 June 2014 (R)

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

Physics
Advanced Subsidiary
Unit 1: Physics on the Go

Tuesday 20 May 2014 – Morning
Time: 1 hour 30 minutes

Paper Reference
6PH01/01R

You must have:
Ruler

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 paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- The list of data, formulae and relationships is printed at the end of this booklet.
- Candidates may use a scientific calculator.

Advice

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

Turn over ▶

P43269A

1/1/1/1/1/C1/

P 4 3 2 6 9 A 0 1 2 8

PEARSON

SECTION A

Answer ALL questions.

For questions 1–10, in Section A, select one answer from A to D and put a cross in the box ☒. If you change your mind, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The newton can be written in base units as

☒ **A** kg m

☒ **B** kg m s^{-1}

☒ **C** kg m s^{-2}

☒ **D** kg m^2 s^{-2}

(Total for Question 1 = 1 mark)

2 Select the row of the table which correctly describes the properties of glass.

	Brittle	**Tough**	**Malleable**
☒ **A**	No	No	No
☒ **B**	Yes	No	No
☒ **C**	Yes	No	Yes
☒ **D**	Yes	Yes	No

(Total for Question 2 = 1 mark)

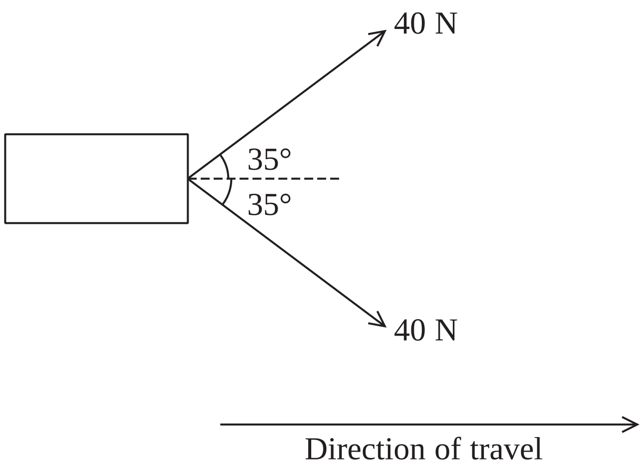
3 The surface of a golf ball is covered in small dimples. These dimples enable the ball to travel a greater distance when struck by a golf club.

Which of these statements is true?

- ☒ **A** The dimples result in only turbulent flow.
- ☒ **B** The dimples result in only laminar flow.
- ☒ **C** The dimples reduce drag.
- ☒ **D** The dimples increase drag.

(Total for Question 3 = 1 mark)

4 Two ropes are attached to a box. Each rope is pulled with a force of 40 N at an angle of 35° to the direction of travel.



The box is moved 20 m in the direction shown.

The work done, in joules, is found using

- ☒ **A** $40 \times \cos 35 \times 20$
- ☒ **B** $2 \times 40 \times \cos 35 \times 20$
- ☒ **C** $40 \times \sin 35 \times 20$
- ☒ **D** $2 \times 40 \times \sin 35 \times 20$

(Total for Question 4 = 1 mark)

Use the following information to answer questions 5 and 6.

A spring obeys Hooke's law. A force of 2.0 N extends the spring by 0.30 m.

5 A 6.0 N force will extend the spring by

- ☒ **A** 0.10 m
- ☒ **B** 0.30 m
- ☒ **C** 0.60 m
- ☒ **D** 0.90 m

(Total for Question 5 = 1 mark)

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6 The energy stored in the spring when a force of 2.0 N is applied is

- ☒ **A** 0.09 J
- ☒ **B** 0.30 J
- ☒ **C** 0.60 J
- ☒ **D** 0.90 J

(Total for Question 6 = 1 mark)

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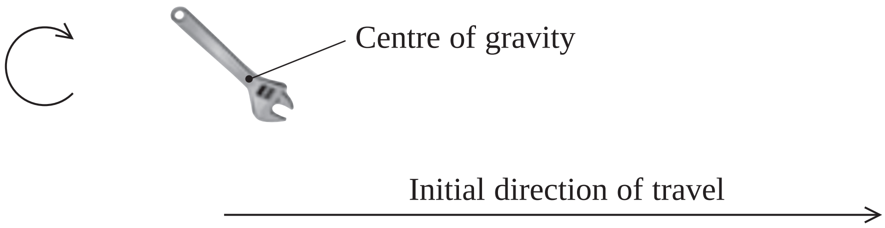
7 A spanner is thrown horizontally. As it moves it spins in a clockwise direction in a vertical plane.



Which row of the table could **not** show the relative positions of the spanner when released and during motion?

	Position when released	**Position during motion**
☒ **A**		
☒ **B**		
☒ **C**		
☒ **D**		

(Total for Question 7 = 1 mark)

8 The mass of a rocket including fuel at take-off is 11 000 kg. The engines produce an upwards vertical thrust of 150 000 N.

The acceleration, in m s^{-2}, of the rocket at take-off is found using

☒ **A** $\dfrac{150\,000}{11\,000}$

☒ **B** $\dfrac{150\,000 - 11\,000}{11\,000}$

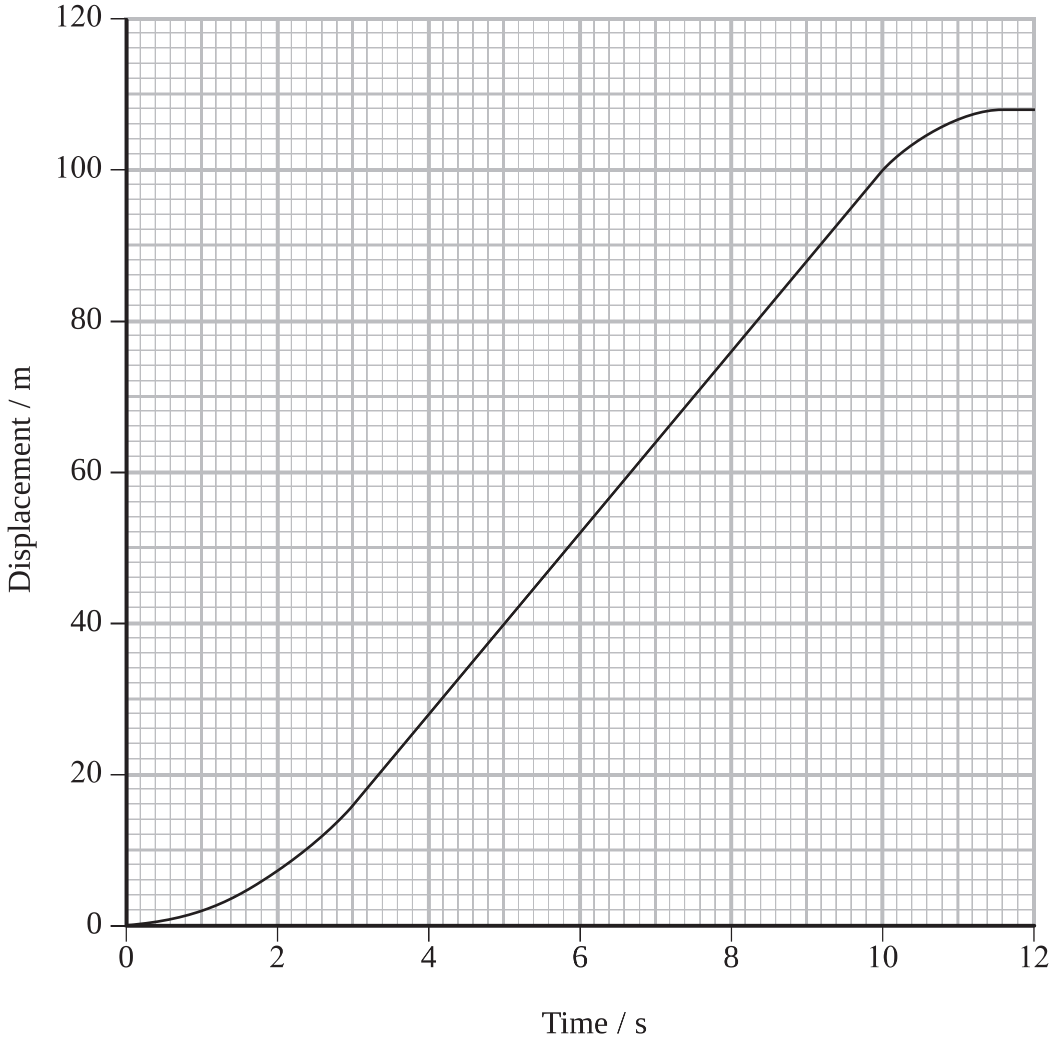
☒ **C** $\dfrac{150\,000 - (11\,000 \times 9.81)}{11\,000}$

☒ **D** $\dfrac{150\,000 - (11\,000 \times 9.81)}{(11\,000 \times 9.81)}$

(Total for Question 8 = 1 mark)

Questions 9 and 10 refer to the graph below.

The graph is a displacement-time graph for a runner.

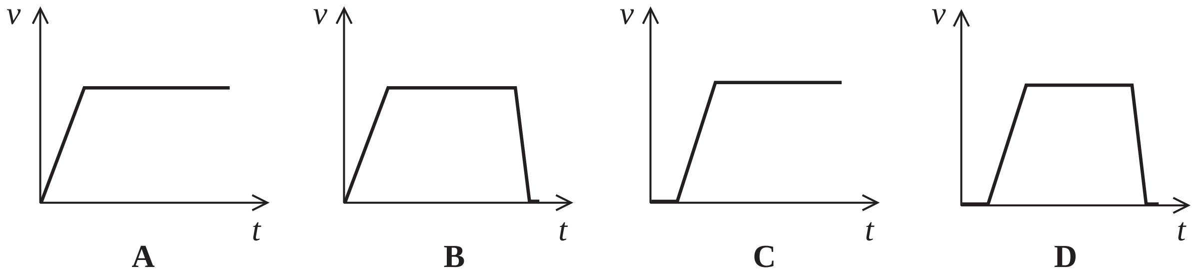


9 The velocity of the runner at 5 s is approximately

- ☒ **A** 8 m s^{-1}
- ☒ **B** 9 m s^{-1}
- ☒ **C** 12 m s^{-1}
- ☒ **D** 40 m s^{-1}

(Total for Question 9 = 1 mark)

10 The velocity-time graph for the runner over the full 12 s is



☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question 10 = 1 mark)

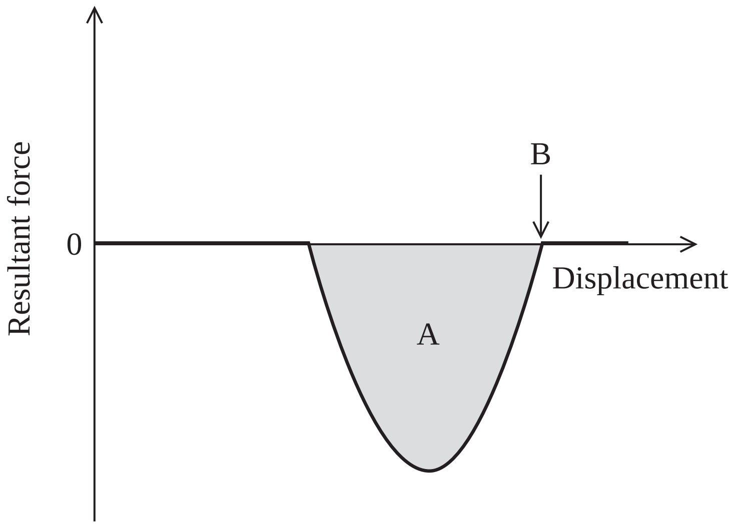
TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

11 (a) A car is moving at constant velocity when the driver applies the brakes.

The graph shows how the resultant force on the car varies with displacement.



(i) State what is represented by the area A.

(1)

....

(ii) State the motion of the car at B.

(1)

....

(b) Displacement and velocity are vector quantities.

Define the term vector and give another example of a vector quantity.

(2)

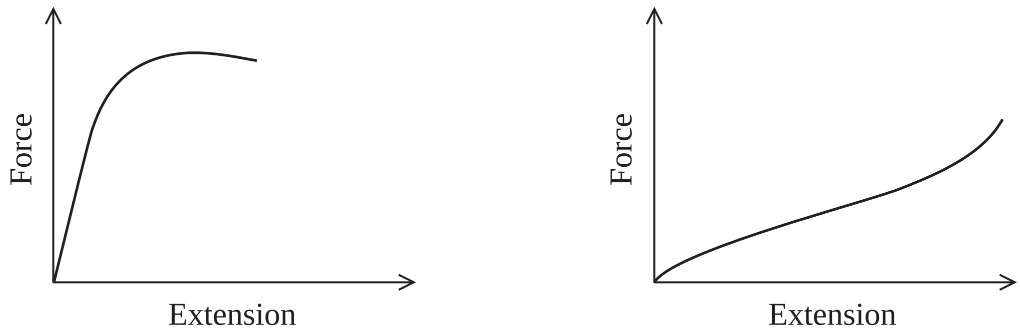
....

....

Example of a vector quantity ....

(Total for Question 11 = 4 marks)

12 In a physics lesson the following graphs are given to the students. The graphs show the relationship between force and extension for samples of two different materials, A and B.



Sample A **Sample B**

A student states that sample A obeys Hooke's law for small extensions and sample B does not.

Use the graphs to explain the validity of the student's statement.

(3)

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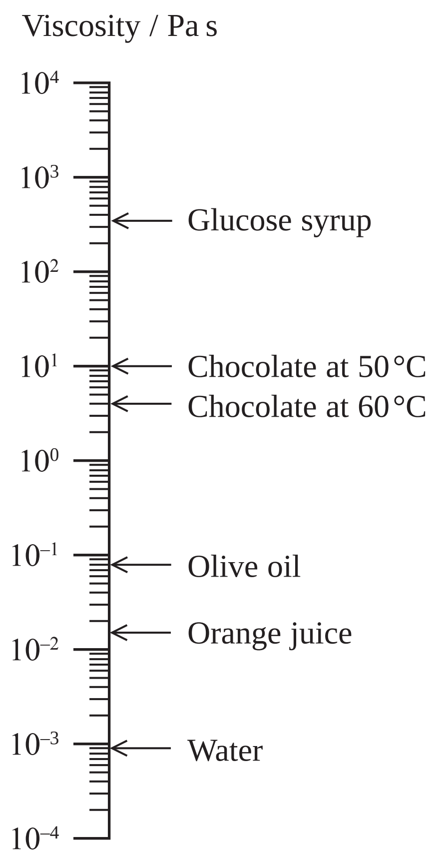
(Total for Question 12 = 3 marks)

13 The following chart shows the viscosity of some food products. Temperatures are at 20 °C unless otherwise indicated.



(a) (i) Explain why there are two different values of viscosity for chocolate.

(2)

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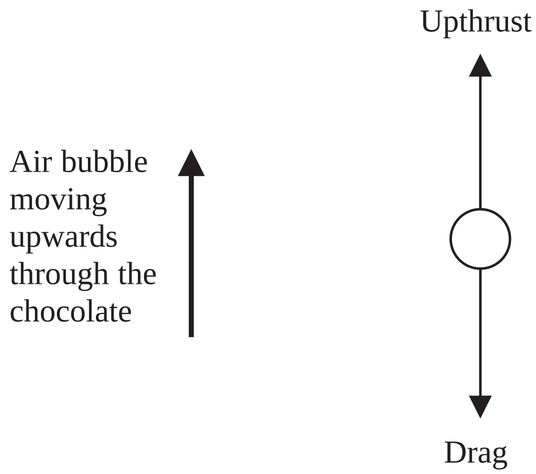
(ii) The viscosity of a sample of chocolate at 40 °C is measured.

Mark the approximate position of its viscosity onto the chart above.

(1)

(b) Some chocolate is poured into a mould. Within the chocolate a bubble of air, of negligible weight, is formed and moves upwards at a constant velocity.



radius of air bubble = 1.0×10^{-3} m

temperature of chocolate = 50 °C

upthrust on air bubble = 3.7×10^{-5} N

Calculate the approximate velocity of the air bubble.

(3)

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....

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....

....

....

Approximate velocity = ...

P 4 3 2 6 9 A 0 1 2 2 8

(c) The following table is an incomplete entry from a chocolate producer's website offering advice on chocolate moulding.

Complete the entry.

(3)

Problem	Air bubbles become trapped in the chocolate because they cannot rise to the surface in time to escape before the chocolate has solidified.
Solution	....
Explanation	....

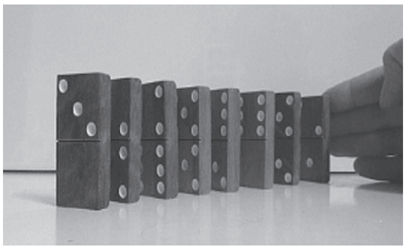
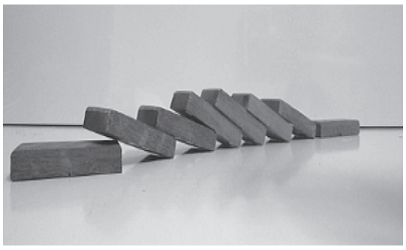
(Total for Question 13 = 9 marks)

14 A teacher sets up two experiments for her students to complete.

The outcome of each experiment can be explained using Newton's laws.

(a) Use Newton's first law of motion to explain the behaviour of the dominoes in experiment 1.

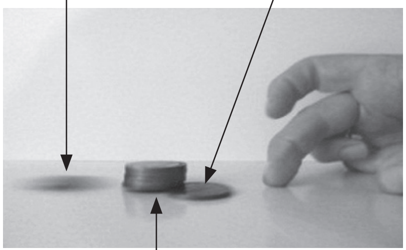
(2)

Experiment 1	**Explanation**
Falling dominoes The first domino is given a gentle push.  **Observation** The domino falls, knocking the next domino; one by one the dominoes fall. 	....

P 4 3 2 6 9 A 0 1 4 2 8

*(b) Apply Newton's laws of motion to explain the three observations in experiment 2.

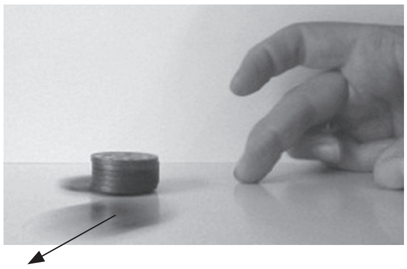
(6)

Experiment 2	Explanation
Stacked coins A coin is flicked towards a stack of coins.  **Observations** The bottom coin is knocked out from under the stack. The flicked coin stops.  The stack drops down.	

(c) Whilst carrying out the stacked coins experiment, the student sometimes observed that the flicked coin did not stop but changed its direction of travel.

Suggest a reason for this observation.

(2)

Observation	**Reason**
 The coin that was flicked changes its direction.	....

(Total for Question 14 = 10 marks)

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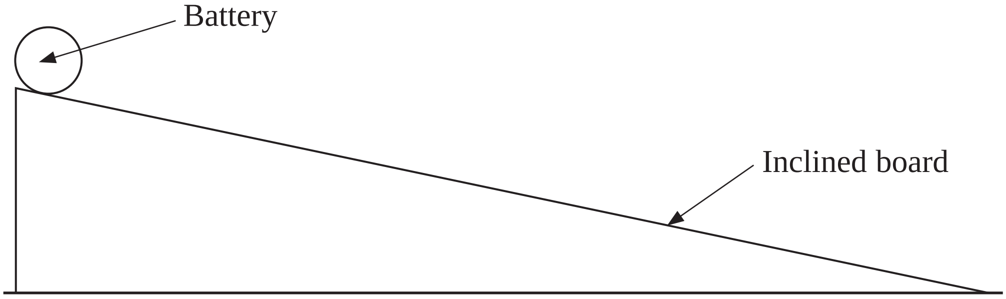
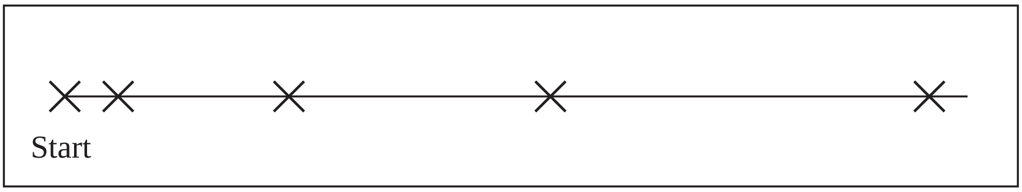
15 A group of students was asked to find how the velocity of a cylindrical battery changes as it rolls down an inclined board.



The group marked the position of the battery on the board every second with an X.



(a) These markings were used to obtain the following results table.

(i) Complete the table.

(3)

		A	**B**
Time / s	**Distance from start position / m**	**Average velocity in previous second / m s^{-1}**	**Average velocity from the start / m s^{-1}**
0.0	0.00	0	0
1.0	0.18	0.18	0.18
2.0	0.84		
3.0	1.75		
4.0	3.14	1.39	0.79

(ii) Justify which of the columns, A or B, gives a more accurate value for the velocity of the battery at the bottom of the inclined board.

(1)

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....

....

(b) The only two pieces of equipment that the students used were a measuring tape and a manual stopwatch.

Give a possible source of error and suggest changes to the equipment and method used to make the values in column A more accurate.

(3)

Source of error ....

....

....

Changes ....

....

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....

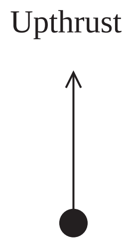
(Total for Question 15 = 7 marks)

16 Kite surfing is the sport of riding on a small surfboard, propelled forwards across water by a large kite. The surfer holds onto a bar that is attached to the lines. As the air moves over the kite an upwards and forwards force is produced, causing a tension in the lines of the kite.

Consider the board and the surfer to be a single object and the lines of the kite to be equivalent to a single line.

(a) (i) Complete the free body diagram for the forces acting on the surfer at the instant he starts to move along the water.

(2)



(ii) At maximum speed, the angle of the kite to the horizontal is 40° and the total tension in the lines is 1100 N.

Show that the horizontal force from the kite on the surfer is about 800 N.

(2)

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(iii) By considering the vertical forces acting on the surfer, explain why the mass of the surfer must be at least 72 kg.

(3)

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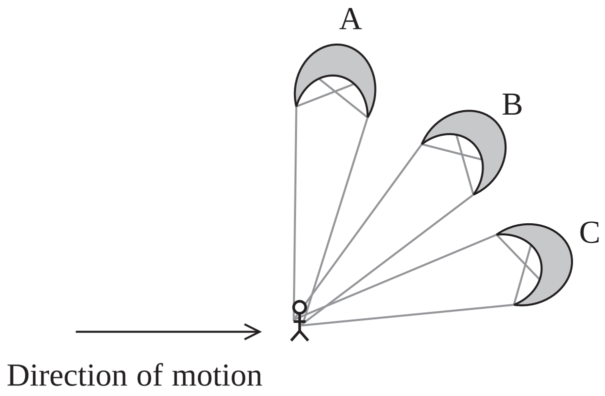
*(b) The diagram shows three positions of the kite when pulling the surfer along.



State and explain which position of the kite would supply the most power to the surfer. Assume that the tension in the kite lines is the same in each position.

(4)

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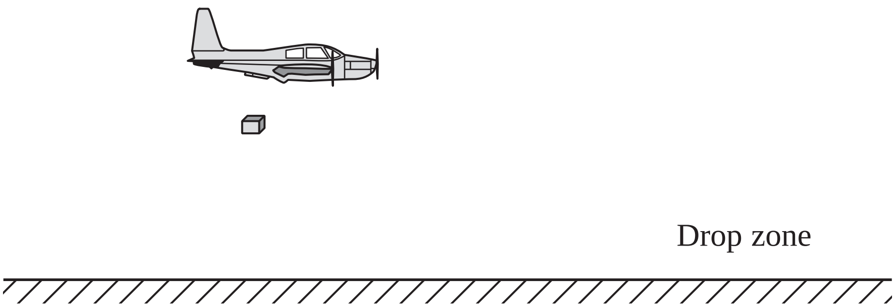
(Total for Question 16 = 11 marks)

17 In areas of the world where a plane is unable to land, free fall airdrops can be used to deliver supplies.



A plane travelling at a speed of 75 m s^{-1} and at a height of 63 m releases a package of supplies.

(a) (i) Draw the path of the falling package on the diagram above.

(1)

(ii) Show that the time taken for the supplies to reach the ground is about 4 s.

(2)

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(iii) Calculate the horizontal distance of the plane from the drop zone when releasing the package.

(2)

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Horizontal distance = ...

(b) (i) Show that the change in gravitational potential energy of the package during the fall is about 6 kJ.

mass of package = 10 kg

(2)

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(ii) Show that the kinetic energy of the package on release is about 28 kJ.

(2)

....

....

(iii) Determine the kinetic energy of the package on impact.

(1)

....

Kinetic energy = ...

(iv) State why in practice the actual value for the kinetic energy on impact with the ground is less than the value you calculated in part (b)(iii).

(1)

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....

(c) Most airdrops are not free fall and use parachutes.

State why using parachutes causes less damage to the package.

(1)

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(Total for Question 17 = 12 marks)

18 The following three properties can be used to describe copper.

Ductile   Malleable   Tough

(a) Select and explain the property that makes copper suitable for the production of wires.

(3)

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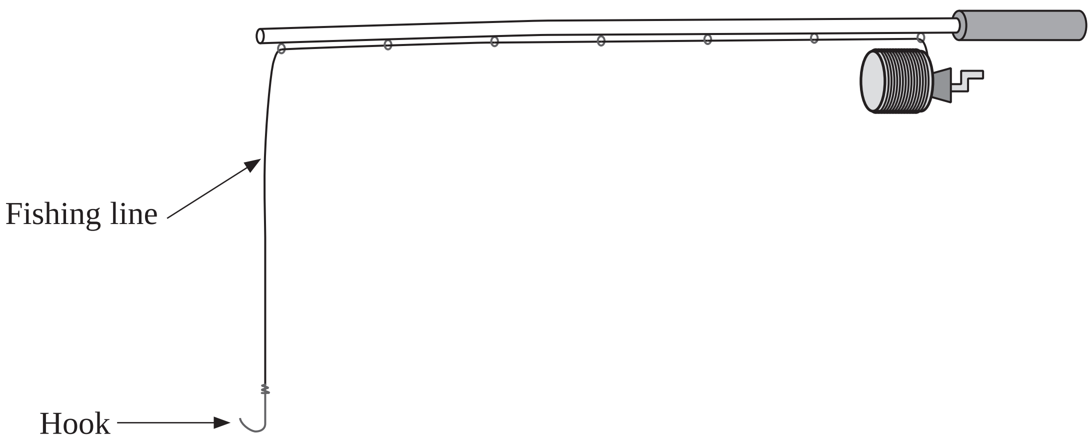
(b) Both nylon and copper can be used to make fishing lines. Copper fishing lines sink faster than those made of nylon. This makes copper fishing lines more suitable for deep water fishing.



(i) By considering the forces acting on the submerged line, explain why nylon is less suitable than copper for deep water fishing. Include a suitable calculation in your answer.

Both lines have the same cross-sectional area.

cross-sectional area of lines = 1.30×10^{-7} m^2

density of saltwater = 1030 kg m^{-3}

weight of 20.0 m of copper line = 0.220 N

weight of 20.0 m of nylon line = 0.0280 N

(4)

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(ii) A fish becomes caught on the hook and the copper line extends. Calculate the extension produced.

cross-sectional area of copper line = 1.30×10^{-7} m^2

load on line = 65.0 N

original length of line = 20.0 m

Young modulus of copper = 129 GPa

(3)

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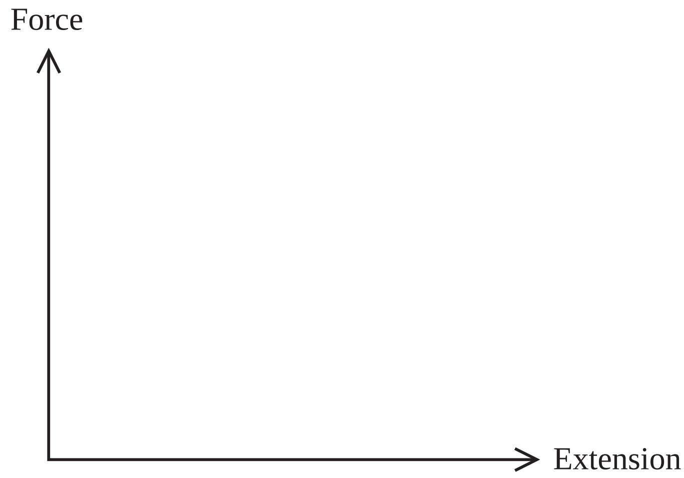
Extension = ...

(c) Some people use fishing lines that have been pre-stretched by loading and unloading.

(i) Sketch the force-extension graph for a copper line during the process of pre-stretching.

(3)



(ii) Suggest a reason why some people prefer to use this type of line.

(1)

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(Total for Question 18 = 14 marks)

TOTAL FOR SECTION B = 70 MARKS

TOTAL FOR PAPER = 80 MARKS

List of data, formulae and relationships

Acceleration of free fall	$g = 9.81\ \text{m s}^{-2}$	(close to Earth's surface)
Electron charge	$e = -1.60 \times 10^{-19}\ \text{C}$	
Electron mass	$m_e = 9.11 \times 10^{-31}\ \text{kg}$	
Electronvolt	$1\ \text{eV} = 1.60 \times 10^{-19}\ \text{J}$	
Gravitational field strength	$g = 9.81\ \text{N kg}^{-1}$	(close to Earth's surface)
Planck constant	$h = 6.63 \times 10^{-34}\ \text{J s}$	
Speed of light in a vacuum	$c = 3.00 \times 10^{8}\ \text{m s}^{-1}$	

Unit 1

Mechanics

Kinematic equations of motion	$v = u + at$ $s = ut + \tfrac{1}{2}at^2$ $v^2 = u^2 + 2as$
Forces	$\Sigma F = ma$ $g = F/m$ $W = mg$
Work and energy	$\Delta W = F\Delta s$ $E_k = \tfrac{1}{2}mv^2$ $\Delta E_{grav} = mg\Delta h$

Materials

Stokes' law	$F = 6\pi\eta rv$
Hooke's law	$F = k\Delta x$
Density	$\rho = m/V$
Pressure	$p = F/A$
Young modulus	$E = \sigma/\varepsilon$ where Stress $\sigma = F/A$ Strain $\varepsilon = \Delta x/x$
Elastic strain energy	$E_{el} = \tfrac{1}{2}F\Delta x$

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