Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Sample assessment material for first teaching 2024

Time 1 hour 40 minutes

Paper reference **4WPH2/1P**

Physics (Modular)
UNIT 2

You must have:
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this unit is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful.

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{orbital speed} = \frac{2\pi \quad \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \quad \pi \quad r}{T}$$

$$\text{pressure} \times \text{volume} = \text{constant} \qquad p_1 \times V_1 = p_2 \times V_2$$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\frac{\text{change of wavelength}}{\text{wavelength}} = \frac{\text{velocity of a galaxy}}{\text{speed of light}} \qquad \frac{\lambda - \lambda_0}{\lambda_0} = \frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$$

Where necessary, assume the acceleration of free fall, $g = 10\,\text{m/s}^2$.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Diagram 1 shows the magnetic field between the poles of two strong bar magnets.

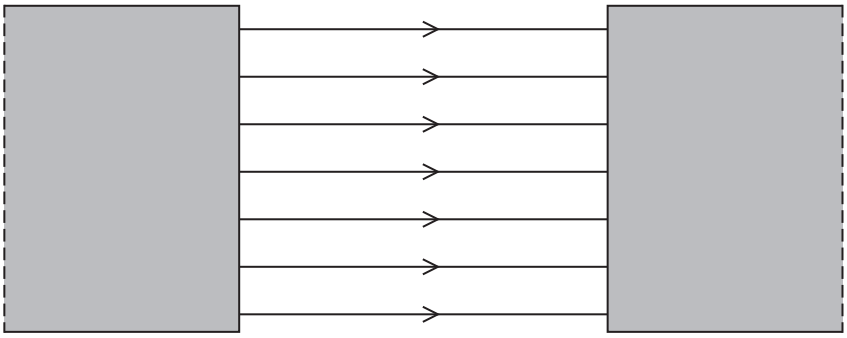

Diagram 1

(a) Add labels to diagram 1 to show the poles of the bar magnets.

(1)

(b) The bar magnets are made from steel.

Give **one** reason why steel is a good material for making bar magnets.

(1)

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(c) Explain how diagram 1 shows a uniform magnetic field.

(2)

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(d) Diagram 2 shows a metal wire being moved downwards through the uniform field between the poles of the same bar magnets. The orientation of the magnets has not been changed.

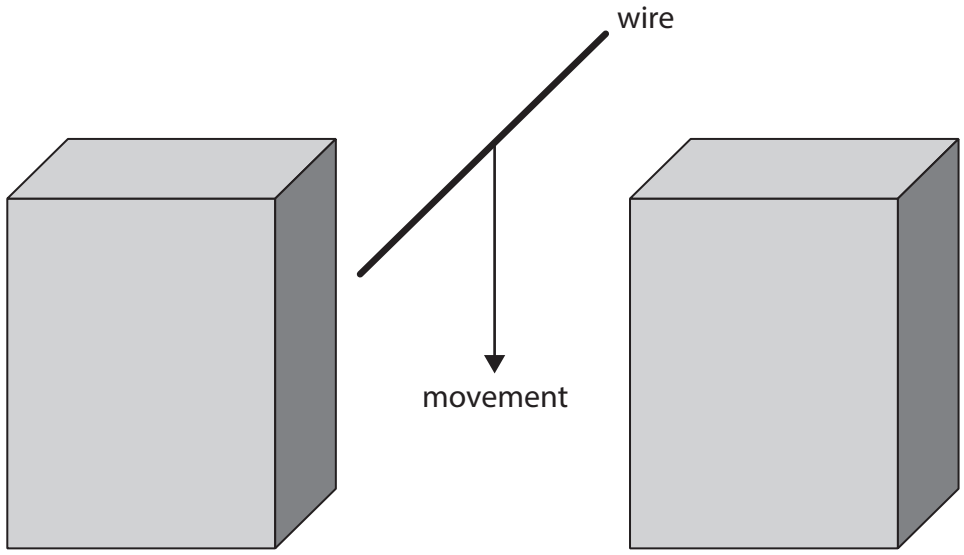

Diagram 2

(i) Give a reason why a voltage is induced between the ends of a metal wire as it moves between the poles of the bar magnets.

(1)

.....

.....

(ii) State **two** changes that could be made to this arrangement that would increase the magnitude of the induced voltage.

(2)

1 .....

2 .....

(Total for Question 1 = 7 marks)

2 (a) Technetium-99m has a half-life of 6 hours and can be used as a medical tracer.

It is injected into a patient's blood and moves around the patient's body.

Technetium-99m emits gamma radiation, which is used to locate the position of the tracer in the patient's body.

(i) Technetium-99m does not exist naturally.

Suggest why technetium-99m is usually made at the hospital where it is used.

(1)

(ii) Explain why technetium-99m is an effective isotope to use as a medical tracer.

(2)

(b) The gamma radiation emitted by technetium-99m is potentially harmful to humans.

Discuss the risks of using technetium-99m to doctors and to patients.

(3)

(Total for Question 2 = 6 marks)

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3 Lead-210 is a radioactive isotope of lead and is represented using this symbol.

$$^{210}_{82}Pb$$

(a) State what is meant by the term **isotope**.

(2)

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.....

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(b) How many protons are in the nucleus of lead-210?

(1)

- ☒ **A** 82
- ☒ **B** 128
- ☒ **C** 210
- ☒ **D** 292

(c) (i) A sample of lead-210 has an initial activity of 240 Bq.

After 66 years, the activity of the sample is 30 Bq.

Calculate the half-life of lead-210.

(2)

half-life = ... years

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(ii) Lead-210 decays into lead-206 through a number of stages.

This involves one alpha decay and a number of beta decays.

This incomplete equation summarises these stages.

$$^{210}_{82}Pb \rightarrow {}^{206}_{82}Pb + \underset{\ldots\ldots}{\ldots\ldots}\alpha + \underset{\ldots\ldots}{\ldots\ldots}{}^{0}_{-1}\beta$$

Complete the equation by giving the missing numbers.

Write your answers in the spaces provided.

(2)

(Total for Question 3 = 7 marks)

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4 This question is about astrophysics.

(a) The table lists some statements about the universe.

Place ticks (✓) in the table to show which statements support the Big Bang theory.

(2)

Statement	Supports the Big Bang theory
black holes are formed from extremely massive stars	
cosmic microwave background radiation is detected in all directions	
cosmic rays from space are detected at the Earth's surface in all directions	
each galaxy contains billions of stars	
most galaxies show a red-shift in the light detected from them	

(b) The sun will become a red giant star when it leaves the main sequence.

Which row correctly describes how the surface temperature and brightness of the Sun will change when it becomes a red giant?

(1)

		Surface temperature	Brightness
☒	**A**	decreases	decreases
☒	**B**	decreases	increases
☒	**C**	increases	decreases
☒	**D**	increases	increases

(c) Astronomical objects can be classified by their absolute magnitude.

State what is meant by the term **absolute magnitude**.

(2)

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(Total for Question 4 = 5 marks)

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5 (a) (i) State the formula linking input power and output power for a transformer.

(1)

(ii) The step-down transformer has an input voltage of 275 kV and an output voltage of 230 V.

The transformer has an output current of 95 A.

Calculate the input current to the transformer.

Assume the transformer is 100% efficient.

(3)

input current = ... A

(b) Explain how transformers are useful in the large-scale transmission of electricity.

You may draw a diagram to support your answer.

(5)

(Total for Question 5 = 9 marks)

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6 (a) (i) Which of these coloured stars has the highest temperature?

(1)

- ☒ **A** orange
- ☒ **B** red
- ☒ **C** white
- ☒ **D** yellow

(ii) Which of these is the stage nearest the end of the life cycle of a star with a mass much greater than the Sun?

(1)

- ☒ **A** main sequence
- ☒ **B** protostar
- ☒ **C** supernova
- ☒ **D** white dwarf

(b) The Sun is a main sequence star.

(i) In the Sun, hydrogen nuclei are changed into helium nuclei, releasing energy.

Name the process that changes hydrogen into helium.

(1)

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(ii) Describe the evolution of the Sun when it leaves the main sequence.

(2)

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(c) The Sun's core has a mass of approximately 7×10^{29} kg.

Approximately 75% of the mass of the core is hydrogen.

(i) Calculate the approximate mass of hydrogen in the Sun's core.

(1)

mass of hydrogen = ... kg

(ii) When most of the hydrogen nuclei in the Sun's core have been changed into helium nuclei the Sun will leave the main sequence.

The Sun's core loses approximately 9×10^{19} kg of hydrogen each year.

Estimate the time until the Sun leaves the main sequence.

Give your answer to one significant figure.

(2)

time = ... years

(d) Diagram 3 shows the orbit of a comet around a star.

Draw a labelled arrow on diagram 3 to show the force acting on the comet due to the star.

(2)

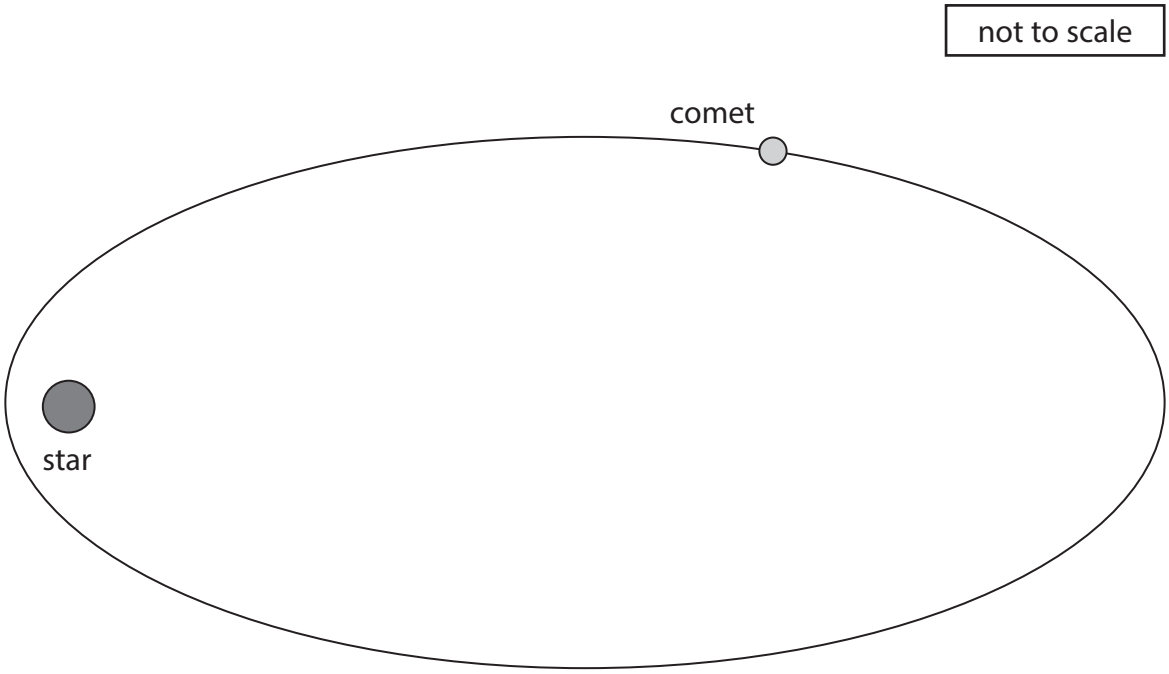

Diagram 3

(Total for Question 6 = 10 marks)

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7 Diagram 4 shows a coil wire, WXYZ, positioned between the opposite poles of a magnet.

The arrows show the direction of the current in the coil.

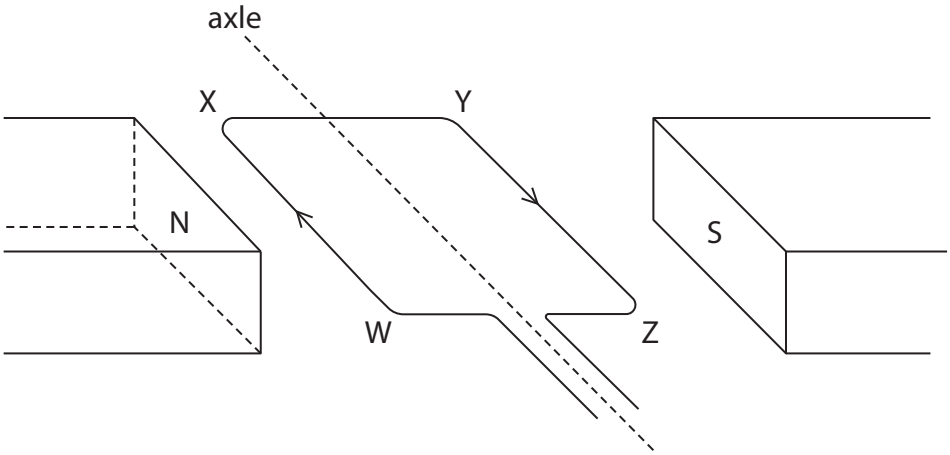

Diagram 4

(a) Draw arrows on diagram 4 to show the direction of the forces that act on the coil due to the magnet.

(2)

(b) Explain the motion of the coil of wire.

Refer to magnetic fields in your answer.

(4)

(c) Explain how the motion of the coil will change if the current is increased.

(2)

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(Total for Question 7 = 8 marks)

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8 (a) Describe an experiment to determine the refractive index of a glass block.

In your answer you should include:

- a labelled diagram
- the apparatus needed
- the method used

(6)

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(b) Give **two** uses of total internal reflection.

(2)

1 .....

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2 .....

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(Total for Question 8 = 8 marks)

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9 This question is about waves.

(a) Diagram 5 represents a wave.

Diagram 5

(i) Determine the amplitude of the wave by measuring it with a ruler.

(1)

amplitude = ... cm

(ii) Determine the wavelength of the wave by measuring it with a ruler.

(1)

wavelength = ... cm

(b) Microwaves are part of the electromagnetic spectrum.

(i) Name the part of the electromagnetic spectrum that has a lower frequency than microwaves.

(1)

.....

(ii) Microwaves travel at a speed of 3.0×10^8 m/s in the air.

A microwave has the wavelength of 2.7 cm.

Calculate the frequency of this microwave.

[wave speed = frequency × wavelength]

(3)

frequency = ... Hz

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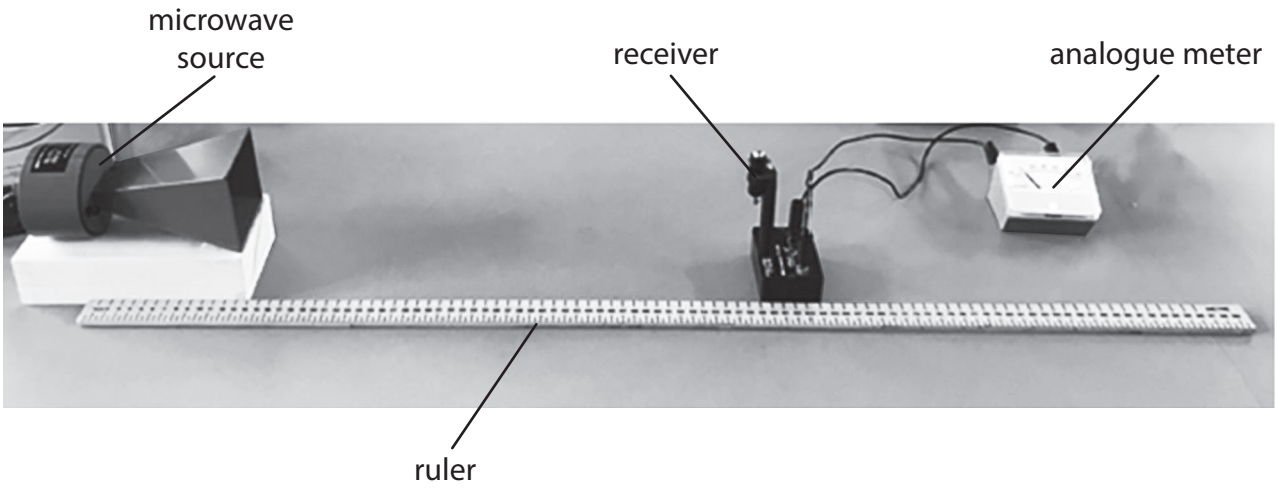
(c) A student uses a microwave source and a receiver to investigate microwaves.

Photograph 1 shows how the student sets up their apparatus.



Photograph 1

The meter shows the strength of the microwaves detected by the receiver.

The strength of the microwaves is measured in arbitrary units.

The student varies the distance between the microwave source and the receiver, and records the meter readings.

(i) Photograph 2 shows the analogue meter for one of the readings.

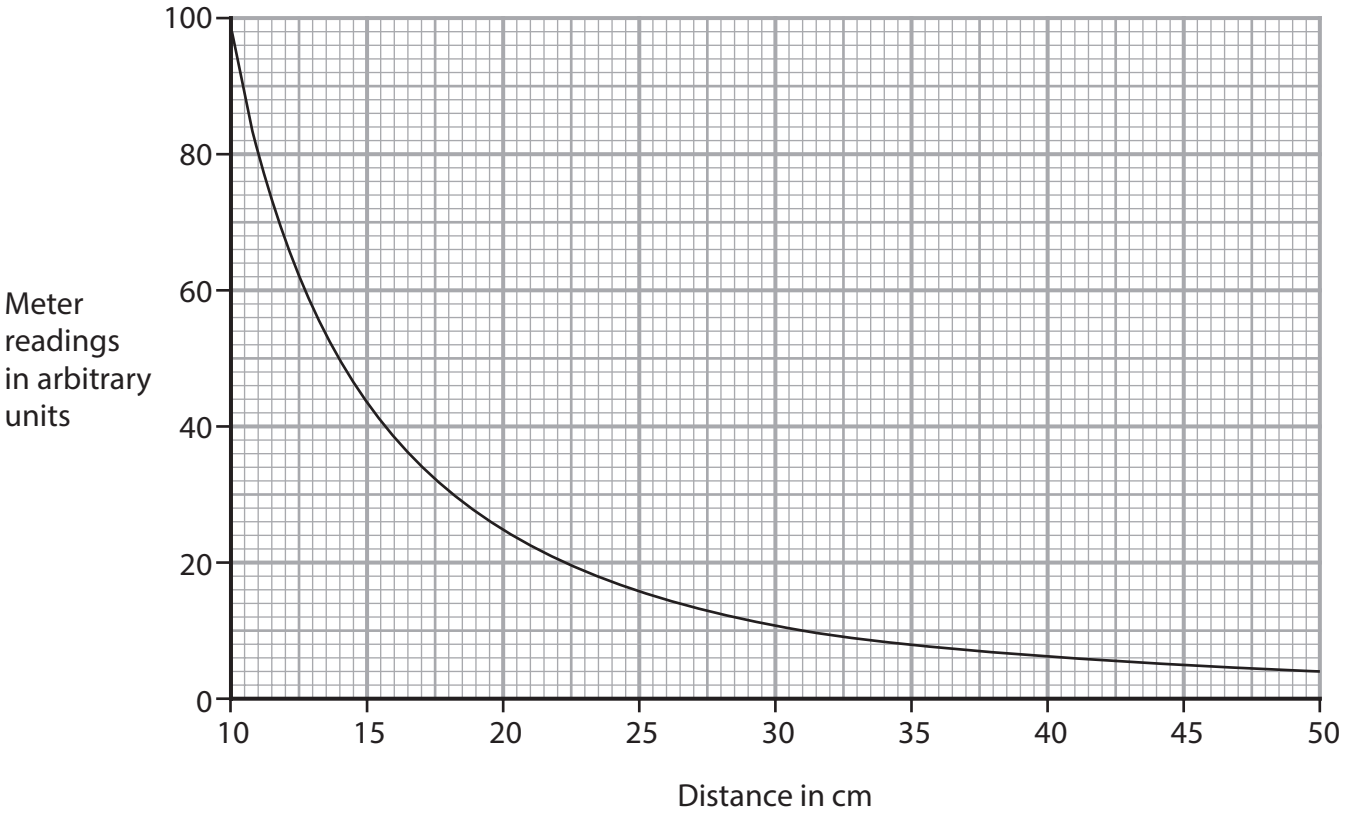
Photograph 2

Give the reading on the analogue meter.

(1)

reading = ... arbitrary units

(ii) The graph shows the results of the student's investigation.



The student concludes that the meter reading is inversely proportional to the distance between the microwave source and the receiver.

To be inversely proportional

meter reading × distance = constant

Comment on the student's conclusion.

You should use data from the graph in your answer.

(4)

(Total for Question 9 = 11 marks)

10 (a) Describe an investigation to determine the speed of sound.

You may draw a diagram to help your answer.

(5)

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(b) A microphone is connected to an oscilloscope.

A sound is detected by the microphone.

Diagram 6 shows the oscilloscope trace.

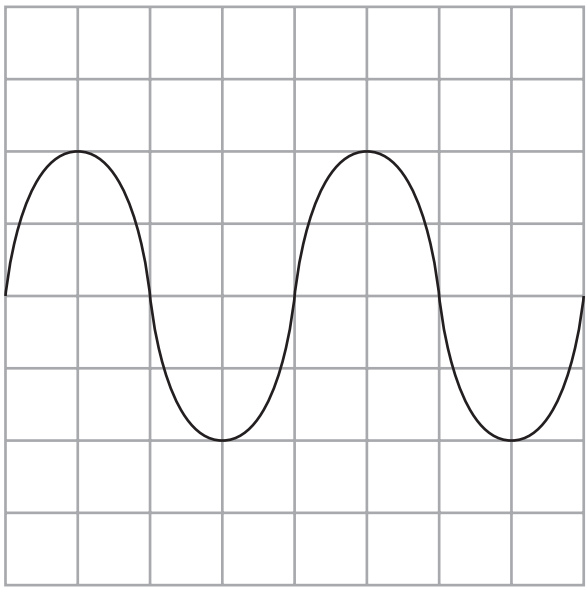

Diagram 6

Oscilloscope settings

y direction: 1 square = 0.1 V

x direction: 1 square = 5.0 ms

(i) Determine the period of the sound wave.

(3)

period = ... s

(ii) Calculate the frequency of the sound wave.

(2)

frequency = ... Hz.

(Total for Question 10 = 10 marks)

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11 (a) Scientific balloons are tested in a laboratory before they are used.

In the first test the pressure of the air inside the balloon is 120 kPa.

The balloon is sealed and has a volume of 92 m^3.

(i) The pressure of the air inside the balloon is reduced to 64 kPa by reducing the external air pressure.

Calculate the new volume of the balloon.

(2)

volume = ... m^3

(ii) Give an assumption that is made in the calculation.

(1)

.....

(b) The pressure of the air in the balloon is returned to 120 kPa.

The temperature of the air inside the balloon is 290 K.

The balloon is tested again, changing the temperature of the air and keeping the volume of the balloon constant.

(i) Explain why the pressure of the air in the balloon decreases when the temperature of the air decreases.

(3)

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.....

(ii) Calculate the temperature of the air when the pressure of the air in the balloon is 64 kPa.

Give your answer in kelvin.

(3)

temperature = ... K

(Total for Question 11 = 9 marks)

TOTAL FOR UNIT = 90 MARKS

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