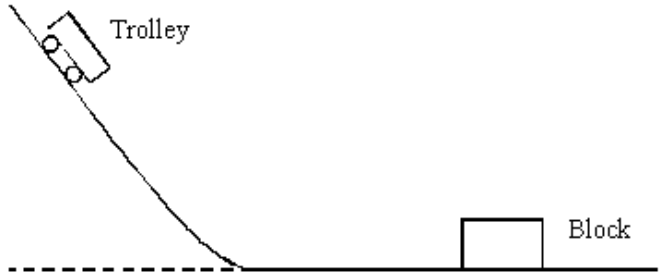
Q3. The diagram represents an experiment that can be used to investigate stopping distances for a moving trolley.



The trolley is placed on the raised section of the track. When released it moves down the track and then travels along the horizontal section before colliding with the block. The trolley and block join and move together after the collision. The distance they move is measured.

(a) State the main energy changes taking place

(i) as the trolley descends,

.....

(ii) after the collision, as the trolley and block move together.

.....

(2)

(b) Describe how the speed of the trolley, just before it collides with the block may be measured experimentally.

You may be awarded marks for the quality of written communication in your answer.

.....

.....

.....

.....

.....

.....

(3)

(c) State and explain how the speed of the trolley, prior to impact could be varied.

.....

.....

.....

(2)

(Total 7 marks)

Q4. A skydiver of mass 70 kg, jumps from a stationary balloon and reaches a speed of 45 m s^{-1} after falling a distance of 150 m.

(a) Calculate the skydiver's

(i) loss of gravitational potential energy,

.....

.....

(ii) gain in kinetic energy.

.....

.....

(4)

(b) The difference between the loss of gravitational potential energy and the gain in kinetic energy is equal to the work done against air resistance. Use this fact to calculate

(i) the work done against air resistance,

.....

.....

(ii) the average force due to air resistance acting on the skydiver.

.....

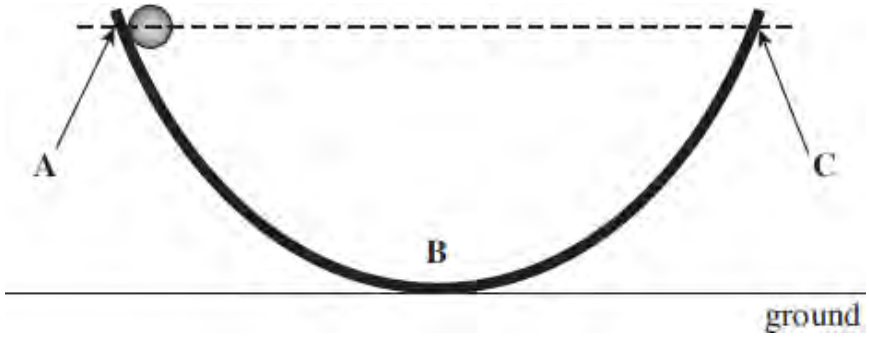
.....

.....

(3)
(Total 7 marks)

Q5. In the 17th century, when thinking about forces, Galileo imagined a ball moving in the absence of air resistance on a frictionless track as shown in **Figure 1**.

Figure 1



(a) Galileo thought that, under these circumstances, the ball would reach position **C** if released from rest at position **A**. Position **C** is the same height above the ground as **A**.

Using ideas about energy, explain why Galileo was correct.

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.....

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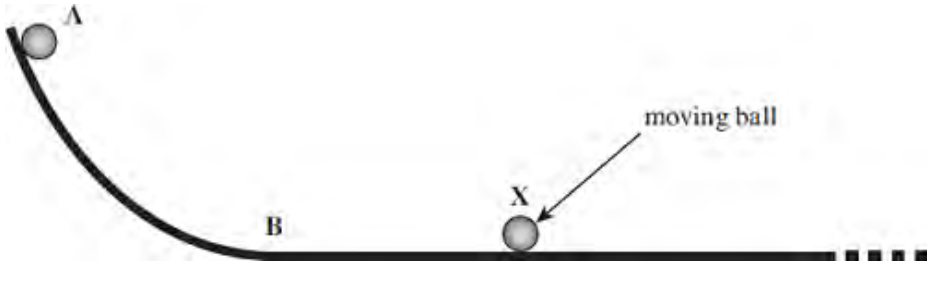
.....

.....

(3)

(b) Galileo then imagined that the track was changed, as shown in **Figure 2**.

Figure 2



The slope beyond **B** was now horizontal.