Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Thursday 10 January 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 ▶

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P 5 5 4 6 4 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 An object has an acceleration of $6\,m\,s^{-2}$ at an angle of 30° to the horizontal.

Which of the following expressions gives the horizontal component of acceleration in $m\,s^{-2}$?

☒ **A** $6 \times \cos 30°$

☒ **B** $6 \times \sin 30°$

☒ **C** $\dfrac{6}{\cos 30°}$

☒ **D** $\dfrac{6}{\sin 30°}$

(Total for Question 1 = 1 mark)

2 A graph of stress against strain is plotted for steel.

Which of the following is equal to the Young modulus of steel?

☒ **A** The area under the graph up to the limit of proportionality

☒ **B** The area under the graph up to the yield point

☒ **C** The gradient of the graph up to the elastic limit

☒ **D** The gradient of the graph up to the limit of proportionality

(Total for Question 2 = 1 mark)

3 The work surface in a kitchen is made from marble.

Marble is suitable for this use because it is

☒ **A** brittle.

☒ **B** ductile.

☒ **C** hard.

☒ **D** malleable.

(Total for Question 3 = 1 mark)

4 A ball is thrown vertically upwards with an initial velocity of $20\,m\,s^{-1}$. An equation of motion is used to calculate the time taken for the ball to move to a displacement of 15 m.

Which of the following expressions shows a correct substitution of appropriate values?

☒ **A** $15 = 20 \times t + \frac{1}{2} \times 9.81 \times t^2$

☒ **B** $15 = -20 \times t + \frac{1}{2} \times 9.81 \times t^2$

☒ **C** $15 = 20 \times t + \frac{1}{2} \times -9.81 \times t^2$

☒ **D** $15 = -20 \times t + \frac{1}{2} \times -9.81 \times t^2$

(Total for Question 4 = 1 mark)

5 Quantities can be either scalars or vectors.

Which row of the table is correct?

	Density	Velocity
☒ **A**	vector	vector
☒ **B**	vector	scalar
☒ **C**	scalar	vector
☒ **D**	scalar	scalar

(Total for Question 5 = 1 mark)

6 A toy car moved down a slope and 1.5 J of gravitational potential energy was transferred. The toy car gained 1.2 J of kinetic energy.

Which of the following could be used to calculate the work done against the frictional forces acting on the toy car from the information above?

☒ **A** Newton's laws of motion

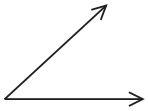
☒ **B** The equations of uniformly accelerated motion

☒ **C** The equation $\Delta W = F\Delta s$

☒ **D** The principle of conservation of energy

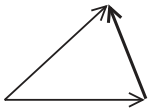
(Total for Question 6 = 1 mark)

7 The diagram represents two forces acting on an object.

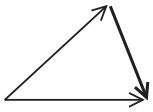


Which of the following shows a correct way to determine the resultant of these two forces?

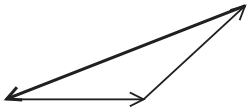
☒ **A**



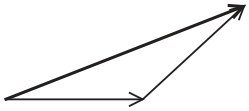
☒ **B**



☒ **C**



☒ **D**



(Total for Question 7 = 1 mark)

8 Which of the following is a correct unit for stiffness of a spring?

☒ **A** $kg\,m^{-1}$

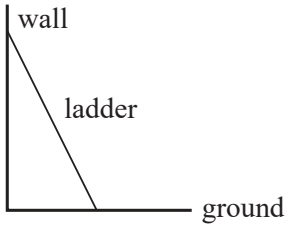
☒ **B** $kg\,s^{-2}$

☒ **C** $N\,m$

☒ **D** $N\,s$

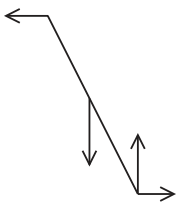
(Total for Question 8 = 1 mark)

9 A stationary, uniform ladder leans against a smooth wall as shown. The ground is rough.



Which of the following diagrams shows the forces acting on the ladder?

☒ **A**



☒ **B**

☒ **C**

☒ **D**

(Total for Question 9 = 1 mark)

10 A particle is falling through a fluid at terminal velocity.

Which of the following statements is correct?

☒ **A** The particle is accelerating.

☒ **B** The velocity of the particle is zero.

☒ **C** There is a resultant force on the particle.

☒ **D** There is more than one force acting on the particle.

(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

11 Sewage is waste water which contains solid material. Sewage is processed at a sewage works.

The sewage arrives at the sewage works through an open channel, travelling quite quickly but smoothly. Further along the channel there are steel blades fixed at various angles. The steel blades churn the sewage so that the flow is disrupted. The sewage then continues at a lower speed.

(a) Describe the types of flow of the sewage before and after it passes the steel blades.

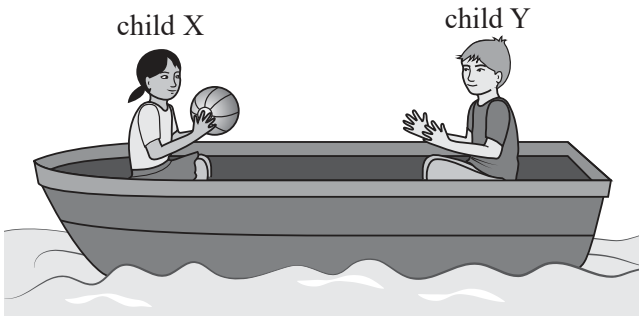
(4)

(b) Describe the energy transfers that take place as the sewage passes the steel blades.

(2)

(Total for Question 11 = 6 marks)

***12** Two children, X and Y, are sitting in a stationary boat as shown.



As child X throws a ball to child Y, the boat moves to the left. As child Y catches the ball, the boat stops moving.

Explain the motion of the boat using Newton's three laws of motion. Ignore all effects of viscous drag.

(6)

(Total for Question 12 = 6 marks)

13 A golfer hits a golf ball so that it lands at a distance of 250 m from the golfer.

(a) The golf ball is given an initial velocity u at an angle of 40° to the horizontal.

Explain why $t = \dfrac{250}{u \cos 40°}$ is a correct expression for the time of flight of the golf ball.

Assume the ground is horizontal and that there are no wind or air resistance forces.

(2)

(b) Calculate the initial velocity u of the golf ball.

(4)

$u =$ .....

(Total for Question 13 = 6 marks)

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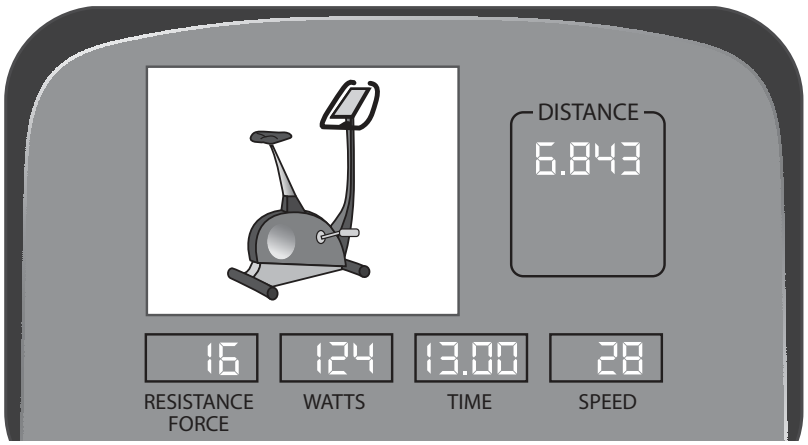
14 A stationary exercise bicycle has the display shown.



The equivalent motion of the bicycle is displayed as a speed and a distance travelled.

(a) One of the quantities being displayed is expressed as 'watts'.

State the name of this quantity.

(1)

.....

(b) The bicycle provides a resistance force against the cyclist. The unit of this resistance force is newtons. The unit of speed is km hours $^{-1}$.

Show that the values displayed for the resistance force and the speed are consistent with the value displayed as watts.

(3)

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(c) The time on the display is given in minutes and the distance on the display is given in kilometres.

Deduce whether the speed given on the display is instantaneous or an average.

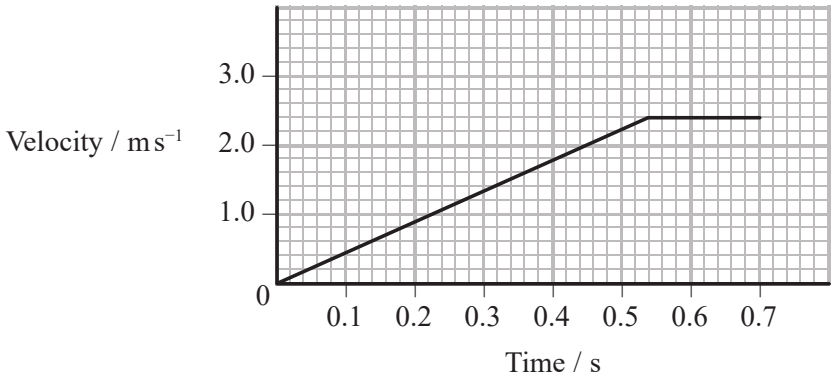
(4)

(Total for Question 14 = 8 marks)

15 A student uses a friction-free trolley and a ramp to investigate motion.

The mass of the trolley is 0.10 kg. The student releases the trolley from rest so it moves down the ramp and then continues along a horizontal surface.

The velocity-time graph for the motion of the trolley is shown.



(a) Show that the acceleration of the trolley on the ramp is about 4 m s^{-2}.

(2)

(b) Calculate the angle of the ramp to the horizontal.

(2)

Angle = ...

(c) Calculate the time it takes for the trolley to move a distance of 0.74 m.

(3)

Time = ...

(d) At $t = 0.70$ s the trolley moves onto a piece of horizontal sponge. The trolley comes to rest after moving through a further 0.25 m.

Calculate the average horizontal force exerted by the sponge on the trolley.

(3)

Average horizontal force = ...

(e) Explain how the acceleration of the trolley down the ramp could be determined experimentally using ICT.

(4)

(Total for Question 15 = 14 marks)

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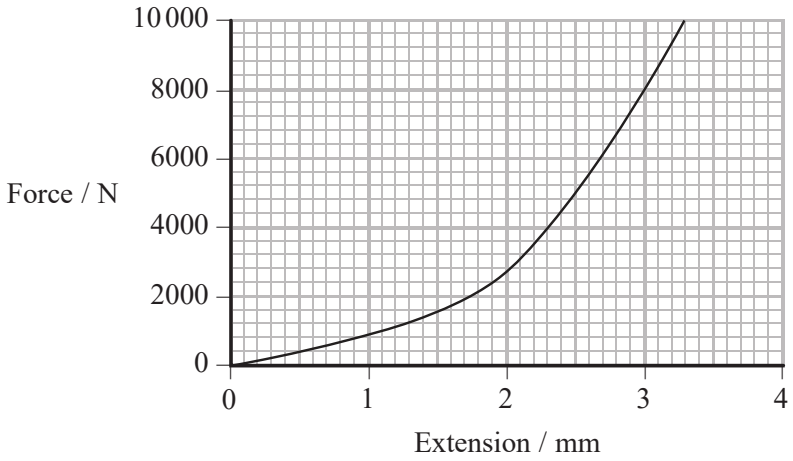
16 A human knee contains a tendon which connects muscle to bone.

The graph shows the variation of force with extension in this tendon.



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

(2)

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(b) Calculate the stress in the tendon at a force of 4000 N.

cross-sectional area of tendon = 101 mm^2

(3)

.....

.....

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.....

.....

Stress = ...

(c) Calculate the strain in the tendon at a force of 4000 N.

unstretched length of tendon = 43 mm

(3)

Strain = ...

(d) A website states that there is a small risk of damaging this tendon when landing from a jump.

(i) The force required to damage this tendon is 10 000 N.

Use the graph to estimate the energy transfer to the tendon when this force is applied.

(3)

Energy transfer = ...

(ii) Calculate the energy that must be transferred when a person lands from a jump of height 0.50 m.

mass of person = 65 kg

(2)

Energy = ...

(iii) Suggest why the risk of damaging this tendon is small.

(1)

(Total for Question 16 = 14 marks)

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17 Submersibles are used to dive below the surface of the ocean.

The photograph shows a submersible called Deep Sea Challenger. In 2012, the Deep Sea Challenger descended eleven kilometres to one of the Pacific Ocean's deepest points.

(a) The materials used to make the submersible were strong and tough.

(i) State what is meant by strong.

(1)

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.....

(ii) Explain what is meant by tough.

(2)

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(b) The submersible had a mass of 11 800 kg. It initially descended at a steady speed.

(i) Complete the free-body force diagram for the submersible while it descended at a steady speed.

(3)

(ii) Calculate the resistive force on the submersible during this part of the descent.

volume of submersible = 11.40 m^3
density of seawater = 1020 $kg\,m^{-3}$

(4)

Resistive force = ...

(iii) A mass of steel was released from the submersible in order to make the return trip back to the surface.

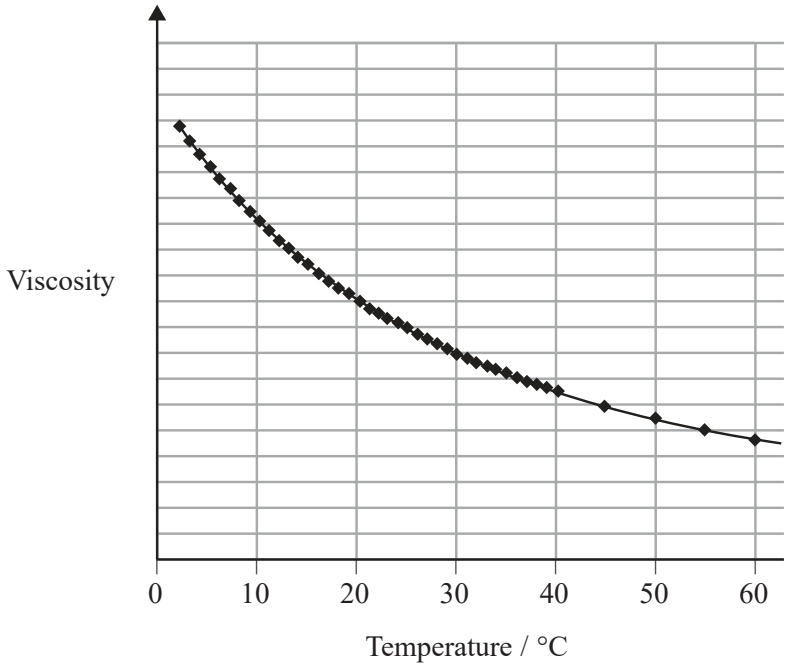
Calculate the minimum mass of steel that would need to be released.
Assume the volume of the submersible is still 11.40 m^3.

(3)

Minimum mass of steel = ...

*(c) The temperature of the ocean decreases as the depth increases.

The graph shows how the viscosity of water varies with temperature.



Explain what effect the change in temperature would have on the speed of descent of the submersible as it reached greater depths in the ocean.

(3)

(Total for Question 17 = 16 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 $E_{el} = \tfrac{1}{2}F\Delta x$