Hooke's Law – Q3 [5 marks] (4/6/21)

Exam Boards

OCR : Mechanics (Year 2)

MEI: Mechanics b

AQA: Mechanics (Year 1)

Edx: Mechanics 1 (Year 2)

A bungee jumper of mass 80kg is attached to a rope of original length 10m and modulus of elasticity 1600N. How far will he or she fall? (Take g=10) [5 marks]

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Solution

Let e be the extension of the rope.

Gain in elastic PE = loss of gravitational PE, so that

$\frac{1}{2}\left(\frac{1600}{10}\right)e^2 = 80(10)(10+e)$ [2 marks]

$\Rightarrow e^2 = 100 + 10e$

$\Rightarrow e^2 - 10e - 100 = 0$ [1 mark]

$\Rightarrow e = \frac{10 \pm \sqrt{100+400}}{2} = 16.18$m (ignoring -ve value)

So bungee jumper falls by $10 + 16.18 = 26.18m$ [2 marks]