Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

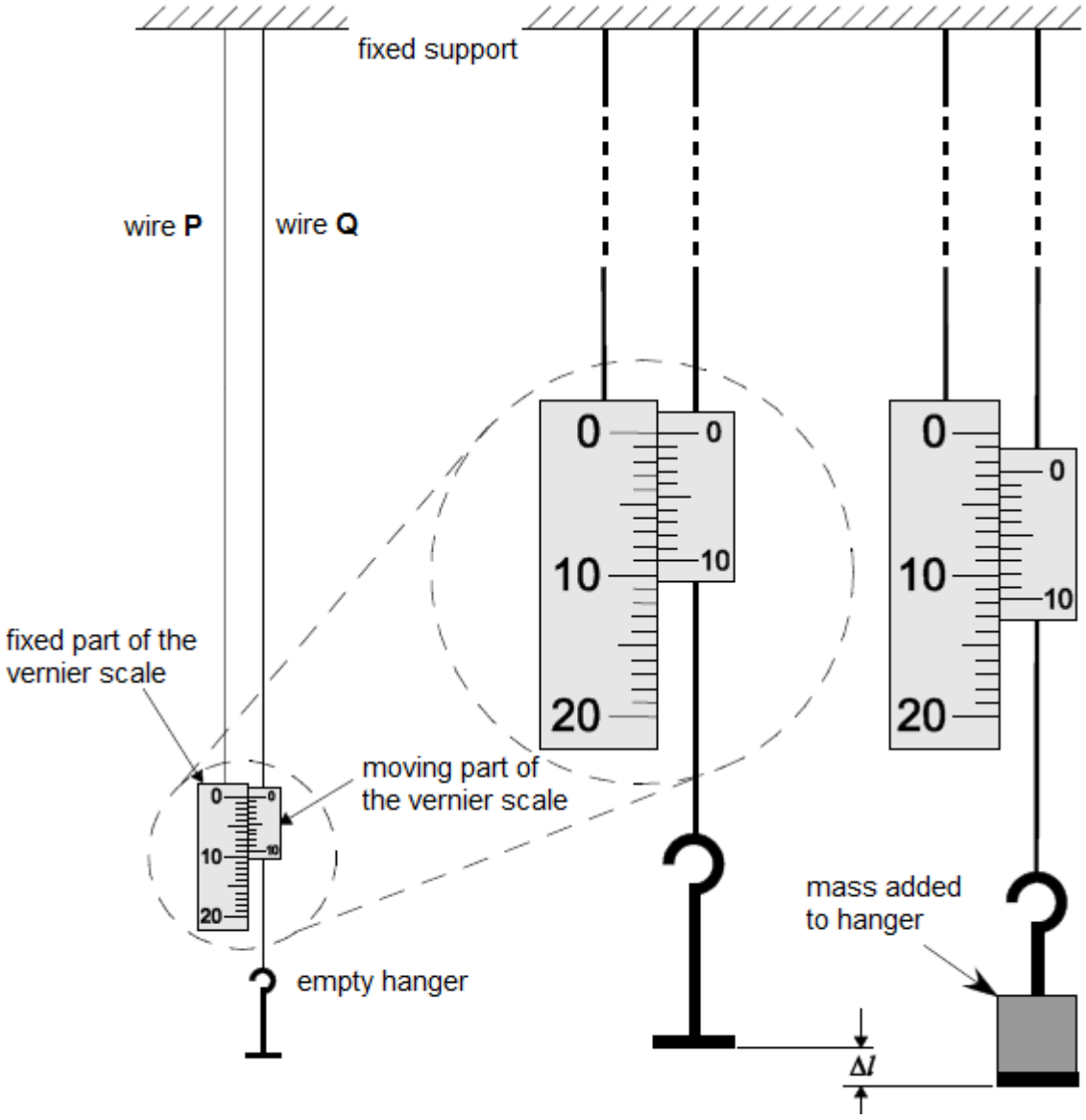
This question is about the determination of the Young modulus of the metal of a wire.

In an experiment, two vertical wires **P** and **Q** are suspended from a fixed support. The fixed part of a vernier scale is attached to **P** and the moving part of the scale is attached to **Q**. The divisions on the fixed part of the scale are in mm.

An empty mass hanger is attached to **Q** and the scale is set to zero. A load is added to the mass hanger so that the extension of **Q** can be measured as shown in **Figure 1**.

Figure 1

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(a) The reading on the vernier scale can be used to determine Δl, the extension of **Q**.

Determine Δl using **Figure 1**.

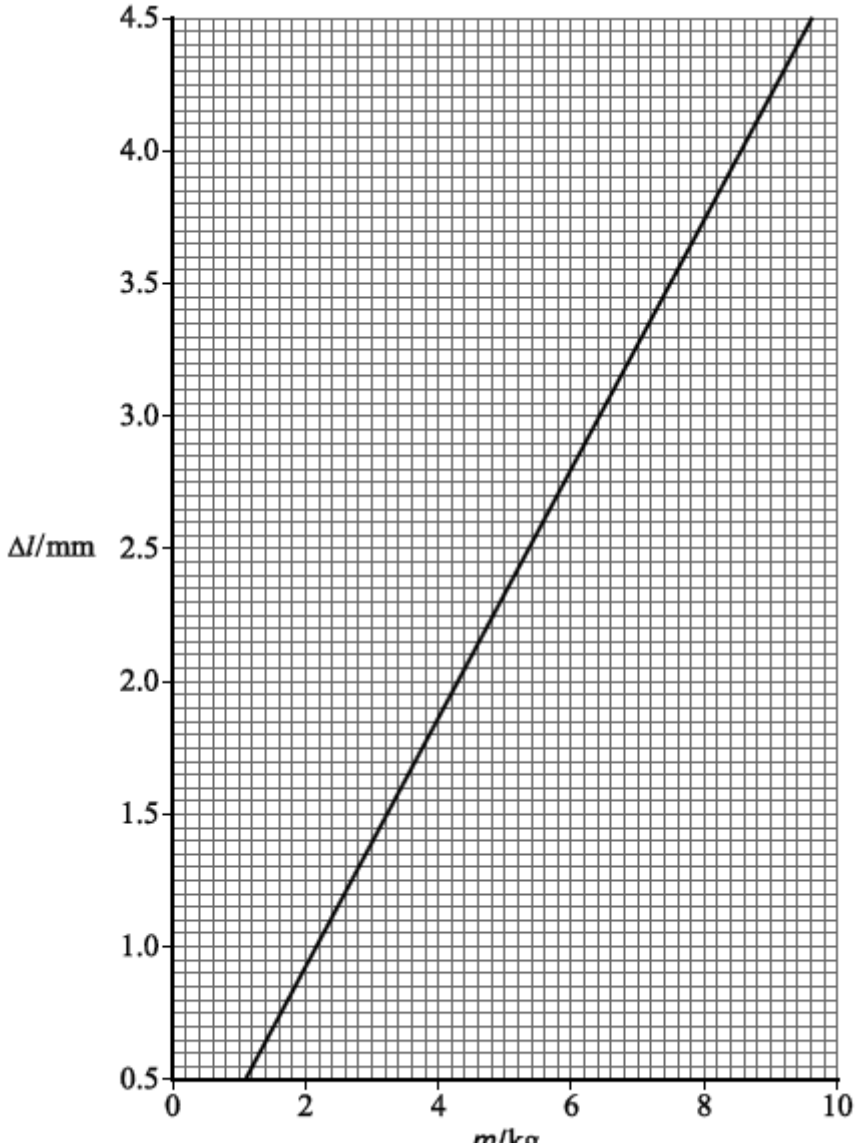
Δl = _____ mm

(1)

(b) **Figure 2** shows how Δl varies with m, the mass added to the hanger.
Determine the mass added to the hanger shown in **Figure 1**.

Figure 2

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mass = _____ kg

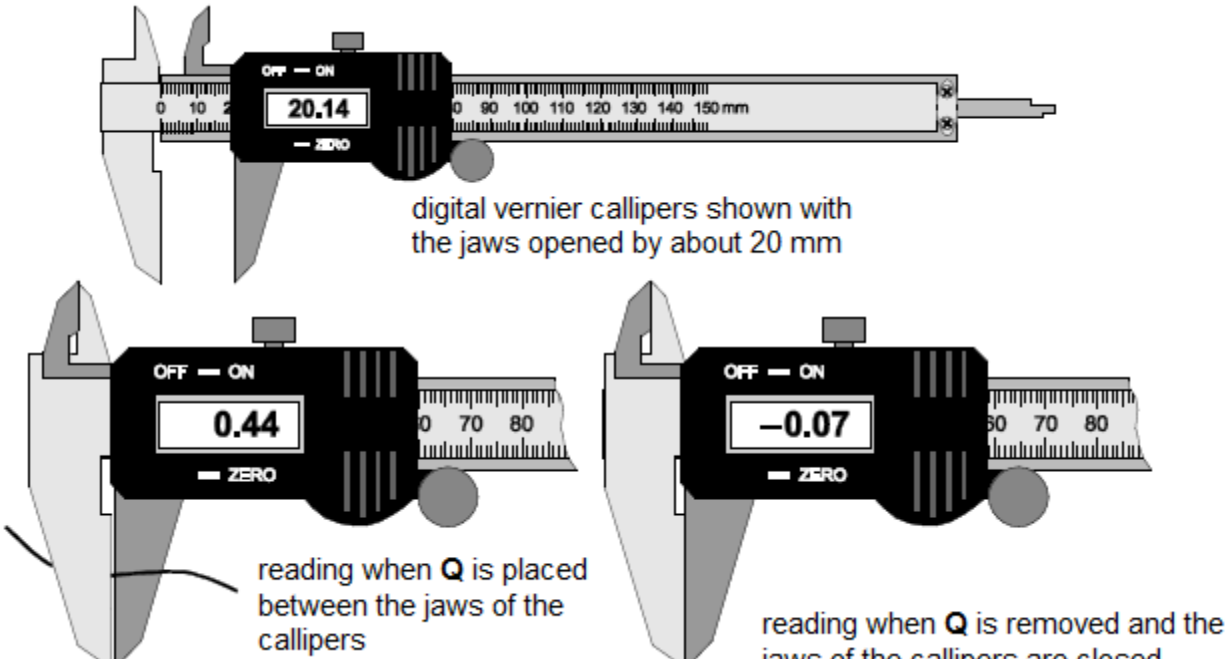
(1)

(c) A student uses digital vernier callipers to measure the diameter of **Q**. She places **Q** between the jaws of the callipers and records the reading indicated. Without pressing the zero button she removes **Q** and closes the jaws.

Views of the callipers before and after she closes the jaws are shown in **Figure 3**.

Figure 3

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Calculate the true diameter of **Q**.

diameter = _____ mm

(1)

(d) The original length of **Q** was 1.82 m.

Determine the Young modulus of the metal in **Q**.

Young modulus = _____ Pa

(4)

(e) The student repeats her experiment using a wire of the same original length and metal but with a smaller diameter.

Discuss **two** ways this change might affect the percentage uncertainty in her result for the Young modulus.

1. _____

_____

_____

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_____

2. _____

_____

_____

_____

(4)

(Total 11 marks)

Q2.

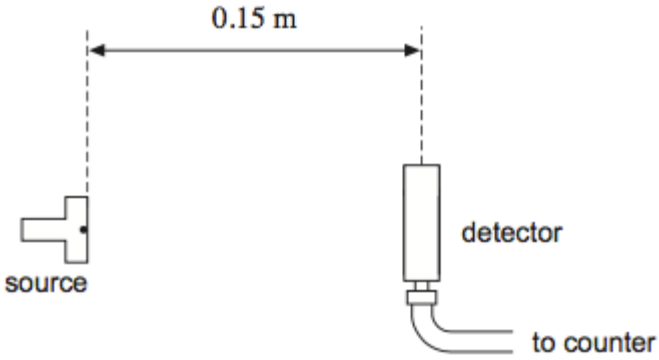
(a) The exposure of the general public to background radiation has changed substantially over the past 100 years.
State **one** source of radiation that has contributed to this change.

_____

_____

(1)

(b) A student measures background radiation using a detector and determines that background radiation has a mean count-rate of 40 counts per minute. She then places a γ ray source 0.15 m from the detector as shown below.



With this separation the average count per minute was 2050.

The student then moves the detector further from the γ ray source and records the count-rate again.

(i) Calculate the average count-rate she would expect to record when the source is placed 0.90 m from the detector.

count-rate = _____ min^{-1}

(3)

(ii) The average count per minute of 2050 was determined from a measurement over a period of 5 minutes. Explain why the student might choose to record for longer than 5 minutes when the separation is 0.90 m.

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_____

_____

_____

_____

(1)

(iii) When the detector was moved to 0.90 m the count-rate was lower than that calculated in part **(b)(i)**. It is suggested that the source may also emit β particles.

Explain how this can be checked.

_____

_____

_____

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

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