

Centre Number						Candidate Number				
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Other Names										
Candidate Signature										



General Certificate of Secondary Education
Higher Tier
January 2012

Science A

Unit Physics P1

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 2(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.

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



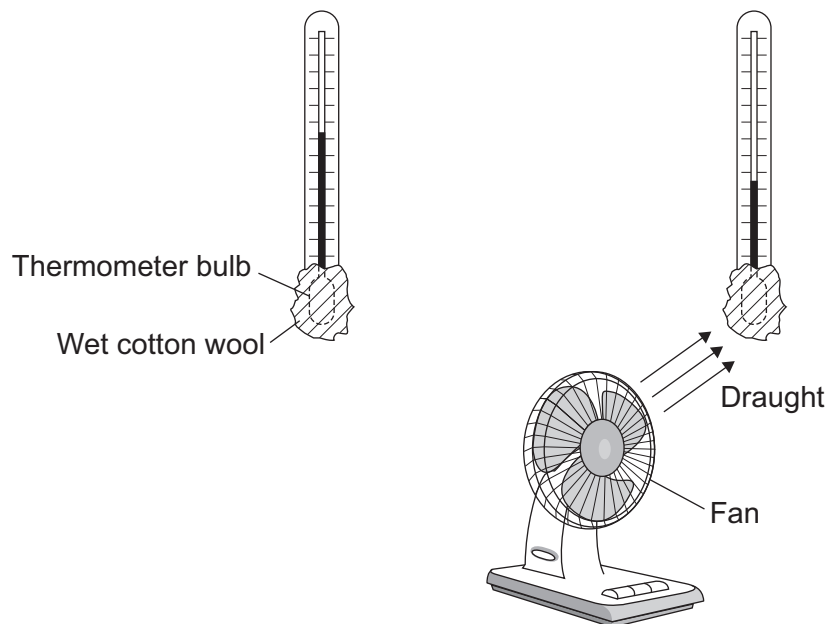
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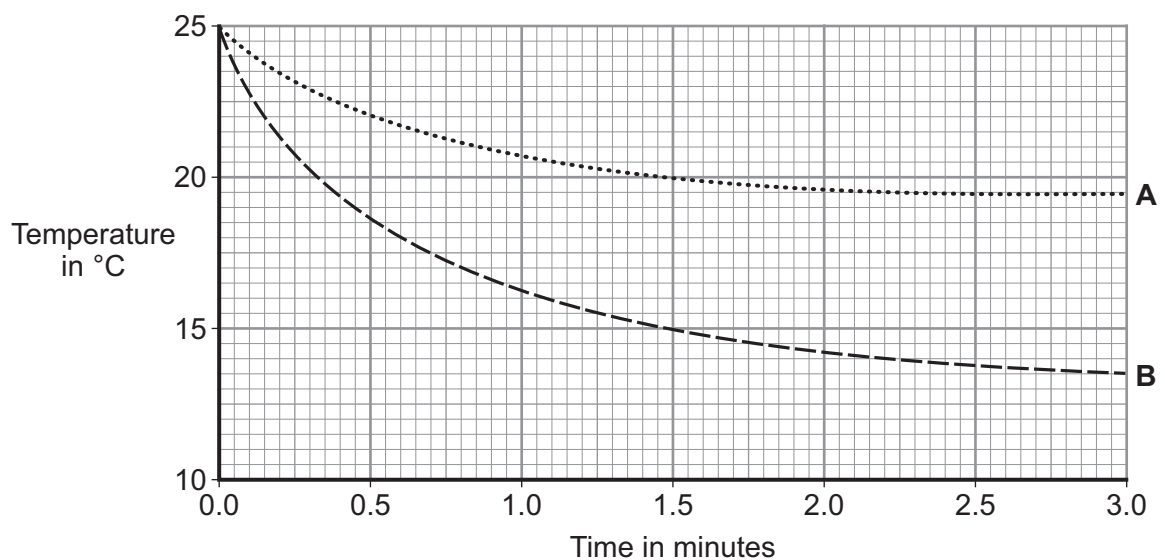
PH1HP

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

- 1** 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.



- 1 (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.

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(3 marks)

- 1 (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.

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(2 marks)

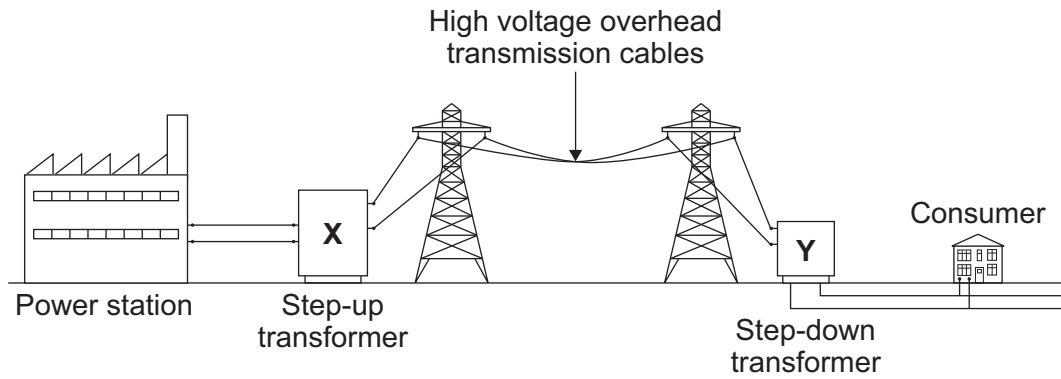
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Turn over for the next question

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- 2 The diagram shows the National Grid system.



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

Explain why.

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(2 marks)



- 2 (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.

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(6 marks)

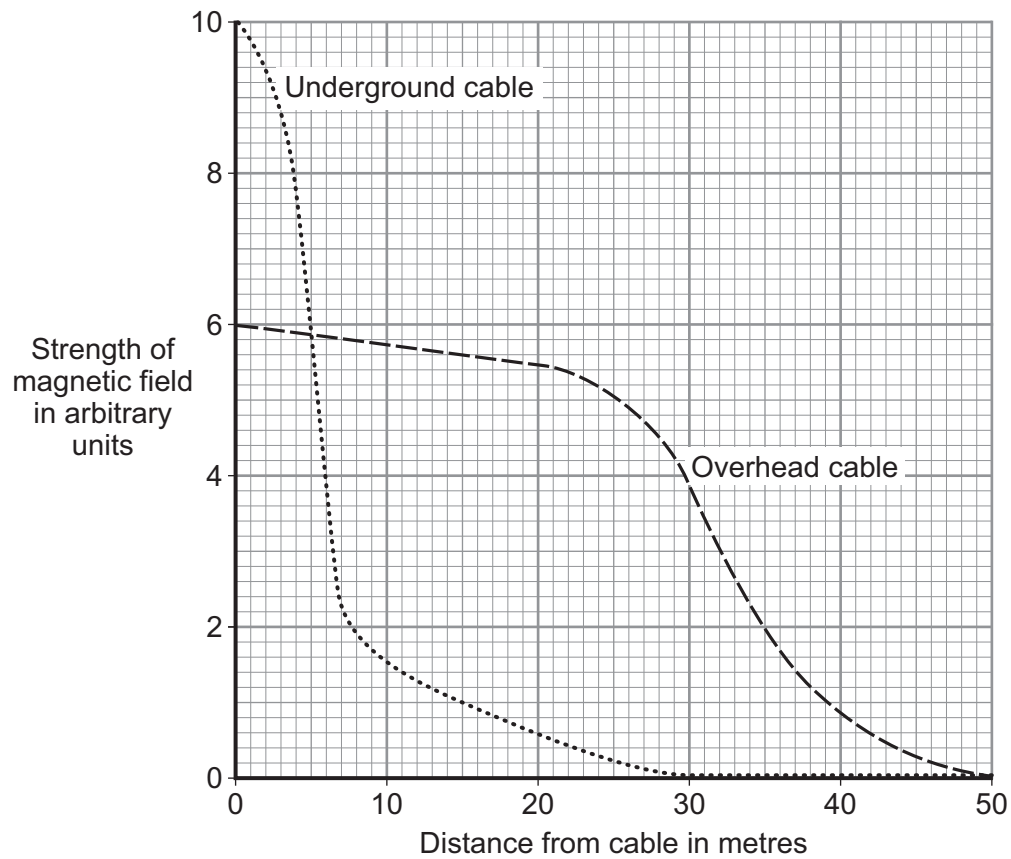
Question 2 continues on the next page

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- 2 (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?

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(2 marks)



- 2 (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)

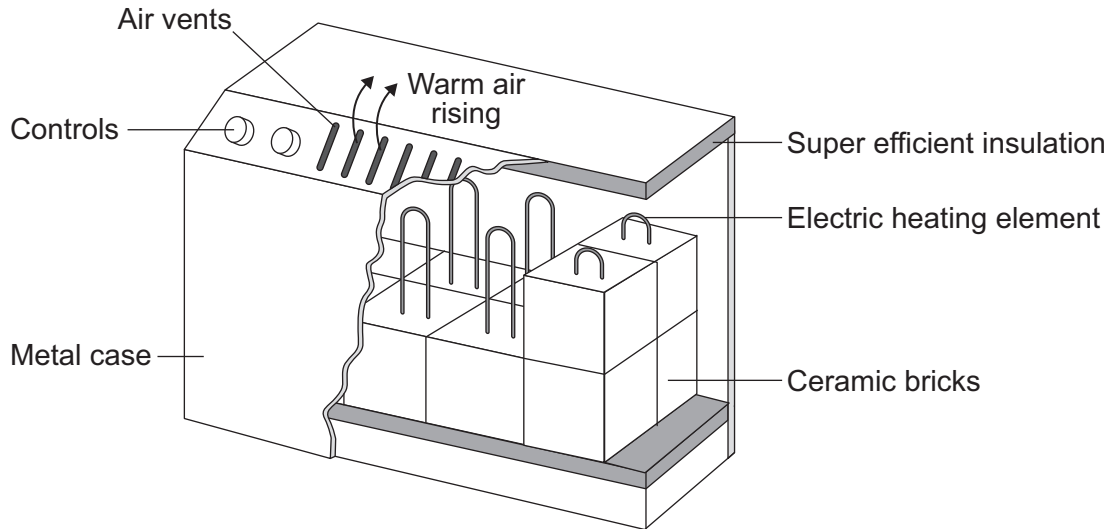
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Turn over for the next question

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- 3** 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.



- 3 (a)** In winter, the electricity supply to a 2.6 kW storage heater is switched on each day between midnight and 7 am. Between these hours, electricity costs 5 p per kilowatt-hour.

Calculate the daily cost of using the storage heater.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Cost = p
(3 marks)



- 3 (b)** Homes with electric storage heaters have a separate meter to measure the electricity supplied between midnight and 7 am. Another meter measures the electricity supplied at other times. This electricity supplied at other times costs 15p per kilowatt-hour.

Electricity companies encourage people to use electricity between midnight and 7 am by selling the electricity at a lower cost.

Suggest why.

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(1 mark)

- 3 (c)** By 7 am, the temperature at the centre of the ceramic bricks is about 800 °C. The temperature of the outside metal casing is about 80 °C.

The ceramic bricks are surrounded by 'super-efficient' insulation.

Explain why.

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(2 marks)

- 3 (d)** At 7 am, the electricity supply switches off and the temperature of the ceramic bricks starts to fall. The temperature of the bricks falls by 100 °C over the next four hours. During this time, 9 000 000 J of energy are transferred from the bricks.

Calculate the total mass of ceramic bricks inside the heater.

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.

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Mass = kg

(2 marks)



4 (a) Water waves are transverse waves. Sound waves are longitudinal waves.

4 (a) (i) Explain the difference between a transverse wave and a longitudinal wave.

You may include labelled diagrams in your answer.

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(3 marks)

4 (a) (ii) Name **one** type of wave that may be either transverse or longitudinal.

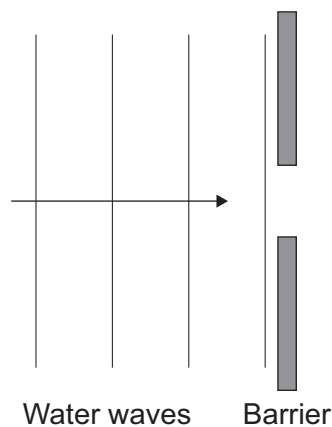
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(1 mark)

4 (b) The diagram shows water waves in a ripple tank moving towards a gap in a barrier.

The water waves diffract as they pass through the gap.

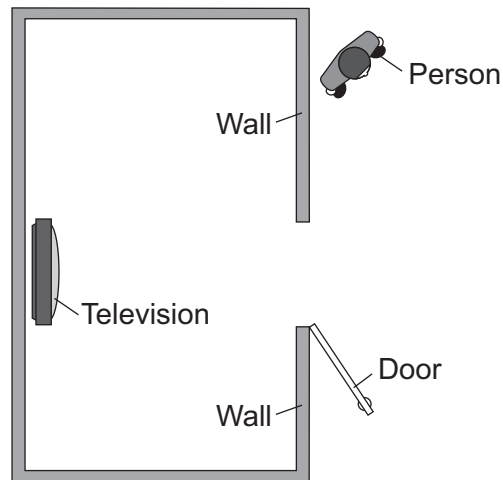
Complete the diagram to show the diffracted water waves.



(1 mark)



- 4 (c)** A television is switched on inside a room. A person outside the room can hear the television, but only when the door is open.



When the door is open, the person can hear the sound but cannot see the television.

Explain why.

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(2 marks)

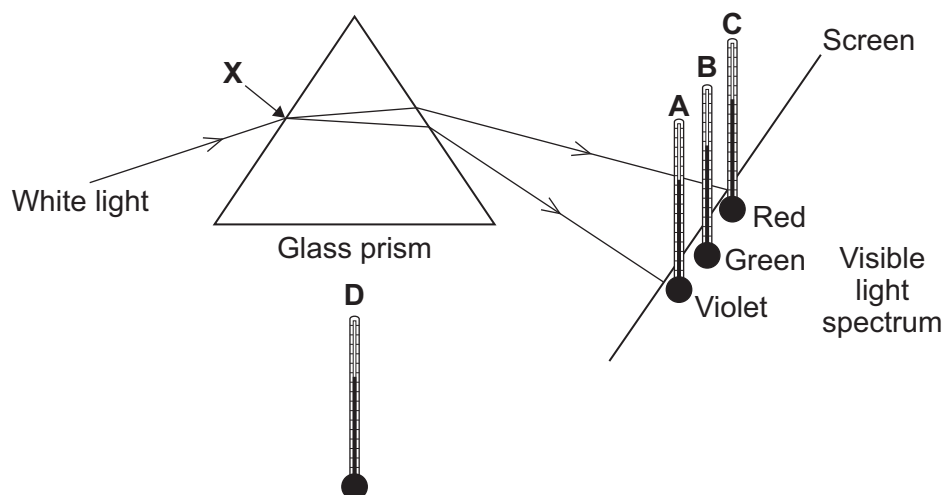
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Turn over for the next question

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- 5** The diagram shows the apparatus that a student used to investigate the heating effect of different wavelengths of light.



- 5 (a) (i)** What process happens at the point labelled **X** on the diagram?

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(1 mark)

- 5 (a) (ii)** The student put thermometer **D** outside of the light spectrum.

Suggest why.

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(1 mark)



- 5 (a) (iii)** The table gives the position and reading of each thermometer 10 minutes after the investigation started.

Thermometer	Position of thermometer	Temperature in °C
A	in violet light	21
B	in green light	22
C	in red light	24
D	outside the spectrum	20

What should the student conclude from the data in the table?

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(2 marks)

- 5 (b)** A similar investigation completed in 1800 by the scientist Sir William Herschel led to the discovery of infrared radiation.

Suggest how the student could show that the spectrum produced by the glass prism has an infrared region.

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(2 marks)

Question 5 continues on the next page

Turn over ►



- 5 (c)** A person emits infrared radiation at a frequency of 3.2×10^{13} Hz.

Calculate the wavelength of the infrared radiation that a person emits.

Take the speed of infrared radiation to be 3.0×10^8 m/s.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Wavelength = m
(2 marks)

- 5 (d)** A thermal imaging camera detects infrared radiation. Electronic circuits inside the camera produce a visible image of the object emitting the infrared radiation.

At night, police officers use thermal imaging cameras to track criminals running away from crime scenes.

Thermal imaging cameras work better at night than during the day.

Explain why.

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(2 marks)



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



- 6** The table gives data about two types of low energy bulb.

Type of bulb	Power input in watts	Efficiency	Lifetime in hours	Cost of one bulb
Compact Fluorescent Lamp (CFL)	8	20 %	10 000	£3.10
Light Emitting Diode (LED)	5		50 000	£29.85

- 6 (a)** Both types of bulb produce the same useful power output.

- 6 (a) (i)** Calculate the useful power output of the CFL.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Useful power output = W
(2 marks)

- 6 (a) (ii)** Calculate the efficiency of the LED bulb.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Efficiency =
(1 mark)



6 (b) Sketch and label a Sankey diagram for the CFL.

(2 marks)

6 (c) LED bulbs are expensive. This is because of the large number of individual electronic LED chips needed to produce sufficient light from each bulb.

6 (c) (i) Use the data in the table to evaluate the cost-effectiveness of an LED bulb compared to a CFL.

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(2 marks)

6 (c) (ii) Scientists are developing brighter and more efficient LED chips than those currently used in LED bulbs.

Suggest **one** benefit of developing brighter and more efficient LED chips.

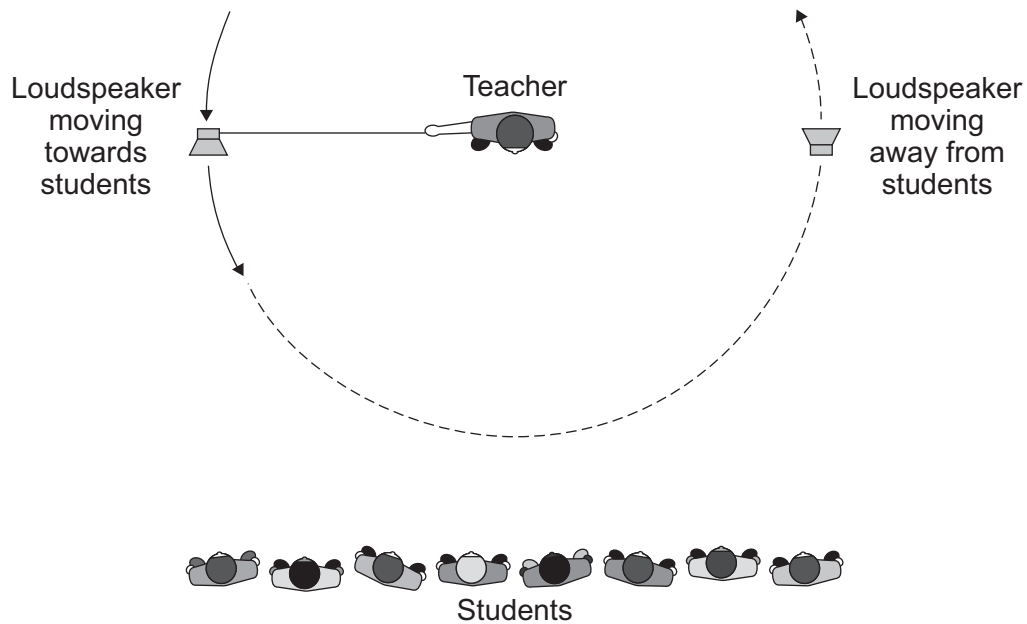
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(1 mark)



- 7 The diagram shows a teacher using a loudspeaker to demonstrate the Doppler effect. The loudspeaker, which produces a note of constant frequency, is swung around in a circle.



- 7 (a) What is the Doppler effect?

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(2 marks)



- 7 (b)** This demonstration of the Doppler effect can be used as a model for the *red-shift* observed in the light spectra from distant galaxies.

What is red-shift and what does the size of the red-shift tell us about distant galaxies?

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(3 marks)

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Turn over for the next question

Turn over ►



- 8 (a)** Nuclear fuels and the wind are two of the energy sources used to generate electricity in the UK.

Explain the advantages of using energy from nuclear fuels to generate electricity rather than using energy from the wind.

Include in your answer a brief description of the process used to generate electricity from nuclear fuels.

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(4 marks)

- 8 (b)** In the UK, most electricity is generated in power stations that emit carbon dioxide into the atmosphere. The impact of these power stations on the environment could be reduced by the increased use of 'carbon capture' technology.

Describe how 'carbon capture' would prevent the build-up of carbon dioxide in the atmosphere.

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(2 marks)

END OF QUESTIONS

