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)

Wednesday 22 May 2024

Morning (Time: 2 hours)

Paper reference 4PH1/1PR 4SD0/1PR

Physics

UNIT: 4PH1
Science (Double Award) 4SD0
PAPER: 1PR

You must have:
Ruler, calculator, protractor, Equation Booklet (enclosed)

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.

Information

- The total mark for this paper is 110.
- 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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FORMULAE

You may find the following formulae useful.

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

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

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

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

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

(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)

$$v^2 = u^2 + (2 \times a \times s)$$

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

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

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

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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 The table shows an incomplete electromagnetic spectrum.

radio waves	microwaves	A	visible light	B	x-rays	gamma rays

Two parts of the electromagnetic spectrum are missing.

The missing parts are labelled A and B.

(a) (i) Name the part labelled A.

(1)

.....

(ii) Name the part labelled B.

(1)

.....

(b) (i) Give a use of microwaves.

(1)

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(ii) Give a use of gamma rays.

(1)

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(Total for Question 1 = 4 marks)

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2 The photograph shows an electric heater connected to the mains electricity supply.



(Source: © Yevhen Prozhyrko / Shutterstock)

The circuit the heater is connected to is fitted with a circuit breaker, which breaks the circuit if the current gets too high.

(a) Give an advantage of using a circuit breaker instead of using a fuse.

(1)

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(b) The voltage of the mains electricity supply is 230 V.

(i) State the formula linking power, current and voltage.

(1)

(ii) The normal operating current of the heater is 11 A.

Calculate the input power to the heater for this current.

Give your answer in kW.

(3)

power = ... kW

(c) The circuit breaker has a rating of 16 A.

Suggest a reason why the heater may switch off before it reaches its normal operating current.

(1)

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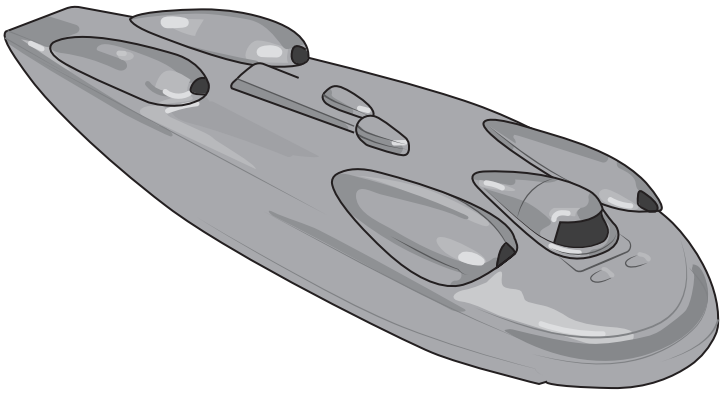
(Total for Question 2 = 6 marks)

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3 In 1947, the Railton Mobil Special was the first ground vehicle to achieve a speed of more than 400 miles per hour.



(a) During a test, the vehicle travelled at a speed of 403 miles per hour.

(i) Calculate a speed of 403 miles per hour in metres per second (m / s).
[1 mile = 1600 m]

(2)

speed = ... m / s

(ii) During the test, the vehicle travelled past two markers.
The markers were placed a known distance apart.

Describe how these markers could be used to determine the speed of the vehicle.

(3)

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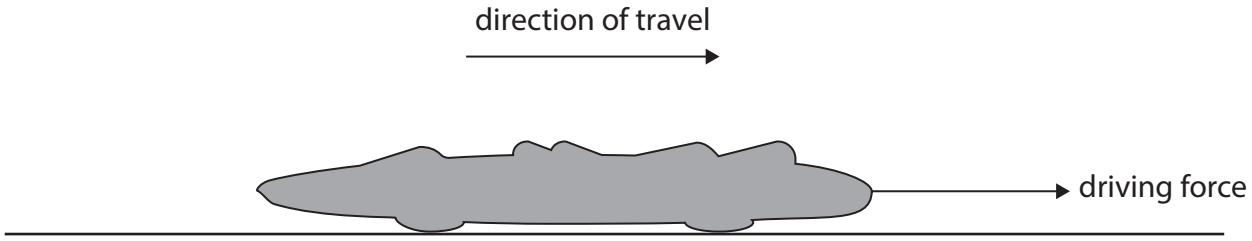
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(b) The diagram shows the vehicle travelling at a constant speed.



One of the horizontal forces acting on the vehicle has been drawn.

Complete the diagram by drawing a labelled arrow for the other horizontal force acting on the vehicle.

(3)

(Total for Question 3 = 8 marks)

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4 This question is about the Sun.

(a) The table shows the different stages in the evolution of stars of different masses.

Complete the table by adding ticks (✓) to show which stages of evolution occur in the life cycle of the Sun.

(4)

Stage of evolution	Occurs in the life cycle of the Sun
black hole	
main sequence	
nebula	
neutron star	
red giant	
red supergiant	
supernova	
white dwarf	

(b) When viewed from Earth, the surface of the Sun is yellow in colour.

The surface of another star, Betelgeuse, is red in colour.

Explain the difference between the Sun and Betelgeuse, based on the different colours of their surfaces.

(2)

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(c) The Sun transfers energy to the Earth by radiation.

(i) Give a reason why energy is not transferred from the Sun to the Earth by conduction or convection.

(1)

(ii) A satellite orbiting the Earth contains sensitive equipment that can be damaged if it gets too hot.

Explain which colour would be most appropriate for the outer surface of the satellite to protect the equipment.

(2)

(Total for Question 4 = 9 marks)

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5 A student needs to determine the density of some small rocks that appear to all be made of the same material.



(Source: © Chake / Shutterstock)

(a) The student decides to measure the mass and the volume of each rock.

Describe a method the student could use to accurately determine the mass and the volume of each rock.

You may draw a diagram to help your answer.

(5)

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(b) The table shows the student's results for three of the rocks.

Rock	Mass in g	Volume in cm^3
A	15	6.3
B	13	6.1
C	16	7.5

(i) State the formula linking density, mass and volume.

(1)

(ii) After looking at the data, the student concludes that one of the rocks may be made of a different material from the others.

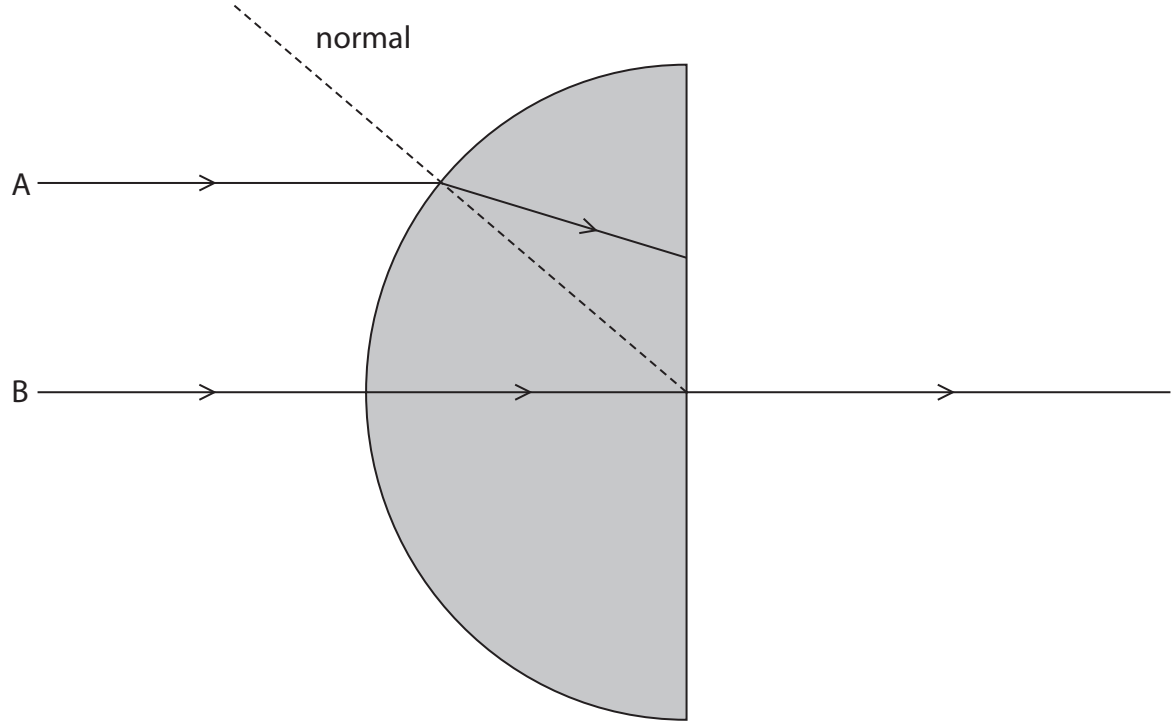
Using the data from the table, justify the student's conclusion.

(4)

(Total for Question 5 = 10 marks)

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6 The diagram shows two rays of green light entering a semicircular glass block.



(a) (i) Measure the angle of incidence and the angle of refraction for ray A as it enters the glass block.

(2)

angle of incidence = ... degrees

angle of refraction = ... degrees

(ii) State the formula linking refractive index, angle of incidence and angle of refraction.

(1)

(iii) Calculate the refractive index of the glass.

(3)

refractive index = ...

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(b) (i) Complete the path of ray A until it crosses ray B.

Label the point where the rays cross with the letter F.

(2)

(ii) The refractive index of glass for red light is lower than for green light.

Explain what would happen to point F if red light were used instead of green light.

You may draw a diagram to help your answer.

(3)

(Total for Question 6 = 11 marks)

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7 A student investigates the voltage-current characteristics of an unknown component, X.

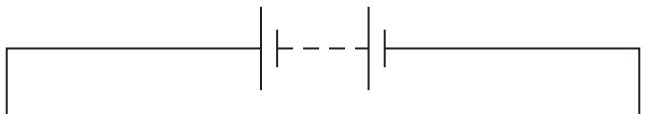
(a) The student is given this equipment to investigate component X.

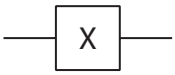
- battery
- variable resistor
- ammeter
- voltmeter
- connecting wires

The diagram shows an incomplete circuit containing the battery and component X.

Complete the diagram by drawing a circuit the student could use for their investigation.

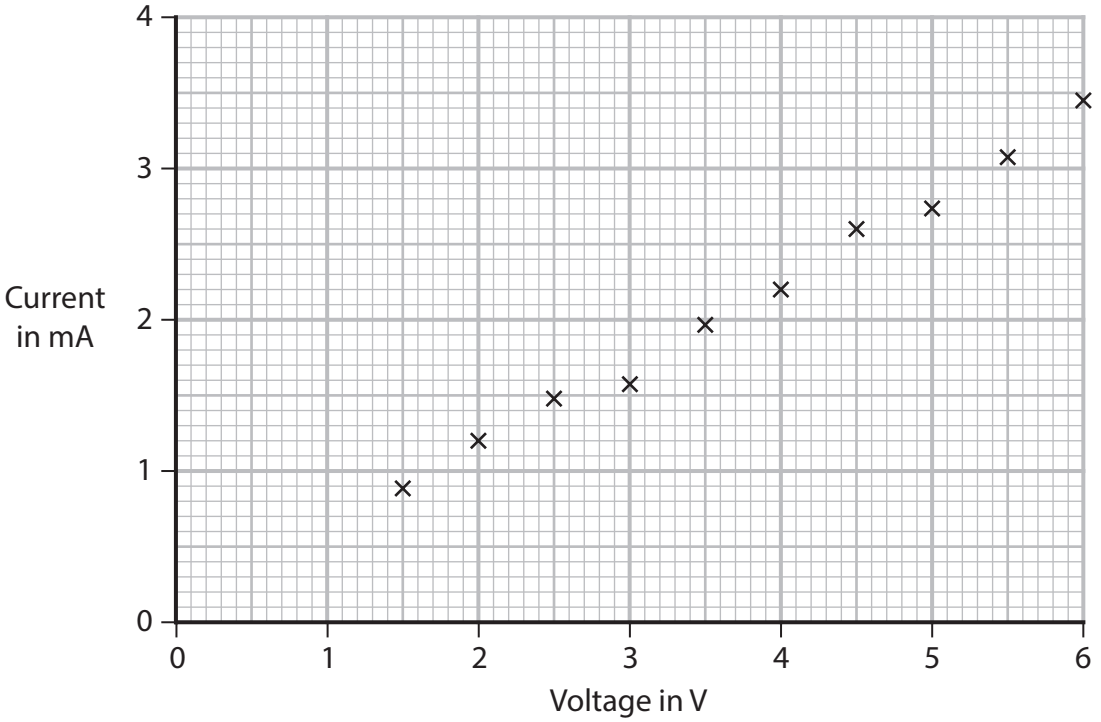
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(b) The graph shows the results of the investigation.



(i) Draw a line of best fit on the graph.

(1)

(ii) Calculate the resistance of component X when the voltage is 4.2 V.

Give the unit.

(5)

resistance = ... unit .....

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(iii) Which of these is equivalent to 4.2 V?

(1)

- ☒ **A** 4.2 coulombs per second (C / s)
- ☒ **B** 4.2 seconds per joule (s / J)
- ☒ **C** 4.2 joules per second (J / s)
- ☒ **D** 4.2 joules per coulomb (J / C)

(iv) The student concludes that component X is a filament lamp.

Comment on the student's conclusion.

(2)

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(Total for Question 7 = 13 marks)

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8 This question is about radioactive isotopes used for medical imaging.

(a) Iodine-131 is represented by this symbol.

$$^{131}_{53}\mathrm{I}$$

(i) How many neutrons are in the nucleus of an atom of iodine-131?

(1)

- ☒ **A** 53
- ☒ **B** 78
- ☒ **C** 131
- ☒ **D** 184

(ii) Iodine-131 is radioactive and decays with a half-life of 8 days.

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

(2)

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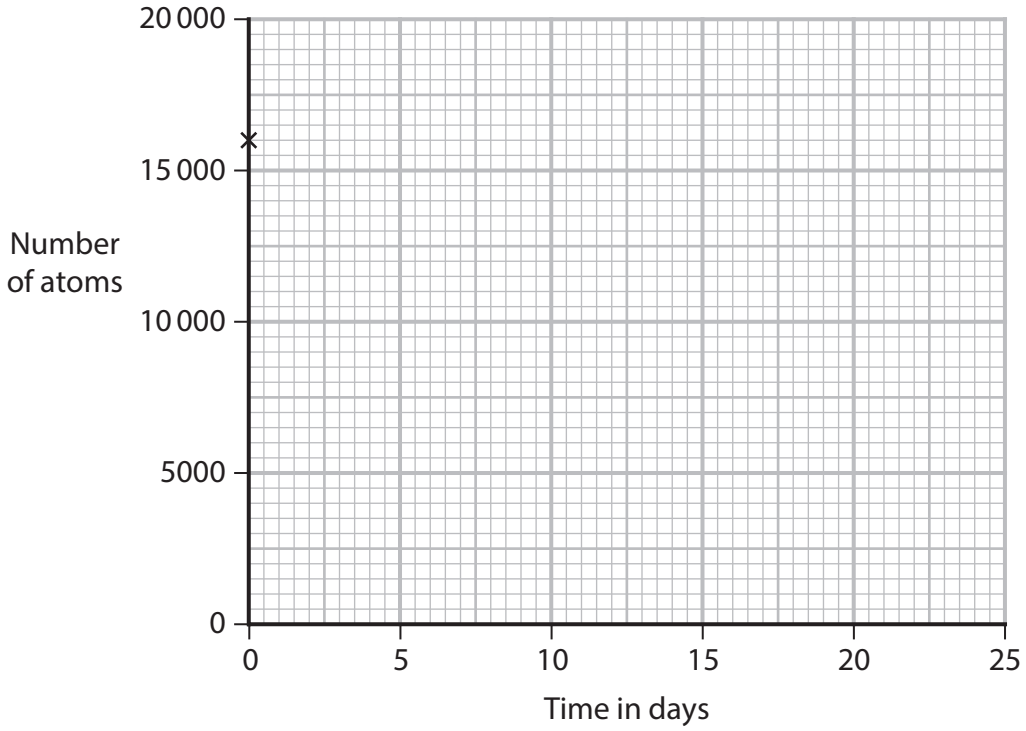
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(iii) The cross (×) on the graph shows the initial number of atoms in a sample of iodine-131.

Draw three more crosses (×) on the graph to show how the number of atoms of iodine-131 in the sample changes during three half-lives.

[iodine-131 half-life = 8 days]

(3)



(iv) Use a curve of best fit on the graph to estimate the time taken for the number of atoms in the sample to decrease to 5000.

(2)

time taken = ... days

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(b) When iodine-131 decays, it emits beta radiation and gamma radiation.

A patient swallows a tablet containing iodine-131. The radiation emitted can be detected outside the body.

(i) State the name of a piece of equipment that can detect the radiation emitted by iodine-131.

(1)

.....

(ii) Give a reason why gamma radiation is more likely to be detected outside the body than beta radiation.

(1)

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(c) Technetium-99m is another radioactive isotope.

Iodine-131 and technetium-99m are both used as medical tracers. Medical tracers use radiation detected outside the body to diagnose illnesses.

The table gives information about some of the properties of iodine-131 and technetium-99m when they undergo radioactive decay.

Isotope	Type(s) of radiation emitted	Half-life
iodine-131	beta and gamma	8 days
technetium-99m	gamma	6 hours

Explain why technetium-99m is likely to be safer than iodine-131 when used as a medical tracer.

(3)

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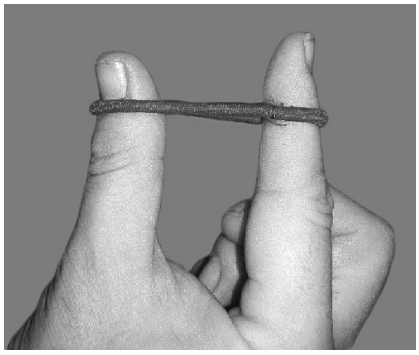
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(Total for Question 8 = 13 marks)

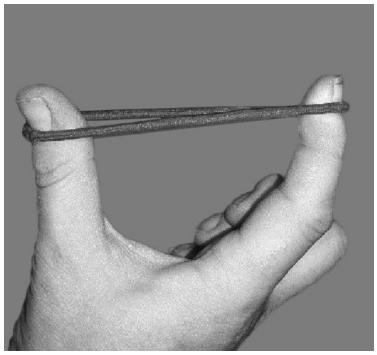
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9 A student stretches a rubber band.

(a) The photographs show a rubber band before and after it has been stretched.



before



after

(i) State which energy store increases in the rubber band after it has been stretched.

(1)

.....

(ii) State the main method of energy transfer when the rubber band is stretched.

(1)

.....

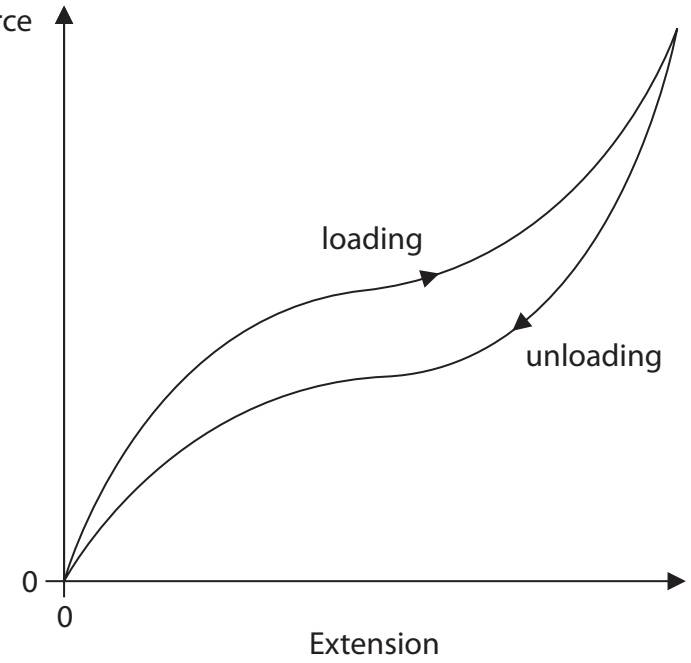
(iii) State the source of the energy transferred to the rubber band.

(1)

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(b) The diagram shows a force-extension graph for a rubber band.



(i) State how the graph shows that the rubber band does not obey Hooke's law.

(1)

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(ii) Explain how the graph shows that the rubber band is elastic.

(2)

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(c) The student stretches the rubber band and then releases it. The band moves vertically upwards.

(i) The band travels with an initial speed of 13 m / s.

When the band reaches its maximum height above the student's hand, the band has a speed of 0 m / s.

Calculate the maximum height that the band reaches.

Give your answer to 2 significant figures.

[acceleration due to gravity = −10 m / s^2]

(4)

maximum height = ... m

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(ii) The band reaches its maximum height.

Explain the motion of the band as it falls from its maximum height to the ground.

Refer to forces in your answer.

You may assume

- the band does not rotate
- the band does not reach terminal velocity

(5)

(Total for Question 9 = 15 marks)

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10 Diagram 1 shows a generator inside a small wind turbine. The generator is connected to a lamp and the windmill blades.

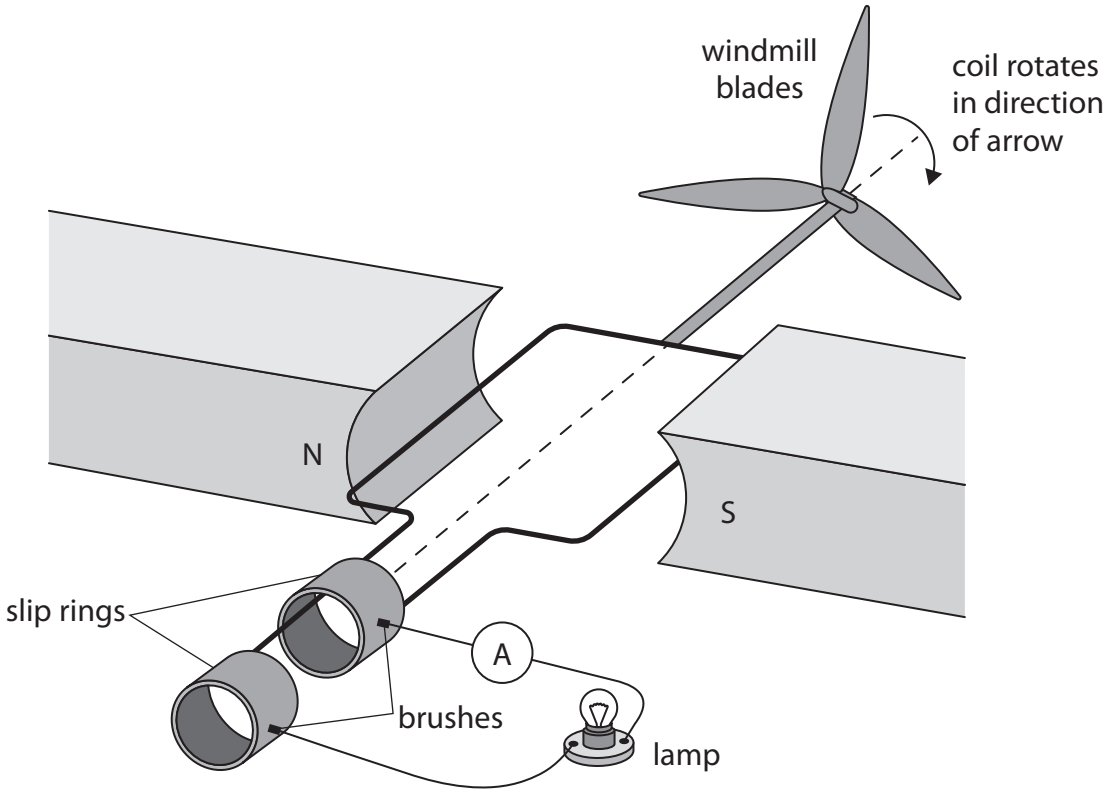


Diagram 1

(a) When the coil rotates in the direction of the arrow, the ammeter displays a small current.

Explain how the generator produces a current.

(2)

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(b) The generator in the wind turbine acts as an alternating current (a.c.) power supply.

Diagram 2 shows an electric circuit containing the generator being used to charge a mobile phone battery.

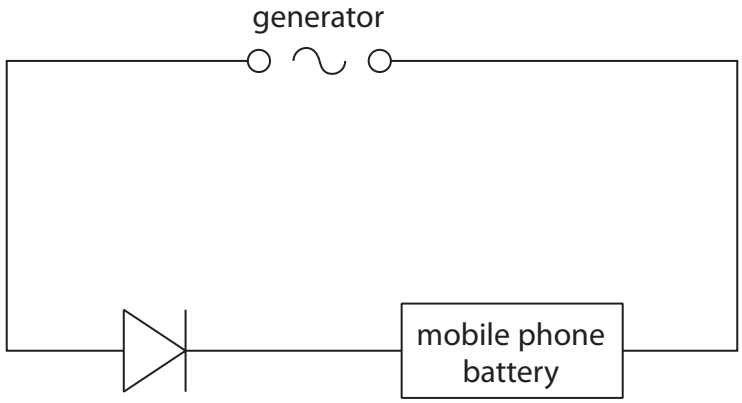


Diagram 2

(i) Direct current (d.c.) is needed to charge the battery.

Explain why there is a diode in the circuit.

(2)

(ii) Explain how the current in the battery will change if the wind speed increases.

(2)

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(c) The mean voltage across the battery is 7.2 V.

The battery gains 14 kJ of energy in 8400 seconds.

Calculate the mean current in the battery.

(3)

mean current = ... A

(Total for Question 10 = 9 marks)

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11 This question is about gas pressure.

(a) Diagram 1 shows some of the molecules of a gas in a sealed container.

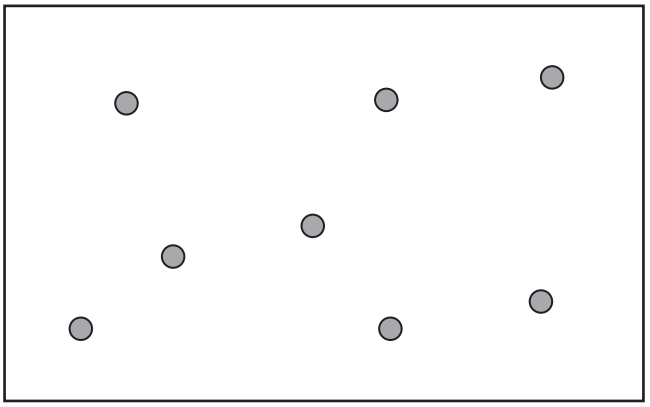


Diagram 1

The molecules collide with all the surfaces of the container. This exerts an outward force on the container and causes pressure.

Describe how the motion of the gas molecules causes an equal pressure on all the walls of the container.

You may add to diagram 1 to help your answer.

(2)

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(b) The width of the container is slowly decreased so that the volume of the container is smaller than before.

Diagram 2 shows the width of the container before and after this change. All other dimensions of the container remain the same.

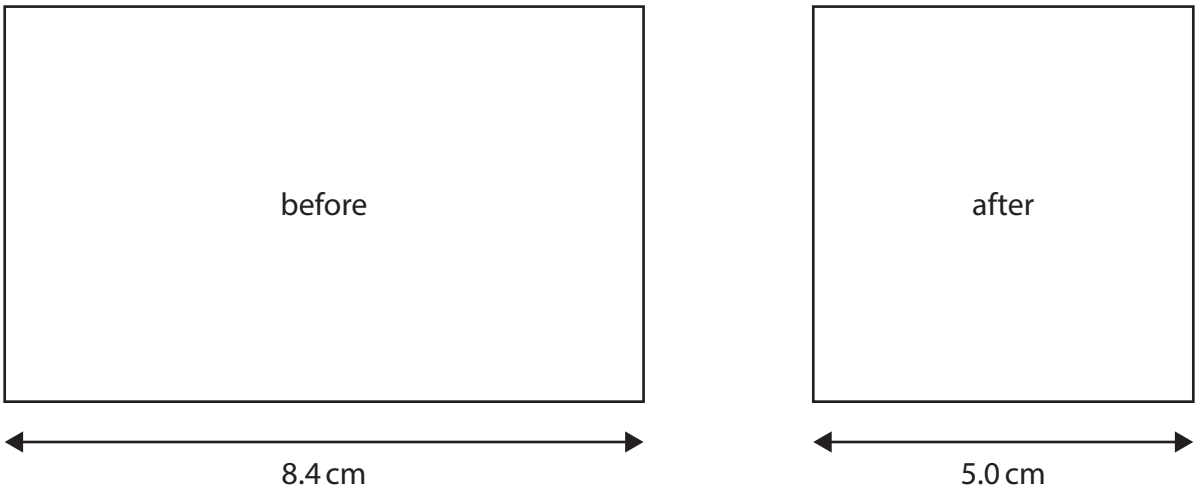


Diagram 2

The initial volume of the gas is 130 cm^3.

The initial pressure of the gas is 100 kPa.

Calculate the pressure of the gas after the width of the container is decreased.

Assume the temperature of the gas remains constant.

(4)

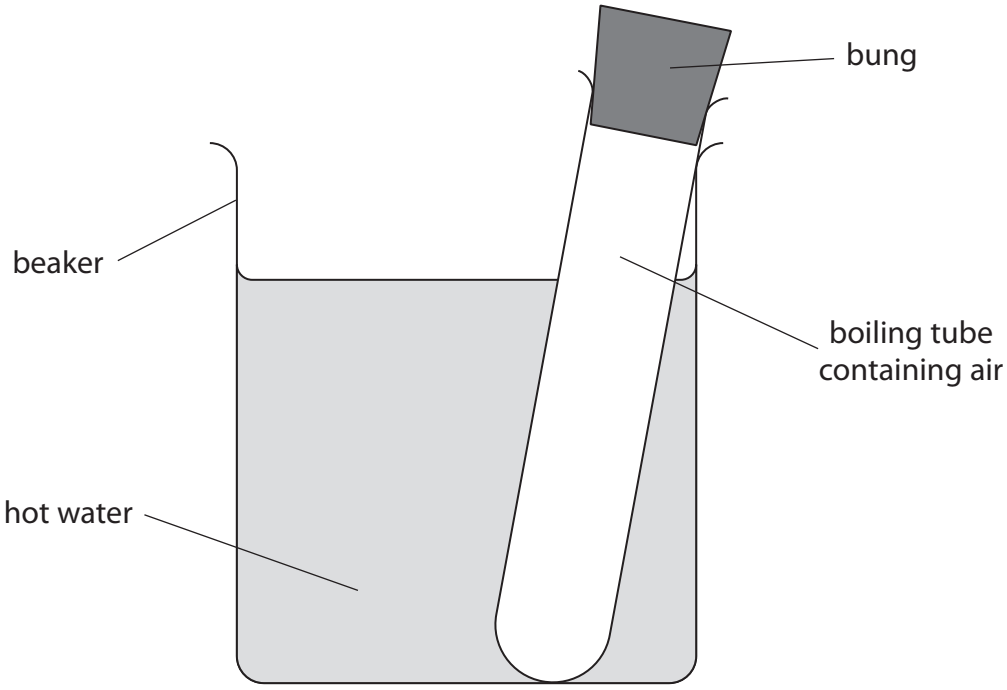
pressure = ... kPa

(Total for Question 11 = 6 marks)

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12 Air is trapped in a boiling tube by sealing the boiling tube with a rubber bung.

The boiling tube is placed in a beaker containing hot water.



(a) Energy is transferred from the thermal store of the water to the thermal store of the air in the boiling tube with an efficiency of 16%.

The air in the boiling tube gains 1800 J of energy during this process. This is defined as the useful energy transfer.

Calculate the amount of energy wasted during this process.

(4)

energy wasted = ... J

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(b) Give two ways that the apparatus could be modified to improve the efficiency of the energy transfer.

(2)

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(Total for Question 12 = 6 marks)

TOTAL FOR PAPER = 110 MARKS

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Pearson Edexcel International GCSE (9–1)

Wednesday 22 May 2024

Morning (Time: 2 hours)

Paper reference **4PH1/1PR 4SD0/1PR**

Physics

UNIT: 4PH1
Science (Double Award) 4SD0
PAPER: 1PR

Equation Booklet

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These equations may be required for both International GCSE Physics (4PH1) and International GCSE Combined Science (4SD0) papers.

1. Forces and Motion	
average speed = $\frac{\text{distance moved}}{\text{time taken}}$	
acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{(v-u)}{t}$
(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)	$v^2 = u^2 + (2 \times a \times s)$
force = mass × acceleration	$F = m \times a$
weight = mass × gravitational field strength	$W = m \times g$
2. Electricity	
power = current × voltage	$P = I \times V$
energy transferred = current × voltage × time	$E = I \times V \times t$
voltage = current × resistance	$V = I \times R$
charge = current × time	$Q = I \times t$
energy transferred = charge × voltage	$E = Q \times V$
3. Waves	
wave speed = frequency × wavelength	$v = f \times \lambda$
frequency = $\frac{1}{\text{time period}}$	$f = \frac{1}{T}$
refractive index = $\frac{\sin(\text{angle of incidence})}{\sin(\text{angle of refraction})}$	$n = \frac{\sin i}{\sin r}$
$\sin(\text{critical angle}) = \frac{1}{\text{refractive index}}$	$\sin c = \frac{1}{n}$

4. Energy resources and energy transfers	
efficiency = $\frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$	
work done = force × distance moved	$W = F \times d$
gravitational potential energy = mass × gravitational field strength × height	$GPE = m \times g \times h$
kinetic energy = $\frac{1}{2}$ × mass × speed^2	$KE = \frac{1}{2} \times m \times v^2$
power = $\frac{\text{work done}}{\text{time taken}}$	$P = \frac{W}{t}$
5. Solids, liquids and gases	
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
pressure = $\frac{\text{force}}{\text{area}}$	$p = \frac{F}{A}$
pressure difference = height × density × gravitational field strength	$p = h \times \rho \times g$
$\frac{\text{pressure}}{\text{temperature}}$ = constant	$\frac{p_1}{T_1} = \frac{p_2}{T_2}$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
8. Astrophysics	
orbital speed = $\frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$	$v = \frac{2 \times \pi \times r}{T}$

The equations on the following page will only be required for International GCSE Physics.

These additional equations may be required in International GCSE Physics papers 2P and 2PR.

1. Forces and Motion	
momentum = mass × velocity	$p = m \times v$
force = $\dfrac{\text{change in momentum}}{\text{time taken}}$	$F = \dfrac{(mv - mu)}{t}$
moment = force × perpendicular distance from the pivot	
5. Solids, liquids and gases	
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta T$
6. Magnetism and electromagnetism	
relationship between input and output voltages for a transformer	$\dfrac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \dfrac{\text{primary turns}}{\text{secondary turns}}$
input power = output power	$V_p I_p = V_s I_s$ for 100% efficiency
8. Astrophysics	
$\dfrac{\text{change in wavelength}}{\text{reference wavelength}} = \dfrac{\text{velocity of a galaxy}}{\text{speed of light}}$	$\dfrac{\lambda - \lambda_0}{\lambda_0} = \dfrac{\Delta\lambda}{\lambda_0} = \dfrac{v}{c}$

END OF EQUATION LIST