Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Advanced Subsidiary
Unit 1: Physics on the Go

Wednesday 15 January 2014 – Morning
Time: 1 hour 30 minutes

Paper Reference
WPH01/01

You must have:
Ruler, protractor

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 ▶

P43112A

©2014 Pearson Education Ltd.

1/1/1/1/1/1/

P 4 3 1 1 2 A 0 1 3 2

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 Which of the following is a correct statement?

☒ **A** Weight is a base quantity.

☒ **B** Velocity is a base quantity.

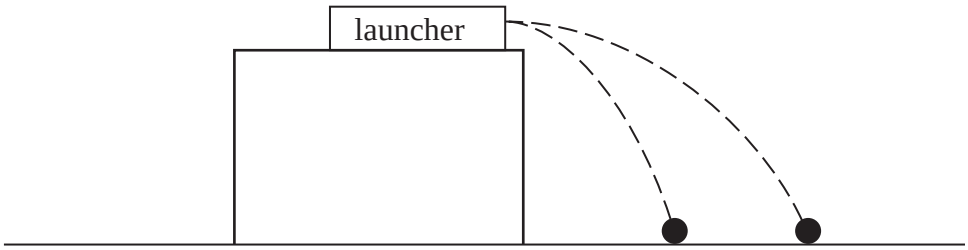
☒ **C** Mass is a derived quantity.

☒ **D** Force is a derived quantity.

(Total for Question 1 = 1 mark)

---

2 A ball launcher fires a ball horizontally off the edge of a lab bench. The paths of the ball after two launches are shown below.



Which of the following quantities is different for the two launches?

☒ **A** gravitational acceleration

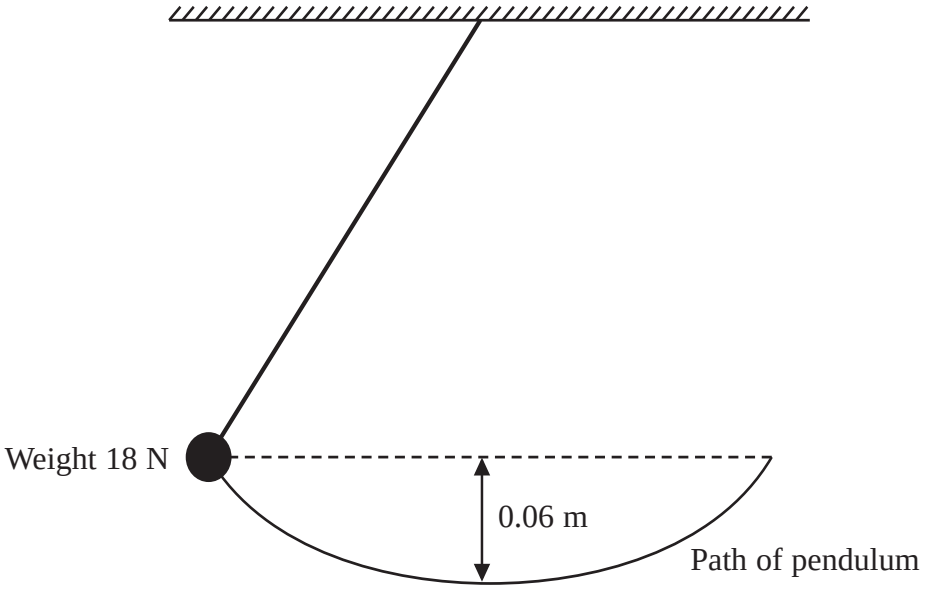
☒ **B** time of flight

☒ **C** launch angle

☒ **D** initial velocity

(Total for Question 2 = 1 mark)

3



A pendulum consists of an 18 N weight attached to a piece of string. The weight is released from the position shown in the diagram. The speed in m s^{-1} at the bottom of the swing is given by

☒ **A** $\sqrt{\dfrac{2 \times 9.81 \times 0.06}{18}}$

☒ **B** $\sqrt{9.81 \times 0.06}$

☒ **C** $\sqrt{2 \times 9.81 \times 0.06}$

☒ **D** $\sqrt{2 \times 9.81 \times 18 \times 0.06}$

(Total for Question 3 = 1 mark)

4 A pump is positioned at the bottom of a well and it pumps 15 kg of water 25 m to the surface each minute.

The power of the pump is

☒ **A** 6.3 W

☒ **B** 61 W

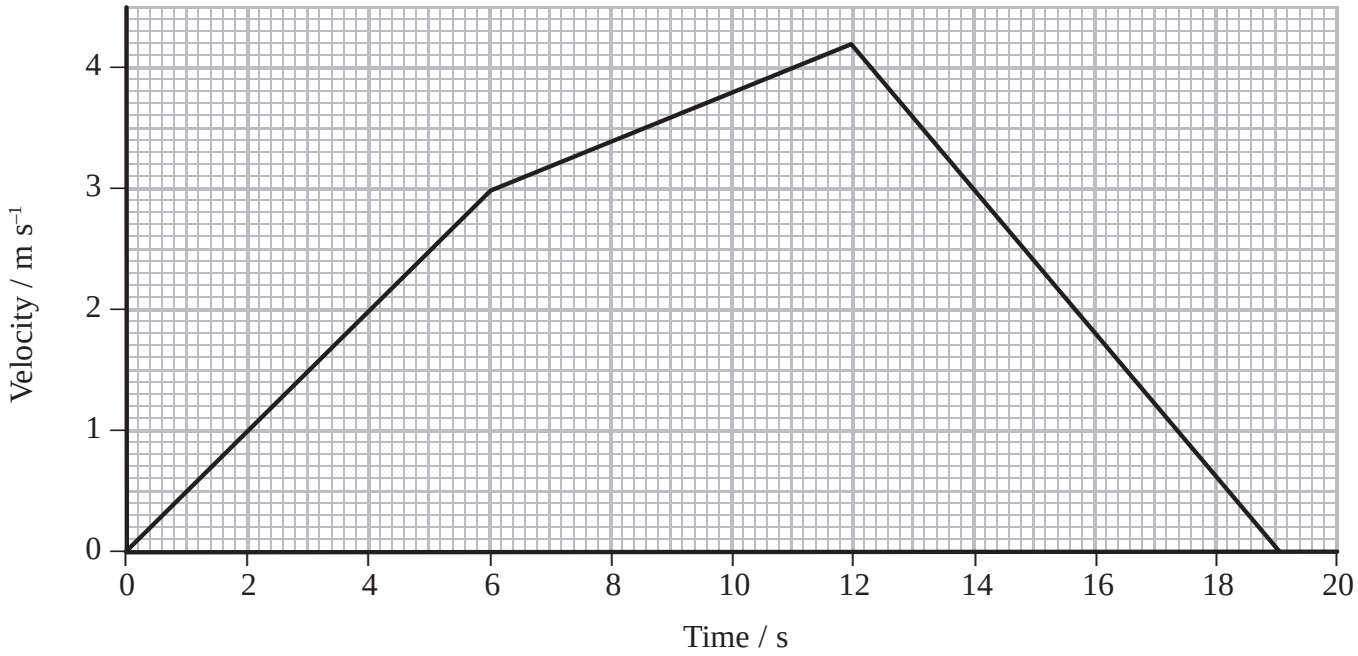
☒ **C** 3700 W

☒ **D** 22 000 W

(Total for Question 4 = 1 mark)

Questions 5 and 6 refer to the graph below.

The velocity-time graph for an object is shown.



5 The initial acceleration of the object is

☒ **A** 0.40 m s^{-2}

☒ **B** 0.50 m s^{-2}

☒ **C** 2.0 m s^{-2}

☒ **D** 9.0 m s^{-2}

(Total for Question 5 = 1 mark)

6 The displacement of the object during the time of deceleration is

☒ **A** 29 m

☒ **B** –29 m

☒ **C** 15 m

☒ **D** –15 m

(Total for Question 6 = 1 mark)

7 A force of 15 N is applied to a wire of cross-sectional area 3.0×10^{-6} m^2. The wire extends by 1% of the original length.

The Young modulus of the wire, in N m^{-2}, can be found from

☒ **A** $\dfrac{15}{1 \times 3.0 \times 10^{-6}}$

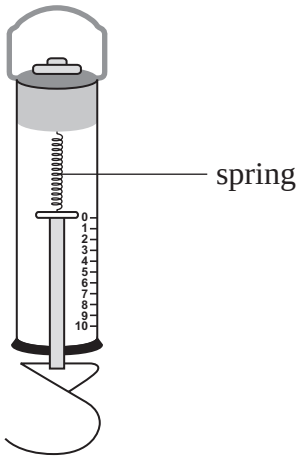
☒ **B** $\dfrac{15}{(0.01)(3.0 \times 10^{-6})}$

☒ **C** $\dfrac{(1)(3.0 \times 10^{-6})}{15}$

☒ **D** $\dfrac{(15)(0.01)}{(3.0 \times 10^{-6})}$

(Total for Question 7 = 1 mark)

8 The main component of a newton meter is a calibrated spring.



The newton meter is to be used over a greater range of forces. Which of the following should be increased to allow this?

☒ **A** ductility of the spring wire

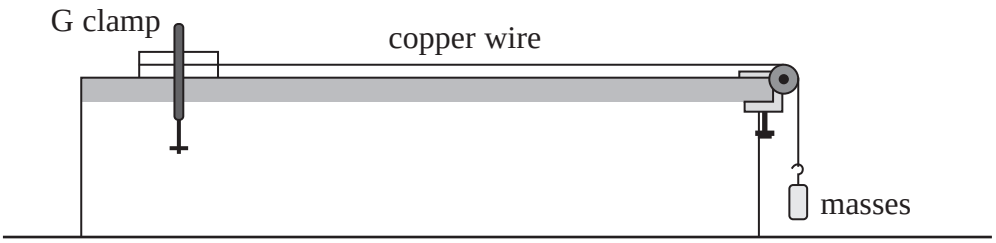
☒ **B** precision of the scale

☒ **C** stiffness of the spring

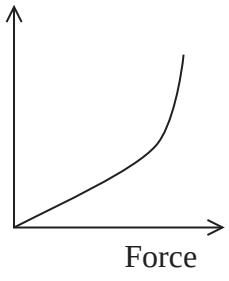
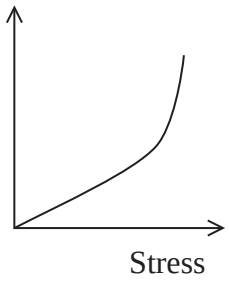
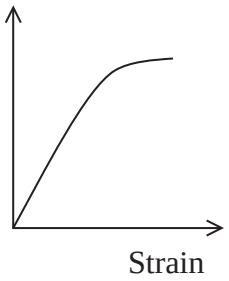
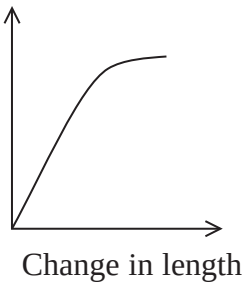
☒ **D** ultimate tensile strength of the spring

(Total for Question 8 = 1 mark)

9 Some masses are added to a piece of copper wire as shown. Measurements are taken of the length of the wire as the force on the wire is increased.

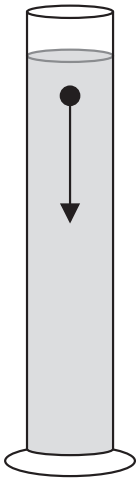


The work done in stretching the wire is given by the area under which graph?

☒ **A**	☒ **B**	☒ **C**	☒ **D**
Change in length 	Strain 	Stress 	Force 

(Total for Question 9 = 1 mark)

10 In an experiment a small metal ball is dropped into a cylinder of oil. The time taken for the ball to fall to the bottom of the cylinder is recorded.



The experiment is repeated. Which changes to the ball would result in the greatest decrease in the time it takes to reach the bottom of the cylinder?

☒ **A** smaller mass and smaller diameter

☒ **B** smaller mass and greater diameter

☒ **C** greater mass and smaller diameter

☒ **D** greater mass and greater diameter

(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

11 One side of a mountain slopes at 35° to the horizontal and the other side at 25°.

A geologist needs to climb to the top to collect rock samples.

By discussing the work done and forces involved, explain which would be the easier side to use to climb to the top.

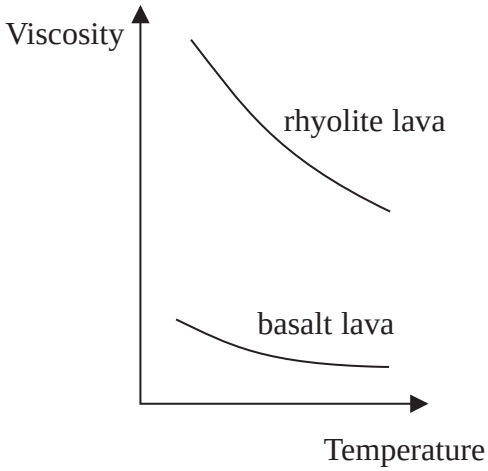
vertical height of mountain = 365 m

mass of geologist = 85 kg

(3)

(Total for Question 11 = 3 marks)

*12 Lava is molten rock, which sometimes erupts from beneath the Earth's surface. As the lava cools volcanoes form. The shape of the volcano is determined by the flow rate of the lava. The graph below shows how the viscosities of two types of lava vary with temperature.



The diagrams below shows the shapes of two typical volcanoes.

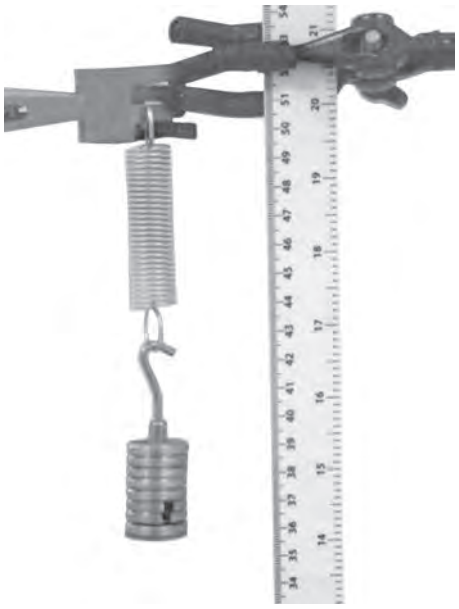


Both types of lava are at the same temperature as they reach the Earth's surface. The shield volcano is formed from basalt lava and the cone volcano is formed from rhyolite lava. Use the information in the graph to explain the shape of each volcano.

(4)

(Total for Question 12 = 4 marks)

13 The apparatus shown can be used to determine the spring constant k of a spring.



*(a) Describe how the apparatus can be used to accurately obtain the measurements needed.

(4)

(b) Describe how the measurements would be used to determine a reliable value of k.

(3)

(c) State why it is important not to exceed the limit of proportionality of the spring.

(1)

(Total for Question 13 = 8 marks)

14 An archer stands 15 m from a target. An arrow is fired horizontally at 36 m s^{-1} towards the target.



(a) (i) On the diagram draw the path of the arrow.

(1)

(ii) Show that the time taken for the arrow to reach the target is about 0.4 s.

(2)

(iii) The archer fires the arrow horizontally from a height of 1.5 m above the ground.

Calculate the height above the ground at which the arrow strikes the target.

(3)

Height above ground = ...

(b) Explain how your answer to part (a)(iii) would be affected if the archer stood closer to the target.

(2)

.....

.....

.....

.....

.....

(Total for Question 14 = 8 marks)

15 The world's tallest building is the Burj Khalifa in Dubai, UAE.

The viewing gallery for the public is on the 124th floor. The lift that visitors use takes 56 seconds to reach this floor. The motion of the lift can be divided into three parts:

- acceleration
- constant velocity of 10 m s^{-1}
- deceleration.



(a) Draw a free-body force diagram for the forces acting on a passenger as the lift rises.

(2)

(b) A physics student of mass 60 kg decides to measure the initial acceleration of the lift. She places a set of scales on the floor of the lift and steps onto them. Whilst the lift is accelerating upwards the reading on the scales increases to 73 kg.

(i) Show that the initial acceleration of the lift is about 2 m s^{-2}.

(3)

(ii) Near the end of the ascent, the velocity of the lift decreases from 10 m s^{-1} to rest in 5.3 seconds.

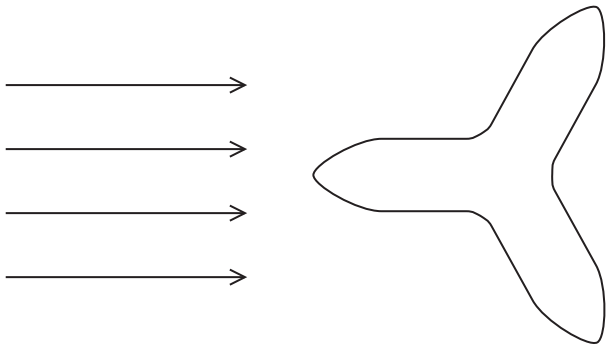
Calculate the deceleration.

(2)

Deceleration = ...

(c) The effects of the wind had to be considered in the position and design of the building, due to its height. It has been shaped, as in the diagram, so that the wind deflects around the building in a way which minimises turbulence.

Aerial view of the Burj Khalifa building

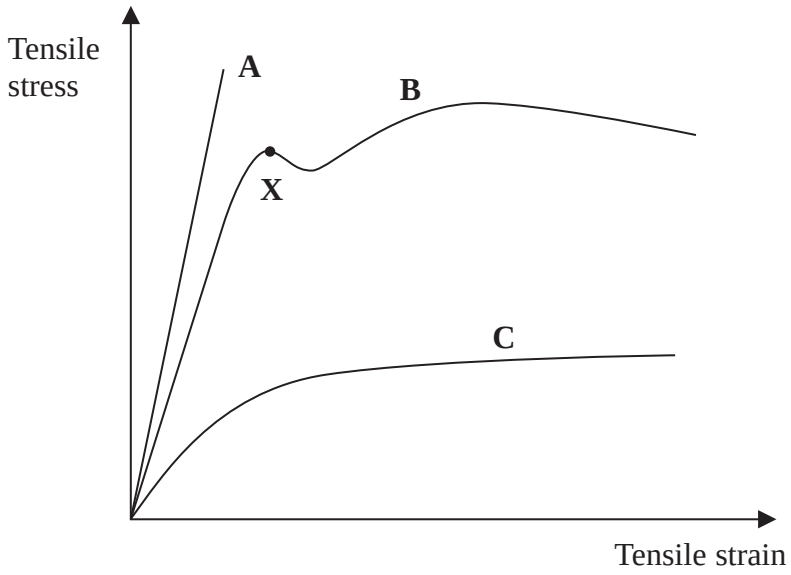


Add to the diagram above to show the air flow around the building, labelling regions of laminar and turbulent flow.

(2)

(Total for Question 15 = 9 marks)

16 The graph shows the stress-strain curves for three materials A, B, and C up to the point of fracture.



(a) (i) Identify which of the materials A, B or C is

(4)

a brittle material .....

a ductile material .....

the strongest material .....

the least stiff material .....

(ii) The three materials are copper, glass and steel.

Identify which graph refers to each material.

(2)

A .....

B .....

C .....

(b) Explain why steel is a suitable material for making paper clips.

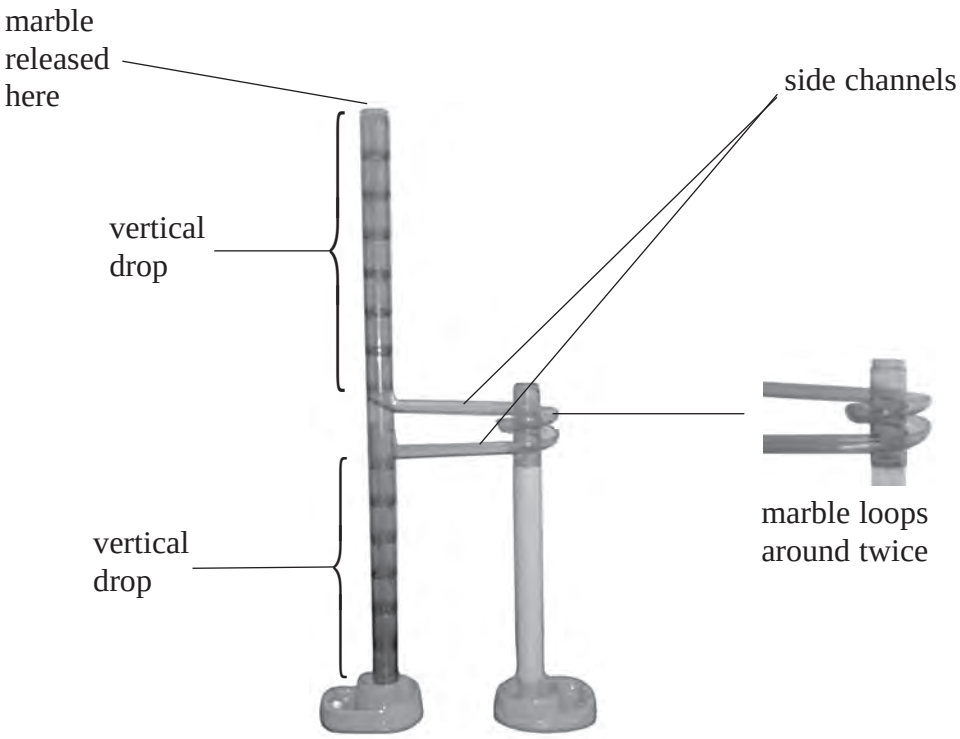
(3)

(c) State the name for the point marked **X** on graph B and explain its significance.

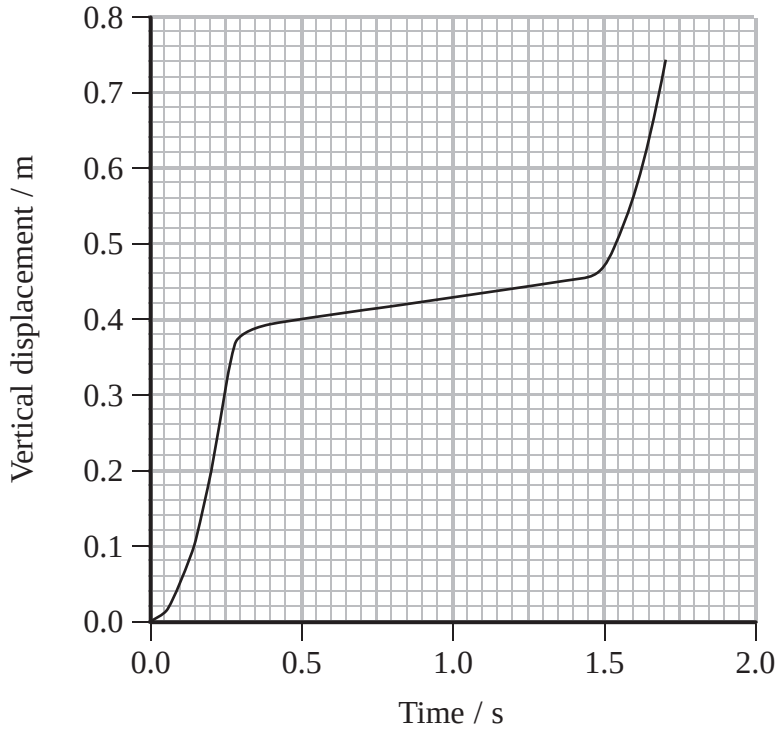
(2)

(Total for Question 16 = 11 marks)

17 The photograph shows a marble game.



A marble was released and its motion was recorded using a digital video camera. The data was uploaded to a computer and then analysed using a motion capture programme. The following vertical displacement-time graph was obtained.



(a) (i) While the marble is in the side channels its speed remains constant.

Use the graph to show that the vertical velocity is about 0.06 m s^{-1}.

(2)

.....

.....

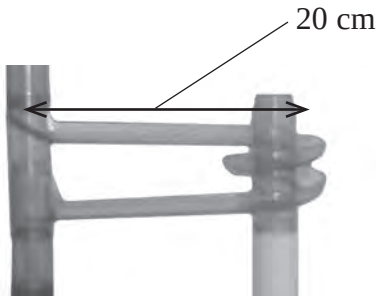
.....

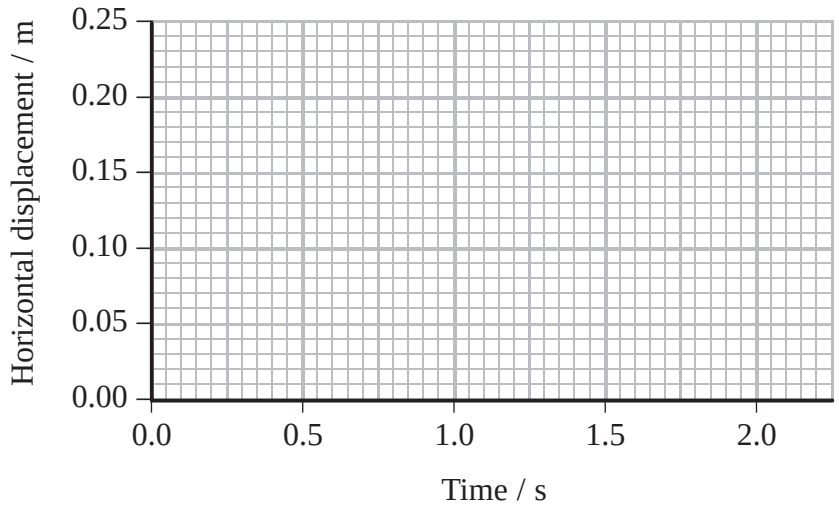
.....

.....

(ii) On the axis below sketch the displacement-time graph for the horizontal displacement of the marble.

(4)





(iii) State the average horizontal velocity of the marble.

(1)

.....

(b) Measurements of the displacement of the marble and time taken could have been made using a rule and stopwatch.

Explain the advantages of using the digital video camera compared with a rule and stopwatch to obtain the data.

(3)

.....

.....

.....

.....

.....

.....

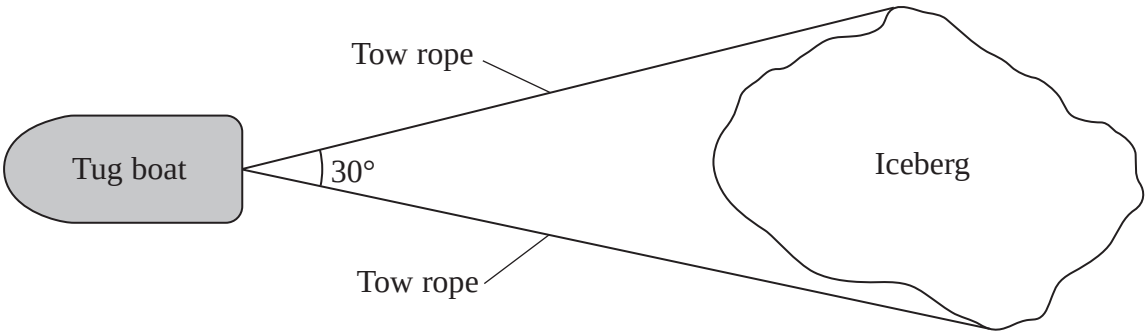
.....

(Total for Question 17 = 10 marks)

18 An iceberg is a large piece of freshwater ice that has broken off a glacier or an ice shelf.

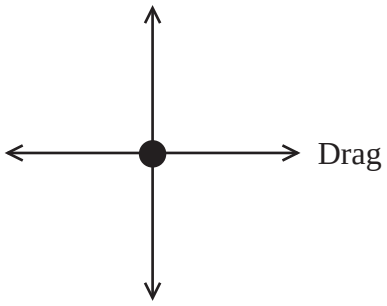
Some scientists believe that icebergs could be used to supply freshwater. It has been estimated that an iceberg of mass 3.0×10^9 kg could provide water for half a million people for up to a year.

Computer models have calculated that just one tug boat would be needed to move such an iceberg half way around the world.



(a) (i) Label the free-body force diagram below, for the iceberg.

(2)



(ii) The iceberg is moving at a constant speed and the tensions in the two tow ropes are equal. Show that the tension in each rope is about 2×10^5 N.

drag force from the water = 3.3×10^5 N

(3)

.....

.....

.....

.....

.....

.....

(iii) Calculate the work done by the tug boat on the iceberg when the iceberg is pulled through 50 km.

(2)

.....

.....

.....

.....

Work done = ...

(iv) State and explain the effect on the motion of the iceberg if the tow ropes were longer. Assume that the tug boat's power output remains the same.

(2)

.....

.....

.....

.....

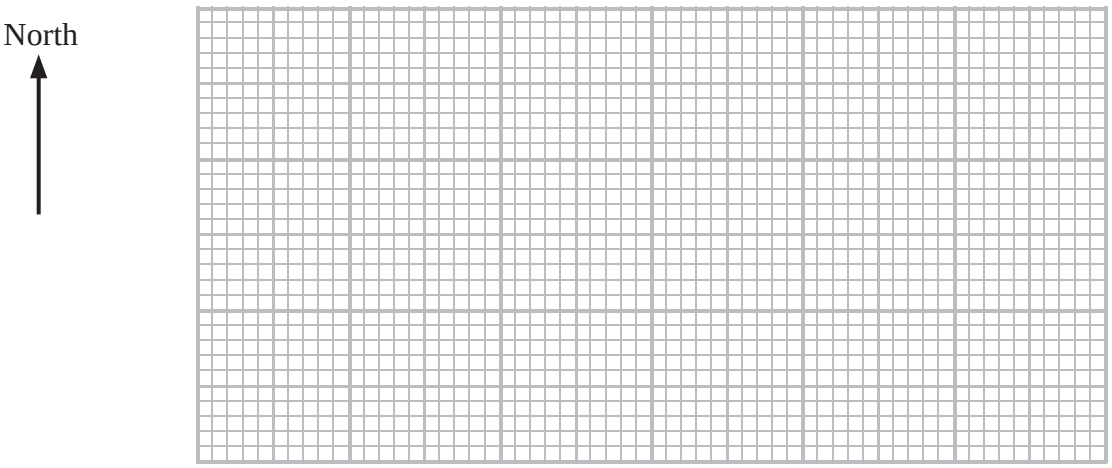
(b) The tug boat is moving through the water due west at 2.6 km hour^{-1}.

There is a water current of 0.9 km hour^{-1} due south.

On the grid below draw a vector diagram to scale, to determine the magnitude and direction of the resultant velocity of the tug boat.

(3)

North



Resultant velocity = ...

(c) Not all of the iceberg is visible above the surface of the water.



Show that the proportion of the volume of the iceberg that is beneath the surface of the water is about 0.9.

density of sea water = 1030 kg m^{-3}

density of freshwater ice = 920 kg m^{-3}

(3)

(d) As the iceberg nears its destination, the climate would become warmer.

State the effect this would have on the following physical quantities.

(2)

Physical Quantity	Effect
Sea temperature	
Viscosity of sea water	
Density of sea water	
Position of the iceberg in the water	

(Total for Question 18 = 17 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 $E_{el} = \tfrac{1}{2}F\Delta x$