Bangladesh International Tutorial Limited

Physics Worksheet

Class-XI

Worksheet- 05

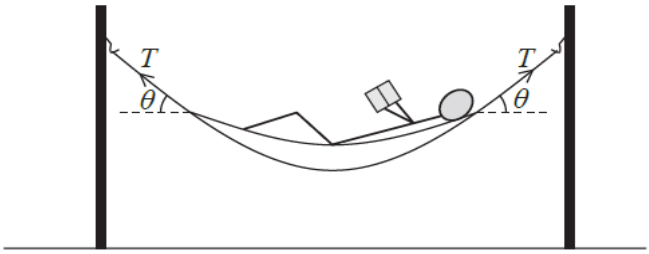
Subject Teacher- P.K. Saha

Total Marks- 50

Name: _____

1.

A hammock is suspended between two rigid poles. Both ropes supporting the hammock are at an angle of θ to the horizontal as shown.



(a) When a man of mass 80 kg lies in the hammock, θ is 40°.

Show that the tension T in each of the hammock's supporting ropes is about 650 N.

mass of hammock and ropes = 4 kg

(3)

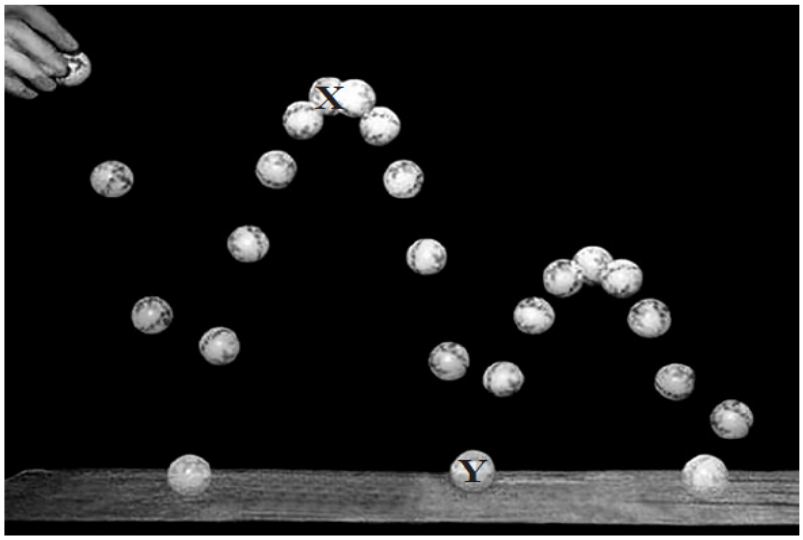
(b) The force of the supporting ropes could cause the poles to fall inwards.

By considering the vertical and horizontal components of the tension in one of the supporting ropes, explain why a larger value of θ creates a smaller force on the poles supporting the hammock.

(5)

2.

The photograph shows a sequence of images of a bouncing ball. 20 images were taken per second.



(a) (i) Show that the distance the ball fell between point X and point Y is about 0.4 m.

(3)

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(ii) Use measurements from the photograph to calculate the horizontal velocity of the ball.

(4)

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Horizontal velocity = ...

(b) The vertical position of the ball a short time before a bounce was always higher than the vertical position the same time after a bounce.

Explain the difference in height of the ball before and after each bounce.

(2)

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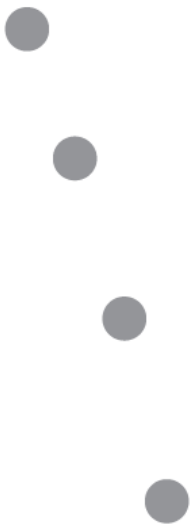
(c) The ball was released with a small horizontal velocity.

(i) The position of the ball in the first 4 images is shown below.

Draw in the first 4 positions of the ball had it been released with no horizontal velocity.

(2)



(ii) Explain why you have drawn the ball in these positions.

(2)

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3.

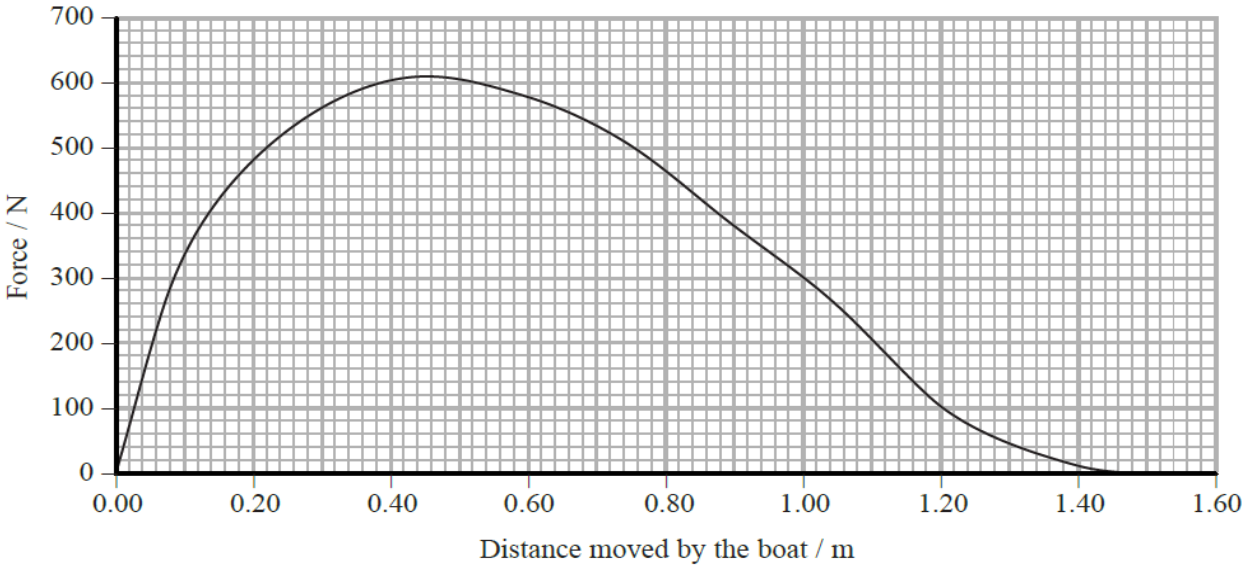
The photograph shows a rower during a race. During each stroke the rower applies a force to the end of each oar. The other end of each oar exerts a force on the water.

(a) At the start of the race the boat is stationary.

Using Newton's laws of motion, explain why the boat begins to move through the water as the rower applies a force.

(4)

(b) The graph shows how the force applied to the boat varies with the distance moved by the boat during one complete stroke.



(i) Use the graph to show that the work done on the boat during one stroke is about 500 J.

(3)

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(ii) Hence calculate the average power developed.

average stroke rate = 24 strokes per minute

(3)

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Average power = ...

(c) The work done by the rower is greater than the kinetic energy gained by the rower and the boat.

Suggest **two** reasons why.

(2)

(d) Suggest why the rower and the boat gain different amounts of kinetic energy during each stroke.

(1)

4.

A crane supports a load of 950 N with a steel cable. If the breaking stress of steel is 500 MPa, calculate the smallest diameter cable that can be used.

(3)

Smallest diameter of cable = ...

5.

Stokes' law can be used to calculate the resistive force F acting on an object as it moves through a fluid.

The equation for Stokes' law is

$$F = 6\pi\eta rv$$

(a) Stokes' law is only valid if the flow around the object is laminar.

(i) State what is meant by laminar flow.

(1)

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(ii) State the conditions required for the flow around the object to be laminar.

(2)

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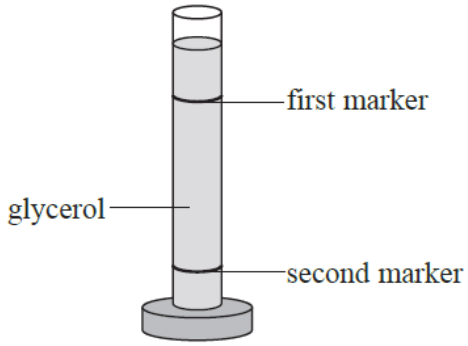
(b) A student carried out an experiment to determine the viscosity of glycerol using the apparatus shown.



A ball bearing was released at the top of a measuring cylinder containing glycerol.
A stopwatch was used to measure the time taken to fall between the markers.
This was repeated for ball bearings of different sizes.

The following equation was used to calculate the viscosity η.

$$\frac{4\pi r^3}{3}\rho_b g - \frac{4\pi r^3}{3}\rho_g g = 6\pi r \eta v$$

r = radius of ball bearing
ρ_b = density of ball bearing
ρ_g = density of glycerol
v = terminal velocity

(i) The density of the glycerol and the ball bearing are known.

State **two** other quantities the student would have to measure directly to calculate the viscosity.

(2)

(ii) State the quantity that is represented by the term $\frac{4\pi r^3}{3}\rho_b g$.

(1)

(iii) State the quantity that is represented by the term $\frac{4\pi r^3}{3}\rho_g g$.

(1)

(iv) Describe how the results obtained and a graphical method can be used to determine a value for the viscosity of the glycerol.

(4)

(c) Glycerol can be pumped into waste systems to remove nitrogen during the treatment of waste water.

Explain the effect that low temperatures could have on the supply of glycerol to a waste system.

(2)

(Total for Question 19 = 13 marks)