

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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9	
TOTAL	



General Certificate of Secondary Education
Foundation Tier
January 2013

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Thursday 17 January 2013 1.30 pm to 2.30 pm

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a ruler • a calculator • the Physics Equations Sheet (enclosed).
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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.



J A N 1 3 P H 1 F P O 1

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

- 1** Three energy sources used to generate electricity are given in **List A**.
Statements about the energy sources used to generate electricity are given in **List B**.

Draw **one** line from each energy source in **List A** to the statement about the energy source in **List B**.

List A
Energy source

Geothermal

Hydroelectric

Nuclear

List B
Statement about energy source

Uses energy from falling water

Uses energy from inside the Earth

Is unpredictable

Produces dangerous waste

(3 marks)

3



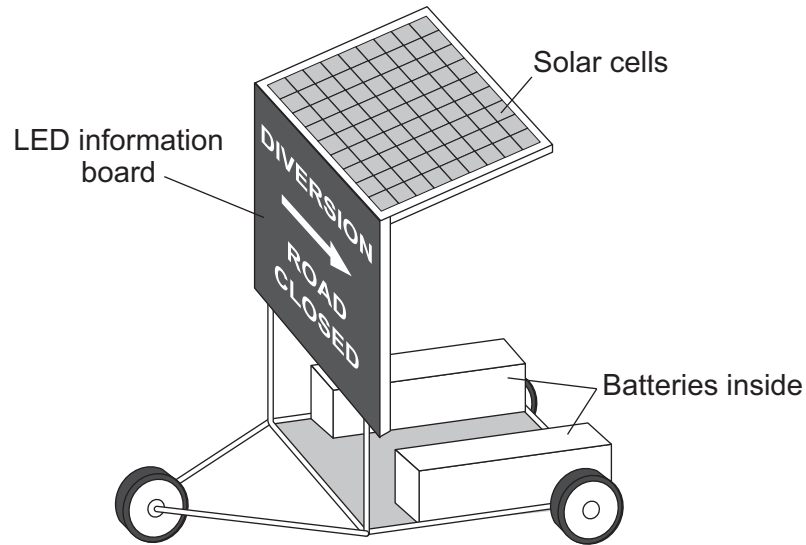
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ANSWER IN THE SPACES PROVIDED**

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- 2 The picture shows a temporary road traffic information board.



The batteries power the LEDs used in the information board.
The solar cells keep the batteries charged.

- 2 (a) Use words from the box to complete each of the following sentences.

chemical	electrical	light	sound
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The solar cells transfer light energy to energy.

The batteries transfer energy to electrical energy.

The LEDs transfer electrical energy to energy.

(3 marks)



2 (b) When the total energy input to the solar cells is 200 joules, the useful energy output from the solar cells to the batteries is 50 joules.

Calculate the efficiency of the solar cells.

Use the correct equation from the Physics Equations Sheet.

.....
.....
.....

Efficiency =
(2 marks)

2 (c) Which **one** of the following statements gives the reason for using solar cells to charge the batteries?

Tick (✓) **one** box.

Solar cells will charge the batteries day and night.

The information board can be used anywhere it is needed.

A small number of solar cells produce a lot of electricity.

(1 mark)

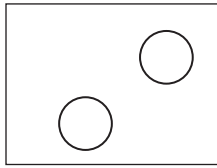
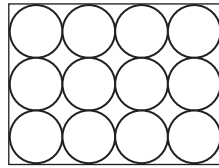
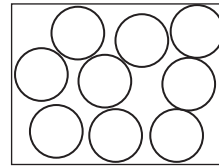
6

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- 3 (a)** The diagrams, **X**, **Y** and **Z**, show how the particles are arranged in the three states of matter.

**X****Y****Z**

- 3 (a) (i)** Which **one** of the diagrams, **X**, **Y** or **Z**, shows the arrangement of particles in a liquid?

Write the correct answer in the box.

(1 mark)

- 3 (a) (ii)** Which **one** of the diagrams, **X**, **Y** or **Z**, shows the arrangement of particles in a gas?

Write the correct answer in the box.

(1 mark)

- 3 (b)** Draw a ring around the correct answer in each box to complete each sentence.

- 3 (b) (i)** In a gas, the particles are

vibrating in fixed positions.
moving randomly.
not moving.

(1 mark)

- 3 (b) (ii)** In a solid, the forces between the particles are

stronger than
equal to
weaker than

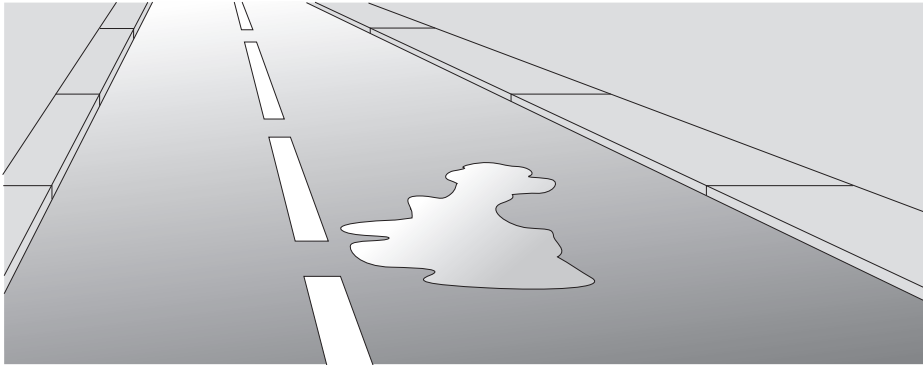
the forces between

the particles in a liquid.

(1 mark)



- 3 (c)** The picture shows a puddle of water in a road, after a rain shower.



- 3 (c) (i)** During the day, the puddle of water dries up and disappears. This happens because the water particles move from the puddle into the air.

What process causes water particles to move from the puddle into the air?

Draw a ring around the correct answer.

condensation

evaporation

radiation

(1 mark)

- 3 (c) (ii)** Describe **one** change in the weather which would cause the puddle of water to dry up faster.

.....

(1 mark)

6

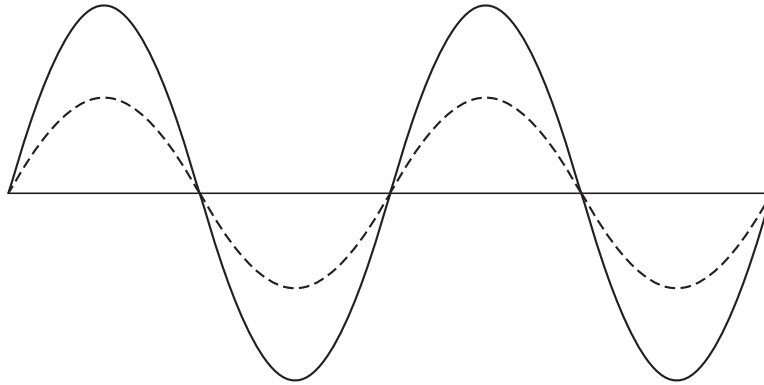
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4 (a) **Diagram 1** shows two waves.

Diagram 1



4 (a) (i) Name **one** wave quantity that is the same for the two waves.

.....

(1 mark)

4 (a) (ii) Name **one** wave quantity that is different for the two waves.

.....

(1 mark)

4 (a) (iii) The waves in **Diagram 1** are transverse.

Which **one** of the following types of wave is **not** a transverse wave?

Draw a ring around the correct answer.

gamma rays

sound

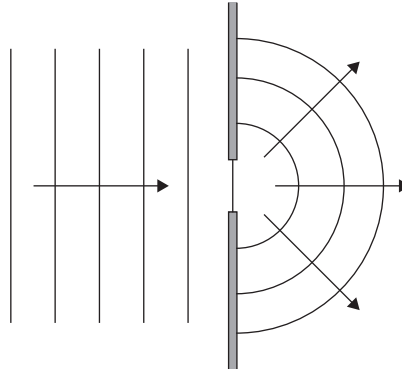
visible light

(1 mark)



4 (b) **Diagram 2** shows water waves in a ripple tank moving towards and passing through a gap in a barrier.

Diagram 2



4 (b) (i) The water waves spread out after passing through the gap in the barrier.

What name is given to the process causing the waves to spread out?

.....

(1 mark)

4 (b) (ii) Every second, 8 waves pass through the gap in the barrier. The waves have a wavelength of 0.015 metres.

Calculate the speed of the water waves and give the unit.

Use the correct equation from the Physics Equations Sheet.

.....

Speed =

(3 marks)

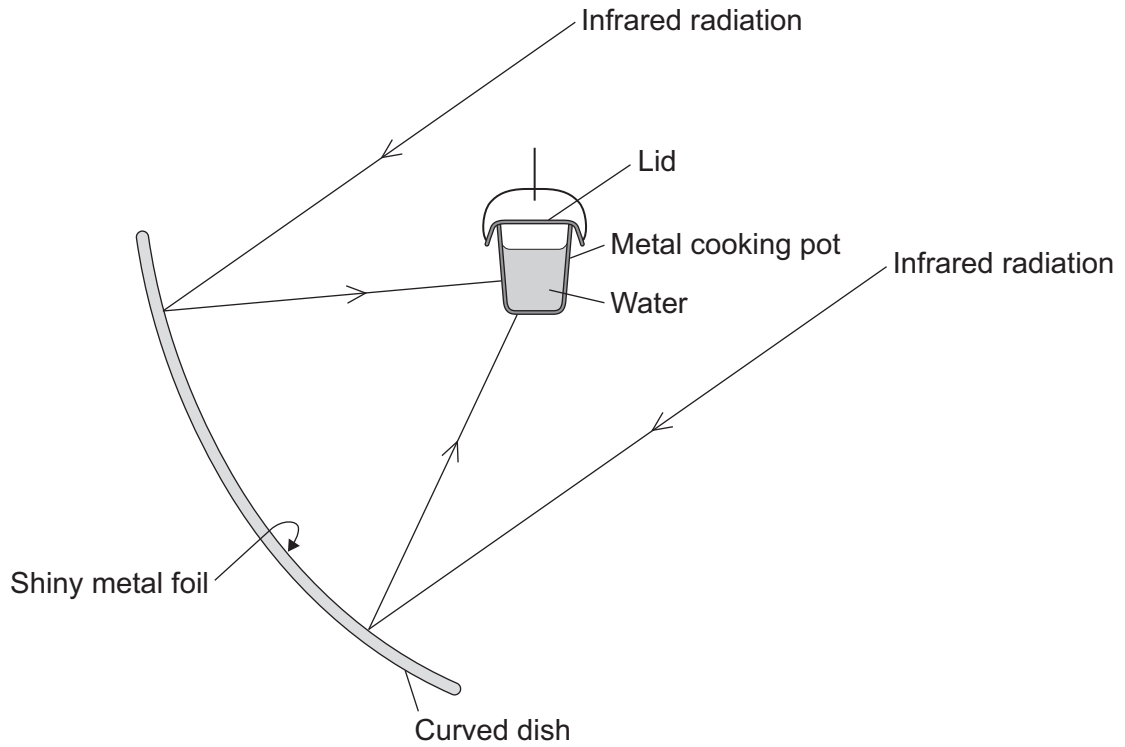
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5 The diagram shows the design of a solar cooker. The cooker heats water using infrared radiation from the Sun.



5 (a) Why is the inside of the large curved dish covered with shiny metal foil?

.....
.....

(1 mark)

5 (b) Which would be the best colour to paint the outside of the metal cooking pot?

Draw a ring around the correct answer.

black

silver

white

Give a reason for your answer.

.....
.....
.....

(2 marks)



5 (c) Why does the cooking pot have a lid?

.....
.....

(1 mark)

5 (d) Calculate how much energy is needed to increase the temperature of 2 kg of water by 80 °C.

The specific heat capacity of water = 4200 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

.....
.....
.....

Energy = J
(2 marks)

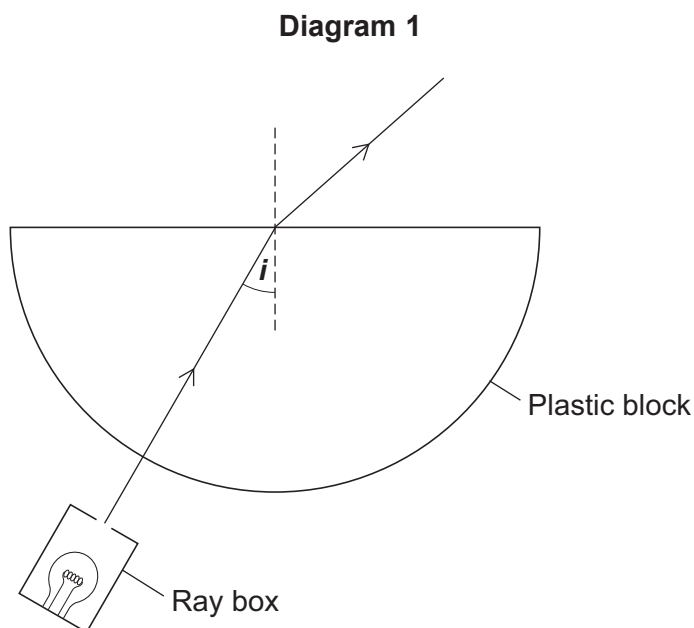
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- 6 A student investigated the refraction of light as it passed out of a clear plastic block into the air.
Diagram 1 shows the apparatus the student used.

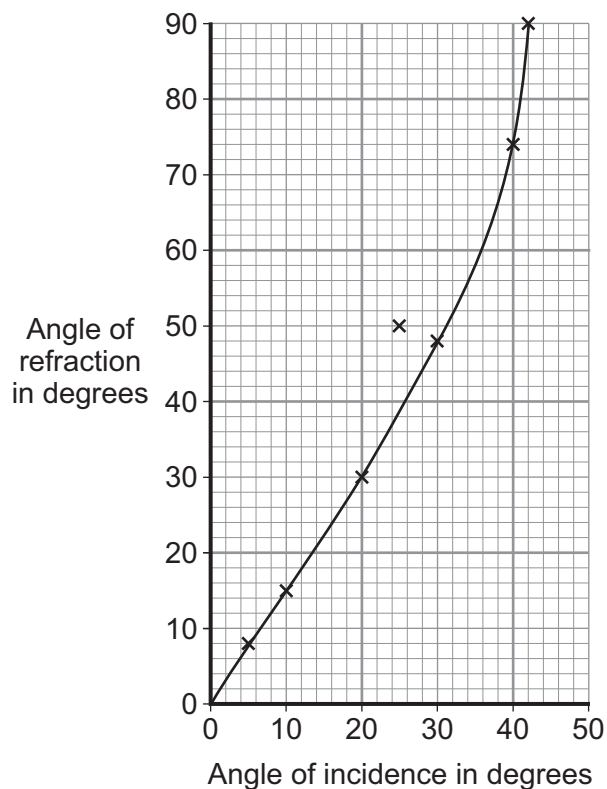


- 6 (a) The angle i is the angle of incidence.

Use the letter r to mark the angle of refraction on **Diagram 1**.

(1 mark)

- 6 (b) The student measured the angle of refraction for different angles of incidence. The results are shown in the graph.



6 (b) (i) One of the results seems to be anomalous.

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

(1 mark)

6 (b) (ii) The student did measure the angles of incidence accurately.

What is likely to have caused the anomalous result?

.....

(1 mark)

6 (b) (iii) What conclusion can the student make from the results shown in the graph.

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

The angle of refraction is

less than
equal to
greater than

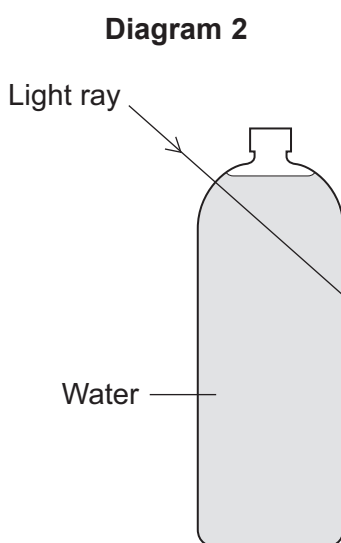
 the angle of incidence.

(1 mark)

6 (c) Light travelling from water into air is refracted in the same way as when light travels from plastic into air.

Diagram 2 shows a large bottle, filled with water. The bottle is made from clear plastic.

Draw on **Diagram 2** the path of the light ray as it passes out of the bottle into the air.



(2 marks)

Question 6 continues on the next page

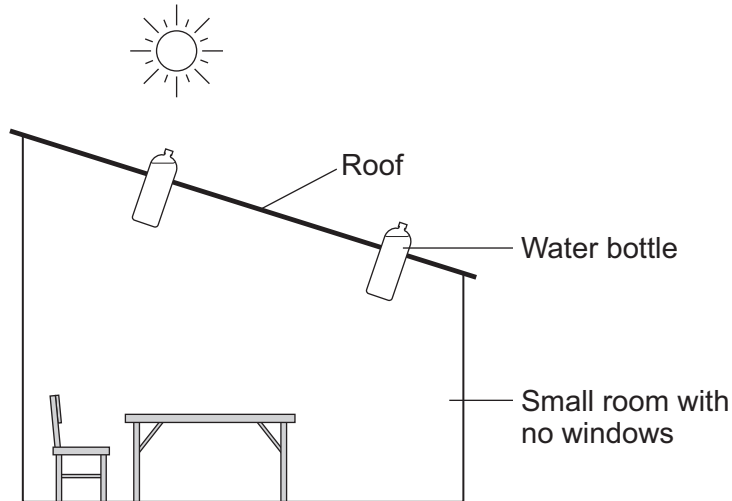
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6 (d) In some countries, people are too poor to pay for electricity. Some people living in small houses with no natural light use bottles filled with water as a sort of light bulb.

The bottles are fitted into small holes in the roof of the house. Sunlight goes into the bottle of water. When the light leaves the bottle, the light is refracted, causing sunlight to spread into the room.

Diagram 3



6 (d) (i) What is likely to be the most important outcome of using this simple device to provide light?

Tick (✓) **one** box.

People will have enough light to work inside their homes.

Fewer plastic bottles will be thrown into rubbish tips.

Plastic bottles will increase in value.

(1 mark)

6 (d) (ii) Suggest **one** disadvantage of using this device compared with using a light bulb.

.....

.....

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(1 mark)

8



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7 (a) Scientists have observed that the wavelengths of the light from galaxies moving away from the Earth are longer than expected.

7 (a) (i) What name is given to this observation?

.....
(1 mark)

7 (a) (ii) Draw a ring around the correct answer in the box to complete the sentence.

This observation gives scientists evidence that

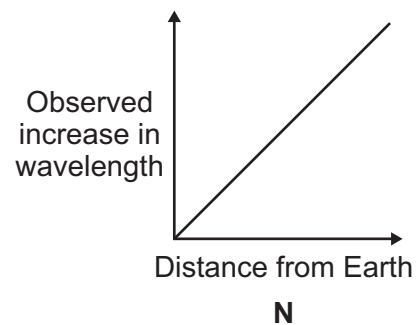
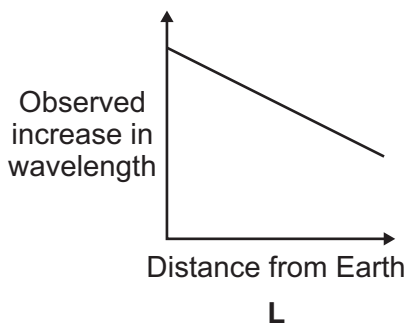
light can be stretched.

galaxies are changing colour.

the Universe is expanding.

(1 mark)

7 (a) (iii) There is a pattern linking the size of the observed increase in the wavelengths of light from a galaxy and the distance the galaxy is from the Earth.



Which **one** of the graphs, **L**, **M** or **N**, shows the correct pattern?

Write the correct answer in the box.

(1 mark)



7 (b) Observations help scientists answer questions about the Universe.

Scientists **cannot** answer every question.

Which **one** of the following questions **cannot** be answered by scientists?

Tick (✓) **one** box.

How old is the Universe?

Why was the Universe created?

How fast does light travel through the Universe?

(1 mark)

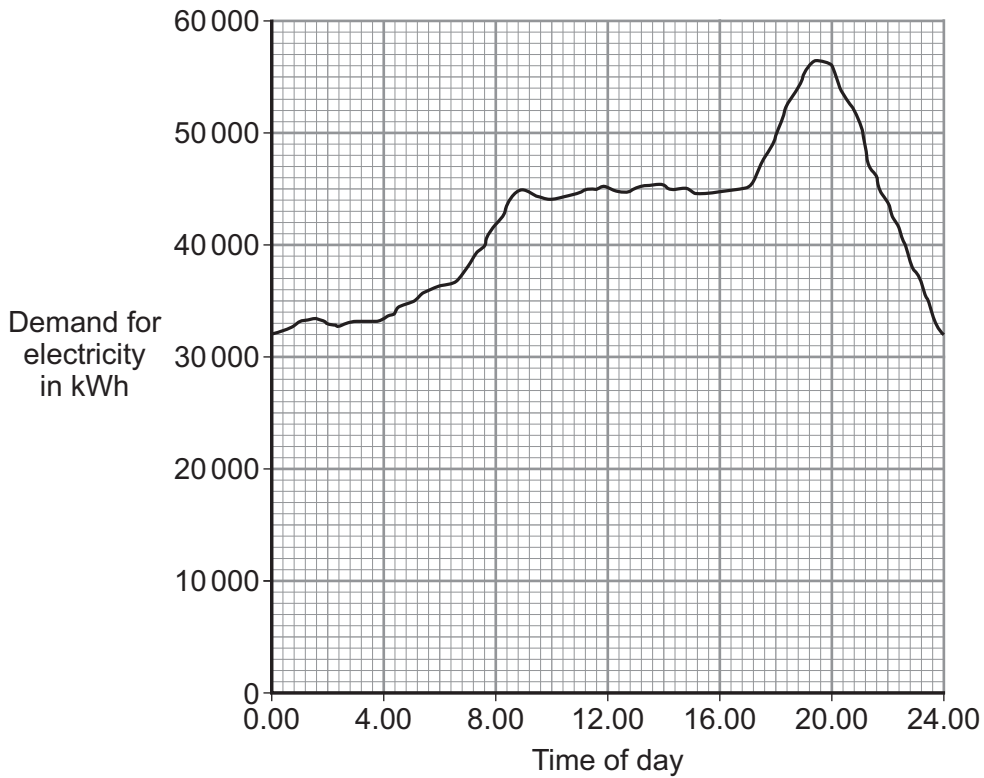
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8 (a) The graph shows how the demand for electricity in the UK changes during one 24-hour period.



The table gives the start-up times for two types of power station.

Type of power station	Start-up time
Gas	A few minutes
Nuclear	Several days

How would these two types of power station be used to meet the demand for electricity during this 24-hour period?

.....

.....

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.....

(3 marks)



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

A farmer plans to generate all the electricity needed on her farm, using either a biogas generator or a small wind turbine.

The biogas generator would burn methane gas. The methane gas would come from rotting the animal waste produced on the farm. When burnt, methane produces carbon dioxide.

The biogas generator would cost £18 000 to buy and install. The wind turbine would cost £25 000 to buy and install.

The average power output from the wind turbine would be the same as the continuous output from the biogas generator.

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

Conclude, with a reason, which system would be better for the farmer to buy and install.

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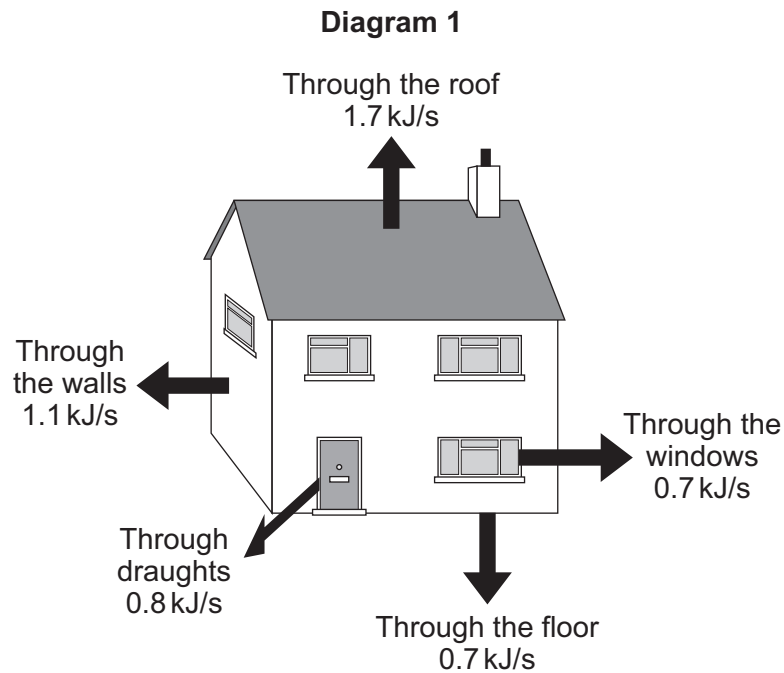
(6 marks)

9

Turn over ►



- 9 **Diagram 1** shows the energy transferred per second from a badly insulated house on a cold day in winter.



- 9 (a) (i) When the inside of the house is at a constant temperature, the energy transferred from the heating system to the inside of the house equals the energy transferred from the house to the outside.

Calculate, in kilowatts, the power of the heating system used to keep the inside of the house in **Diagram 1** at a constant temperature.

1 kilowatt (kW) = 1 kilojoule per second (kJ/s)

Power of the heating system = kW
(1 mark)



9 (a) (ii) In the winter, the heating system is switched on for a total of 7 hours each day.

Calculate, in kilowatt-hours, the energy transferred each day from the heating system to the inside of the house.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Energy transferred each day = kWh
(2 marks)

9 (a) (iii) Energy costs 15 p per kilowatt-hour.

Calculate the cost of heating the house for one day.

.....

Cost =
(1 mark)

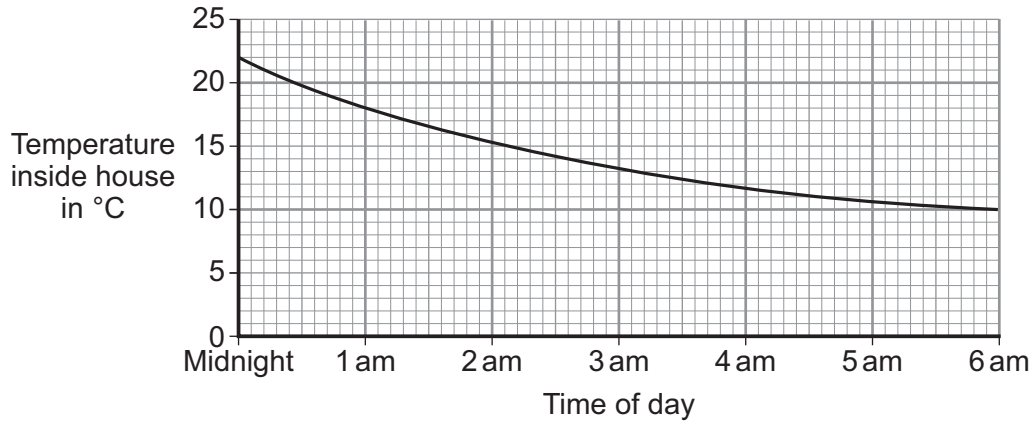
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9 (a) (iv) The heating system is switched off at midnight.

The graph shows how the temperature inside the house changes after the heating system has been switched off.



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

Between midnight and 6 am the rate of energy transfer from

the house	decreases.
	decreases then stays constant.
	increases.

Give the reason for your answer.

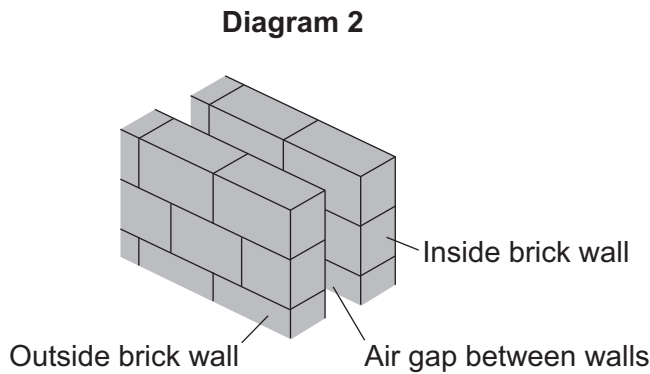
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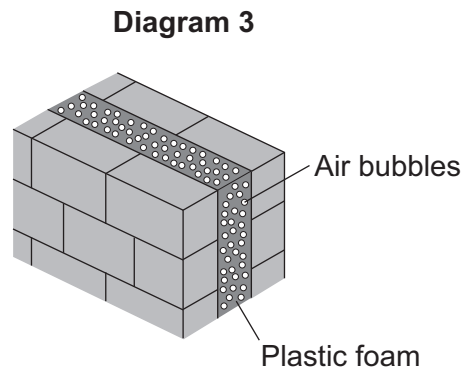
(2 marks)



- 9 (b)** **Diagram 2** shows how the walls of the house are constructed.
Diagram 3 shows how the insulation of the house could be improved by filling the air gap between the two brick walls with plastic foam.



U-value of the wall = 0.7



U-value of the wall = 0.3

- 9 (b) (i)** The plastic foam reduces energy transfer by convection.

Explain why.

.....

.....

.....

.....

(2 marks)

- 9 (b) (ii)** Filling the air gap with plastic foam reduces the U-value of the wall.

What is meant by the term *U-value*?

.....

.....

(1 mark)

Question 9 continues on the next page

Turn over ►



9 (c) A homeowner has part of the outside wall of her house removed and replaced with double-glazed glass doors.

U-value of the wall = 0.3

U-value of glass doors = 1.8

Explain the effect of replacing part of the outside wall with glass doors on the rate of energy transfer from the house.

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(2 marks)

11

END OF QUESTIONS

