

Name of the Student: _____

Max. Marks : 17 Marks

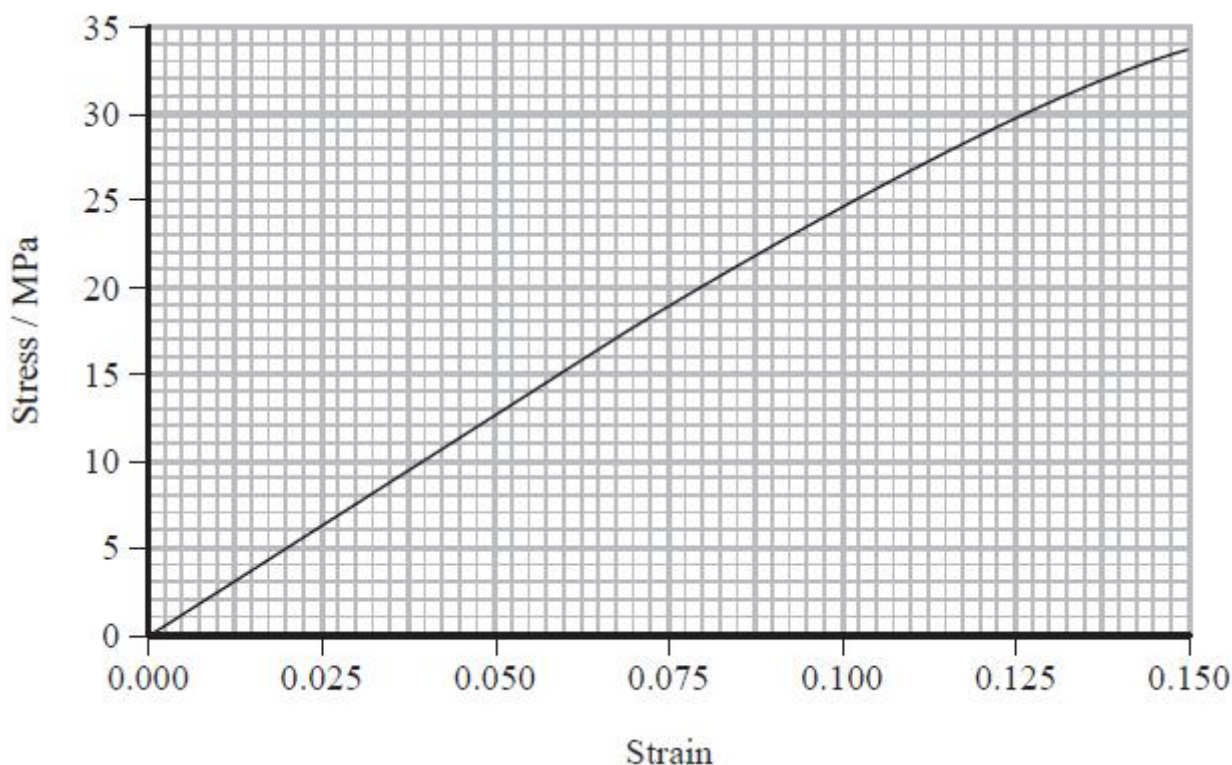
Time : 17 Minutes

Q1.

Seat belts are being tested by a car manufacturer. In the test, a car moving at a steady speed of 28 m s^{-1} collides with a wall and stops.

A crash-test dummy in the driving seat is wearing a seat belt made from polyester webbing. The seat belt has a cross-sectional area of 0.85 cm^2 and a total length of 2.0 m . A student suggests that in the collision the seat belt absorbs all the kinetic energy of the dummy.

The graph shows how stress varies with strain for the seat belt.



(i) Show that the area under the graph represents the energy stored per unit volume in the seat belt.

(2)

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(ii) Use the graph to determine whether the seat belt absorbs all the kinetic energy of the dummy from part (a).
 In this collision, the maximum strain of the seat belt is 0.075

(3)

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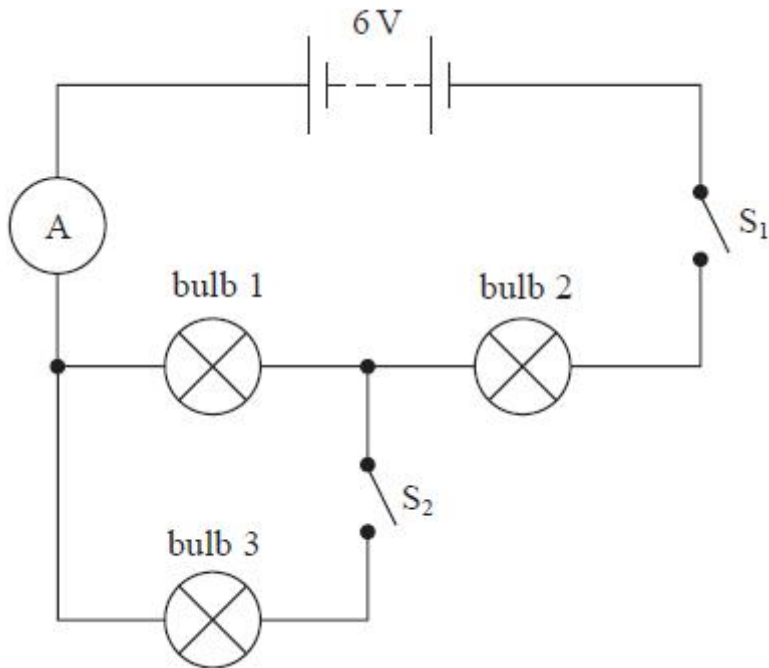
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(Total for question = 5 marks)

Q2.

* A student connects three identical 3 V bulbs to a 6 V battery of negligible internal resistance. The circuit includes two switches, S_1 and S_2 , as shown.



The student closes S_1 and records the brightness of each bulb.
With S_1 still closed, the student closes S_2 .
Explain how the brightness of bulb 1 compares with the brightness of bulb 2 before and after S_2 is closed.

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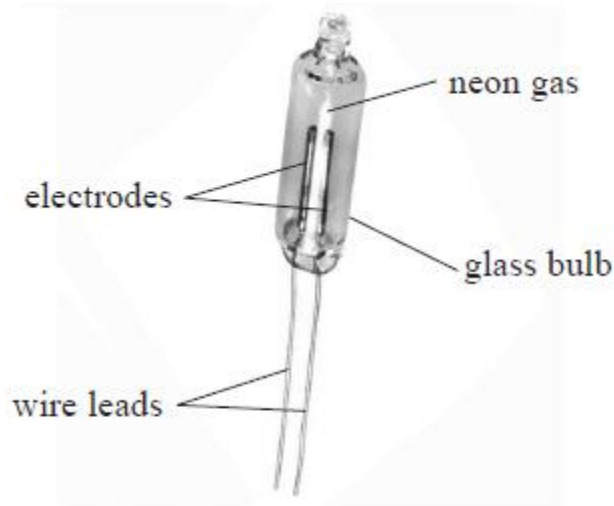
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Q3.

The neon lamp shown is a glass bulb filled with neon gas at low pressure.



(Source: <https://media.digikey.com/Photos/Visual%20Communications%20Company%20VCC/A1A.JPG>)

- * When in use, the neon gas between the electrodes emits electromagnetic radiation.
Explain why this happens when there is an electric current between the electrodes.

(6)

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