Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Physics

Advanced Subsidiary
Unit 1: Physics on the Go

Thursday 17 May 2012 – Morning
Time: 1 hour 30 minutes

Paper Reference
6PH01/01

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 ▶

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P 3 9 8 5 3 A 0 1 2 4

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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 these quantities is **not** measured in an SI base unit?

☐ **A** distance

☐ **B** force

☐ **C** mass

☐ **D** time

(Total for Question 1 = 1 mark)

2 Displacement can be found from the

☐ **A** area under a distance-time graph.

☐ **B** area under a velocity-time graph.

☐ **C** gradient of a distance-time graph.

☐ **D** gradient of a velocity-time graph.

(Total for Question 2 = 1 mark)

3 A wire of length x is stretched by a force F. The extension is Δx.

A second wire of the same material and cross-sectional area is stretched by the same force. If it has twice the length of the first wire its extension will be

☐ **A** $1/2\ \Delta x$

☐ **B** Δx

☐ **C** $2\Delta x$

☐ **D** $4\Delta x$

(Total for Question 3 = 1 mark)

4 Which equation shows a scalar quantity as the product of two vector quantities?

☒ **A** energy = power × time

☒ **B** force = stiffness × extension

☒ **C** mass = density × volume

☒ **D** work = force × displacement

(Total for Question 4 = 1 mark)

5 A material which can be drawn into a wire is described as being

☒ **A** brittle.

☒ **B** ductile.

☒ **C** hard.

☒ **D** soft.

(Total for Question 5 = 1 mark)

6 A bowling ball of mass 7.0 kg is travelling at a speed of 4.0 m s^{-1}.

The kinetic energy of the ball is

☒ **A** 14 J

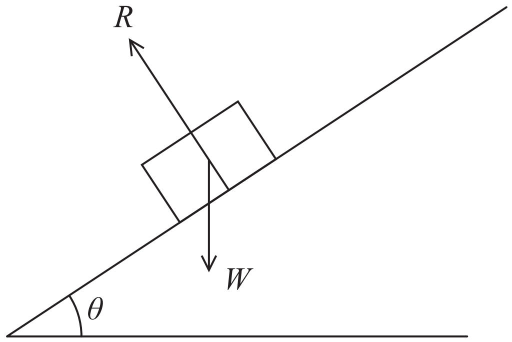
☒ **B** 28 J

☒ **C** 56 J

☒ **D** 112 J

(Total for Question 6 = 1 mark)

7



The diagram shows an object on an inclined surface.

The component of the weight W parallel to the surface is

☒ **A** 0

☒ **B** 1

☒ **C** $W \cos \theta$

☒ **D** $W \sin \theta$

(Total for Question 7 = 1 mark)

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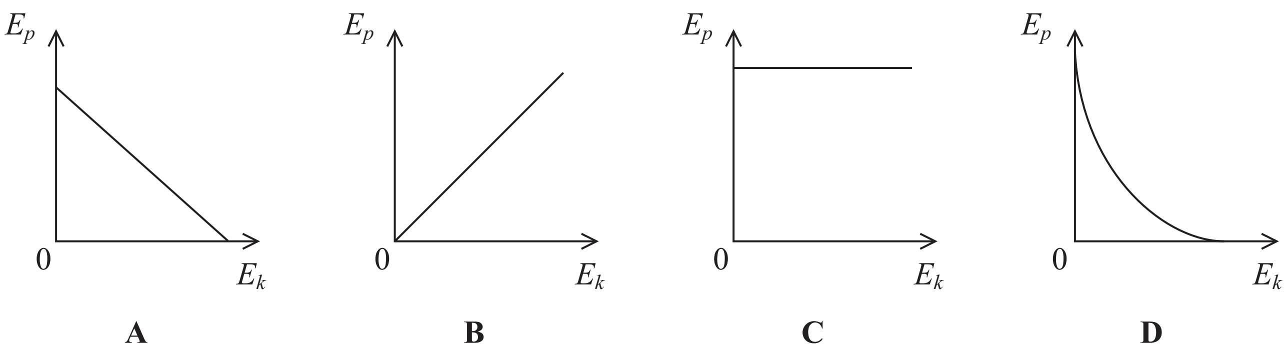
8 A stone is dropped from a bridge into a river.

Which graph correctly shows the variation of gravitational potential energy E_p with kinetic energy E_k for the falling stone?



☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question 8 = 1 mark)

9 A motor raises a mass *m* through a height Δh in time *t*.

The power of the motor is given by

☒ **A** $mgt\Delta h$

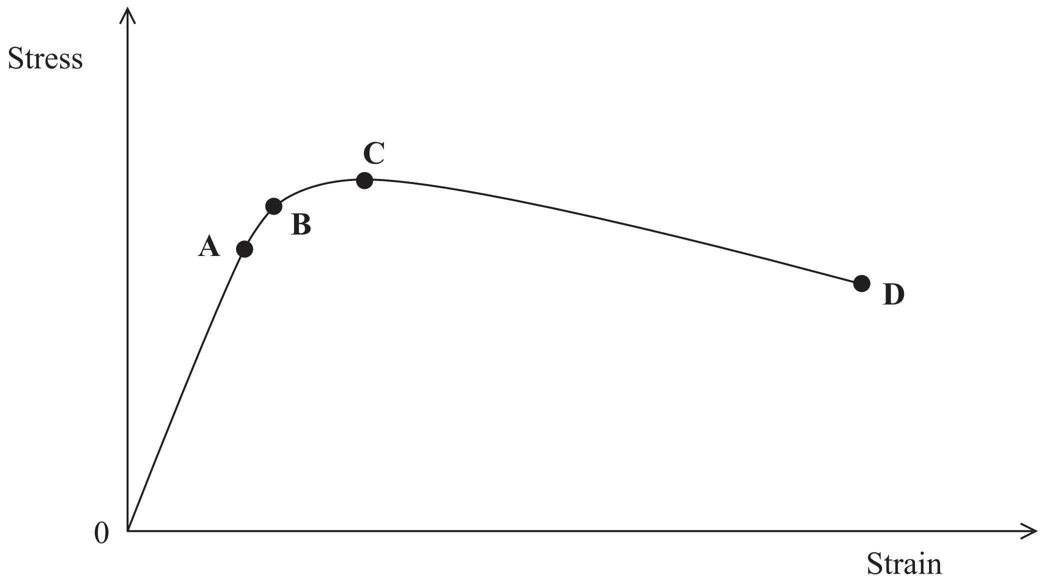
☒ **B** $\frac{mg}{t\Delta h}$

☒ **C** $\frac{mg\Delta h}{t}$

☒ **D** $\frac{mgt}{\Delta h}$

(Total for Question 9 = 1 mark)

10 The graph shows the stress-strain graph for a wire.



Which point would give the value for maximum tensile stress?

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question 10 = 1 mark)

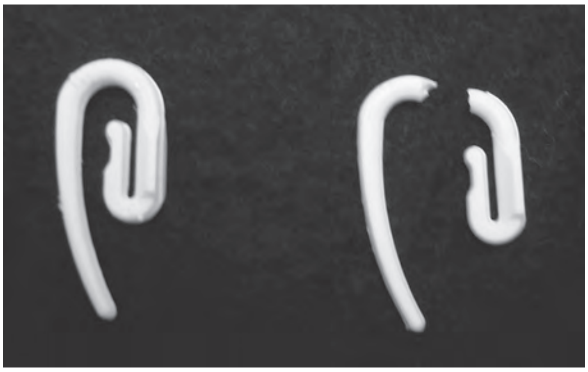
TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

***11** A student is taking down some curtains and notices that several of the curtain hooks snap when they are bent.

The photograph shows an unsnapped hook and a snapped hook.



The student thinks that it is odd that the material the hooks are made from is referred to as plastic when the hooks don't show plastic behaviour.

The student finds the following list of terms used to describe materials.

Brittle   Ductile   Hard   Malleable   Tough

Only one of these terms describes the behaviour of the hooks.

Explain what is meant by 'the hooks don't show plastic behaviour' and state and explain the term from the list that correctly describes the behaviour.

(4)

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(Total for Question 11 = 4 marks)

12 A student entering a physics classroom sees the following sentences on the board. These sentences are being used as examples in an explanation of Newton's third law.

The car tyre exerts a frictional contact force of 300 N backwards on the road.

The road exerts a frictional contact force of 300 N forwards on the car tyre.

State Newton's third law.

Explain how the sentences provide a good example of a Newton's third law pair.

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(Total for Question 12 = 5 marks)

13 Metrology is the science of measurement and World Metrology Day is May 20th. In 2010, the day was used to celebrate the 50th anniversary of the SI system.

A metrologist from the National Physical Laboratory said on a radio programme that the SI system uses units that everyone can understand. He stated the following example.

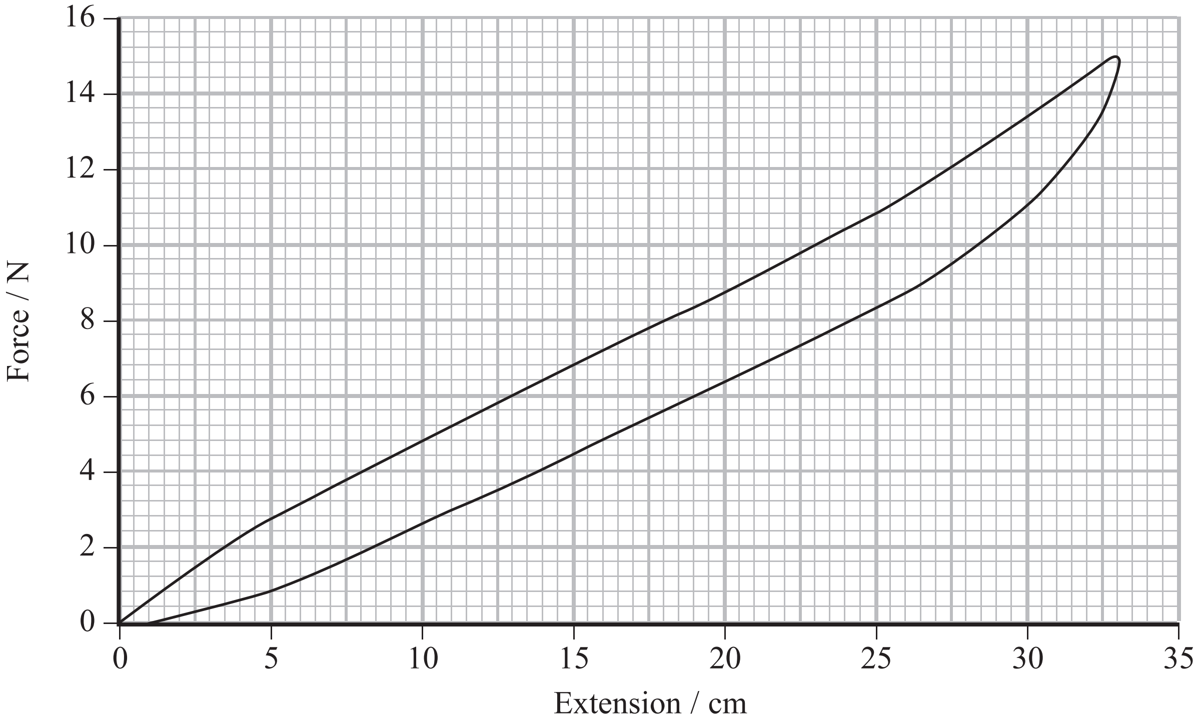
> "If you hold an apple in your hand it's about a *newton*, if you raise it through one metre that's about a *joule* and if you do it in one second that's about a *watt*."

Assuming that the apple has a mass of 100 g, explain and justify the statements made about the three words in italics.

(6)

(Total for Question 13 = 6 marks)

14 A student investigates the effect of varying the stretching force applied to the elastic waistband of some trousers.



The graph produced by the student shows the stretching force against extension for the elastic waistband. The top line was recorded as the force increased and the lower line as the force decreased.

(a) Explain whether the elastic waistband obeys Hooke's law.

(2)

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(b) Show that, in this investigation, the work done on the elastic waistband in stretching it is less than 3 J.

(2)

(c) Suggest how the elastic properties of the waistband help in keeping the trousers in place.

(2)

(d) The line for the decreasing force is lower than the line for the increasing force.

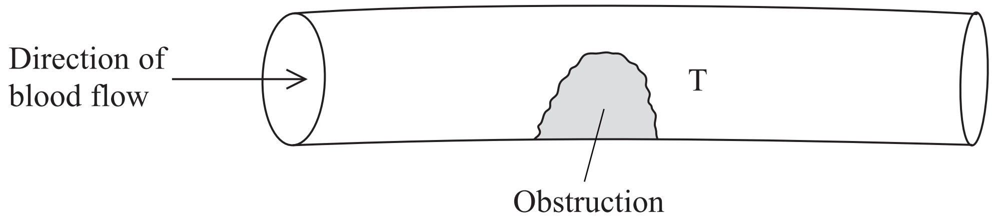
Explain the significance of this.

(2)

(Total for Question 14 = 8 marks)

15 Blood clots can lead to heart attacks. Blood flow through arteries is normally laminar, but an obstruction may cause the blood flow to become turbulent. This can lead to the formation of blood clots.

(a) The diagram shows an artery containing an obstruction.



After passing the obstruction the laminar flow becomes turbulent in the area marked T.

(i) Add flow lines to the diagram to show laminar flow changing to turbulent flow after passing the obstruction.

(2)

(ii) Explain what is meant by laminar flow and turbulent flow.

(2)

Laminar flow

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Turbulent flow

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(b) In one experiment on blood flow, the viscosity of the blood and the velocity of blood flow were measured.

(i) Describe how you would expect the velocity of blood flow to vary with the viscosity.

(1)

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(ii) Suggest and explain how a rise in the temperature of the blood would affect the velocity of flow.

(2)

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(Total for Question 15 = 7 marks)

16 The photograph shows an arrangement used to launch a light, foam rocket at a school science competition.

The rocket is launched at the level of one end of a long table and lands at the other end at the same level. The students measure the horizontal distance travelled by the rocket and the time of flight.

(a) The rocket travels 1.88 m in a time of 0.88 s.

(i) Show that the horizontal component of the initial velocity of the rocket is about 2 m s^{-1}.

(2)

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(ii) Show that the vertical component of the initial velocity of the rocket is about 4 m s^{-1}.

(2)

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(iii) Calculate the initial velocity of the rocket.

(4)

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Magnitude of initial velocity = ...

Angle to the horizontal of the initial velocity = ...

(b) The students obtained their data by filming the flight. When they checked the maximum height reached by the rocket they found it was less than the height predicted using this velocity.

(i) Suggest why the maximum height reached was less than predicted.

(1)

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(ii) Give two advantages of filming the flight to obtain the data.

(2)

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(Total for Question 16 = 11 marks)

17 Soil is usually made up of a variety of particles of different sizes. The photograph shows what happens when soil is mixed up with water and the particles are allowed to settle.

(a) The dot below represents a particle of the soil falling through water.

(i) Add labelled arrows to show the three forces acting on the particle as it falls through the water.

(2)

*(ii) Explain why a particle held stationary in water and then released accelerates downwards at first but then reaches a steady downwards speed.

(4)

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(iii) Write an expression showing the relationship for these forces when the particle is falling at a steady speed.

(1)

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(b) A typical particle of sand in the sample has the following properties:

diameter = 1.6×10^{-3} m

volume = 2.1×10^{-9} m^3

density = 2.7×10^{3} kg m^{-3}

weight = 5.7×10^{-5} N

(i) Show that the upthrust acting on the particle is about 2×10^{-5} N.

density of water = 1.0×10^{3} kg m^{-3}

(2)

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(ii) Calculate the steady downwards speed this particle would achieve if allowed to fall through water.

viscosity of water = 1.2×10^{-3} Pa s

(3)

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Speed = ...

(c) The different types of particles in soil can be defined according to their diameters, as in the following table.

Soil particle	Particle diameter
clay	less than 0.002 mm
silt	0.002 mm – 0.05 mm
sand	0.05 mm – 2.00 mm
fine pebbles	2.00 mm – 5.00 mm
medium pebbles	5.00 mm – 20.00 mm
coarse pebbles	20.00 mm – 75.00 mm

The photograph shows that when soil is allowed to settle in water, the pebbles tend to be found towards the bottom, followed by sand, silt and clay in succession.

Explain why this happens. Assume that all particles have the same density.

(3)

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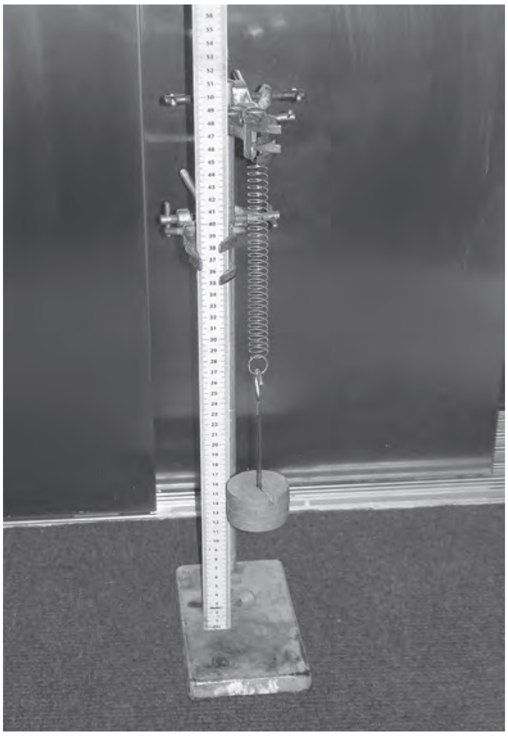
(Total for Question 17 = 15 marks)

18 A student uses a mass hanging on a spring to investigate the motion of a lift travelling between two floors.

The photograph shows the apparatus used which is placed in the lift.



(a) The weight of the mass hanging on the spring is 3.90 N.

It produces an extension of 12.2 cm.

Show that the spring constant is about 30 N m^{-1}.

(2)

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(b) The lift takes 7.0 s to travel between floors, starting and ending at rest.

The student makes a video of the apparatus and constructs the following table from the observations made. The student notes three phases of the motion.

Phase of motion	**Duration of phase / s**	**Average extension of spring / cm**	**Average acceleration / m s^{-2}**
Start	2.0	12.7	0.4
Middle	3.0	12.2	0.0
End	2.0	11.7	–0.4

(i) Show that the spring exerts a force of about 4 N on the mass during the start phase.

(2)

(ii) Show how the average acceleration during the start phase is calculated.

mass hanging on spring = 0.40 kg

(2)

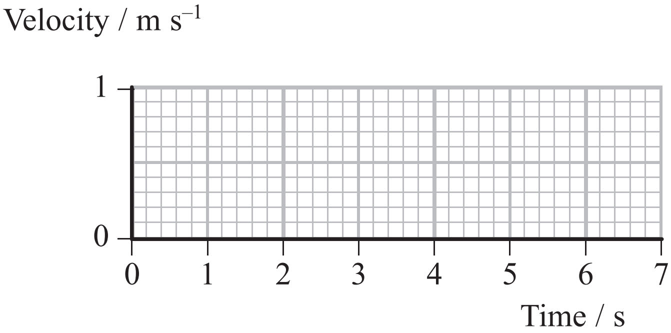
(iii) Use the values in the table to calculate the speed at the end of the start phase.

(2)

Speed = ...

(iv) Complete the graph to show the motion of the lift.

(2)



(v) Use your graph to find the distance travelled between the floors.

(2)

Distance = ...

(vi) Explain how the data for the average extension of the spring shows that the lift is moving upwards.

(2)

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

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