Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International Advanced Level

Centre Number | Candidate Number

Tuesday 14 May 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **WPH01/01**

Physics

Advanced Subsidiary
Unit 1: Physics on the Go

You do not need any other materials.

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 on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

1/1/1/1/1/1/1/1/1/
P 5 6 1 4 2 A 0 1 2 4
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 unit for viscosity?

☐ **A** $kg\,m^{-1}\,s^{-3}$

☐ **B** $kg\,m^{-1}\,s^{-1}$

☐ **C** $kg\,m\,s^{-3}$

☐ **D** $kg\,m\,s^{-1}$

(Total for Question 1 = 1 mark)

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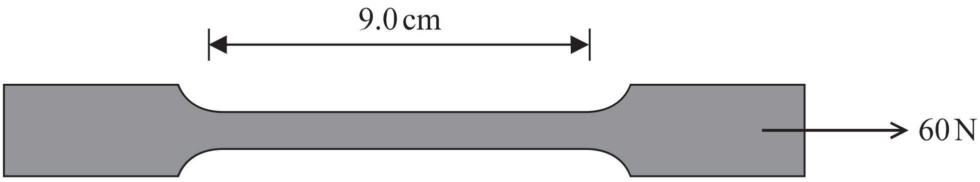
2 A specimen of a material was fixed at one end and subjected to a tensile force of 60 N. The length of the specimen became 9.0 cm as shown.



The force was increased to 100 N. The length of the specimen became 11.0 cm.

The specimen obeyed Hooke's law throughout.

Which of the following was the original length, in cm, of the specimen before any force was applied?

☐ **A** 6.0

☐ **B** 7.0

☐ **C** 8.0

☐ **D** 9.0

(Total for Question 2 = 1 mark)

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3 Clay can be worked, by hand, to create pots of various shapes and sizes.

Which of the following words describes a property that makes clay suitable for this process?

- ☒ **A** Brittle
- ☒ **B** Ductile
- ☒ **C** Malleable
- ☒ **D** Strong

(Total for Question 3 = 1 mark)

4 A spring is stretched by a force F. The energy stored in the spring is E.
The spring is connected to a second identical spring. The combination is stretched by the same force F as shown.

Which of the following is the total energy stored in the combination of two springs?

- ☒ **A** $\frac{E}{2}$
- ☒ **B** E
- ☒ **C** $2E$
- ☒ **D** $4E$

(Total for Question 4 = 1 mark)

5 Quantities can be either scalars or vectors.

Which row of the table correctly describes work and time?

	Work	Time
☒ **A**	vector	vector
☒ **B**	vector	scalar
☒ **C**	scalar	vector
☒ **D**	scalar	scalar

(Total for Question 5 = 1 mark)

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6 A man at a gym lifted a 150 N weight through a height of 2.1 m. He did this 36 times in 122 seconds.

Which of the following gives the minimum average power *P*, in watts, developed by the man?

☒ **A** $P = \dfrac{150 \times 2.1 \times 122}{36}$

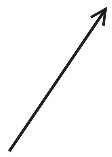
☒ **B** $P = \dfrac{150 \times 2.1 \times 36}{122}$

☒ **C** $P = \dfrac{150 \times 36}{122 \times 2.1}$

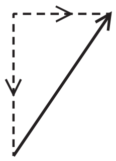
☒ **D** $P = \dfrac{150 \times 122}{36 \times 2.1}$

(Total for Question 6 = 1 mark)

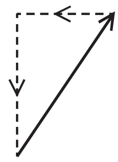
7 The arrow shown represents a force.



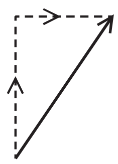
Which of the following shows a correct way of resolving this force into two components at right angles to each other?



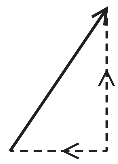
☒ **A**



☒ **B**



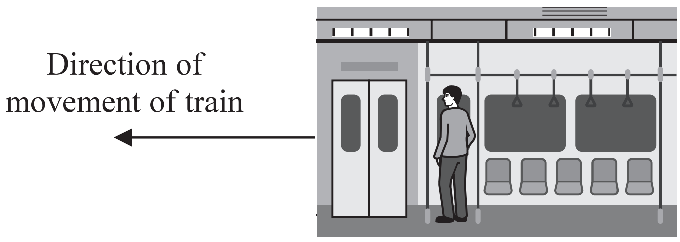
☒ **C**



☒ **D**

(Total for Question 7 = 1 mark)

8 A passenger is standing in a stationary train.
The train starts to move and the passenger starts to fall.

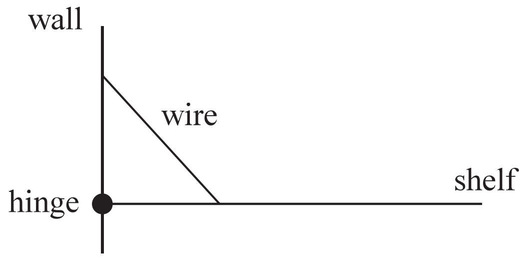


Which line gives the direction of the horizontal force acting on the passenger and the direction in which the passenger starts to fall?

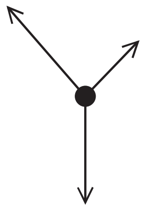
	Direction of horizontal force on passenger	Direction passenger starts to fall
☒ **A**	forwards	forwards
☒ **B**	forwards	backwards
☒ **C**	backwards	forwards
☒ **D**	backwards	backwards

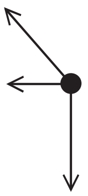
(Total for Question 8 = 1 mark)

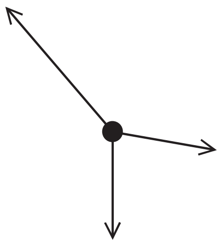
9 A stationary uniform shelf is hinged to a wall as shown. The shelf is held horizontal by a wire connected to the wall as shown.

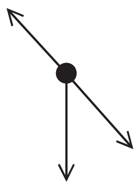


Which of the following shows the free-body force diagram for the shelf?

☒ **A** 

☒ **B** 

☒ **C** 

☒ **D** 

(Total for Question 9 = 1 mark)

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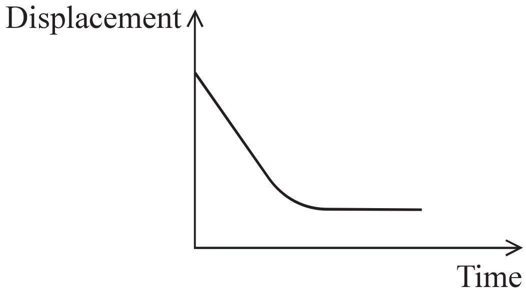
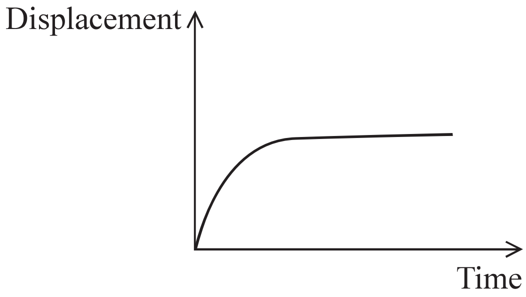
10 Which of the following displacement-time graphs shows a particle starting from rest and reaching terminal velocity?

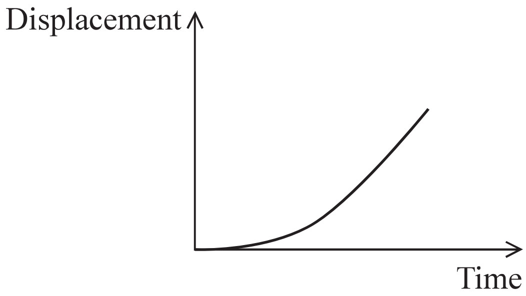
☒ **A**



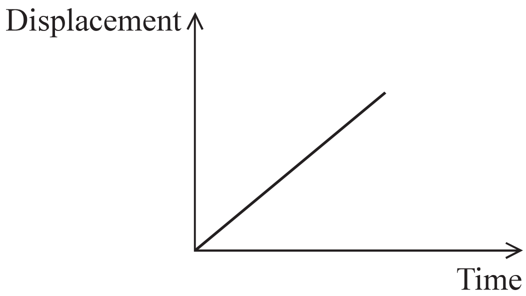
☒ **B**



☒ **C**



☒ **D**



(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

11 Glass is brittle, hard and strong.

(a) State what is meant by

(i) brittle,

(1)

....

....

(ii) hard,

(1)

....

....

(iii) strong.

(1)

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....

(b) When glass is heated it can be formed into different shapes, such as ornaments or dishes.

Explain why the glass needs to be at a high temperature for this process.

(2)

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(Total for Question 11 = 5 marks)

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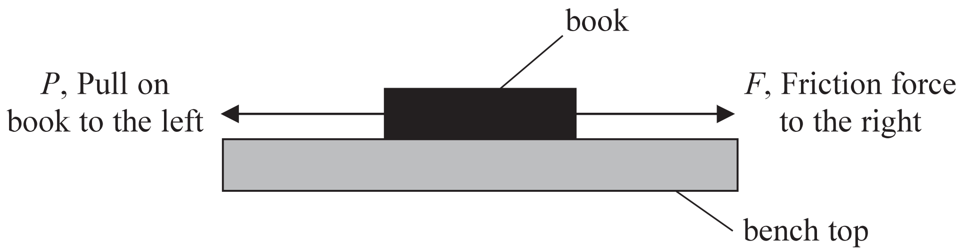
***12** Newton's third law is often poorly explained.

The following notes were written by a student.

Newton's third law



The book moves at a steady speed because *F*, the friction force to the right, is equal and opposite to *P*, the force pulling the book to the left.

Discuss why this is **not** an example of Newton's third law.

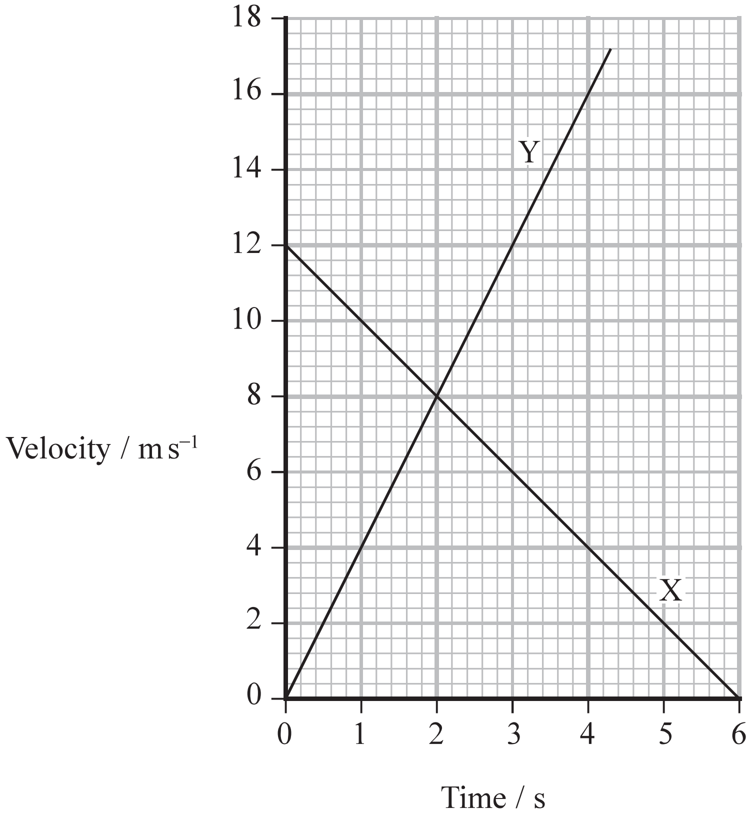
(6)

(Total for Question 12 = 6 marks)

P 5 6 1 4 2 A 0 9 2 4

Turn over

13 The velocity-time graph shows the motion of two vehicles, X and Y, along a track.
At time = 0 seconds, the two vehicles are side by side.



(a) Describe the motion of vehicle X between 0 and 6 s.

(3)

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(b) Calculate the time at which vehicle Y overtakes vehicle X.

(4)

Time = ...

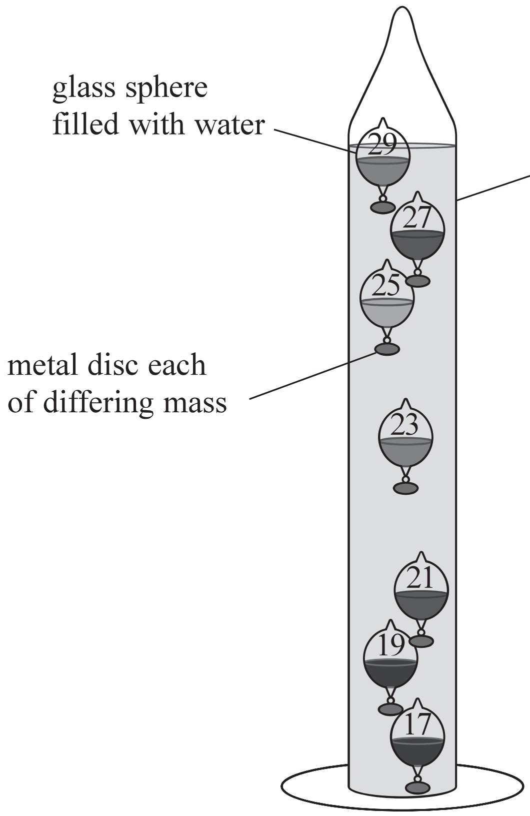
*(c) A video camera is used to film vehicle X.

Explain how a velocity-time graph can be produced from the recording.

(4)

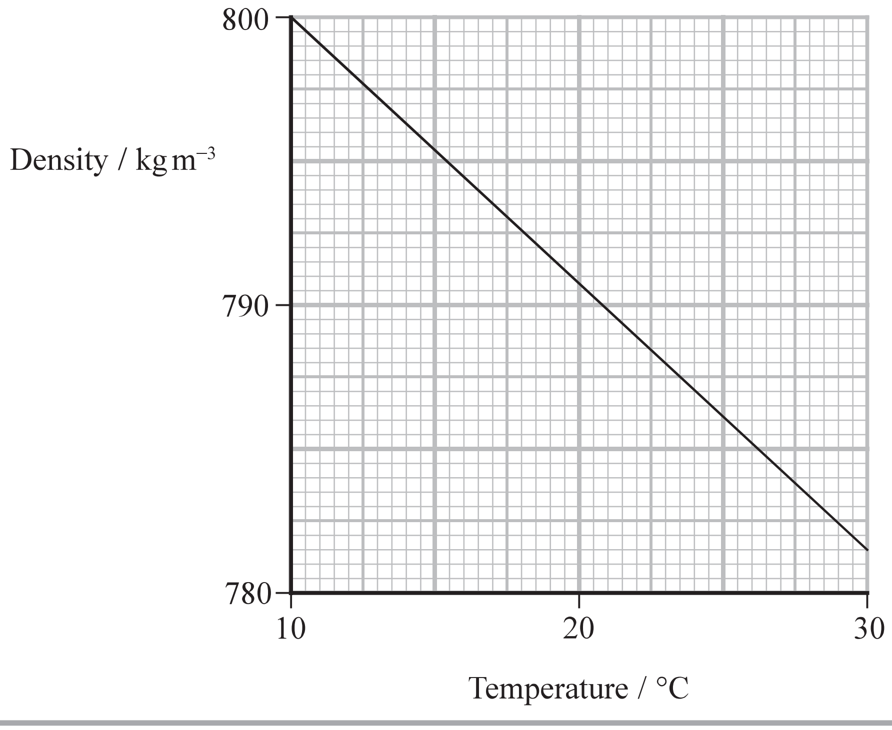
(Total for Question 13 = 11 marks)

14 A Galilean thermometer consists of a set of glass spheres suspended in a column of ethanol. Each sphere is filled with a quantity of water and is attached to a metal disc to give each sphere a different mass. The masses have been adjusted so that each sphere would float, at rest, when fully submerged in ethanol at the temperature marked on the disc. Hence the temperature can be deduced from the positions of the spheres.



On one occasion the sphere marked 23 was seen to be stationary between the top and bottom of the column, as shown in the diagram.

The graph of density against temperature for ethanol is shown below.



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(a) Calculate the weight of the sphere and disc marked 23.

volume of sphere and disc = $1.77 \times 10^{-6}\,m^3$

(4)

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Weight of sphere and disc = ...

(b) The sphere and disc marked 23 move downwards when the temperature of the ethanol increases.

(i) Explain why the sphere and disc move downwards.

(3)

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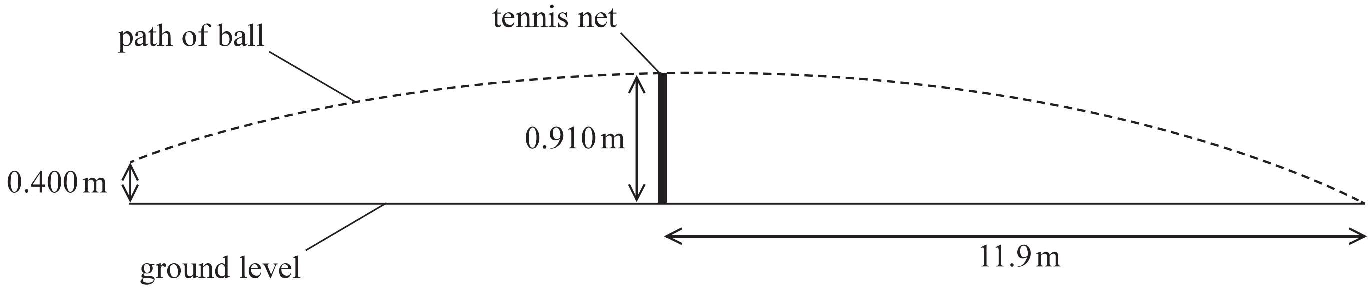
(ii) Complete the free-body force diagram for this sphere and disc as they move downwards.

(3)

(Total for Question 14 = 10 marks)

P 5 6 1 4 2 A 0 1 3 2 4

15 A ball is hit when it is at a height of 0.400 m. It just clears the tennis net, travelling horizontally, and then lands on the ground at a distance of 11.9 m from the net.



Ignore the effects of air resistance.

(a) Show that the horizontal component of velocity of the ball is about $30\,m\,s^{-1}$.

(4)

(b) Show that the initial vertical component of velocity of the ball, after it is hit, is about $3\,m\,s^{-1}$.

(3)

(c) Calculate the initial velocity of the ball after it is hit.

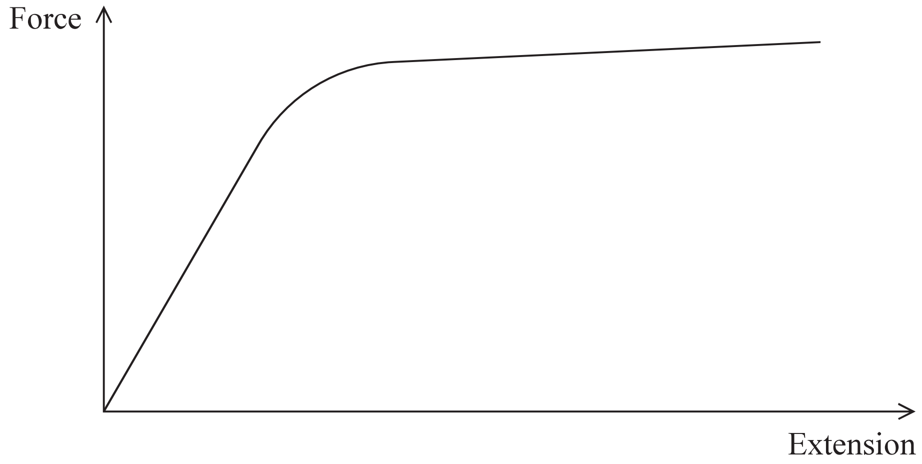
(4)

Initial velocity = ...

Angle to horizontal = ...

(Total for Question 15 = 11 marks)

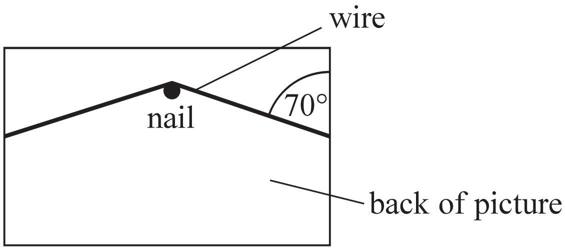
16 The force-extension graph shown is obtained for a copper wire. The wire does not break.



(a) Label key points on the graph and use them to explain the behaviour of the wire.

(6)

(b) A picture is hung symmetrically using a copper wire attached to the vertical sides of the picture. A nail in the wall supports the midpoint of the wire. The wires are inclined at an angle of 70° to the vertical as shown.



The total length of wire should not extend more than 1 mm for safety reasons.

Determine whether it would be safe to use this copper wire.

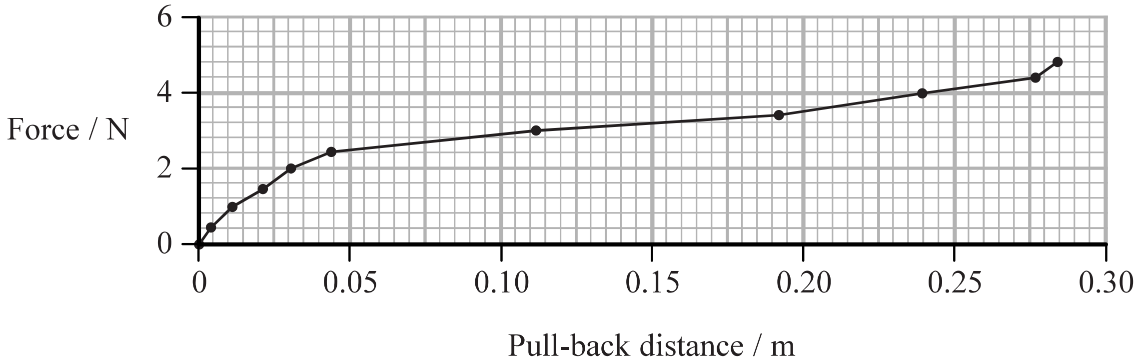
cross sectional area of wire = $3.3 \times 10^{-7}\,m^2$
length of wire = 0.70 m
Young modulus of copper = 1.3×10^{11} Pa
weight of picture = 10.8N

(6)

(Total for Question 16 = 12 marks)

17 The photograph shows a "pull-back" toy car. When the car is pulled backwards, a spring inside the car is tightened. The car is then released and the spring mechanism drives it forwards. Once the spring has untightened the car runs on freely.

(a) The force used to pull back the car was measured. The graph shows how the force varies with pull-back distance.



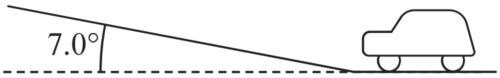
Estimate the work done when the pull-back distance is a maximum.

(2)

Work done = ...

P 5 6 1 4 2 A 0 1 8 2 4

(b) The car was pulled back to its maximum pull-back distance and released at the bottom of a track. The track was inclined at 7.0° to the horizontal.



The car moved a distance of 1.2 m along the slope before stopping.

Calculate the transfer to gravitational potential energy as the car moves up the track.

mass of toy car = 153 g

(3)

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....

Transfer to gravitational potential energy = ...

(c) The transfer to gravitational potential energy calculated in (b) is less than the work done calculated in (a).

A student says “This shows that the principle of conservation of energy does not apply in this situation.”

Explain why the student is **not** correct.

(4)

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(d) The toy car was pulled back and released so that it moved along a horizontal floor.

(i) The car reached a maximum speed of $1.3\,m\,s^{-1}$.

Calculate the maximum kinetic energy of the car.

mass of toy car = 153 g

(2)

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Maximum kinetic energy = ...

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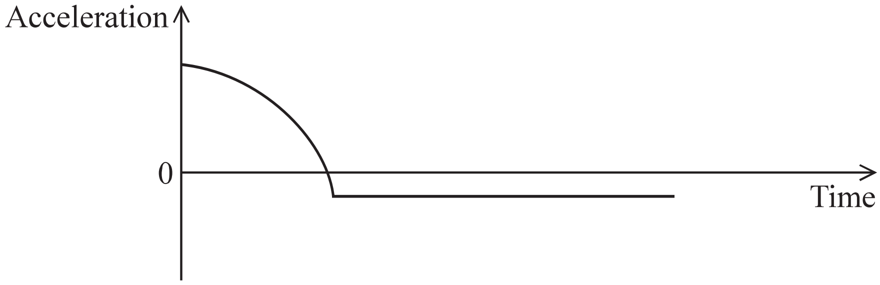
(ii) The sketch graph shows how the acceleration of the toy car varied with time until the car stopped moving.



Discuss how this graph relates to the forces acting on the toy car.

(4)

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(Total for Question 17 = 15 marks)

TOTAL FOR SECTION B = 70 MARKS
TOTAL FOR PAPER = 80 MARKS

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List of data, formulae and relationships

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

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 $E_{el} = \tfrac{1}{2}F\Delta x$