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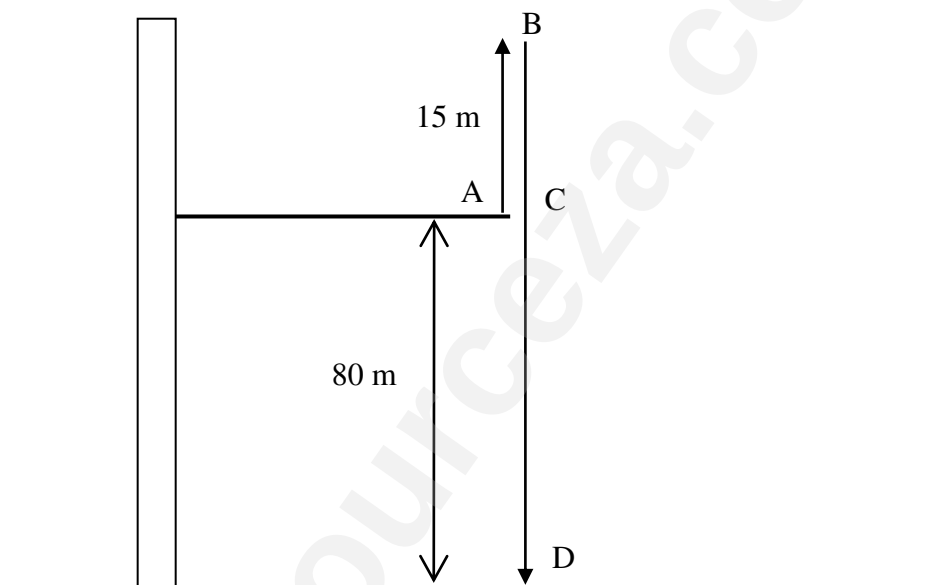
Please take note of the mark allocation and time to complete the questions

Total: 30 marks Time allocation: 30 minutes

**QUESTION 1 – 15 minutes**

(taken from the WC Prelim paper 2008)

A cross-bow (bow and arrow) is used to shoot an arrow vertically upwards into the air from the top of a 80 m high platform. The arrow reaches a height of 15 m above the platform and then falls to the ground below. Ignore the effects of air friction.

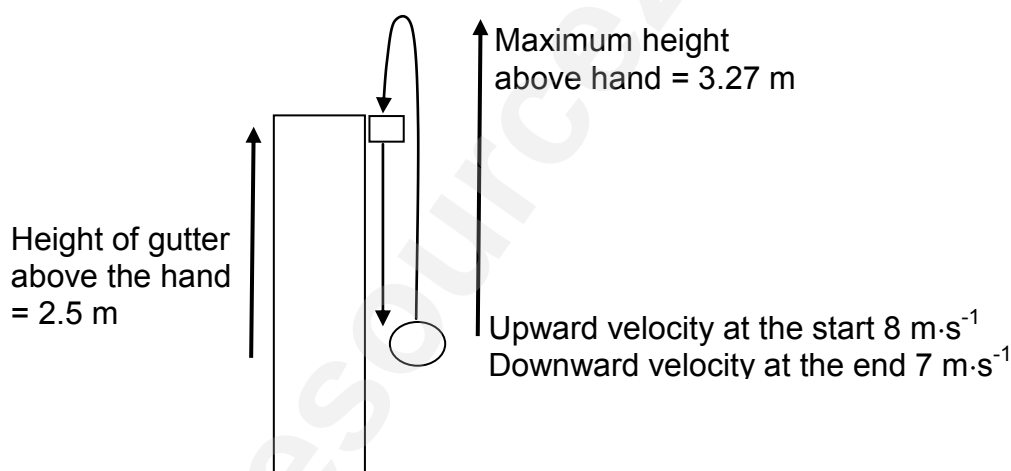


- 1.1 Calculate the magnitude of the velocity of the arrow at the instant it is shot up into the air from the top of the platform. (6)
  - 1.2 Calculate the time it takes for the arrow to reach the ground from the moment it is shot upwards. (5)
  - 1.3 Draw a sketch graph of position versus time to illustrate the arrow's motion from the moment it leaves the cross-bow until it reaches the ground. Indicate all relevant values on your axes. Do not do any additional calculation. (5)
- [16]

**QUESTION 2 – 7 minutes**

(taken from Gauteng Prelim paper 2009)

Sandile throws a small metal ball of mass 10 g vertically up into the air. The ball accidentally lands in the gutter of a building. It remains in the gutter for 0.5 s during which time it rolls a few centimeters in the gutter and then falls through a hole in the gutter back to the original position in Sandile's hand. The upward velocity with which the ball left Sandile's hand was  $8 \text{ m}\cdot\text{s}^{-1}$ . When the ball finally falls back into his hand the velocity is  $7 \text{ m}\cdot\text{s}^{-1}$  downward. Ignore friction as well as all horizontal movement and answer the following questions.



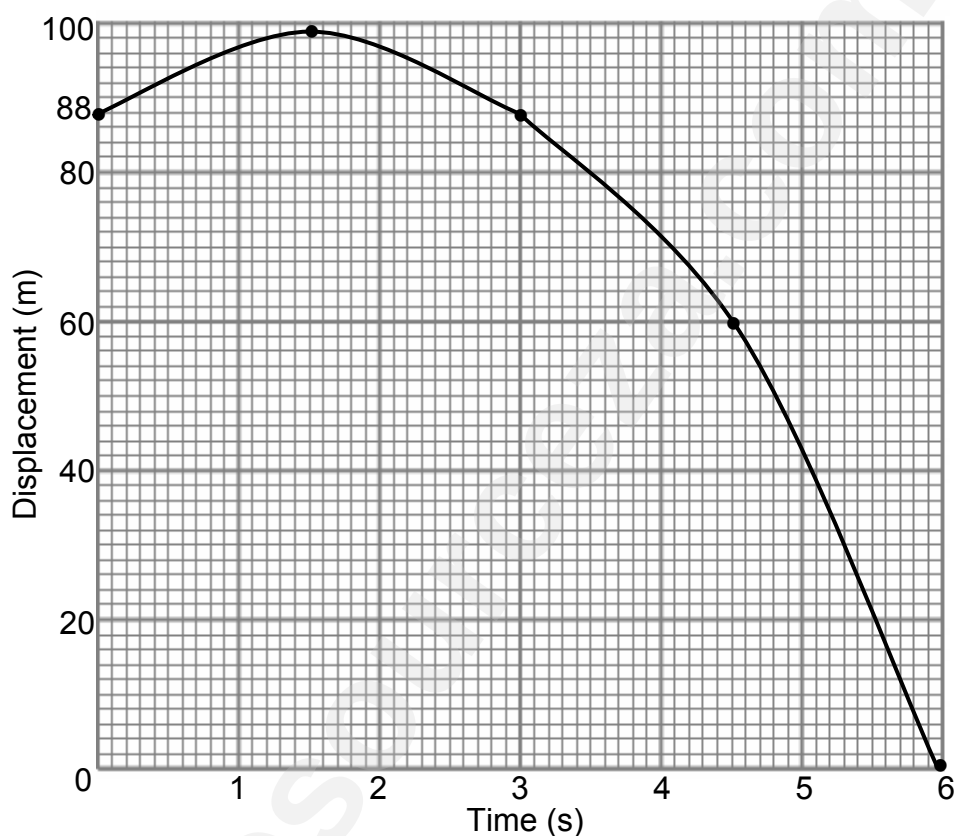
- 2.1 At what speed would the ball have fallen into Sandile's hand if the ball had not fallen into the gutter? (1)
- 2.2 The maximum height that the ball reaches above Sandile's hand is 3.27 m. Prove that this is correct by using an equation of motion and not energy principles. (4)

**[5]**

**QUESTION 3 – 8 minutes**

(NSC Exemplar 2008)

A hot-air balloon is rising vertically at constant velocity. When the balloon is at a height of 88 m above the ground, a stone is released from it. The displacement-time graph below represents the motion of the stone from the moment it is released from the balloon until it strikes the ground. Ignore the effect of air resistance.



Use information from the graph to answer the following questions:

3.1 Calculate the velocity of the hot-air balloon at the instant the stone is released. (6)

3.2 Draw a sketch graph of velocity versus time for the motion of the stone from the moment it is released from the balloon until it strikes the ground. Indicate the respective values of the intercepts on your velocity-time graph. (3)

[9]