Write your name here

| Surname | | Other names |
|---|---|---|
| | | |

**Pearson Edexcel International GCSE**

Centre Number

Candidate Number

# Physics

**Unit: 4PH0**
**Science (Double Award) 4SC0**
**Paper: 1PR**

Wednesday 24 May 2017 – Afternoon
**Time: 2 hours**

Paper Reference
**4PH0/1PR**
**4SC0/1PR**

**You must have:**
Ruler, protractor, 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 120.
- 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* ▶

*P 4 8 4 4 4 A 0 1 3 2*

Pearson

GradeMax

## EQUATIONS

You may find the following equations useful.

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

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

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

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

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

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

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

**Answer ALL questions.**

**1** (a) The table gives some information about different objects in the universe.

| Object | Description |
|---|---|
| Gliese 832c | Orbits the star Gliese 832 in an almost circular orbit |
| Hoag's Object | A large collection of billions of stars |
| Holmes | Orbits the Sun in an elliptical orbit |
| Io | Orbits the planet Jupiter in an almost circular orbit |

(i) Which of these is a comet?

**(1)**

☒ **A** Gliese 832c

☒ **B** Hoag's Object

☒ **C** Holmes

☒ **D** Io

(ii) Which of these is a galaxy?

**(1)**

☒ **A** Gliese 832c

☒ **B** Hoag's Object

☒ **C** Holmes

☒ **D** Io

(b) Which galaxy is our solar system in?

**(1)**

☒ **A** Cartwheel

☒ **B** Milky Way

☒ **C** Sombrero

☒ **D** Sunflower

**(Total for Question 1 = 3 marks)**

*P 4 8 4 4 4 A 0 3 3 2*
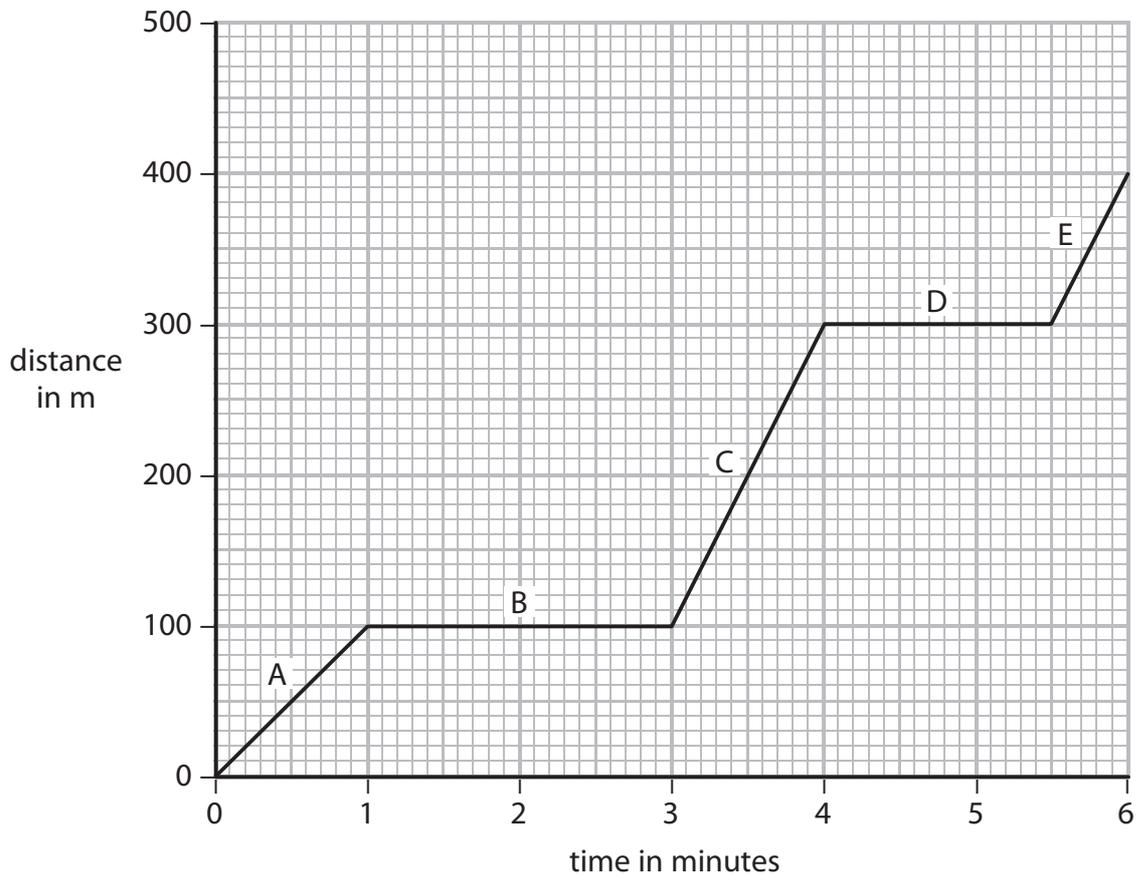
**2** A car travels along a very busy road.

© AnRo0002 (Wikipedia)

The graph shows how the distance travelled by the car changes during a six-minute period.



(a) Calculate the total amount of time the car is stationary during this period.

**(2)**

time = ................................................ minutes

(b) Explain which stage of the graph, A, B, C, D or E, shows the car moving at the slowest speed.

**(2)**

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(c) (i) State the equation linking average speed, distance moved and time taken.

**(1)**

(ii) Calculate the speed of the car at stage C.

Give a suitable unit for your answer.

**(3)**

speed = ............................................... unit ...............................................

(d) State two factors that could affect the braking distance of the car.

**(2)**

1 ......................................................................................................................................................................................

2 ......................................................................................................................................................................................

**(Total for Question 2 = 10 marks)**

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**3** A student investigates the motion of a 10 cm square piece of card as it falls.

He attaches some weights to the bottom of the card to make sure it falls vertically.

10 cm

10 cm

weights attached
to the card
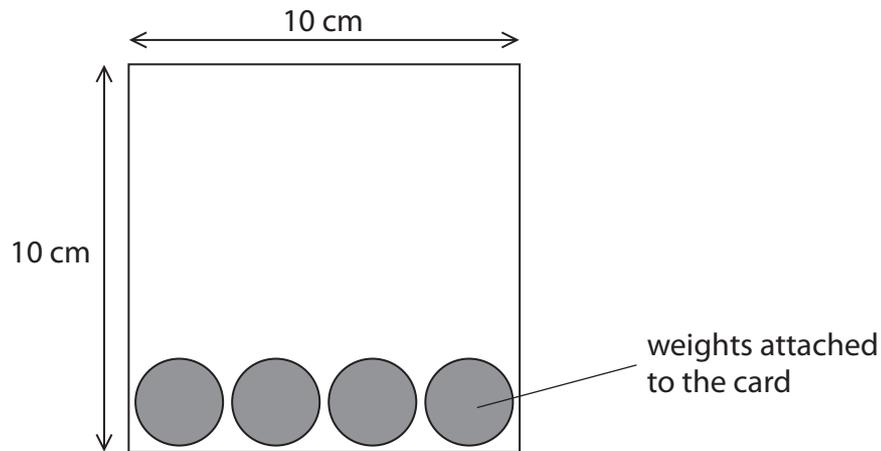
(a) Add an X to the diagram to show the position of the centre of gravity after the
weights have been attached.

**(1)**

(b) The student writes this plan for his investigation.

> Measure the final speed of the card when it is dropped from different heights.
>
> Drop the card from 6 different heights (10, 20, 30, 40, 50 and 60 cm) and measure the final speed using a light gate.
>
> Repeat the final speed measurement 3 times for each height, and take an average.
>
> Make sure that the initial speed of the card is always zero.

Which of these is the dependent variable in the student's investigation?

**(1)**

☒ **A**  the final speed of the card

☒ **B**  the initial height of the card

☒ **C**  the initial speed of the card

☒ **D**  the mass of the card

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

| Height in cm | Final speed in m/s | | | |
| --- | --- | --- | --- | --- |
| | trial 1 | trial 2 | trial 3 | average (mean) |
| 10.0 | 1.40 | 1.38 | 1.40 | 1.39 |
| 20.0 | 1.97 | 1.96 | 1.97 | 1.97 |
| 30.0 | 2.44 | 2.42 | 2.44 | 2.43 |
| 40.0 | 2.46 | 2.44 | 2.45 | 2.45 |
| 50.0 | 3.09 | 3.10 | 3.08 | 3.09 |
| 60.0 | 3.41 | 3.36 | 3.42 | |

(i) Complete the table by calculating the missing average.

Give your answer to two decimal places.

**(2)**

(ii) Plot a graph to show how the average final speed changes with height.

**(4)**
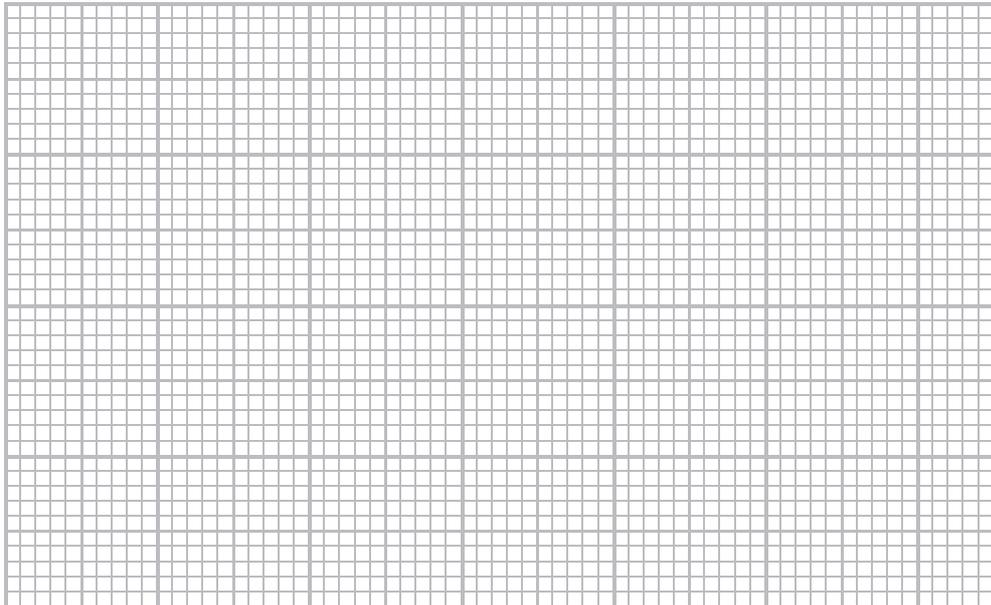
(iii) Circle the anomalous point on the graph.

**(1)**

(iv) Add a curve of best fit to the graph.

**(1)**

(v) Describe the relationship between height and average final speed.

**(2)**

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(d) The photograph shows the student releasing a card.



distance scale on stand

10 cm card

light gate connected to data logger
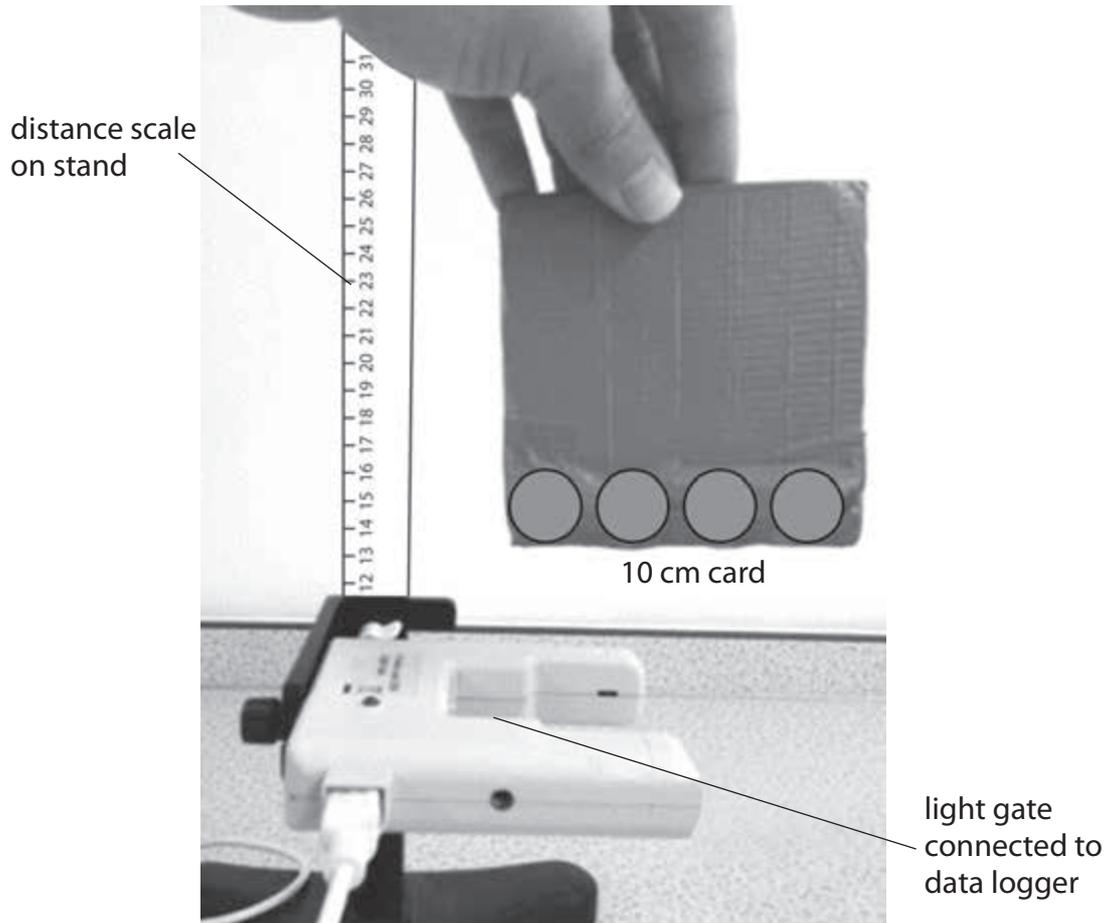
Give two ways that the student could improve the accuracy of his measurements.

**(2)**

1 ...................................................................................................................................................................

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2 ...................................................................................................................................................................

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**(Total for Question 3 = 14 marks)**

**4** (a) The table shows the names and circuit symbols of some electrical components.

Complete the table by giving the missing information.

(4)

| Component | Circuit symbol |
|---|---|
| fixed resistor | |
| variable resistor | |
| | |
| lamp | |
| | |
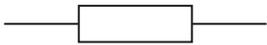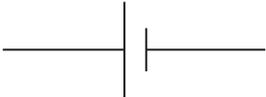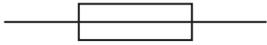
*P48444A01032*

(b) A student wants to find the resistance of a fixed resistor.

She measures a current of 0.50 A in the resistor when the voltage across it is 8.0 V.

(i) State the equation linking voltage, current and resistance.

**(1)**

(ii) Calculate the resistance of the resistor.

**(2)**

resistance = ................................................................ Ω

(c) The student replaces the fixed resistor with a light dependent resistor (LDR) and measures its resistance at different light intensities.

Sketch a graph of the expected results.

**(3)**

**(Total for Question 4 = 10 marks)**

P 4 8 4 4 4 A 0 1 1 3 2

**5** (a) The diagram shows a transverse wave.
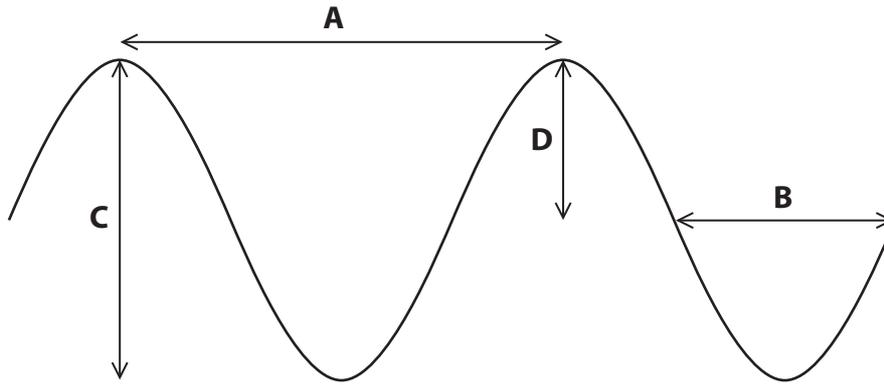


Which letter represents the amplitude of the wave?

**(1)**

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) A person observes water waves on the surface of a pond.

18 waves pass by the person in 12 s.

Calculate the frequency of these water waves.

Give the unit.

**(3)**

frequency = .............................. unit ..............................

(c) Waves on the surface of water are transverse.

Give another example of a transverse wave.

**(1)**

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*P 4 8 4 4 4 A 0 1 2 3 2*

(d) Describe the difference between transverse and longitudinal waves.

You may include a diagram in your answer.

(3)

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**(Total for Question 5 = 8 marks)**

P 4 8 4 4 4 A 0 1 3 3 2

**6** Diamonds are used in jewellery.

Diamonds are cut to increase the effect of total internal reflection of light.

The critical angle for diamond is 24°.

(a) Continue the incident ray on the diagram to show the path of the ray until it emerges from the diamond.

(3)
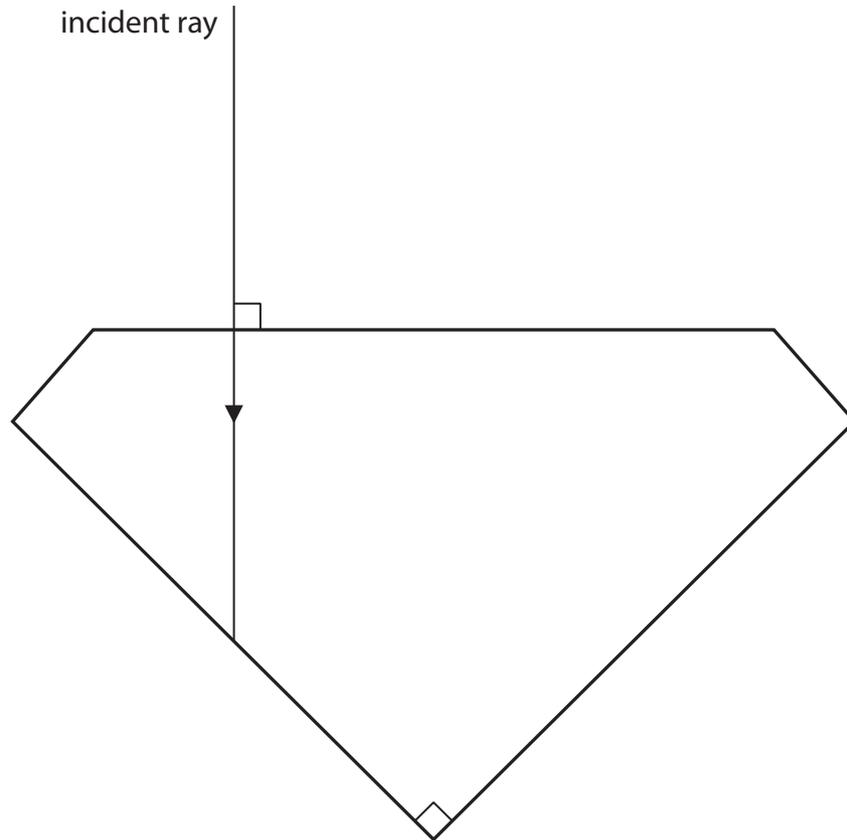
incident ray

(b) (i)  State the equation linking critical angle and refractive index.

**(1)**

(ii)  Calculate the refractive index of diamond.

**(3)**

refractive index = .................................................

(c)  State another use of total internal reflection.

**(1)**

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**(Total for Question 6 = 8 marks)**

*Turn over* ▶

**7** (a) Wind turbines are used to generate electricity.



What is the useful energy transfer in a wind turbine?

(1)

☒ **A** chemical to kinetic

☒ **B** electrical to kinetic

☒ **C** kinetic to chemical

☒ **D** kinetic to electrical

(b) Wind turbines use a renewable energy resource to generate electricity.

State two other methods of generating electricity using renewable energy resources.

(2)

1 ......................................................................................................................................................................................................................................

2 ......................................................................................................................................................................................................................................

(c) Modern wind turbines operate with an efficiency of 30%.

(i) State a type of energy that is wasted by the wind turbine.

**(1)**

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(ii) Draw a labelled Sankey diagram for a modern wind turbine.

**(3)**

**(Total for Question 7 = 7 marks)**

**8** Before the invention of modern air pumping systems, fires were sometimes used to help ventilate mines.

A fire was lit at the bottom of the ventilation shaft to make sure that fresh air flowed in to the mine through the access shaft, as shown in the diagram.
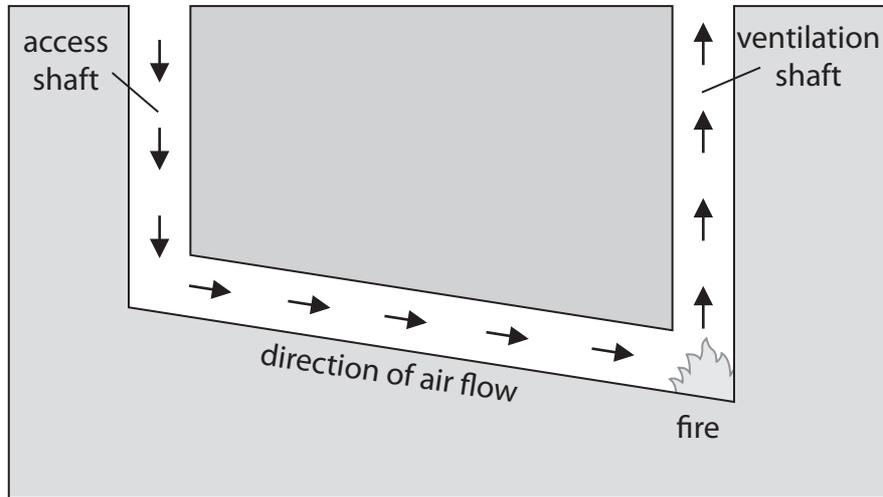


(a) The passage explains the movement of air in the mine.

Use words from the box to complete the passage.

Each word may be used once, more than once, or not at all.

**(4)**

| | | | |
|---|---|---|---|
| conduction | contracts | faster | expands |
| increases | convection | decreases | slower |

Air is heated by the fire and the air molecules move ........................................................................................ .

The air ........................................................................ as the molecules move further apart.

The density of the air ........................................................................ and the hot air rises.

Cold air flows in to replace the hot air and the process continues as a

........................................................................ current.

(b) A large rock of mass 50 kg is lifted 80 m to remove it from the mine.

   (i)   State the equation linking gravitational potential energy (GPE), mass, *g* and height.

   **(1)**

   (ii)  Calculate the gain in GPE when the rock is lifted 80 m.

   **(2)**

gain in GPE = ....................................................... J

   (iii) State the work done in lifting the rock.

   **(1)**

work done = ....................................................... J

**(Total for Question 8 = 8 marks)**

P 4 8 4 4 4 A 0 1 9 3 2

GradeMax

**9** A ship is taken out to sea before being intentionally sunk.
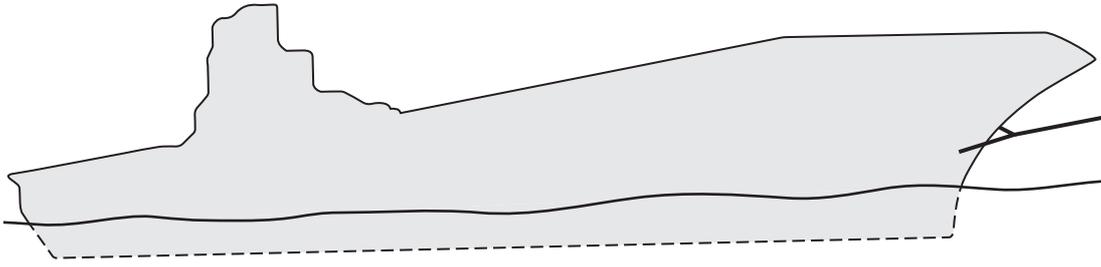
(a) The ship is floating on the water and is not moving.

Add two labelled arrows to the diagram to show the forces acting on the ship.

**(2)**

(b) The ship is then sunk.

It sinks to a depth of 48 m below the surface of the sea.

(i) State the equation linking pressure difference, height, density and $g$.

**(1)**

(ii) The density of sea water is 1030 kg/m³.

Show that the pressure difference from the surface is about 500 kPa when the ship is at a depth of 48 m.

**(2)**

P 4 8 4 4 4 A 0 2 0 3 2

(c) A small pocket of air is trapped inside the ship as it sinks.



air

sea

48 m

pocket of
trapped air
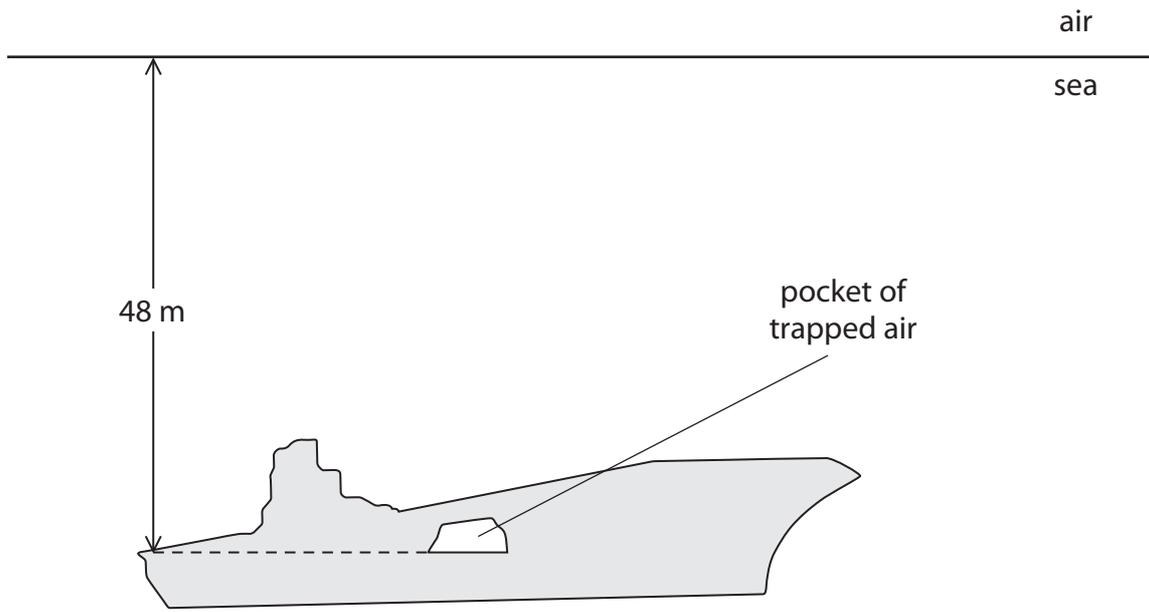
Air has a pressure of 100 kPa at the surface of the sea.

(i) Calculate the total pressure of the air at a depth of 48 m below the surface.

**(1)**

pressure = ................................................... kPa

(ii) The volume of trapped air is 24 m³ at the surface of the sea.

Calculate the volume of the trapped air at a depth of 48 m below the surface.

**(3)**

volume = ................................................... m³

**(Total for Question 9 = 9 marks)**

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P 4 8 4 4 4 A 0 2 2 3 2

**10** This question is about magnetic fields.

(a) Describe an investigation to show the shape of the magnetic field for a permanent bar magnet.

(3)

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(b) The diagram shows a bar magnet.

Draw the magnetic field pattern of the bar magnet.

(3)

**N**                        **S**

(c) A student uses two bar magnets to create a uniform magnetic field.

She places a current-carrying wire at right angles to the magnetic field, as shown in the diagram.

N            S

uniform
magnetic field

current-carrying
wire
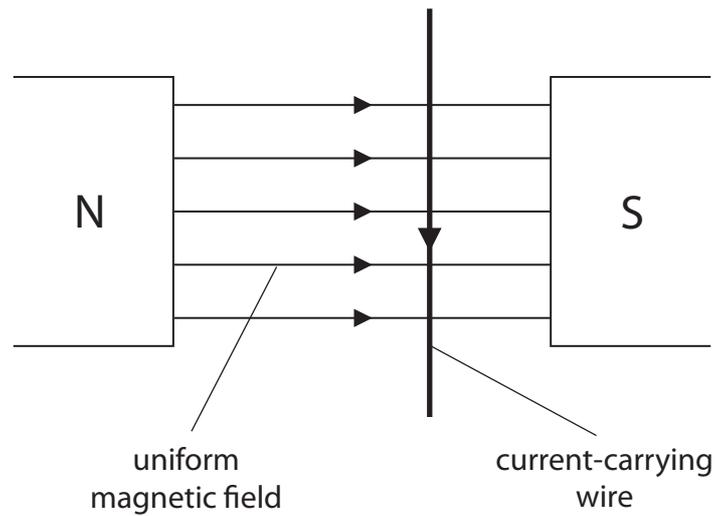
(i) The student observes that the wire experiences a force.

What is the direction of the force on the wire?

**(1)**

☒ **A**  to the left

☒ **B**  to the right

☒ **C**  out of the page

☒ **D**  into the page

(ii) State two changes, each of which would reverse the direction of the force.

**(2)**

1 ................................................................................................................................................................................................................

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2 ................................................................................................................................................................................................................

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(iii) The student moves the bar magnets further apart.

Explain what effect this would have on the force on the wire.

**(2)**

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**(Total for Question 10 = 11 marks)**

**11** A student investigates how the current in a filament lamp varies as the voltage across it changes.

(a) Draw a suitable circuit diagram for this investigation.

(3)

(b) Describe a method the student could use for this investigation.

(4)

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**(Total for Question 11 = 7 marks)**

P 4 8 4 4 4 A 0 2 6 3 2

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**12 (a)** Brownian motion provides evidence for particle theory.

    **(i)** Give an example of how Brownian motion can be demonstrated.

(1)

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    **(ii)** Explain how Brownian motion provides evidence for particle theory.

(3)

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  **(b)** Using ideas about particles, explain how air inside a container exerts pressure.

(3)

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(c) A car tyre exerts a pressure of 193 kPa on the ground.

The contact area between the tyre and the ground is 0.013 m².

(i) State the equation linking pressure, force and area.

(1)

(ii) Calculate the force that the tyre exerts on the ground.

(3)

force = ...................................................... N

(iii) The air in the tyre heats up when the car is driven.

Explain how this affects the contact area between the tyre and the ground.
[assume the volume of the air in the tyre remains constant]

(3)

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**(Total for Question 12 = 14 marks)**

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GradeMax

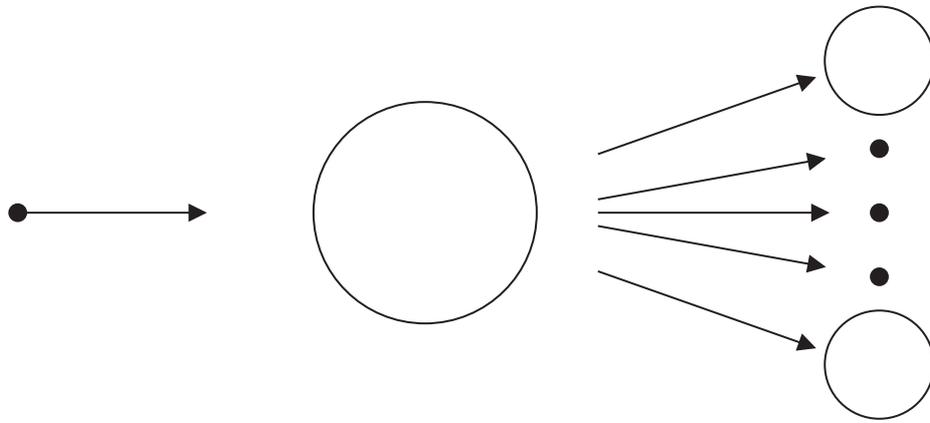**13** A nuclear power station generates electricity using the energy released from the nuclear fission of uranium-235, symbol $^{235}_{92}U$.

(a) How many neutrons are in a nucleus of uranium-235?

(1)

☒ **A** 92

☒ **B** 143

☒ **C** 235

☒ **D** 327

(b) The diagram shows the process of nuclear fission.

(i) Add labels to the diagram to show the parent nucleus and a daughter nucleus.

(2)

(ii) Explain how this fission process can lead to a chain reaction.

(3)

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*P 4 8 4 4 4 A 0 3 0 3 2*

(c) Describe the purpose of the control rods in a nuclear reactor.

(2)

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(d) In 1986, an accident occurred at a nuclear power station in Chernobyl, Ukraine.

Workers attempted to shut down the nuclear reactor by fully inserting the control rods into the reactor core.

The nuclear reactor design was flawed because the ends of the control rods entering the reactor were made of graphite.

(i) Graphite is used as a moderator in a nuclear reactor.

What is the purpose of the moderator in a nuclear reactor?

(1)

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(ii) Suggest why there was an accident when the control rods were fully inserted into the reactor core.

(2)

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**(Total for Question 13 = 11 marks)**

**TOTAL FOR PAPER = 120 MARKS**

P 4 8 4 4 4 A 0 3 1 3 2

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