

## **Work & Energy – Q3 [5 marks](19/6/21)**

### **Exam Boards**

OCR : Mechanics (Year 1)

MEI: Mechanics a

AQA: Mechanics (Year 1)

Edx: Mechanics 1 (Year 1)

A car of mass  $1200\text{kg}$  starts to descend a slope at  $10\text{ms}^{-1}$ . The slope is at a constant angle  $\theta$  to the horizontal, where  $\sin\theta = \frac{1}{10}$ . If the car is not accelerating or braking, and there is a constant resistance to motion of  $500\text{N}$ , find the speed of the car when it has travelled  $100\text{m}$ . Assume that  $g = 10\text{ms}^{-2}$ . [5 marks]

## Solution

### Method 1

By the Work-Energy principle,

Gain in KE = Work done by forces,

$$\text{so that } \frac{1}{2}(1200)(v^2 - 10^2) = 1200g(100\sin\theta) - 500(100)$$

[3 marks]

$$\Rightarrow 600v^2 = 120000 - 50000 + 60000 = 130000$$

$$\Rightarrow v^2 = \frac{650}{3} \Rightarrow v = 14.7 \text{ ms}^{-1} \text{ (3sf) [2 marks]}$$

### Method 2

By Conservation of Energy,

work done against resistance = loss of PE – gain in KE

$$\Rightarrow 500(100) = 1200g(100\sin\theta) - \frac{1}{2}(1200)(v^2 - 10^2),$$

which gives the same equation.