

Centre Number						Candidate Number				
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Other Names										
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



General Certificate of Secondary Education  
Higher Tier  
January 2013

**Science A**  
Unit Physics P1

**PH1HP**

**H**

**Physics**  
Unit Physics P1

**Thursday 17 January 2013 1.30 pm to 2.30 pm**

**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 3(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**

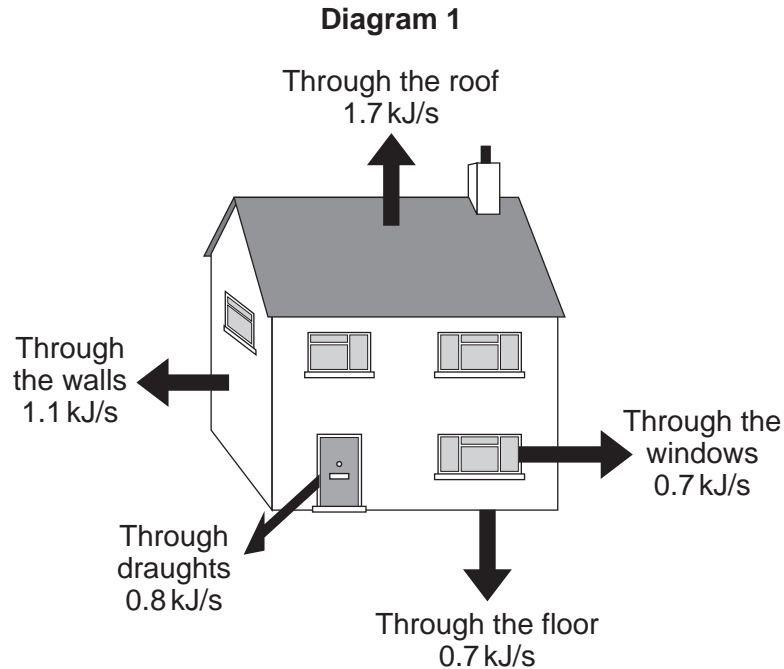
- In all calculations, show clearly how you work out your answer.



J A N 1 3 P H 1 H P 0 1

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

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



- 1 (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)



**1 (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)

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

Calculate the cost of heating the house for one day.

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Cost = .....  
(1 mark)

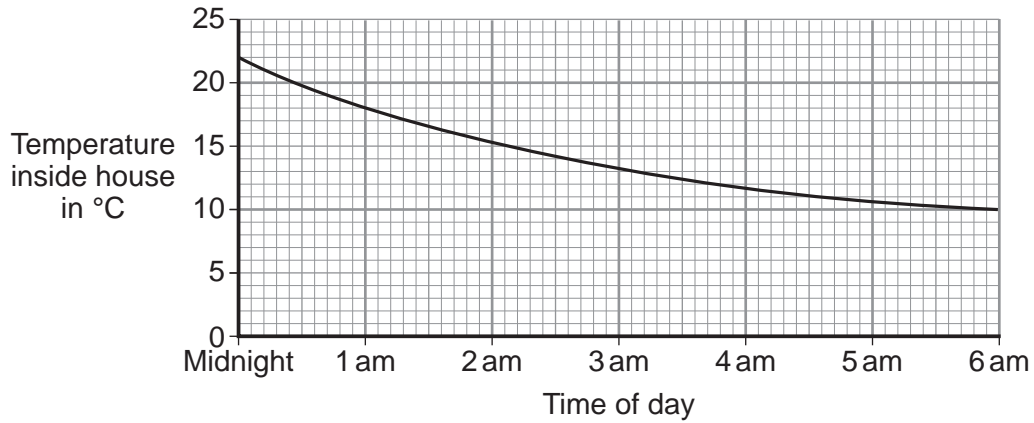
**Question 1 continues on the next page**

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1 (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.

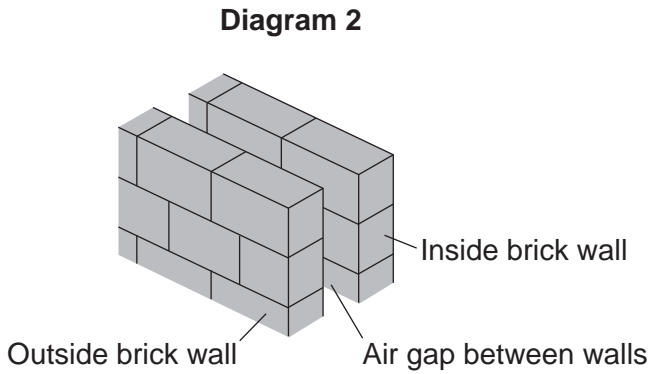
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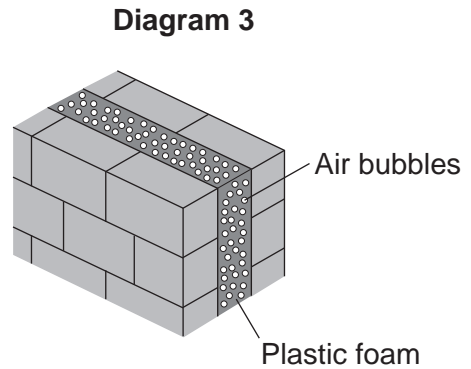
(2 marks)



- 1 (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

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

Explain why.

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(2 marks)

- 1 (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 1 continues on the next page**

**Turn over ►**



**1 (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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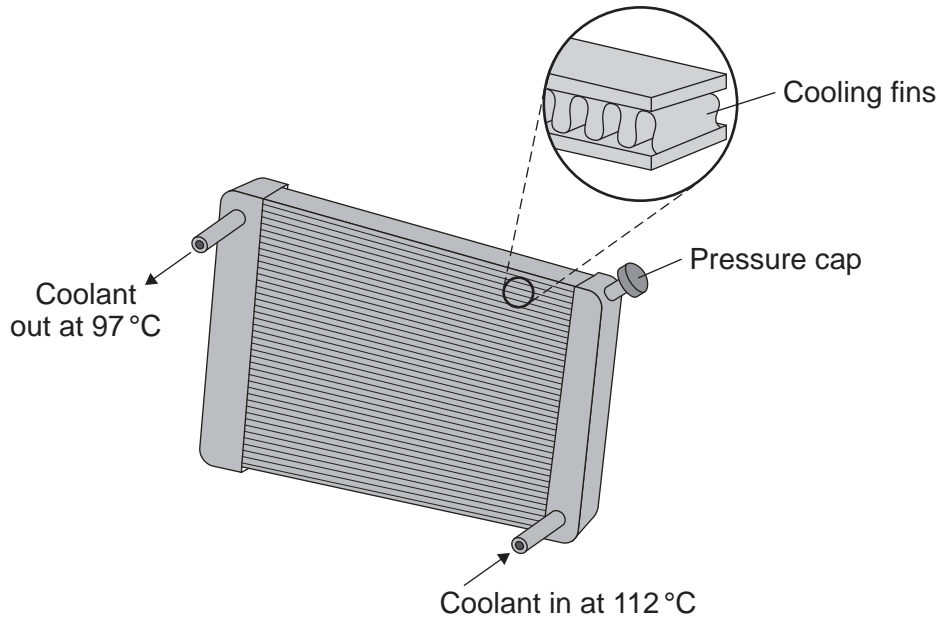
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(2 marks)

11



2 The diagram shows a car radiator. The radiator is part of the engine cooling system.



Liquid coolant, heated by the car engine, enters the radiator. As the coolant passes through the radiator, the radiator transfers energy to the surroundings and the temperature of the coolant falls.

2 (a) Why is the radiator painted black?

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(2 marks)

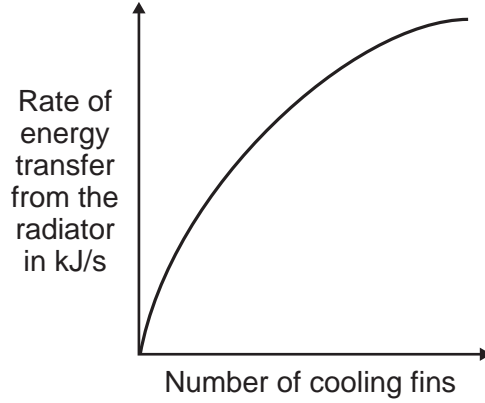
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**2 (b)** Different radiators have different numbers of cooling fins along the length of the radiator.

The sketch graph shows how the number of cooling fins affects the rate of energy transfer from the radiator.



The number of cooling fins affects the rate of energy transfer from the radiator.

Explain how.

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(2 marks)





**2 (c)** When the car engine is working normally, 2 kg of coolant passes through the radiator each second. The temperature of the coolant falls from 112 °C to 97 °C.

Calculate the energy transferred each second from the coolant.

Specific heat capacity of the coolant = 3800 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

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Energy transferred each second = ..... J  
(3 marks)

**2 (d)** On cold days, some of the energy transferred from a hot car engine is used to warm the air inside the car. This is a useful energy transfer.

What effect, if any, does this energy transfer have on the overall efficiency of the car engine?

Draw a ring around the correct answer.

**decreases  
the efficiency**

**does not change  
the efficiency**

**increases  
the efficiency**

Give a reason for your answer.

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(2 marks)

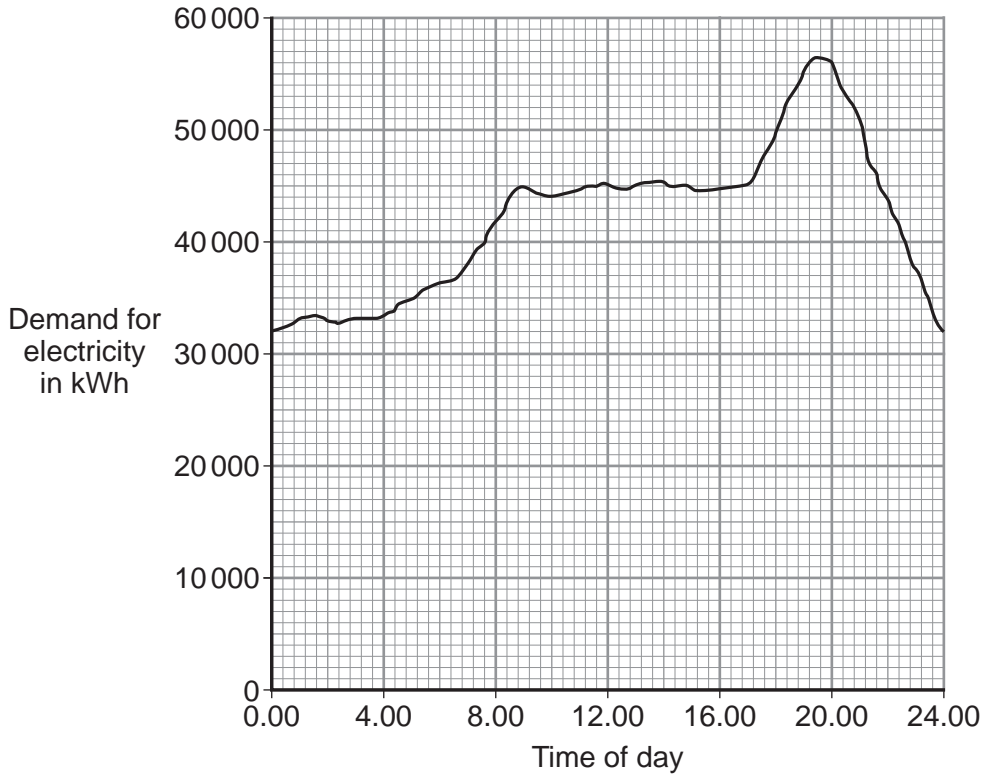
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**3 (a)** The graph shows how the demand for electricity in the UK changes during one 24-hour period.



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)



**3 (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)

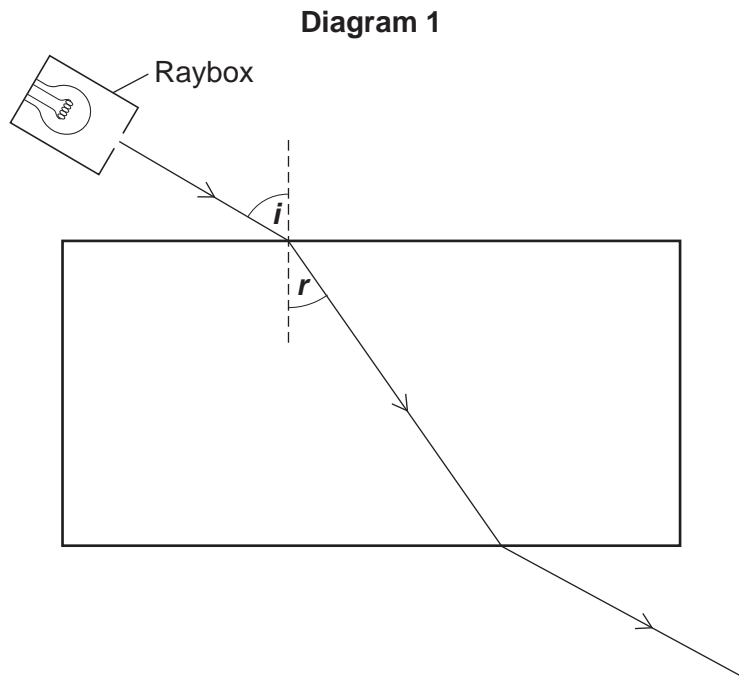
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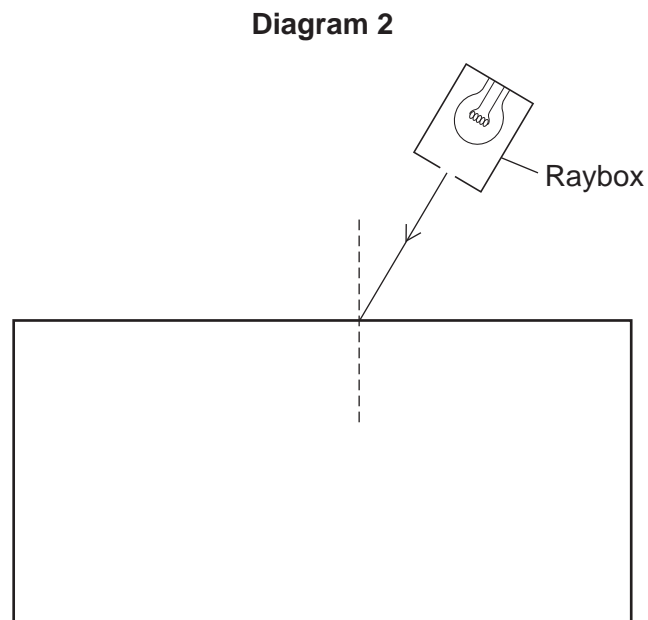
- 4 A student investigated the refraction of light as it passes into and out of a clear plastic block.

**Diagram 1** shows the apparatus the student used.



- 4 (a) **Diagram 2** shows the same apparatus.

Use a ruler to draw on **Diagram 2** the path of the light ray.

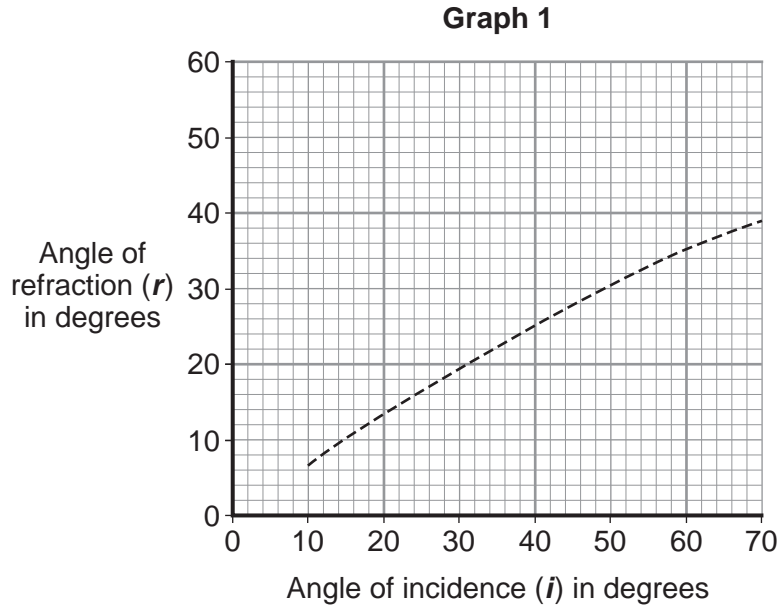


(2 marks)



**4 (b)** The student measured the angle of refraction ( $r$ ) for different angles of incidence ( $i$ ) for light entering the plastic block.

The results are shown in **Graph 1**.



**4 (b) (i)** What **two** conclusions can be made about the relationship between the angle of incidence and the angle of refraction from **Graph 1**?

- 1 .....
- .....
- 2 .....
- .....

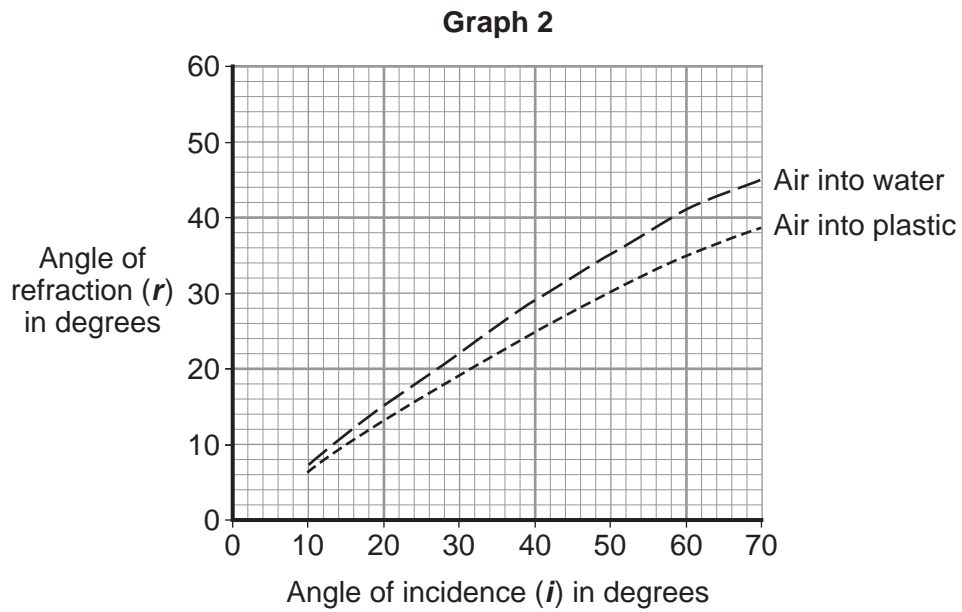
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**Question 4 continues on the next page**

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- 4 (b) (ii) **Graph 2** shows the student's results for light passing from air into plastic. The graph also shows the results for light passing from air into water.



How does the refraction of light passing from air into water compare to the refraction of light passing from air into plastic?

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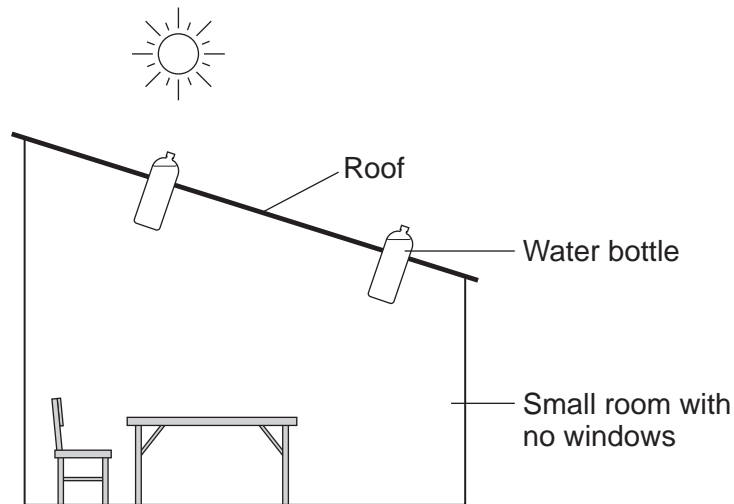
(1 mark)



4 (c) In some countries people are too poor to pay for electricity. Some people living in small houses with no natural light are using bottles filled with water instead of light bulbs.

The bottles are fitted into small holes in the roof of the house. Sunlight refracts as it passes into and out of the bottle, causing light to spread into the room. This simple device gives about the same amount of light as a 50W light bulb.

Diagram 3



4 (c) (i) Suggest **one** way this simple device can help improve the lives of the people using it.

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.....

(1 mark)

4 (c) (ii) The increasing use of energy resources to generate electricity within developed countries has ethical implications.

Suggest **one** ethical implication.

.....

.....

(1 mark)

7

Turn over for the next question

Turn over ►



5 Galaxies emit all types of electromagnetic wave.

5 (a) (i) Which type of electromagnetic wave has the shortest wavelength?

.....

(1 mark)

5 (a) (ii) State **one** difference between an ultraviolet wave and a visible light wave.

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.....

(1 mark)

5 (b) Electromagnetic waves travel through space at a speed of  $3.0 \times 10^8$  m/s.

The radio waves emitted from a distant galaxy have a wavelength of 25 metres.

Calculate the frequency of the radio waves emitted from the galaxy and give the unit.

Use the correct equation from the Physics Equations Sheet.

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Frequency = .....

(3 marks)

5 (c) Scientists use a radio telescope to measure the wavelength of the radio waves emitted from the galaxy in part (b) as the waves reach the Earth. The scientists measure the wavelength as 25.2 metres. The effect causing this observed increase in wavelength is called red-shift.

5 (c) (i) The waves emitted from most galaxies show red-shift.

What does red-shift tell scientists about the direction most galaxies are moving?

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(1 mark)





**5 (c) (ii)** The size of the red-shift is **not** the same for all galaxies.

What information can scientists find out about a galaxy when they measure the size of the red-shift the galaxy produces?

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(2 marks)

**5 (c) (iii)** What does the observation of red-shift suggest is happening to the Universe?

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(1 mark)

9

**Turn over for the next question**

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**6** About half of the UK's electricity is generated in coal-burning power stations and nuclear power stations.

**6 (a)** Coal-burning power stations and nuclear power stations provide a reliable way of generating electricity.

What is meant by a *reliable way of generating electricity*?

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.....

(1 mark)

**6 (b)** Over the next few years, most of the older nuclear power stations in the UK will be closed down, and the process of decommissioning will start.

What does it mean to *decommission* a nuclear power station?

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(1 mark)

**6 (c)** Climate change has been strongly linked to the emission of carbon dioxide. Many governments around the world are committed to reducing carbon dioxide emissions.

Generating electricity can increase carbon dioxide emissions.

The companies generating electricity could reduce carbon dioxide emissions.

Give **two** ways the companies could do this.

1 .....

2 .....

(2 marks)



**6 (d)** Electricity is distributed from power stations to consumers along the National Grid.

The voltage across the overhead cables of the National Grid needs to be much higher than the output voltage from the power station generators.

Explain why.

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(3 marks)

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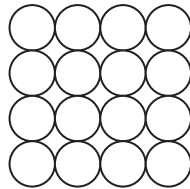
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7 According to kinetic theory, all matter is made up of small particles. The particles are constantly moving.

**Diagram 1** shows how the particles may be arranged in a solid.

**Diagram 1**



7 (a) One kilogram of a gas has a much larger volume than one kilogram of a solid.

Use kinetic theory to explain why.

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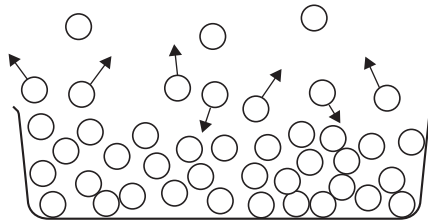
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(4 marks)



7 (b) **Diagram 2** shows the particles in a liquid. The liquid is evaporating.

**Diagram 2**



7 (b) (i) How can you tell from **Diagram 2** that the liquid is evaporating?

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.....

(1 mark)

7 (b) (ii) The temperature of the liquid in the container decreases as the liquid evaporates.

Use kinetic theory to explain why.

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(3 marks)

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**END OF QUESTIONS**



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