Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 4_Materials

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Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

The diagram shows a rock climber of mass 55 kg. She is hanging on a rope with one foot in contact with a rock face. She uses this foot to push herself horizontally away from the rock face. The rope is inclined at 20° to the vertical.

(a) Complete the free-body force diagram below to represent the forces acting on the climber.

(3)

(b) (i) Show that the tension in the rope is about 600 N.

(3)

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(ii) The rope extends by 2.5 cm when used as shown.
Calculate the energy stored within the rope.

(2)

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Energy stored = ...

(iii) State one assumption made in this calculation.

(1)

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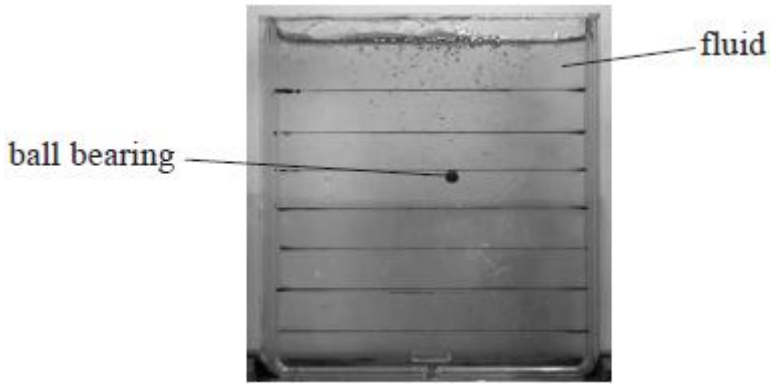
(Total for question = 9 marks)

Q2.

A student carried out an experiment to identify a fluid from its viscosity at room temperature.

A ball bearing of diameter *d* was released at the top of a container containing the fluid. The motion of the ball bearing was recorded using a video camera and hence the terminal velocity *v* of the ball bearing was determined.

This was repeated for ball bearings of increasing diameter with the fluid at a constant temperature.



(a) To determine the viscosity η, the student used the equation

$$v = \frac{d^2 g(\rho_b - \rho_f)}{18\eta}$$

where ρ_b = density of the material of the ball bearing
ρ_f = density of the fluid.
Explain why a graph of *v* on the *y*-axis and d^2 on the *x*-axis should be a straight line through the origin.

(3)

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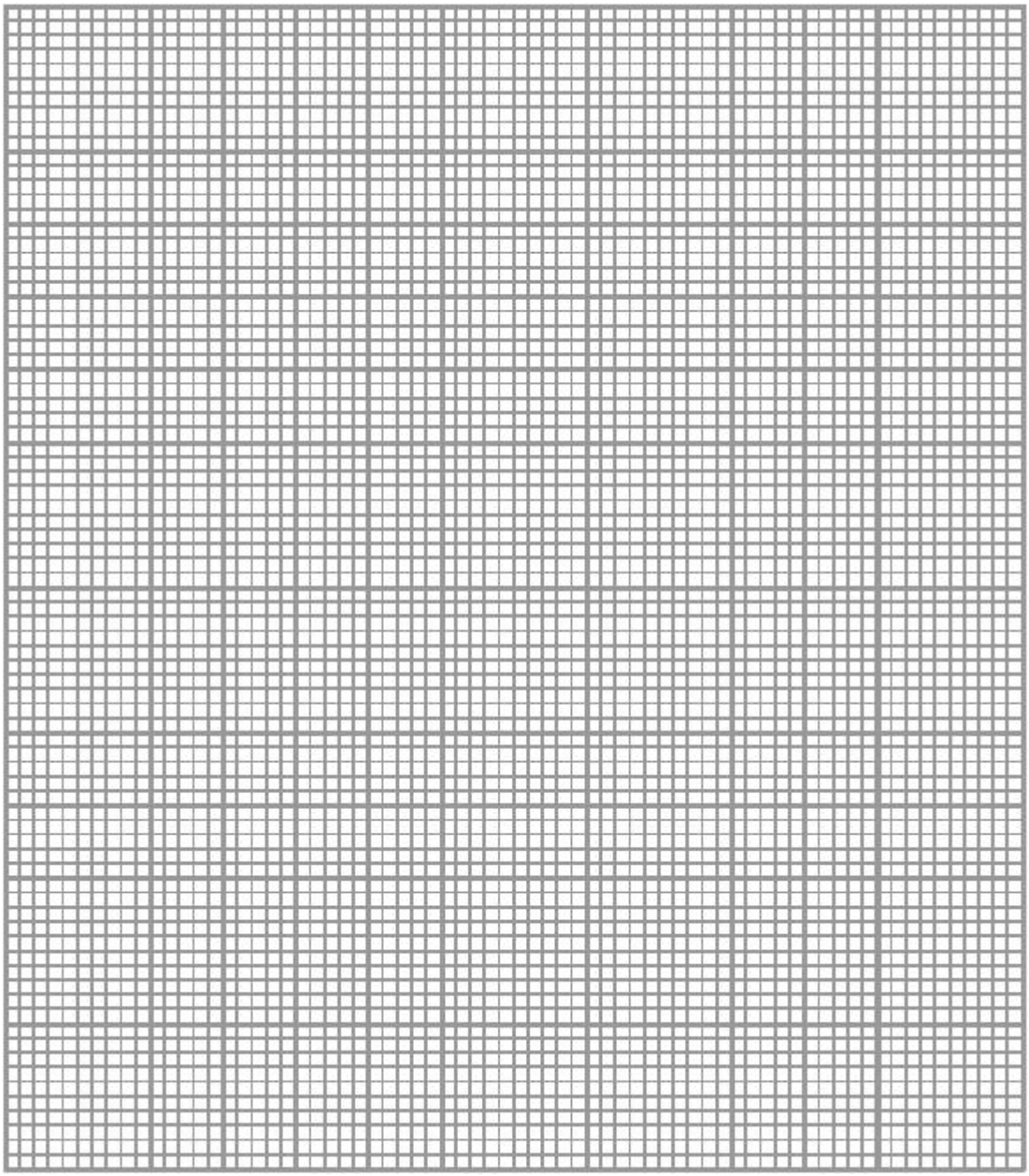
(b) The student obtained the following data.

d / 10^{-3} m	d^2 / 10^{-6} m^2	v / 10^{-3} m s^{-1}
1.0	1.0	2.3
2.0	4.0	11
3.0	9.0	23
4.0	16.0	39
5.0	25.0	64

Plot the graph of v against d^2.

(4)



(c) The table shows the viscosity of some different fluids.

Fluid	Viscosity at room temperature / Pa s
castor oil	1.0
glycerol	1.2
corn syrup	1.4
honey	1.9

Use the graph to deduce which fluid the student used.
density of ball bearing = 8000 kg m^{-3}
density of fluid = 1260 kg m^{-3}

(4)

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(Total for question = 11 marks)