Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Physics

International Advanced Subsidiary/Advanced Level
Unit 1: Mechanics and Materials

Sample Assessment Materials for first teaching September 2018

Time: 1 hour 30 minutes

Paper Reference **WPH11/01**

You must have:
Scientific calculator, ruler, protractor

Total Marks

Instructions

- Use **black** ink or **black** 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.*
- **Show all your working in calculations and include units where appropriate**.

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.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

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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SECTION A

Answer ALL questions.

For questions 1–10, 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 Quantities can be scalar or vector.

Select the row of the table that correctly states a scalar quantity and a vector quantity.

	Scalar quantity	Vector quantity
☒ **A**	mass	momentum
☒ **B**	momentum	weight
☒ **C**	speed	mass
☒ **D**	weight	speed

(Total for Question 1 = 1 mark)

2 As lava leaves a volcano it cools down.

Select the row of the table that correctly describes the effect of a lower temperature on the viscosity and rate of flow of lava.

	Viscosity	Rate of flow
☒ **A**	decreases	decreases
☒ **B**	decreases	increases
☒ **C**	increases	increases
☒ **D**	increases	decreases

(Total for Question 2 = 1 mark)

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3 A car is travelling at a velocity v. The driver applies the brakes and the car decelerates until it comes to rest. The work done by the brakes on the car is W.

Which of the following expressions is correct?

☒ **A** $W \propto v$

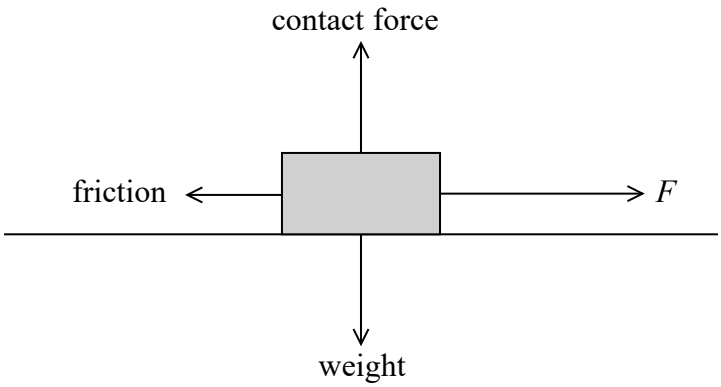
☒ **B** $W \propto v^2$

☒ **C** $W \propto \frac{1}{v}$

☒ **D** $W \propto \frac{1}{v^2}$

(Total for Question 3 = 1 mark)

4 A man applies a force F to a box and the box accelerates. The forces acting on the box are shown on the diagram.



According to Newton's third law, the box will exert a force on the man.

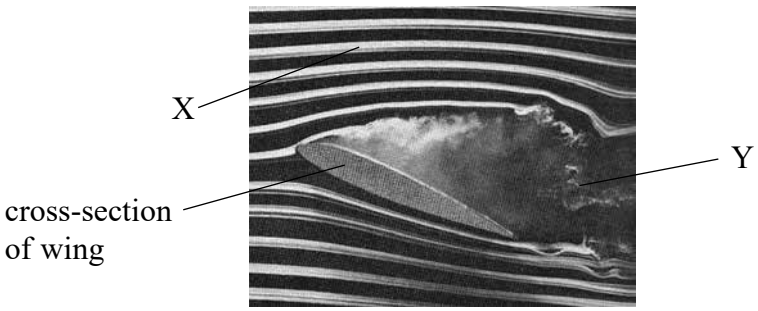
Select the row of the table that correctly describes the magnitude and direction of the force of the box on the man.

	Magnitude	In the direction of
☒ **A**	F	F
☒ **B**	F	friction
☒ **C**	friction	F
☒ **D**	friction	friction

(Total for Question 4 = 1 mark)

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5 The photograph shows the flow of air around the wing of an aeroplane.



Source from: http://ffden 2.phys.uaf.edu/211.fall2000.web.projects/c.%20Schaefer/aero4.htm

X and Y are two points in the path of the air flow.

Which of the following statements about the speed of the air is correct?

☒ **A** The speed of the air at X is constant.

☒ **B** The speed of the air at X is continuously changing.

☒ **C** The speed of the air at X is equal to the speed of the air at Y.

☒ **D** The speed of the air at Y is constant.

(Total for Question 5 = 1 mark)

6 A ball is dropped from a window and takes 1.6 s to reach the ground.

Which of the following is the height of the window?

☒ **A** 8 m

☒ **B** 13 m

☒ **C** 16 m

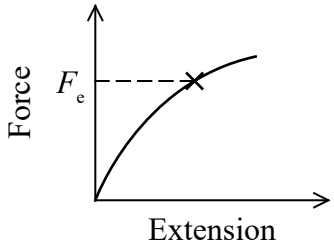
☒ **D** 25 m

(Total for Question 6 = 1 mark)

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Questions 7 and 8 refer to the following information.

Increasing forces were applied across the ends of a wire and the corresponding extensions recorded. A force-extension graph was plotted for the wire.



7 The point marked × is the elastic limit of the wire.

Which of the following statements is **not** correct?

☒ **A** F_e is the maximum force at which the wire behaves elastically.

☒ **B** F_e is the maximum force at which the wire obeys Hooke's law.

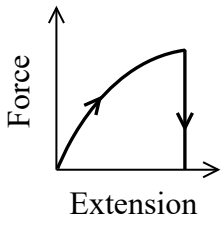
☒ **C** F_e is the minimum force at which the wire permanently deforms.

☒ **D** F_e is the minimum force at which the wire behaves plastically.

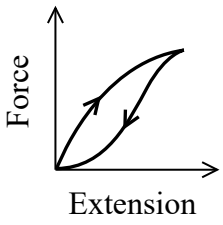
(Total for Question 7 = 1 mark)

8 The force on the wire was then decreased and the corresponding extensions recorded. The values were plotted onto the same axes.

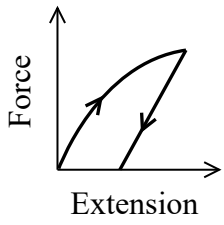
Which of the following is the correct graph?



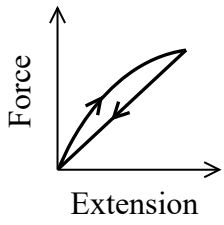
☒ **A**



☒ **B**



☒ **C**



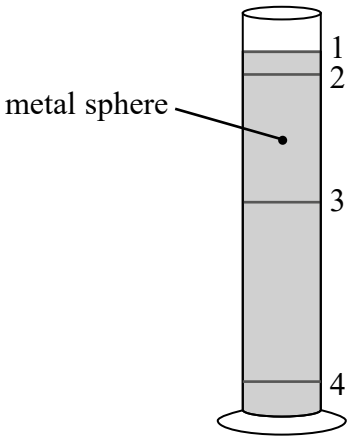
☒ **D**

(Total for Question 8 = 1 mark)

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Questions 9 and 10 refer to the following information.

A student carries out a practical to determine the viscosity η of a liquid. A small metal sphere of radius r is dropped into a cylinder of the liquid.



9 Elastic bands are placed around the cylinder in the positions 1, 2, 3 and 4 as shown. The time taken for the sphere to fall between two of the elastic bands is going to be recorded.

Which of the following are the best two elastic bands to use?

☒ **A** 1 and 3

☒ **B** 2 and 4

☒ **C** 1 and 4

☒ **D** 3 and 4

(Total for Question 9 = 1 mark)

10 The sphere is made from a metal of density ρ_M and the liquid has density ρ_L.

Which of the following expressions correctly gives the forces acting on the sphere when travelling at a terminal velocity v through the liquid?

☒ **A** $6\pi\eta rv + \frac{4}{3}\pi r^3\rho_L g + \frac{4}{3}\pi r^3\rho_M g = 0$

☒ **B** $6\pi\eta rv - \frac{4}{3}\pi r^3\rho_L g - \frac{4}{3}\pi r^3\rho_M g = 0$

☒ **C** $6\pi\eta rv - \frac{4}{3}\pi r^3\rho_L g + \frac{4}{3}\pi r^3\rho_M g = 0$

☒ **D** $6\pi\eta rv + \frac{4}{3}\pi r^3\rho_L g - \frac{4}{3}\pi r^3\rho_M g = 0$

(Total for Question 10 = 1 mark)

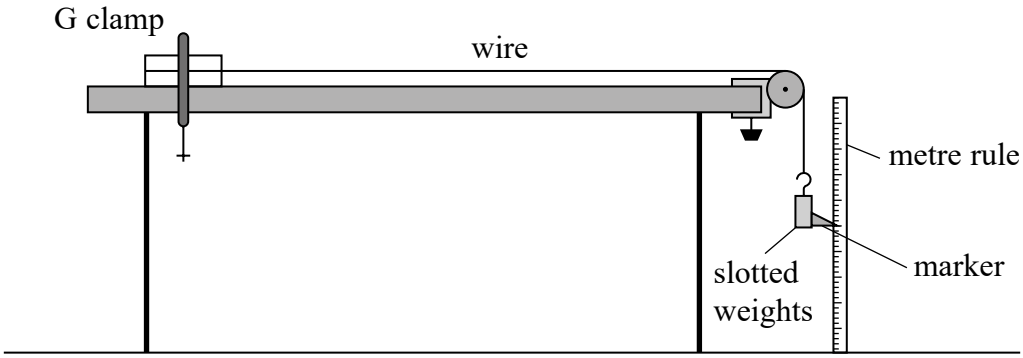
TOTAL FOR SECTION A = 10 MARKS

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SECTION B

Answer ALL questions.

11 A student carried out an experiment to determine the Young modulus of a material in the form of a wire. The student set up the apparatus as shown.



The initial length of the wire was measured. Slotted weights of known values were added to the hanger at the free end of the wire. Each time a weight was added, the new position of the marker was read from the metre rule and the extension calculated.

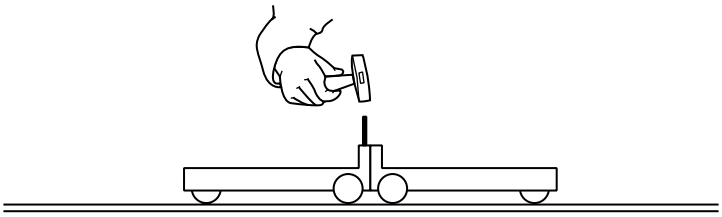
Describe a graphical method that the student should use to obtain a value for the Young modulus. State the additional measurement that would have to be taken.

(5)

(Total for Question 11 = 5 marks)

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12 Two trolleys, A and B, are placed on a smooth track so that they are touching. When a peg is tapped on trolley A, a spring inside trolley A is released and the trolleys move apart.



(a) Explain why the two trolleys move apart when the spring is released.

(2)

(b) Explain which trolley will move off with the greater speed.

mass of trolley A = 0.1 kg

mass of trolley B = 0.2 kg

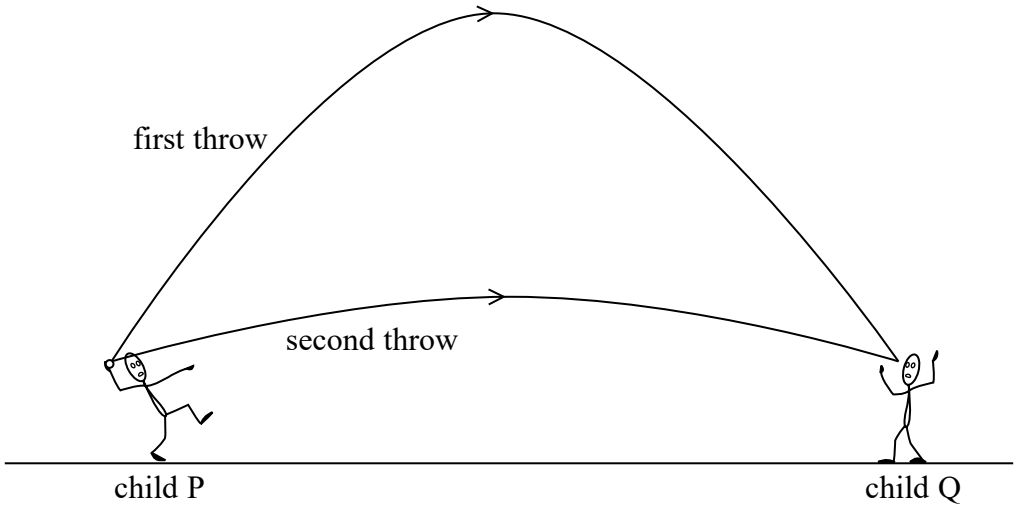
(3)

(Total for Question 12 = 5 marks)

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13 Child P throws a ball towards child Q at a speed of $20\,m\,s^{-1}$ at an angle of 75° to the horizontal.

While this ball is in the air, child P throws a second ball, also at a speed of $20\,m\,s^{-1}$ at an angle of 15° to the horizontal. Both balls reach child Q at the same time.



Determine how long the child P should wait before throwing the second ball.

(4)

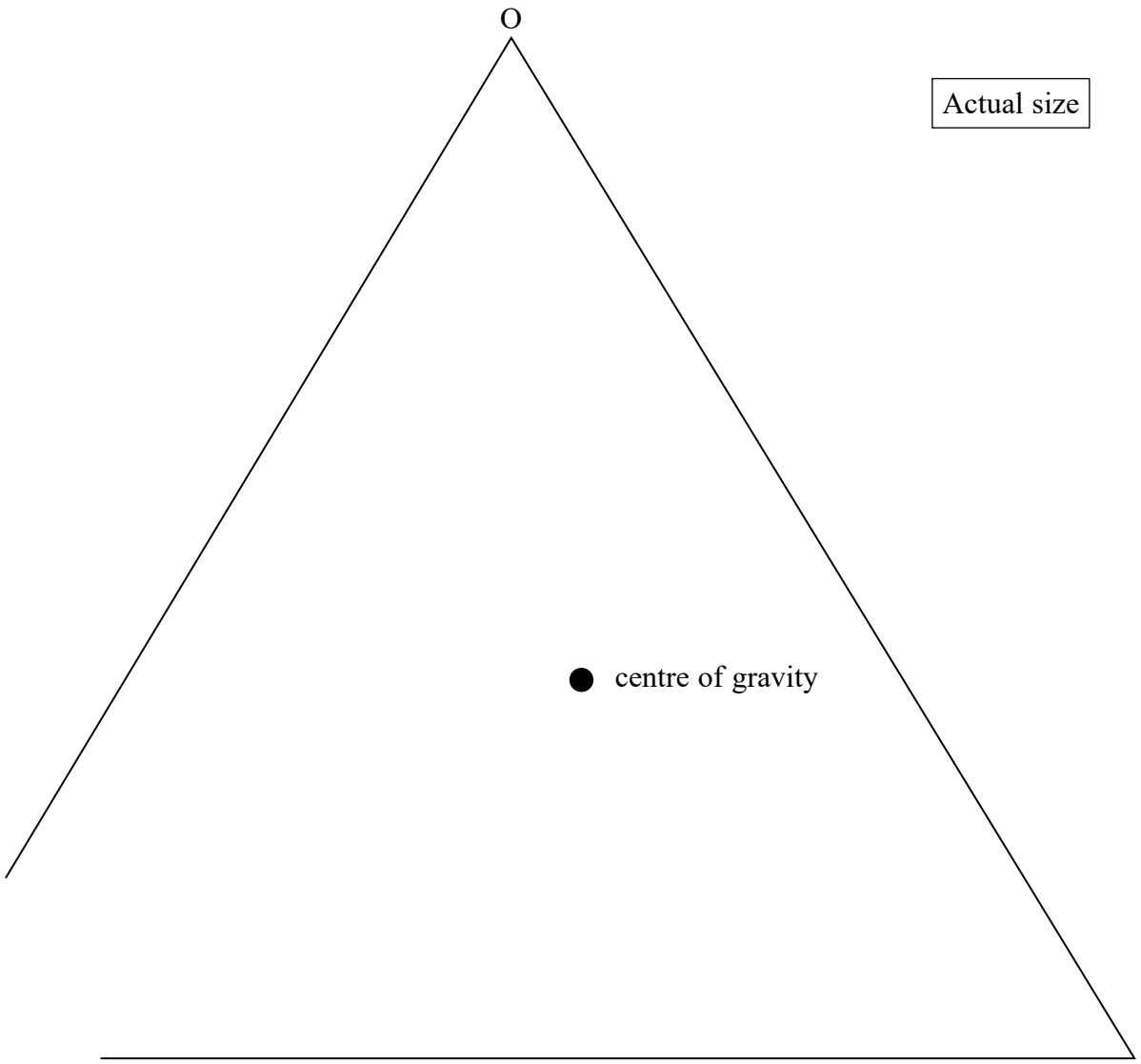
Time between throws = ...

(Total for Question 13 = 4 marks)

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14 A musical instrument called a triangle consists of a metal bar bent into a triangular shape.

The triangle is open at one corner. A full size diagram of a triangle is shown below. The position of the centre of gravity has been added.



(a) State what is meant by centre of gravity.

(1)

.....

.....

.....

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(b) Determine the moment of the weight of the triangle about O.

mass of triangle = 0.180 kg

(4)

Moment of weight of the triangle = ...

(c) The triangle is now suspended by a thread from O.

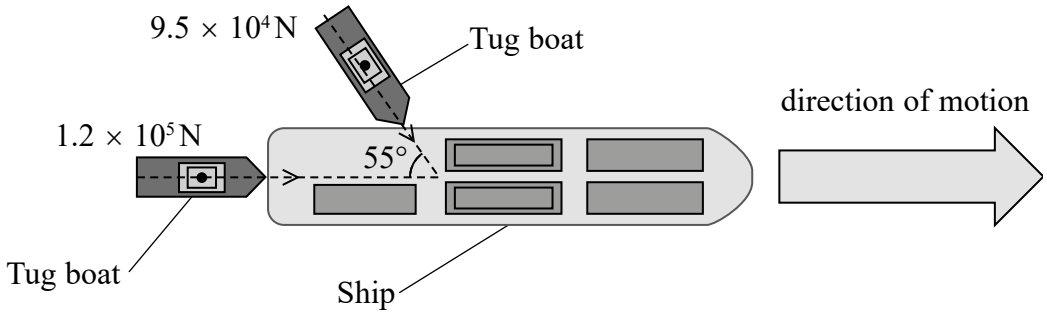
Explain why the triangle settles in a position where the base is no longer horizontal.

(2)

(Total for Question 14 = 7 marks)

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15 The diagram shows a ship used to carry heavy loads. Two tug boats are used to guide the ship into port applying forces as shown.



(a) Draw a vector diagram to determine the resultant force acting on the ship due to the tug boats.

(4)

Magnitude of resultant force = ...

Direction of resultant force = ...

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(b) The ship has a velocity of $4.00\,m\,s^{-1}$ in the direction of the $1.2 \times 10^5\,N$ force.

(i) Calculate the rate at which work is done on the ship by the tug boat that provides the $1.2 \times 10^5\,N$ force.

(2)

Rate at which work is done = ...

(ii) This tug boat has two engines, each of power 950 kW.

Calculate the efficiency of this tug boat in pushing the ship.

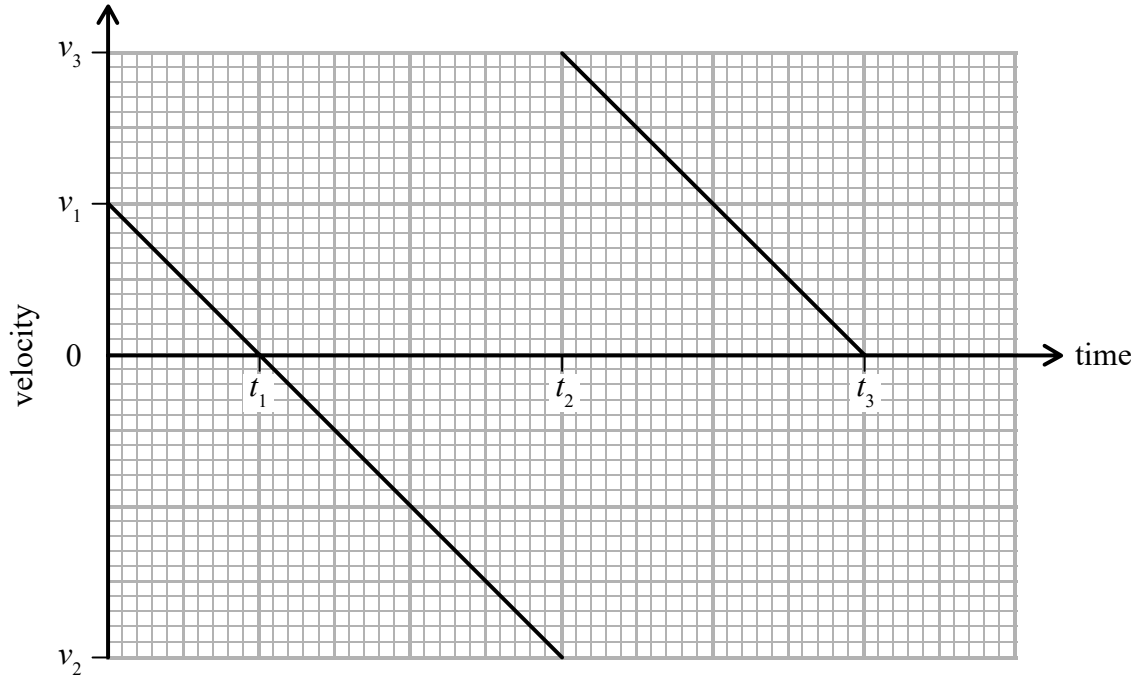
(2)

Efficiency = ...

(Total for Question 15 = 8 marks)

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16 A ball is thrown upwards with a velocity v_1. The velocity-time graph for the initial part of the motion is shown. The time of contact with the ground can be taken as negligible.



Assume that resistive forces are negligible.

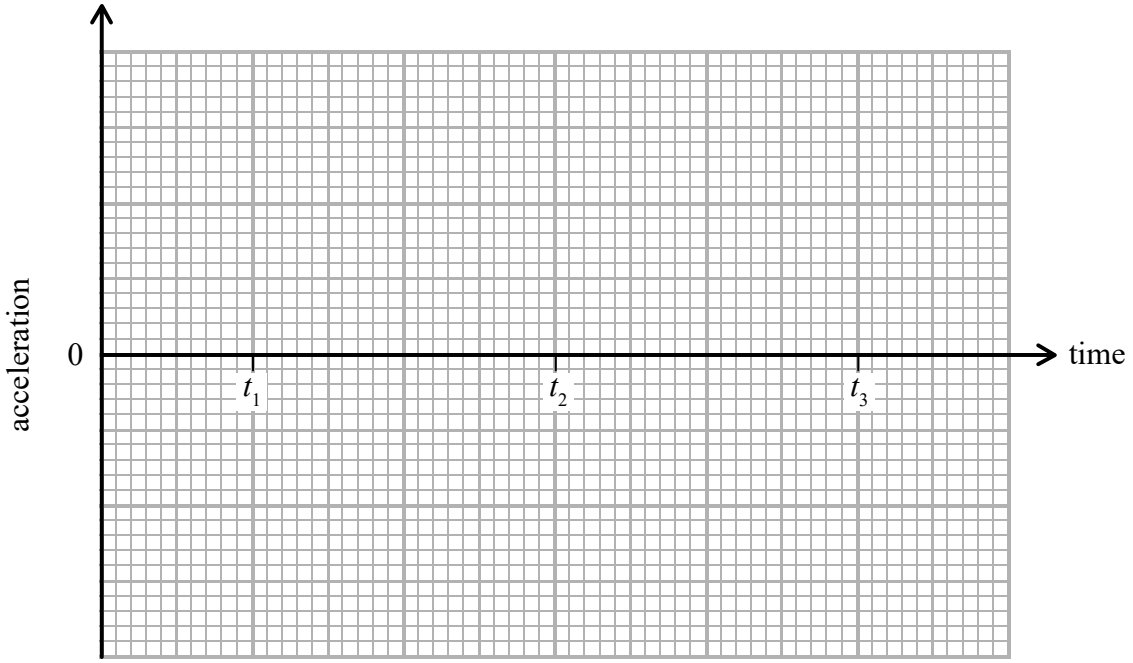
(a) Describe the motion of the ball between times 0 and t_3.

(4)

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(b) Draw an acceleration-time graph on the axes below for the motion of the ball from time = 0 to time t_3. You can ignore any temporary change in acceleration on impact with the ground.

(2)

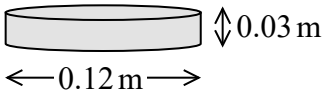


(Total for Question 16 = 6 marks)

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17 A student is investigating a spring.

He uses the steel disc shown in the diagram.

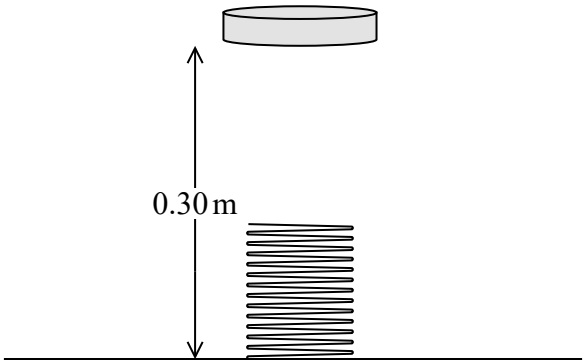


(a) Show that the weight of the disc is about 26 N.

density of steel = 7900 kg m^{-3}

(4)

(b) The student drops the disc from a height of 0.300 m onto a spring. The original length of the spring is 0.110 m. The maximum compression of the spring when the disc lands on it is 0.060 m



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(i) Calculate the change in gravitational potential energy of the disc between when the disc is released and when the spring has maximum compression.

(3)

Change in gravitational potential energy = ...

(ii) Hence calculate the maximum force that the disc exerts on the spring at maximum compression.

(2)

Maximum force on spring = ...

(iii) Hence, determine the stiffness of the spring.

(2)

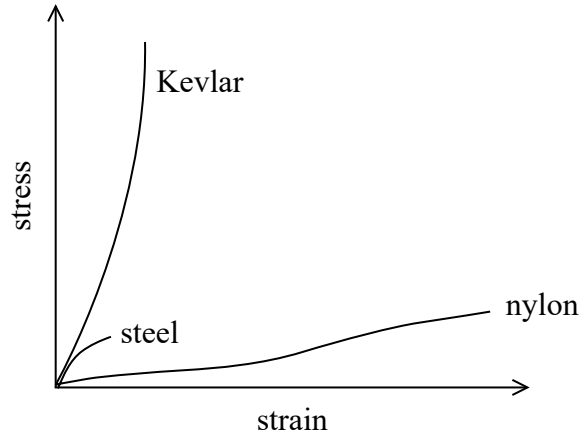
Stiffness of spring = ...

(Total for Question 17 = 11 marks)

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18 Kevlar is a modern lightweight material. Due to its physical properties, Kevlar is being used to replace nylon and steel in many applications.

The stress-strain graphs for Kevlar, nylon and steel are shown.



(a) When pulling a heavy load, Kevlar cables are now often used instead of nylon cables.

Explain two advantages of using Kevlar in cables compared to using nylon.

(4)

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(b) The photograph shows a machine used for surveying the seabed. A communications cable connects the machine to a ship on the surface.

communications cable



Source from: http://www2.dupont.com/Personal_Protection/en_GB/assets/PDF/OandG/Nexans%20Case%20Study.pdf

The material used in the outer casing of the communications cable must withstand the large pressures at the seabed, yet be light enough to lift out of the water.

density of Kevlar = 1400 kg m^{-3}

density of steel = 7800 kg m^{-3}

(i) Deduce whether steel or Kevlar is more suitable to use in the outer casing of a communications cable at the seabed.

(4)

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(ii) Due to the effects of upthrust, the 'apparent' weight of a cable in seawater is less than it is in air.

Calculate the 'apparent' weight of a sample of Kevlar of volume $8.5 \times 10^{-3}\,m^3$ in seawater.

Density of seawater = $1030\,kg\,m^{-3}$

(4)

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(Total for Question 18 = 12 marks)

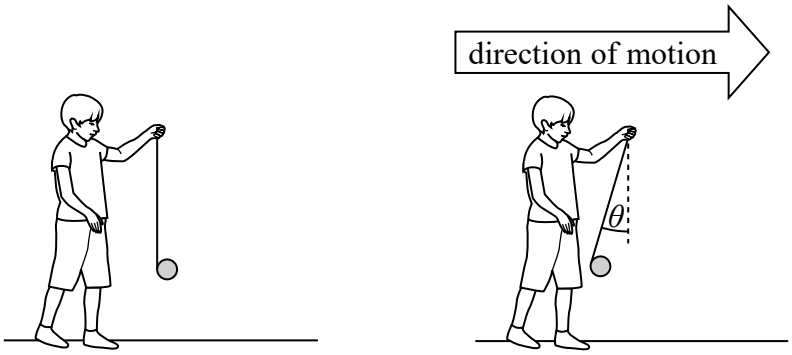
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19 A yo-yo is a toy that consists of two connected discs on a piece of string.



© homydesign/Shutterstock

A child stands in a stationary train holding a yo-yo. The train accelerates and the string moves into the position shown, at an angle θ to the vertical.



train stationary train accelerating

(a) Draw the free-body force diagram for the yo-yo when the train is accelerating.

(2)

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(b) Calculate the acceleration of the train by resolving horizontally and vertically for the forces on the yo-yo.

mass of yo-yo = 0.050 kg

$\theta = 8.0°$

(4)

Acceleration of the train = ...

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*(c) Discuss whether the string could ever become completely horizontal or completely vertical while the train is accelerating.

(6)

(Total for Question 19 = 12 marks)

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

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