Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number	Candidate Number

Friday 12 June 2020

Morning (Time: 1 hour 15 minutes) | Paper Reference **4PH1/2PR**

Physics

Unit: 4PH1
Paper: 2PR

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.*
- Show all the steps in any calculations and state the units.
- 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 ☒.

Information

- The total mark for this paper is 70.
- 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.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 5 0 6 7 A 0 1 2 0

Pearson

FORMULAE

You may find the following formulae useful.

energy transferred = current × voltage × time $E = I \times V \times t$

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

$\text{power} = \dfrac{\text{work done}}{\text{time taken}}$ $P = \dfrac{W}{t}$

$\text{power} = \dfrac{\text{energy transferred}}{\text{time taken}}$ $P = \dfrac{W}{t}$

$\text{orbital speed} = \dfrac{2\pi \times \text{orbital radius}}{\text{time period}}$ $v = \dfrac{2 \times \pi \times r}{T}$

(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)
$v^2 = u^2 + (2 \times a \times s)$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

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

$\text{force} = \dfrac{\text{change in momentum}}{\text{time taken}}$ $F = \dfrac{(mv - mu)}{t}$

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

change in thermal energy = mass × specific heat capacity × change in temperature
$\Delta Q = m \times c \times \Delta T$

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

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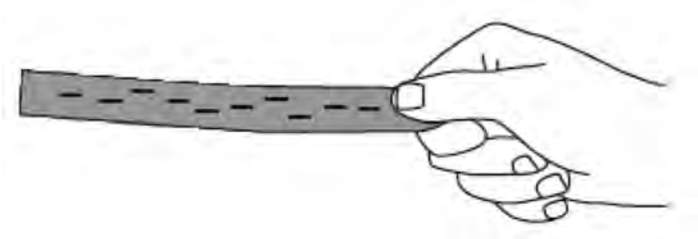
Answer ALL questions.

1 This question is about electrostatics.

(a) A student uses a plastic rod to investigate electrostatics.



(i) Describe how the student could have charged the plastic rod.

(2)

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(ii) The student uses a meter to measure the amount of charge on the rod.

The meter displays a reading of –5.2 mC.

Which of these is the same as –5.2 mC?

(1)

☒ **A** –0.52 C

☒ **B** –0.052 C

☒ **C** –0.0052 C

☒ **D** –0.00052 C

(iii) The rod is negatively charged.

Which statement correctly explains why the rod is negatively charged?

(1)

☒ **A** the rod has gained negatively charged electrons

☒ **B** the rod has gained positively charged electrons

☒ **C** the rod has lost negatively charged electrons

☒ **D** the rod has lost positively charged electrons

(iv) Using a meter is one method of demonstrating that the rod is charged.

Describe another method of demonstrating that the rod is charged.

(2)

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(b) Electrostatic charges can be useful but they can also be dangerous.

(i) Give one use of electrostatic charges.

(1)

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(ii) Explain why electrostatic charges can be dangerous when fuelling an aeroplane.

(2)

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(Total for Question 1 = 9 marks)

2 X-rays are electromagnetic waves used to obtain images of bones.

An x-ray machine produces x-ray waves with a frequency of 1.25×10^{18} Hz.

(a) Calculate the time period of these x-rays.

(2)

time period = ... s

(b) X-rays have a speed of 3.00×10^{8} m/s in air.

Calculate the wavelength of these x-rays.

(3)

wavelength = ... m

(Total for Question 2 = 5 marks)

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3 A builder needs to lift a large stone block.

(a) Diagram 1 shows the stone block.

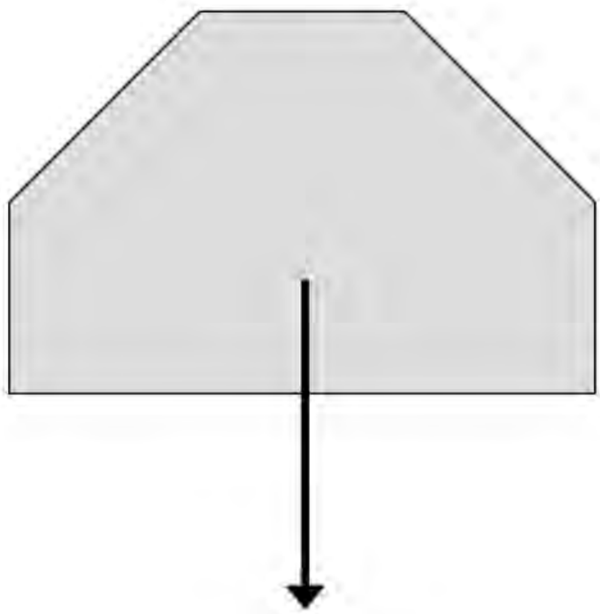

Diagram 1

(i) Draw an X on diagram 1 at the centre of gravity of the stone block.

(1)

(ii) State the formula linking weight, mass and gravitational field strength.

(1)

(iii) The mass of the stone block is 130 kg.

Calculate the weight of the stone block.

(2)

weight = ... N

(b) The builder uses a wooden plank to lift the large stone block.

The plank is uniform and pivoted at its centre.

The builder pushes down on one end of the plank to lift the stone block.

Diagram 2 shows the plank when it is horizontal and stationary.

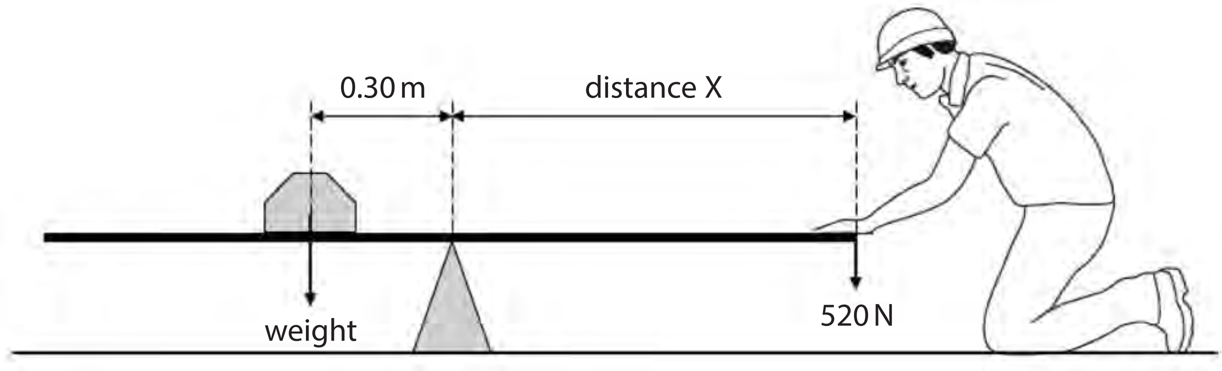

Diagram 2

(i) State the principle of moments.

(2)

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(ii) The builder is pushing down with a force of 520 N to keep the plank horizontal.

Calculate distance X.

(3)

distance X = ... m

(iii) Calculate the length of the plank.

(1)

length of plank = ... m

(Total for Question 3 = 10 marks)

4 A student investigates the speed of sound in air.

(a) The student sets up two microphones, A and B, as shown in Diagram 1.

Diagram 1

The microphones are connected to a datalogger.

A sound is made to the left of microphone A.

The datalogger records the time when the sound wave reaches each microphone.

The student uses the data to calculate the time taken for the sound wave to travel from microphone A to microphone B.

(i) Describe how the student could determine the speed of sound in air using his calculated value of time taken.

(3)

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(ii) Suggest why the student does not use a stop clock in this investigation.

(1)

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(b) The student investigates how the speed of sound in air varies with temperature.

He places several Bunsen burners in the space between the microphones, as shown in diagram 2.

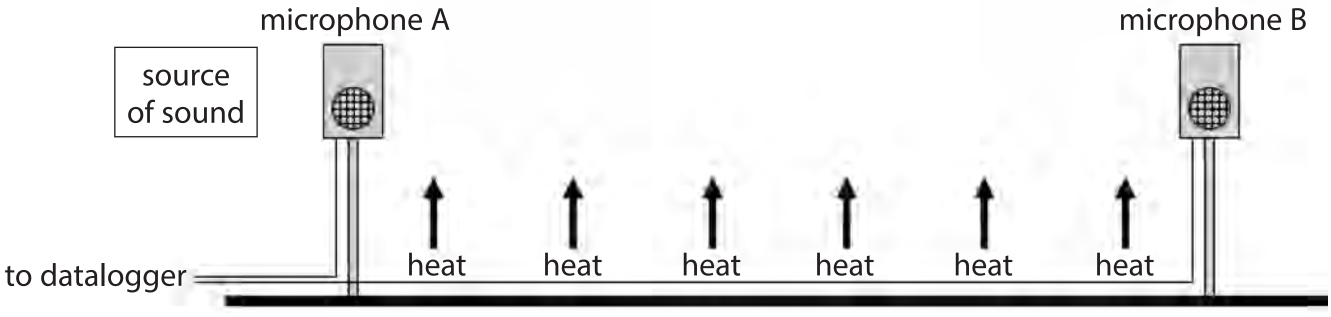

Diagram 2

He uses this method

- light all the Bunsen burners on a low heating flame
- measure the air temperature in three places between the microphones using three temperature sensors
- use the datalogger to record the time taken for a sound wave to travel from microphone A to microphone B
- determine the speed of sound

The student repeats this method as the air temperature increases.

(i) Suggest why it is important for all the Bunsen burners to burn the same amount of gas each second.

(1)

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(ii) The table shows the student's results.

Temperature in °C				Time in ms	Speed in m/s
sensor 1	sensor 2	sensor 3	mean		
20.3	20.2	19.9	20.1	4.37	344
29.9	31.3	30.0	30.4	4.29	350
39.7	41.0	39.0	39.9	4.22	358
51.0	50.2	49.3	50.2	4.15	362
59.8	61.5	58.6		4.08	368

Calculate the mean temperature for the last row in the table.

Give your answer to a suitable number of decimal places.

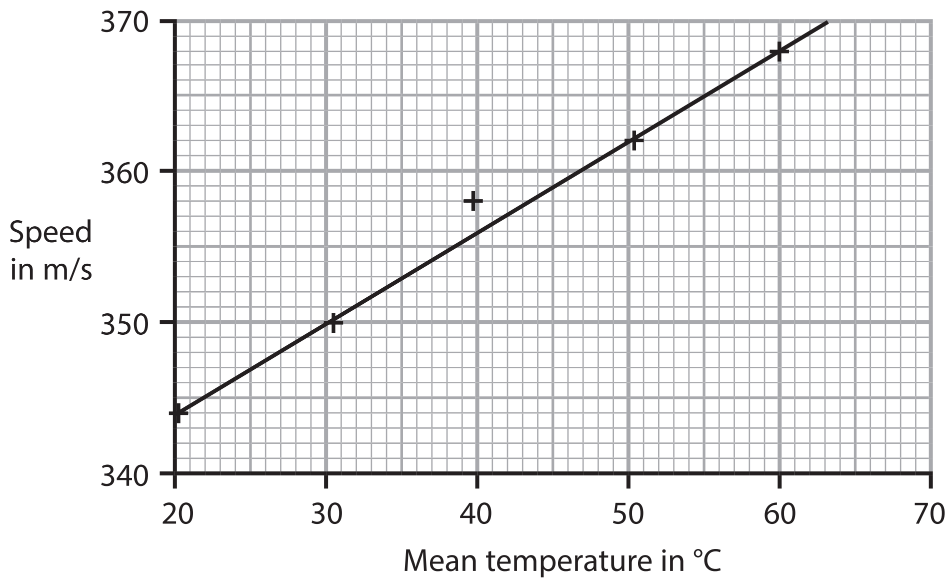
(2)

mean temperature = ... °C

(iii) The student plots his results and draws the line of best fit.

Draw a circle around the anomalous result.

(1)



(iv) State how the student should deal with the anomalous result.

(1)

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(v) Explain why a line graph is the correct type of graph to display these results.

(2)

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(vi) Describe the relationship between the speed of sound in air and temperature.

(2)

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(Total for Question 4 = 13 marks)

5 Energy is transferred from the Sun to the Earth.

(a) Nuclear fusion happens in the Sun.

(i) Which energy store of the Sun decreases during nuclear fusion?

(1)

☒ **A** chemical

☒ **B** kinetic

☒ **C** nuclear

☒ **D** thermal

(ii) How is energy transferred through space from the Sun to the Earth?

(1)

☒ **A** by heating

☒ **B** by radiation

☒ **C** electrically

☒ **D** mechanically

(b) Solar panels use energy from the Sun to heat water.

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(i) The total area of the solar panels is 15 m^2.

Each 1.0 m^2 of the solar panels receives 1000 J of energy per second from the Sun.

Show that the total energy transferred to the solar panels in 2 hours is about 100 MJ.

(3)

(ii) A mass of 1100 kg of cold water is in the solar panels at an initial temperature of 20 °C.

Calculate the final temperature of this water after it has been heated by the Sun for 2 hours.

[specific heat capacity of water = 4200 J/kg °C]

(4)

final temperature = ... °C

(iii) Give a reason why the actual final temperature of the water will be lower than the calculated value.

(1)

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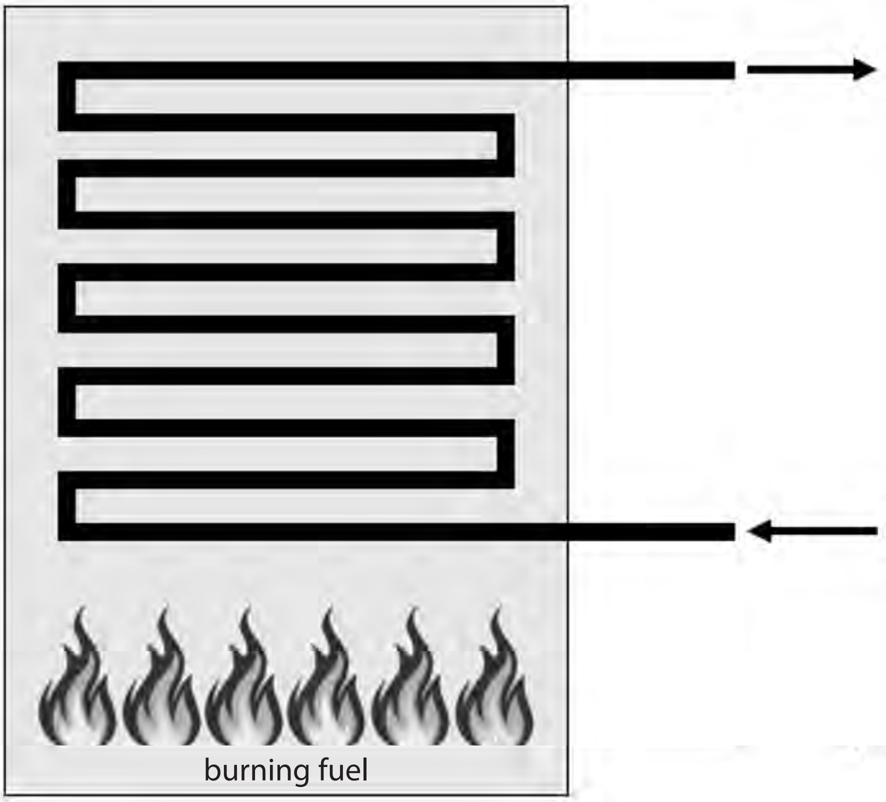
(Total for Question 5 = 10 marks)

Turn over

6 Conventional power stations burn fuel in a furnace.



(a) The fuel can be a solid, a liquid or a gas.

Describe the motion of particles in a solid, a liquid and a gas.

(3)

solid ....

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liquid ....

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gas ....

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P 6 5 0 6 7 A 0 1 6 2 0

(b) When the fuel is burned, energy is transferred from the fuel to the water.

The water boils and turns into steam.

(i) Describe how energy stored in the fuel is transferred to the water.

Refer to energy stores and transfers in your answer.

(3)

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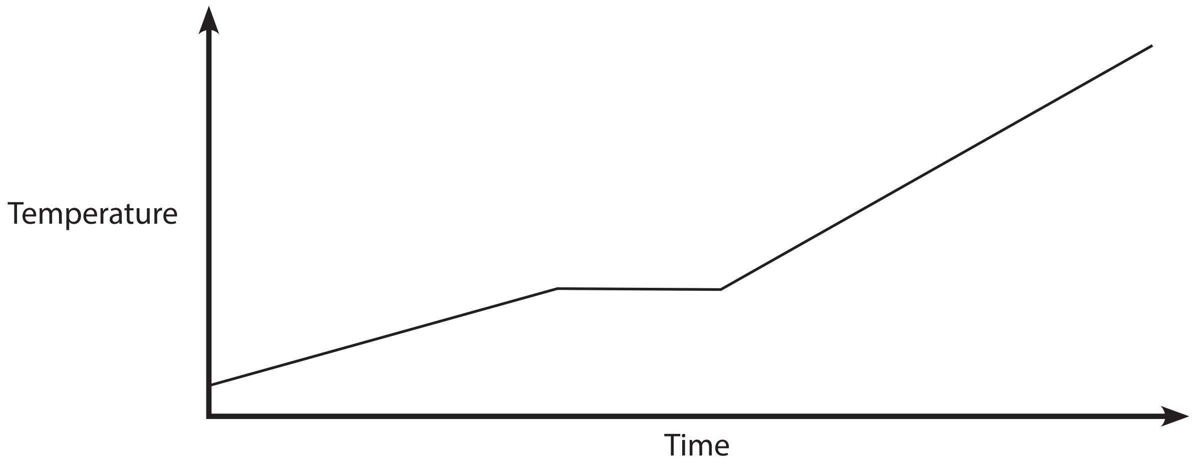
(ii) The temperature-time graph shows how the temperature of the water changes as it is heated in the furnace at a constant rate.



Explain how the graph shows that the water changes state as it is heated.

(2)

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(Total for Question 6 = 8 marks)

7 A machine called the synchrocyclotron (SC) was designed to cause protons to move in a circular path using strong magnetic fields.

(a) The SC used electromagnets to produce the strong magnetic fields.

Describe the construction of a simple electromagnet.

You may draw a diagram to support your answer.

(3)

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(b) The diagram shows a proton moving at velocity v in the magnetic field produced by the SC.

The direction of the magnetic field is into the page.

Using the left hand rule, determine the direction of the force acting on the proton due to the magnetic field.

(1)

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(c) The SC is surrounded by very thick concrete walls.

The radiation produced by the SC created atoms of radioactive barium-133 in the concrete walls.

Barium-133 has a half-life of 10.5 years.

(i) State what is meant by the term **half-life**.

(2)

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(ii) In 1990, the SC stopped being used at CERN, a research centre.

In 1990, the largest number of barium-133 atoms were found 40 cm deep in the concrete walls.

Since 2014, members of the public have been allowed to visit the SC at CERN.

Explain why the radioactive barium-133 in the concrete walls is not a risk to people visiting the SC.

(2)

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(Total for Question 7 = 8 marks)

TURN OVER FOR QUESTION 8

8 The Big Bang theory suggests that the Universe is approximately 14 billion years old.

(a) Describe the evolution of the Universe from the Big Bang until the present day.

(3)

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(b) Describe the evidence that supports the Big Bang theory.

(4)

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(Total for Question 8 = 7 marks)

TOTAL FOR PAPER = 70 MARKS