Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 2 (Mechanics)

Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

(a) A vehicle that skids can leave a mark on the road surface. This skid mark can be used to calculate the velocity of the vehicle at the start of the skid.

At a test track a car of mass 1500 kg was collided into the back of a stationary car of mass 1200 kg. The two cars skidded along the road together, leaving skid marks of length 7.5 m. The cars decelerated at 5.6 m s^{-2} to a stop at the end of the skid.

Calculate the velocity with which the car of mass 1500 kg collided with the stationary car.

(3)

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Velocity = ...

(b) In practice, the velocity of the car is not exactly the same as that calculated.

Explain why.

(2)

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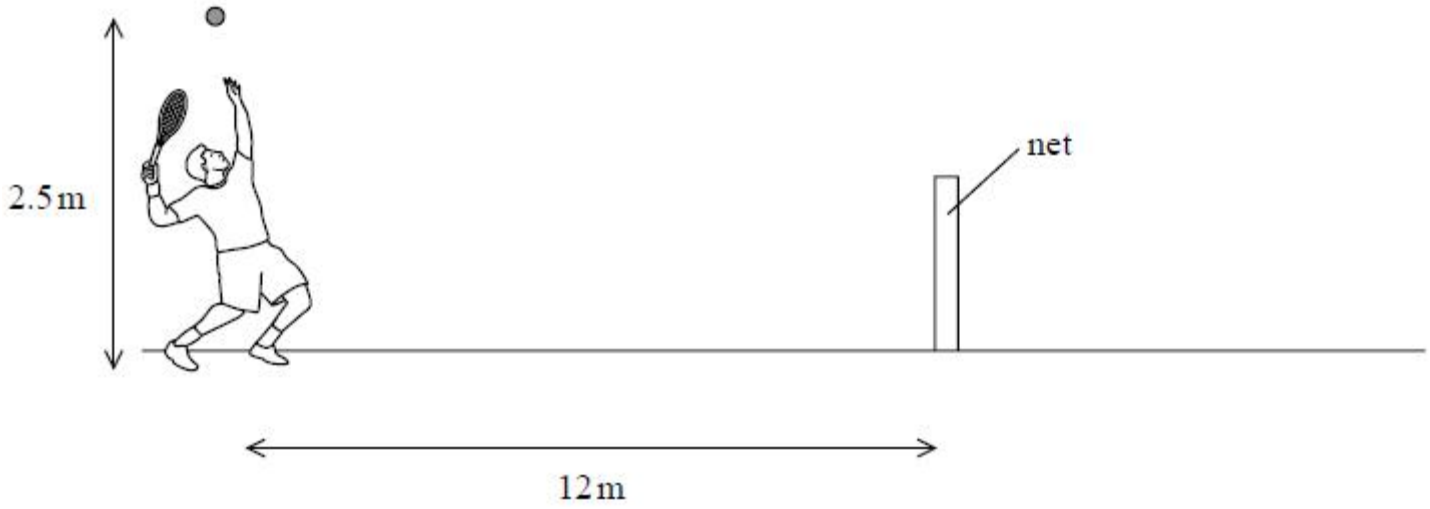
(Total for question = 5 marks)

Q2.

A tennis player uses a racket to hit a ball over a net.



The player stands 12 m from the net. He throws the ball vertically upwards and hits the ball at a height of 2.5 m above the ground. The ball leaves the racket **horizontally** with a velocity of 25 m s^{-1}. The ball has a mass of 0.06 kg.

The ball is in contact with the racket for 0.04 s.

Calculate the average force on the ball.

(3)

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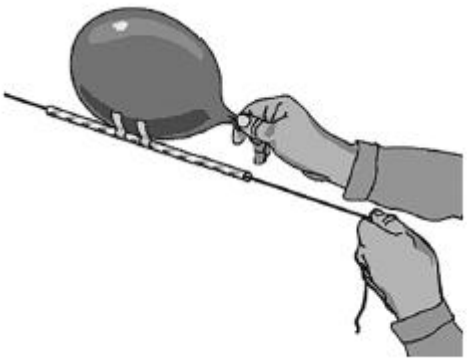
Average force = ...

(Total for question = 3 marks)

Q3.

A length of string is threaded through a drinking straw. The string is fixed at one end and held at the other so that it is at 30° to the horizontal. A balloon is inflated and attached to the straw. When the balloon is released, the air escapes from the balloon and the balloon and straw start to move up the string.



Calculate the minimum force on the balloon due to the escaping air if the balloon is to move in this way.

mass of straw and balloon = 11 g

(3)

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Minimum force = ...

Q4.

A website about the physics of baseball states, "The bat hits the ball with a force equivalent to 2 tonnes."

In a baseball game, a ball travelling at 40 ms^{-1} is in contact with a bat for 0.70 ms and has a speed after impact of 49 ms^{-1}.

1 tonne = 1000 kg
mass of ball = 0.15kg

Evaluate the statement from the website.

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Q5.

The photograph shows a praying mantis hanging from a thin twig. Four of the praying mantis's six legs are in contact with the twig. The tension in the legs balances the weight to keep the praying mantis stationary.

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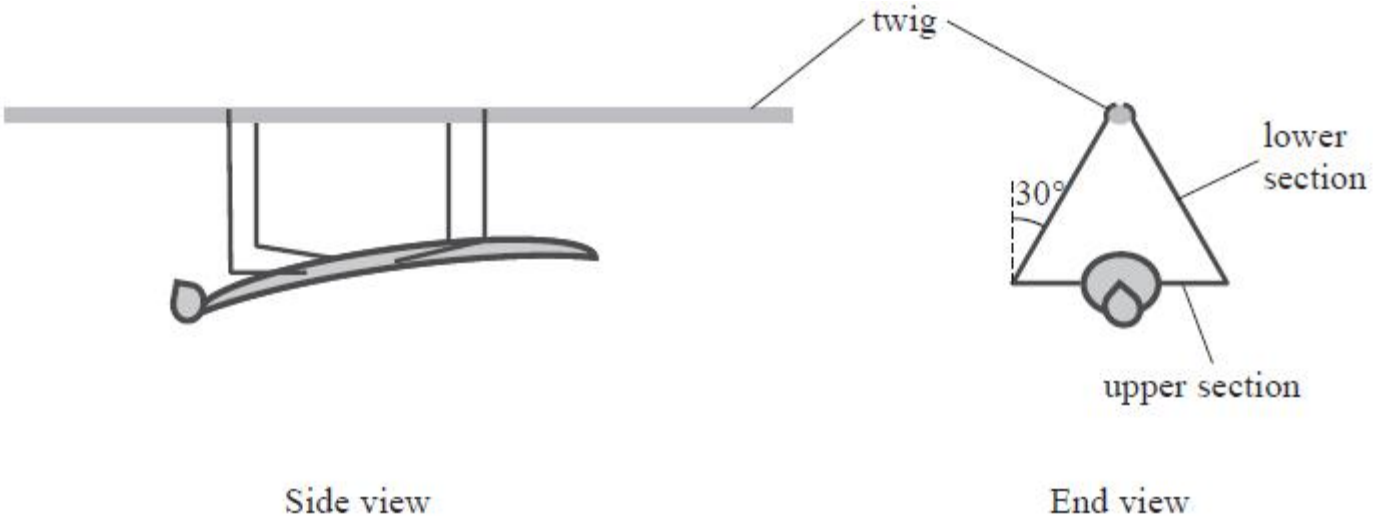
(a) The diagrams show a simplified model of the situation. For each leg in contact with the twig, the upper section is horizontal and the lower section is at an angle of 30° to the vertical.



(i) Calculate the tension in the lower section of each leg in contact with the twig assuming that these tensions are all equal.

mass of praying mantis = 5.4×10^{-4} kg

(4)

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Tension = ...

(ii) A student suggests that the tension in each leg in contact with the twig is 25% of the weight of the praying mantis. State why this is **not** correct.

(1)

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(b) The praying mantis moves around the twig so that it is now standing upright and on top of the twig.

State the difference between the stress in the legs when the praying mantis is beneath the twig and when it is on top of the twig.

(1)

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(Total for question = 6 marks)