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 **4PH1/1P 4SD0/1P**

Physics

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

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 ▶

Pearson

FORMULAE

You may find the following formulae useful.

energy transferred = current × voltage × time	$E = I \times V \times t$
frequency = $\dfrac{1}{\text{time period}}$	$f = \dfrac{1}{T}$
power = $\dfrac{\text{work done}}{\text{time taken}}$	$P = \dfrac{W}{t}$
power = $\dfrac{\text{energy transferred}}{\text{time taken}}$	$P = \dfrac{W}{t}$
orbital speed = $\dfrac{2\pi \times \text{orbital radius}}{\text{time period}}$	$v = \dfrac{2 \times \pi \times r}{T}$
$(\text{final speed})^2 = (\text{initial speed})^2 + (2 \times \text{acceleration} \times \text{distance moved})$	$v^2 = u^2 + (2 \times a \times s)$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
$\dfrac{\text{pressure}}{\text{temperature}}$ = constant	$\dfrac{p_1}{T_1} = \dfrac{p_2}{T_2}$

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

P 7 5 8 2 6 A 0 2 3 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 This question is about the motion of objects in the solar system.

(a) (i) Draw a labelled diagram showing the Moon orbiting the Earth.

(2)

(ii) Give the name of the force that causes the Moon to orbit the Earth.

(1)

....

(iii) Give the name of another object that orbits the Earth.

(1)

....

(b) A planet and a comet both orbit a star.

Give a difference between the orbit of a planet and the orbit of a comet.

(1)

....

....

(Total for Question 1 = 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

2 This question is about radioactivity.

(a) The nucleus of an atom of carbon has 6 protons and 8 neutrons.

Which row of the table shows the nucleus of an atom that is a different isotope of carbon?

(1)

		Number of protons	Number of neutrons
☒	**A**	6	6
☒	**B**	6	8
☒	**C**	8	6
☒	**D**	8	8

(b) Which type of radiation is a high-energy electron?

(1)

☒ **A** alpha

☒ **B** beta

☒ **C** gamma

☒ **D** neutron

(c) A nucleus emits radiation. This causes the mass number to decrease by one. The atomic number stays the same.

Which type of radiation does the nucleus emit?

(1)

☒ **A** alpha

☒ **B** beta

☒ **C** gamma

☒ **D** neutron

(d) The nucleus of an isotope of uranium can be represented using this symbol.

$$^{238}_{92}U$$

The nucleus forms part of a positively charged ion.

How many electrons could be in this ion?

(1)

☒ **A** 90

☒ **B** 92

☒ **C** 146

☒ **D** 238

(e) A radioactive isotope has an initial activity of 400 Bq.

The half-life of the isotope is 8 hours.

What is the activity of the isotope after 16 hours?

(1)

☒ **A** 25 Bq

☒ **B** 50 Bq

☒ **C** 100 Bq

☒ **D** 200 Bq

(Total for Question 2 = 5 marks)

3 The photograph shows infrared heating lamps being used to harden fresh paint on a car.

(Source: © Dmitry Kalinovsky / Shutterstock)

(a) Give a harmful effect of infrared waves.

(1)

....

....

(b) The heating lamps produce visible light waves in addition to infrared waves.

(i) Give two similar properties of visible light waves and infrared waves.

(2)

1 ....

....

2 ....

....

(ii) Give two differences between the properties of visible light waves and infrared waves.

(2)

1 ....

....

2 ....

....

(c) The infrared heating lamps are placed 1.5 m from the car.

Calculate the time taken for infrared waves emitted from a lamp to reach the car.

[for infrared waves, speed = 3.0×10^8 m/s]

(3)

time taken = ... s

(d) Paint takes less time to harden when it absorbs more energy from infrared radiation.

A technician observes that white paint takes more time to harden than black paint.

Explain this observation.

(2)

....

....

....

....

....

....

(Total for Question 3 = 10 marks)

4 This question is about the evolution of a star.

(a) A main sequence star is created in a collapsing region of a nebula.

The table gives different energy stores for the gases in the collapsing nebula, from when the nebula starts to collapse to just before the main sequence star is created.

Complete the table by placing ticks (✓) to show whether each energy store increases, decreases or stays the same.

(4)

Energy store	Increases	Decreases	Stays the same
chemical			
gravitational potential			
nuclear			
thermal			

(b) At the end of the main sequence stage of a star's evolution, the star can become a red giant or a red supergiant.

Give the property of a star that determines whether it becomes a red giant or a red supergiant.

(1)

....

....

(c) A red giant star eventually becomes a white dwarf star.

Discuss the differences between a red giant star and a white dwarf star.

(4)

....

....

....

....

....

....

....

....

(Total for Question 4 = 9 marks)

BLANK PAGE

5 (a) A metal spring obeys Hooke's law.

Sketch a graph to show that the spring obeys Hooke's law as it is stretched.

You should label both axes with appropriate physical quantities.

(3)

(b) Diagram 1 shows an object suspended from a support using a metal spring.

The object is initially at rest.

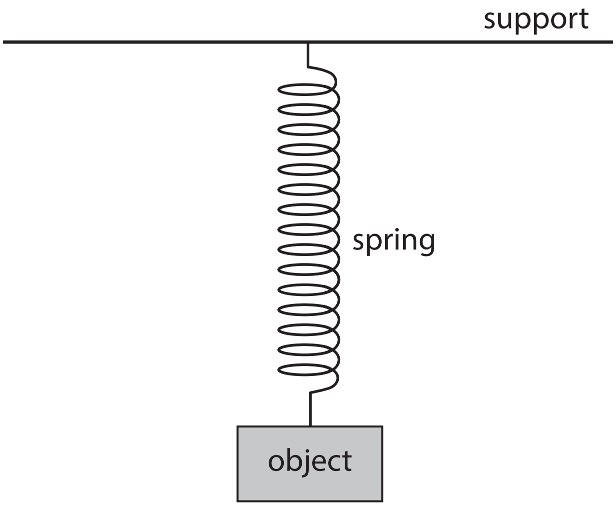


Diagram 1

(i) The object is pulled down and then released.

Diagram 2 shows the forces acting on the object at the instant it is released.

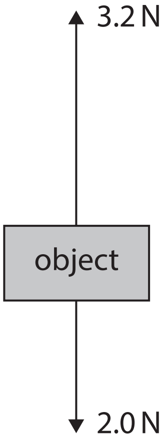


Diagram 2

Determine the magnitude and direction of the resultant force acting on the object.

(2)

magnitude of resultant force = ... N

direction of resultant force = ...

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

P 7 5 8 2 6 A 0 1 2 3 2

(ii) The object has a mass of 0.20 kg.

Calculate the acceleration of the object at the instant it is released.

(3)

acceleration = ... m/s^2

(iii) Explain how the magnitude of the acceleration of the object changes, from the instant the object is released until the first time the object returns to its initial resting position.

You should refer to the forces acting on the object in your answer.

(3)

....

....

....

....

....

....

(Total for Question 5 = 11 marks)

6 Diagram 1 shows the magnetic field lines near the south pole of a bar magnet.

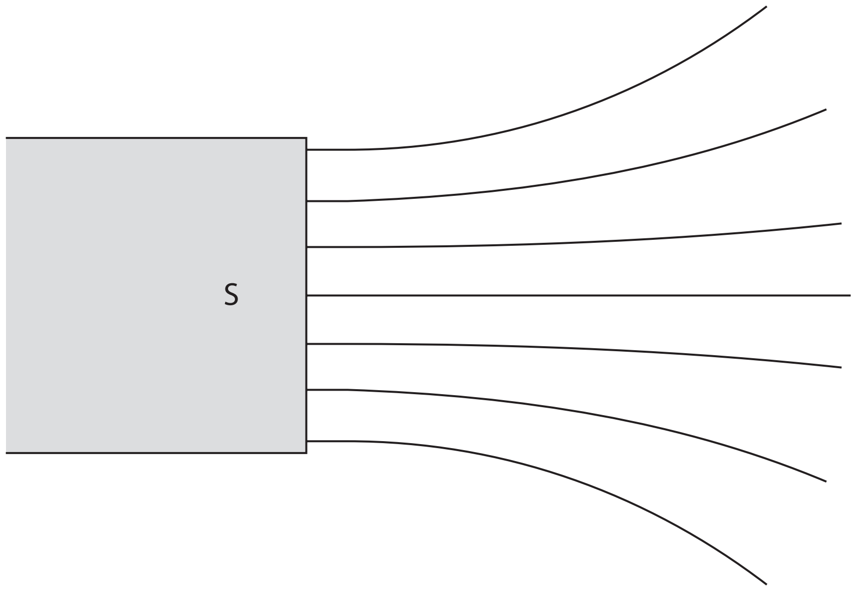


Diagram 1

(a) Draw two arrows on the field lines in diagram 1 to show the direction of the magnetic field lines.

(1)

(b) Which of these is attracted to the bar magnet if placed in the magnetic field?

(1)

☒ **A** copper

☒ **B** nickel

☒ **C** plastic

☒ **D** zinc

(c) The strength of the magnetic field changes as the distance from the south pole increases.

Explain how the magnetic field lines show this.

(2)

....

....

....

....

(d) Diagram 2 shows a small piece of iron that has been placed in the magnetic field.

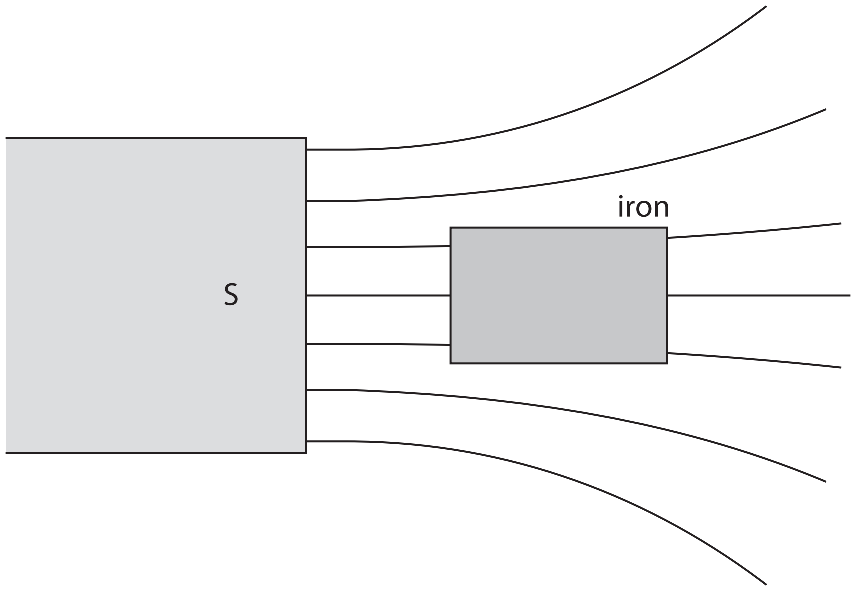


Diagram 2

The piece of iron becomes magnetised when placed in the magnetic field.

(i) Explain why the piece of iron experiences a force towards the south pole of the bar magnet.

You may add to diagram 2 to help your answer.

(2)

....

....

....

....

(ii) A student suggests that the piece of iron is now a permanent magnet.

Explain why the student is incorrect.

(2)

....

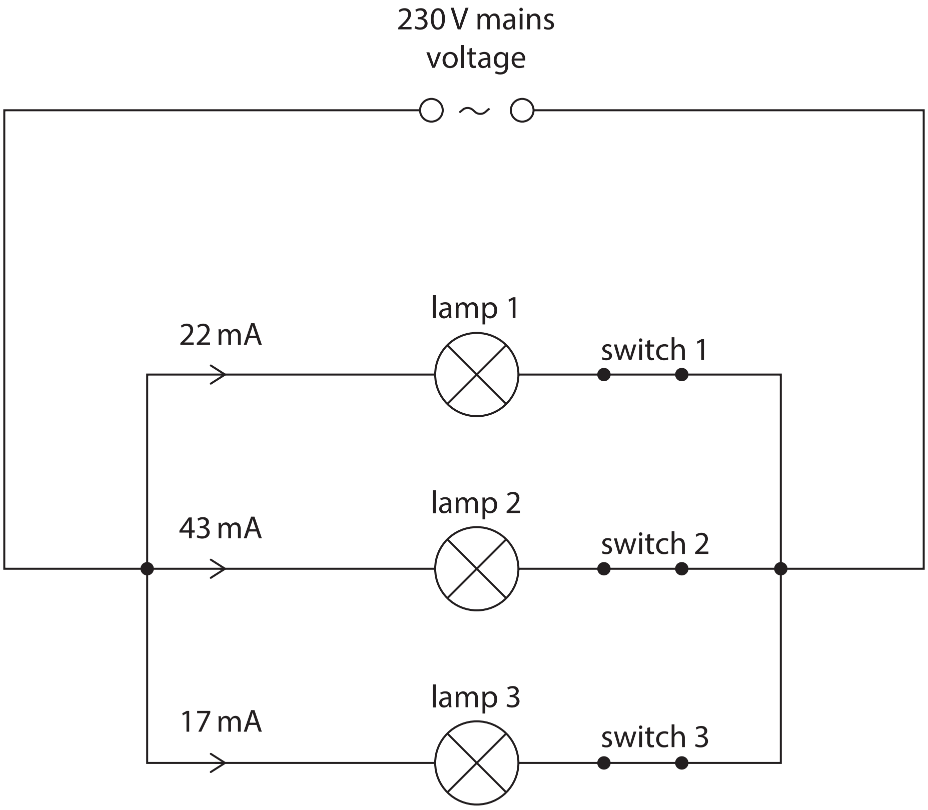
....

....

....

(Total for Question 6 = 8 marks)

7 The diagram shows a domestic lighting circuit.



(a) Explain an advantage of using this circuit for domestic lighting.

(2)

....

....

....

....

(b) When switch 1 is closed, the current in lamp 1 is 22 mA.

(i) Give the name of the charged particle that moves in an electric current.

(1)

....

(ii) Show that lamp 1 has a power of about 5 W.

(3)

(iii) Calculate the energy transferred by lamp 1 when it is on for 30 seconds.

(3)

energy transferred = ... J

(c) The circuit is connected to the mains supply. Mains voltage is 230 V.

(i) State what is meant by the term **voltage**.

(1)

....

....

(ii) Switches 1 and 3 are closed, which turn on lamps 1 and 3.

Switch 2 is open.

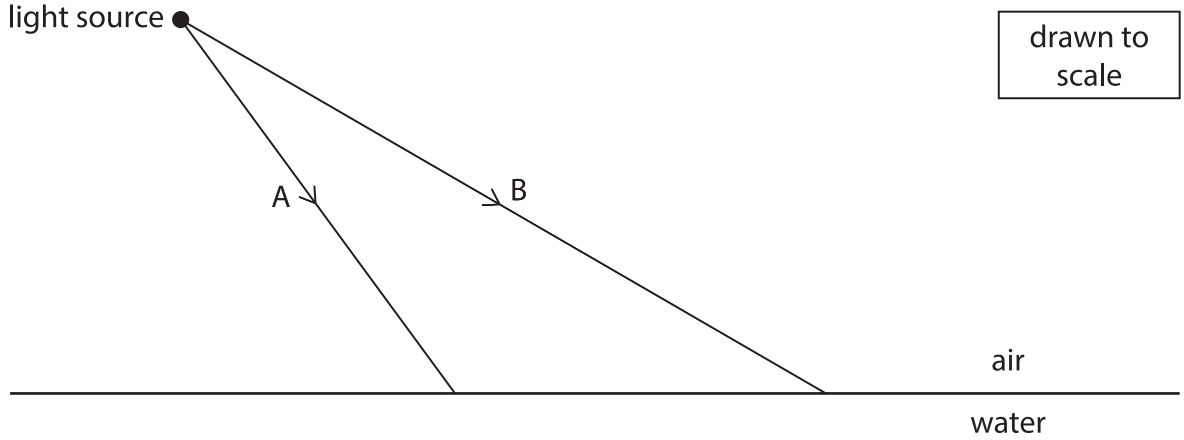
Calculate the current in the mains supply.

(2)

current = ... mA

(Total for Question 7 = 12 marks)

8 The diagram shows two rays of light, A and B, incident on the boundary between air and water.



The refractive index of water is 1.33

Explain the paths of the two rays of light after they strike the boundary between air and water.

Include calculations in your answer and draw on the diagram to support your answer.

....

....

....

....

....

....

....

....

....

....

....

....

(Total for Question 8 = 6 marks)

9 This question is about air pressure.

(a) During an aeroplane flight, a passenger drinks some water from a plastic bottle.

The passenger then replaces the top to seal the bottle, as shown in diagram 1.

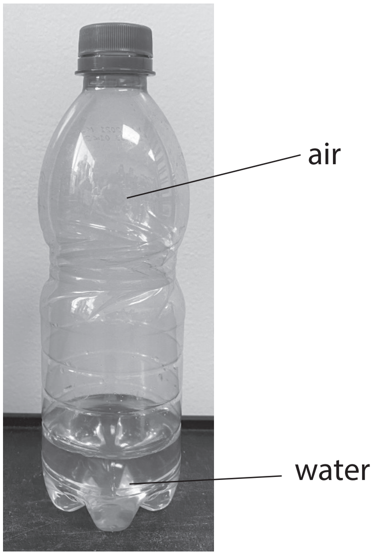


Diagram 1

The air pressure outside the bottle is 80 kPa.

State the air pressure inside the bottle just after the bottle has been sealed.

(1)

air pressure = ... kPa

(b) As the aeroplane descends, the air pressure inside the aeroplane changes.

When the aeroplane lands, the passenger notices that the plastic bottle has collapsed, as shown in diagram 2.

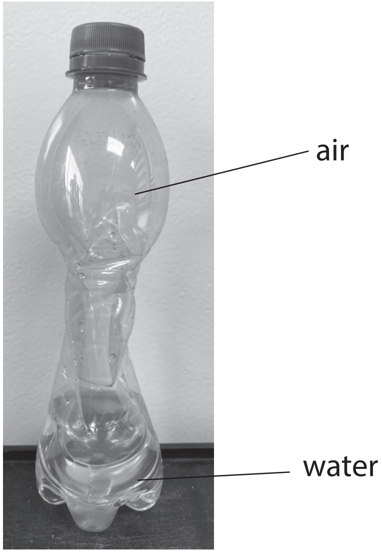


Diagram 2

Explain why the bottle has collapsed.

(2)

....

....

....

....

(c) Explain how gas molecules in the air exert a pressure on the surface of the bottle.

(3)

....

....

....

....

....

....

(Total for Question 9 = 6 marks)

10 Diagram 1 shows the apparatus a student uses to investigate the bending of a wooden strip.

Part of the wooden strip is clamped to a table.

A load is fixed to the free end of the wooden strip, causing it to bend.

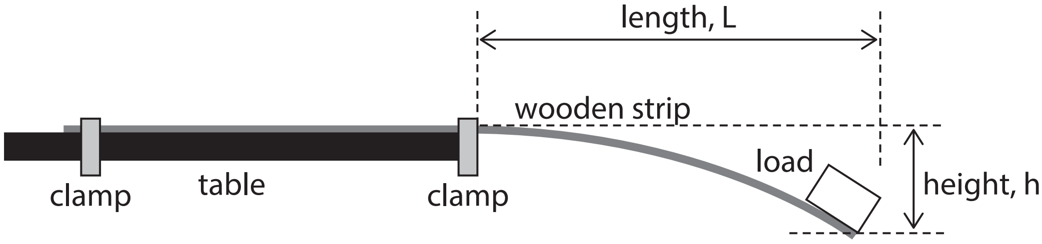


Diagram 1

The free end of the wooden strip is positioned a length, L, beyond the edge of the table, as shown in diagram 1.

The weight of the load causes the end of the wooden strip to move down through a height, h.

A student investigates how the length, L, affects the height, h.

(a) The load has a mass of 250 g.

Calculate the weight of the load.

Use the formula

$$\text{weight} = \text{mass} \times \text{gravitational field strength, } g$$

(2)

weight = ... N

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

P 7 5 8 2 6 A 0 2 2 3 2

(b) This is the student's method for the investigation.

- clamp the wooden strip so that L = 20 cm
- fix the load to the end of the wooden strip, as shown in diagram 1
- measure the height, h

The student repeats this method for different values of L.

(i) Give the independent and dependent variables in the investigation.

(2)

independent variable

....

dependent variable

....

(ii) Give two control variables in the investigation.

(2)

1 ....

2 ....

(iii) Suggest how the student could accurately measure the height, h.

(2)

....

....

....

....

....

....

(c) The table shows the results of the investigation.

Length (L) in cm	Height (h) in cm
20	2
40	8
60	18
80	
100	53
120	71

(i) Diagram 2 shows the wooden strip when L = 80 cm.

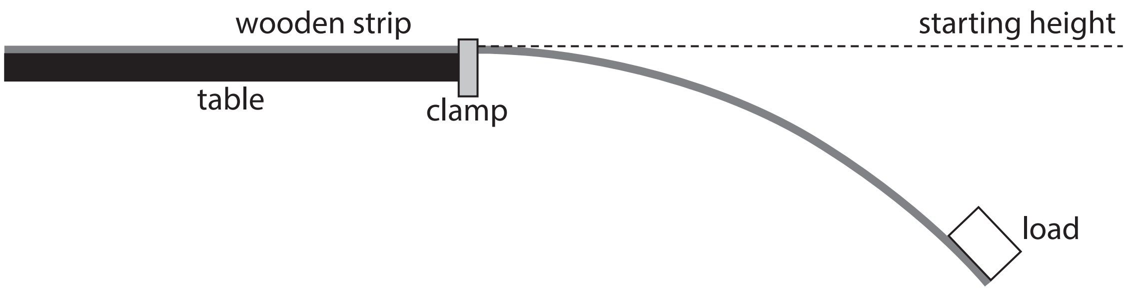


Diagram 2

Using diagram 2, determine the height, h, in the laboratory.
[1 cm on the diagram = 10 cm in the laboratory]

(2)

height, h = ... cm

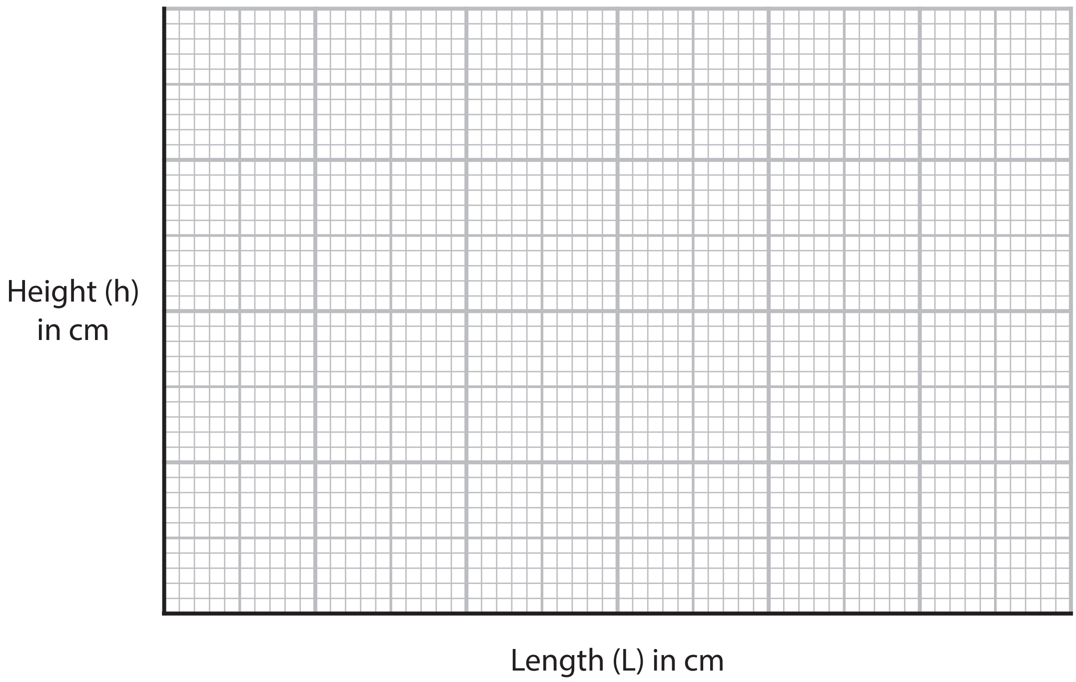
DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

(ii) Plot a graph of the student's results.

(2)

(iii) Draw the curve of best fit.

(1)



(iv) The student concludes that h is directly proportional to L.

Evaluate the student's conclusion.

(2)

....

....

....

....

....

....

(Total for Question 10 = 15 marks)

11 The photograph shows a power bank used to recharge the battery in an electronic device.

(a) The power bank stores charge.

The charge stored can be measured in amp-hours (Ah). 1 Ah is the amount of charge transferred by a current of 1 A in a time of 1 hour.

Calculate the charge stored in coulombs when the charge stored is 1 Ah.

Use the formula

$$\text{charge stored} = \text{current} \times \text{time taken}$$

(2)

charge stored = ... C

(b) An electronic device is connected to the power bank.

Whilst recharging, the electronic device receives a constant current of 2.4 A and 3.8×10^3 C of charge is transferred.

(i) Calculate the time taken to recharge the electronic device.

Give your answer in minutes.

(3)

time = ... minutes

(ii) The electronic device is connected to the power bank using a long cable.

Suggest how using a long cable affects the time taken to recharge the electronic device when compared with a short cable.

(2)

....

....

....

....

....

....

(c) A student owns three electronic devices. Each electronic device stores a different amount of charge.

The table gives some information about the charge stored by the electronic devices and how often they need to be recharged.

Electronic device	Charge stored in Ah	Frequency of recharging
A	2.4	once every day
B	4.2	once during the week
C	6.8	once during the week

The power bank stores a maximum charge of 26.8 Ah.

The student needs to take these three electronic devices on a school trip for one week.

Determine whether the maximum charge of the power bank is enough to recharge the batteries of the three electronic devices during the school trip.

(4)

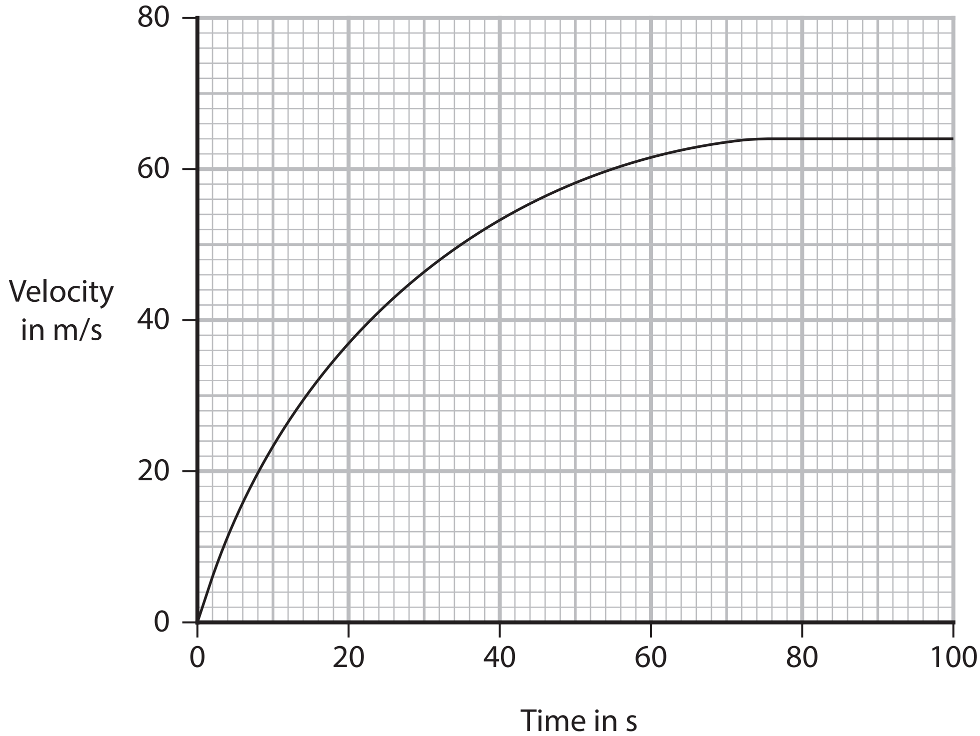
(Total for Question 11 = 11 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

BLANK PAGE

12 A car accelerates with a constant driving force along a horizontal road and reaches its maximum speed.

This is the velocity-time graph for the car's journey.



(a) By drawing a tangent to the curve, determine the acceleration of the car at a time of 20 s.

(4)

acceleration = ... m/s^2

(b) Determine the distance travelled by the car during the first 80 s of its journey.

(5)

distance = ... m

(c) Explain the motion of the car after 80 s.

(3)

....

....

....

....

....

....

....

....

(Total for Question 12 = 12 marks)

TOTAL FOR PAPER = 110 MARKS

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

BLANK PAGE

Pearson Edexcel International GCSE (9–1)

Wednesday 22 May 2024

Morning (Time: 2 hours)

Paper reference	4PH1/1P 4SD0/1P

Physics

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

Equation Booklet

Do not return this Booklet with the question paper.

Turn over ▶

P75826A

F:1/1/1/1/1/1/

P 7 5 8 2 6 A

Pearson

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 = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{(v-u)}{t}$
$(\text{final speed})^2 = (\text{initial speed})^2 + (2 \times \text{acceleration} \times \text{distance moved})$	$v^2 = u^2 + (2 \times a \times s)$
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 = $\frac{\text{change in momentum}}{\text{time taken}}$	$F = \frac{(mv - mu)}{t}$
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	$\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$
input power = output power	$V_p I_p = V_s I_s$ for 100% efficiency
8. Astrophysics	
$\frac{\text{change in wavelength}}{\text{reference wavelength}} = \frac{\text{velocity of a galaxy}}{\text{speed of light}}$	$\frac{\lambda - \lambda_0}{\lambda_0} = \frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$

END OF EQUATION LIST