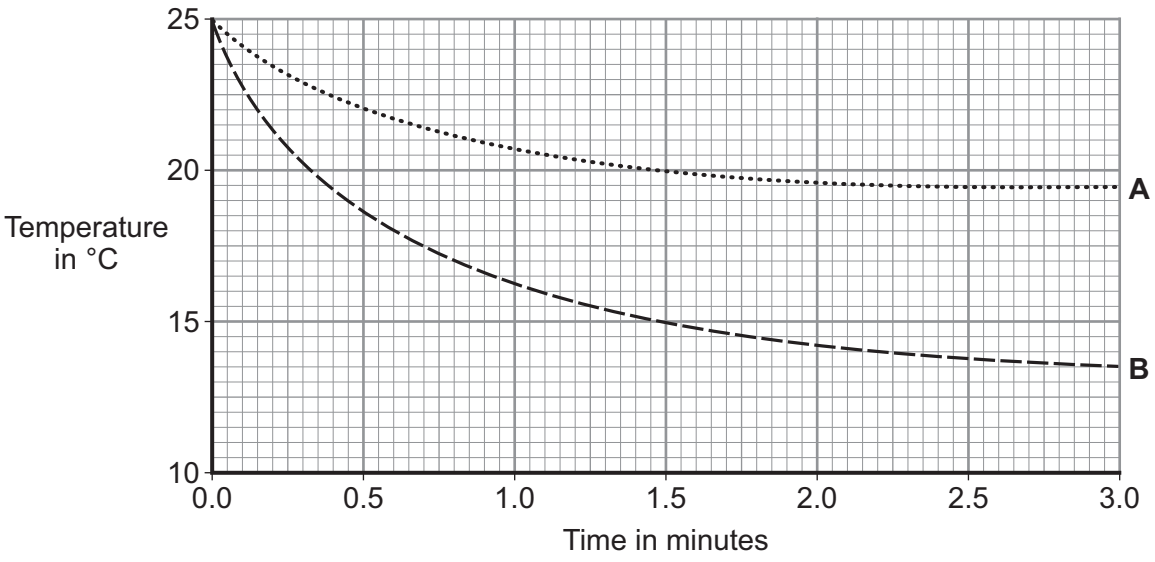
(2 marks)

8

7 The diagram shows two thermometers. The bulb of each thermometer is covered with a piece of wet cotton wool. One of the thermometers is placed in the draught from a fan.



The graph shows how the temperature of each thermometer changes with time.



7 (a) Which of the graph lines, **A** or **B**, shows the temperature of the thermometer placed in the draught?

Write the correct answer in the box. ☐

Explain, in terms of evaporation, the reason for your answer.

.....

.....

.....

.....

.....

.....

(3 marks)

7 (b) A wet towel spread out and hung outside on a day without wind dries faster than an identical wet towel left rolled up in a plastic bag.

Explain why.

.....

.....

.....

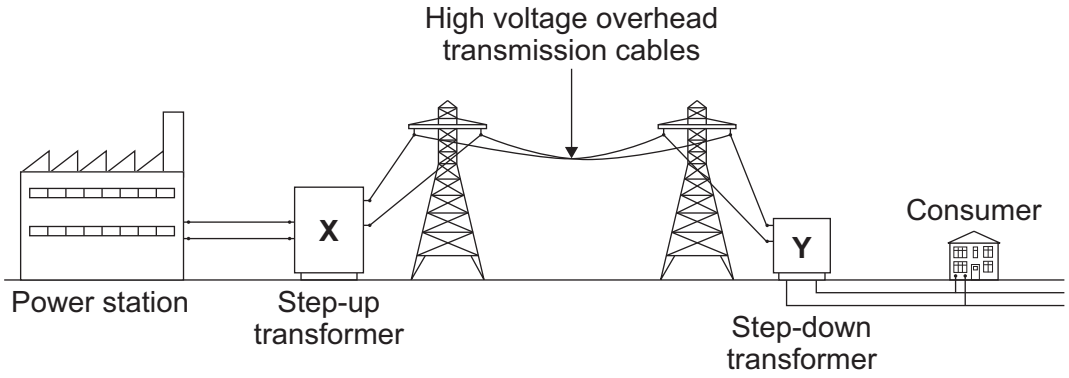
.....

(2 marks)

5

Turn over for the next question

8 The diagram shows the National Grid system.



8 (a) The National Grid includes step-up transformers.

Explain why.

.....

.....

.....

.....

(2 marks)

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

Over the next 10 years, more than 300 kilometres of new high voltage transmission cables are to be added to the National Grid. Most of the new cables will be suspended from pylons and run overhead while the rest will be buried underground.

Outline the advantages and disadvantages of both overhead transmission cables and underground transmission cables.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

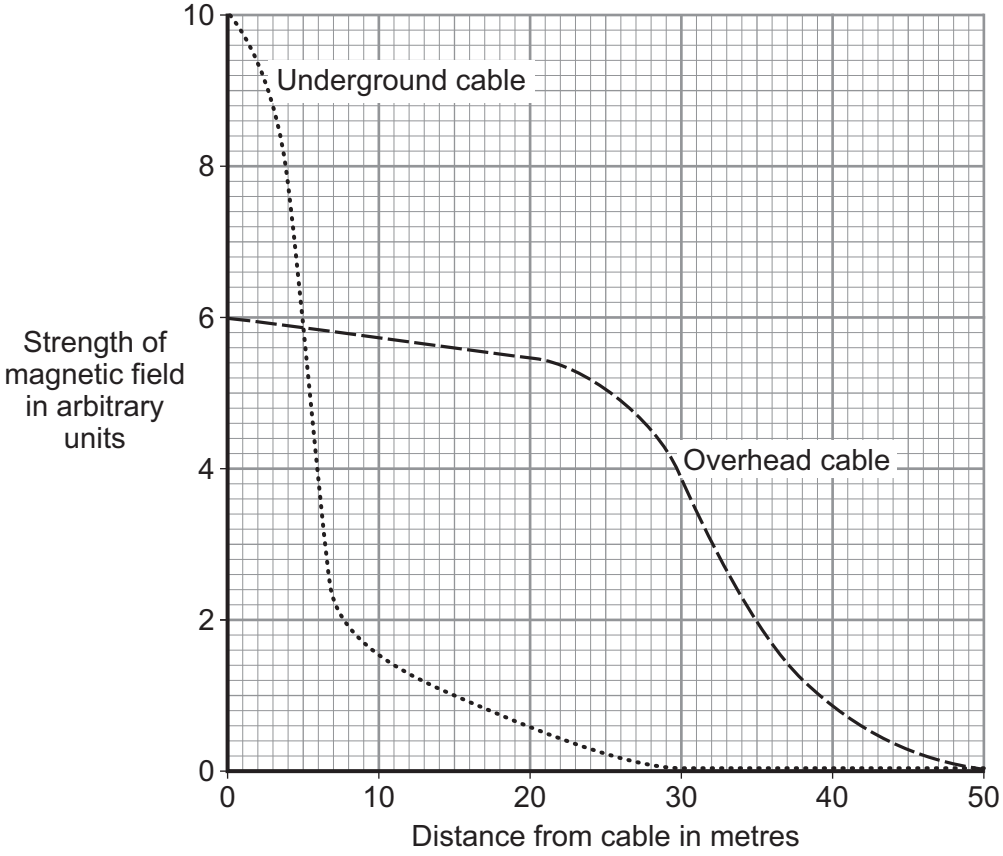
.....

(6 marks)

Question 8 continues on the next page

8 (c) When an electric current flows through a transmission cable, a magnetic field is produced.

The graph shows how the strength of the magnetic field varies with distance from both overhead and underground transmission cables that carry the same current.



What conclusions may be drawn from this graph?

.....

.....

.....

.....

(2 marks)

8 (d) Some people think that, because of the magnetic fields, living close to transmission cables is dangerous to health. Laboratory studies on mice and rats exposed to magnetic fields for two or more years found that the magnetic fields had no effect on the animals' health.

Draw a ring around the correct answer in the box to complete the sentence.

Using animals in scientific research raises | economic / environmental / ethical | issues.

(1 mark)

11

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED