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**Applecross SHS**

**Year 11 Physics Movement Sets Validation Test**

Name : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Instructions : Answer All Questions Time : 50 minutes

Show All Working

Give All Numerical Answers to Three (3) Significant Figures

1. Two competitors in an orienteering competition knew that the next check point was some distance east of their location. To avoid crossing some very difficult terrain, the competitors decided to get to the check point by jogging east 800 m; then south for 400 m; then east for 1.00 km; then north for 800 m; and finally 200 m east. The competitors found that this journey took them 21.0 minutes.  
   [a] Draw a vector diagram of their journey. (1 mark)

[b] Calculate their average speed for this journey in ms-1. (2 marks)

[c] Calculate the average velocity for the journey between the starting position and the check point. Include the direction. (3 marks)

2. As part of the pre-match entertainment at a football grand final, a skydiver parachuted towards the football oval at a constant downward velocity of 6.00 ms-1. When he was 80.0 m above the ground he released a football directly above the centre of the playing field. Assuming that the ball's motion was not significantly affected by air resistance, calculate:  
[a] the speed at which the football struck the ground; (2 marks)

[b] the time difference between the ball landing and the skydiver landing. (2 marks)

3. A 15.0 kg crate of oranges falls off the back of a truck that is travelling at 8.50 m s-1 to market. If the crate slides along the road for 2.10 seconds before coming to rest, calculate the average frictional force the road surface applies to the crate. (2 marks)

4. A motorist is driving his vehicle at 80.0 km h-1 when he encounters an emergency situation.  
Every driver has a 'reaction time’ in which the driver recognises a hazard, decides what to do, and begins to react.  
[a] The motorist in this case has a reaction time of 0.500 seconds.  
Calculate how far the car travels between seeing a hazard and beginning to respond to the hazard. (1 mark)

[b] Calculate the acceleration required to stop this vehicle in a time of 4.50 s once the brakes have been applied. (1 mark)

[c] Assuming constant acceleration, calculate the 'braking distance’ that his vehicle travels after the brakes are applied. (2 marks)

[d] Calculate the total stopping distance; that is, the distance travelled including both the reaction time and the braking time. (1 mark)

5. Legend has it that a Swiss hero called William Tell shot an apple from his son's head using a crossbow. Consider a 100 g apple balanced on the head of young Tell. His father shoots an arrow of mass 120 g at a speed of 35.0 m s-1. Calculate the speed at which the apple leaves the son's head if:  
[a] the arrow is permanently embedded in the apple; (2 marks)

[b] the arrow passes through the apple and exits with a speed of 20.0 m s-1 (2 marks)

6. During a collision between two cars, a passenger's head strikes the unpadded dashboard with an average force of 58.0 N for 2.00 ms. With a suitable airbag, the impact would have lasted a longer time of 82.0 ms.  
[a] Calculate the average reaction force the airbag would exert on the passenger's head.

(2 marks)

[b] Use your knowledge of impulse and momentum to explain why the air bag is a safety

End of Test

feature. (2 marks)