Physics 3AB - Year 12

Motion & Forces Test One 2015

Name:

Mark: / 57

= %

Time Allowed: 50.0 Minutes

Notes to Students:

1. You must include **all** working to be awarded full marks for a question.
2. Marks will be deducted for incorrect or absent units and answers stated to an incorrect number of significant figures.
3. **No** graphics calculators are permitted – scientific calculators only.

Question 1 **(3 marks)**

A car on the freeway is traveling at 108 kmh^{-1} North when the driver spots a hazard 78.0 m ahead. Calculate the acceleration needed to bring the car to a stop before the hazard.

Question 2 **(4 marks)**

A football is kicked from a stationary position at an angle of 45° to the horizontal. On the diagram below draw the path of the football if:

(a) there is no air resistance (use a solid line ——————)

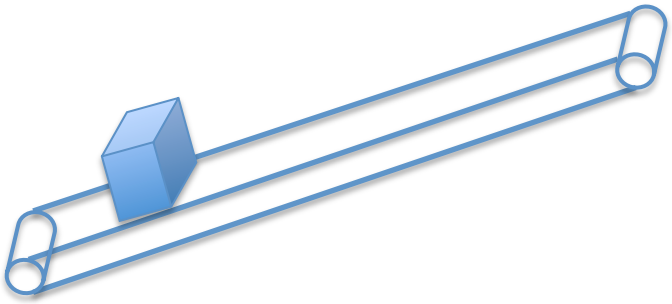
(1 mark)

(b) there is air resistance (use a dashed line – – – – – – -)

(3 marks)

Question 3 **(6 marks)**

Conveyer belts are used in a factory to move boxes. One conveyer belt, which starts at ground level, has a length of 5.60 m and is angled at 32.0° to the horizontal. The frictional force the belt can provide is 210 N.



(a) Calculate the maximum mass that can be moved up the conveyer belt, without slipping.

(3 marks)

(b) The conveyer belt brings the box to a stop at the top of the ramp. Due to incorrect set up, the box falls off the top of the ramp after it has been brought to a stop. Using energy considerations, calculate the speed of the box when it reaches the ground.

(3 marks)

Question 4 **(9 marks)**

In a game of Mini Golf, a golfer attempts to make a hole in one when the hole is positioned on a platform that is 2.40 m above ground level. He strikes the ball so that it travels with a velocity of 12.6 ms^{-1} at an angle of 40.0° to the horizontal.

(a) If he is to make a hole in one, calculate how far from the hole he must stand.

(5 marks)

(b) Calculate the velocity of the ball as it reaches the hole.

(4 marks)

Question 5 **(4 marks)**

When turning a corner in a car, a passenger feels like he is being pushed against the side of the vehicle. Making reference to any of Newton's Laws of Motion that are appropriate, explain why this is the case.

Question 6 **(5 marks)**

A cyclist is turning a corner on a flat road. He has a mass of 68.0 kg and his bike has a mass of 7.40 kg. The radius of the curve is 30.0 m and his speed is 28.5 kmh^{-1}.

(a) What provides the centripetal force in this situation?

(1 mark)

_____

(b) Calculate the magnitude of this force.

(4 marks)

Question 7 **(9 marks)**

(a) On a Formula 1 racetrack some corners are banked. With the aid of a labelled diagram, explain why cars are able to travel at a higher speed when taking these corners than they would on a flat road.

(4 marks)

(b) A car of mass 700 kg is racing around a banked corner. He wants to be able to maintain a speed of 40.0 ms^{-1} as he takes the corner, which has a radius of 181 m. Calculate the minimum angle that the corner must be banked at in order for him to be able to do this.

(5 marks)

Question 8 **(8 marks)**

Some speed bumps are added to a road where the speed limit is 40.0 kmh^{-1}. A driver going over the speed bumps observes that he feels lighter as he drives over them.

(a) Explain why this is the case with the derivation of any appropriate formulae.

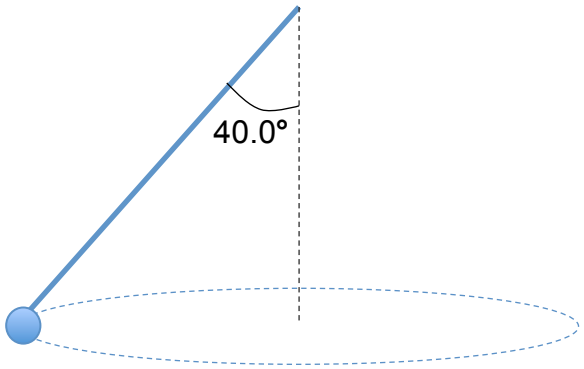
(5 marks)

(b) Calculate the minimum radius of the speed bump if a car of mass 1200 kg is able to drive along the road at the speed limit without losing contact with the road surface. Any formulae derived in part (a) do not need to be stated again.

(3 marks)

Question 9 **(9 marks)**

A poi performance involves swinging tethered masses through a variety of rhythmical and geometric patterns. One performer has poi equipment that is made of a 55.0 cm string with a 0.600 kg mass attached to the end. He begins to rotate it so that it follows the horizontal path shown below.



(a) If the speed of the poi is 7.00 ms^{-1}, calculate the magnitude of tension in the string.

(4 marks)

The poi is now swung in a vertical circle.

(b) At which point in the circle is the string most likely to break?

(1 mark)

_____

(c) If the limit of tension that the string can withstand is 160 N, calculate the maximum speed with which the poi can be swung at this point in the circle.

(4 marks)

END OF TEST