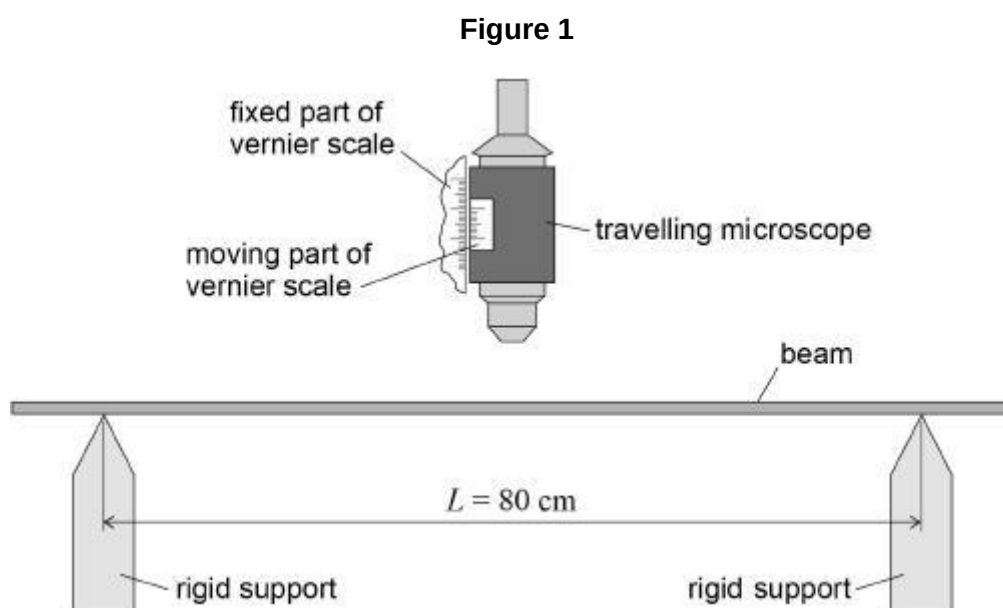


Name of the Student: _____

Max. Marks : 23 Marks

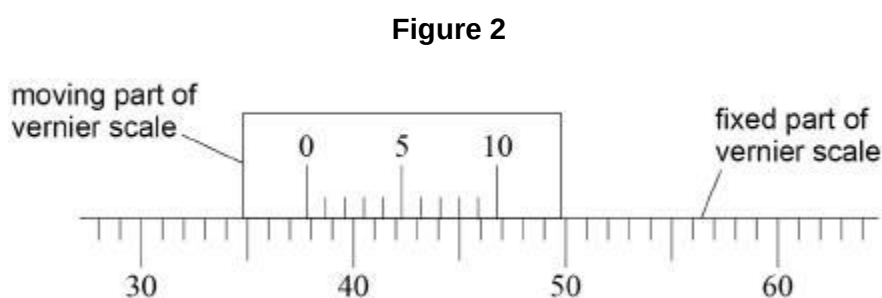
Time : 23 Minutes

Q1.**Figure 1** shows apparatus used to investigate the bending of a beam.

The beam is placed horizontally on rigid supports.

The distance L between the supports is 80 cm.

A travelling microscope is positioned above the midpoint of the beam and focused on the upper surface.

(a) **Figure 2** shows an enlarged view of both parts of the vernier scale.

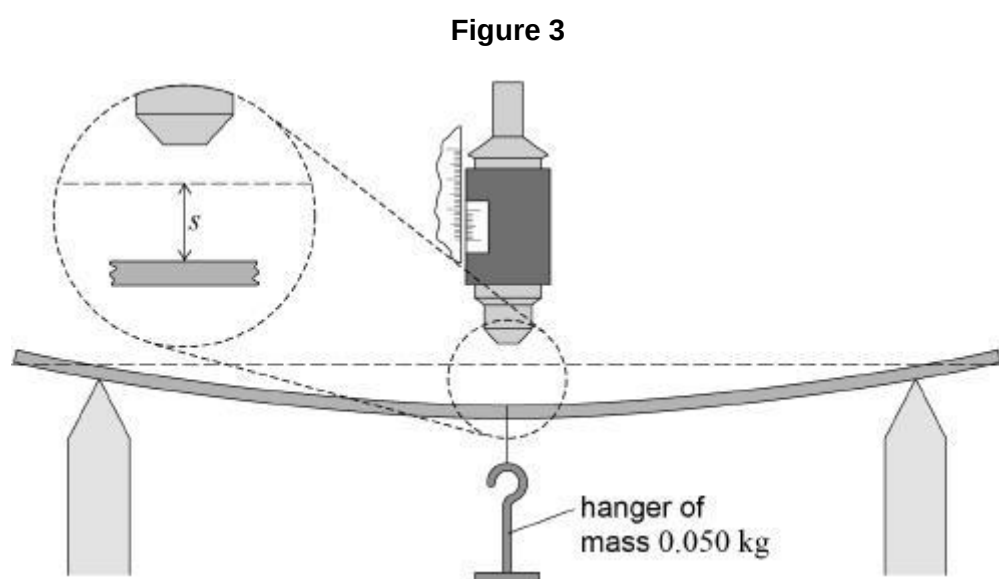
The smallest division on the fixed part of the scale is 1 mm.

What is the value of the vernier reading R_0 in mm?Tick (✓) **one** box.

34.8	
37.8	
45.8	
49.8	

(1)

- (b) **Figure 3** shows the beam bending when a hanger of mass 0.050 kg is suspended from the midpoint.



The microscope is refocused on the upper surface and the new vernier reading R is recorded. The vertical deflection s of the beam is equal to $(R - R_0)$.

The total mass m suspended from the beam is increased in steps of 0.050 kg. A value of s is recorded for each m up to a value of $m = 0.450$ kg. Further values of s are then recorded as m is decreased in 0.050 kg steps until m is zero.

Student **A** performs the experiment and observes that values of s during unloading are **sometimes** different from the corresponding values for loading.

State the type of error that causes the differences student **A** observes.

(1)

- (c) Student **B** performs the experiment using a thinner beam but with the same width and made from the same material as before.

Discuss **one** possible advantage and **one** possible disadvantage of using the thinner beam.

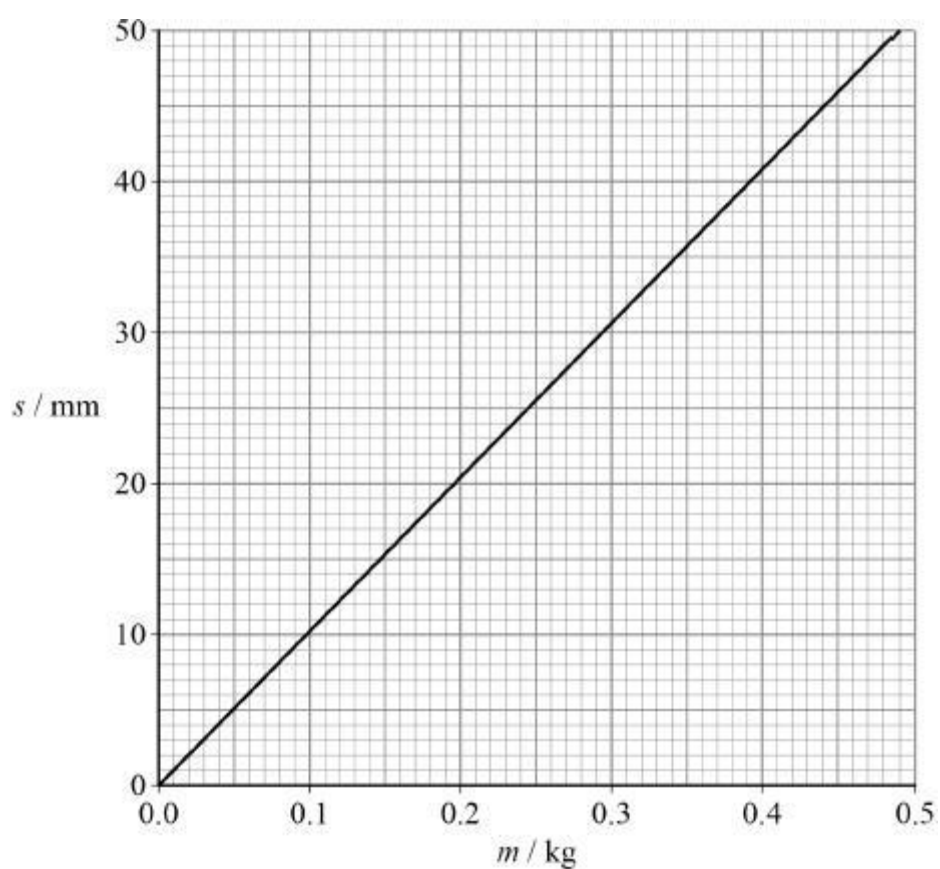
Advantage _____

Disadvantage _____

(3)

- (d) **Figure 4** shows the best-fit line produced using the data collected by student A.

Figure 4



It can be shown that $s = \frac{\eta m}{E}$

where E is the Young modulus of the material of the beam and η is a constant.

Deduce in s^{-2} the order of magnitude of η .

$$E = 1.14 \text{ GPa}$$

- (e) Student **C** performs a different experiment using the same apparatus shown in **Figure 1**. A mass M is suspended from the midpoint of the beam. The vertical deflection s of the beam is measured for different values of L .

Figure 5 shows a graph of the results for this experiment.

Figure 5

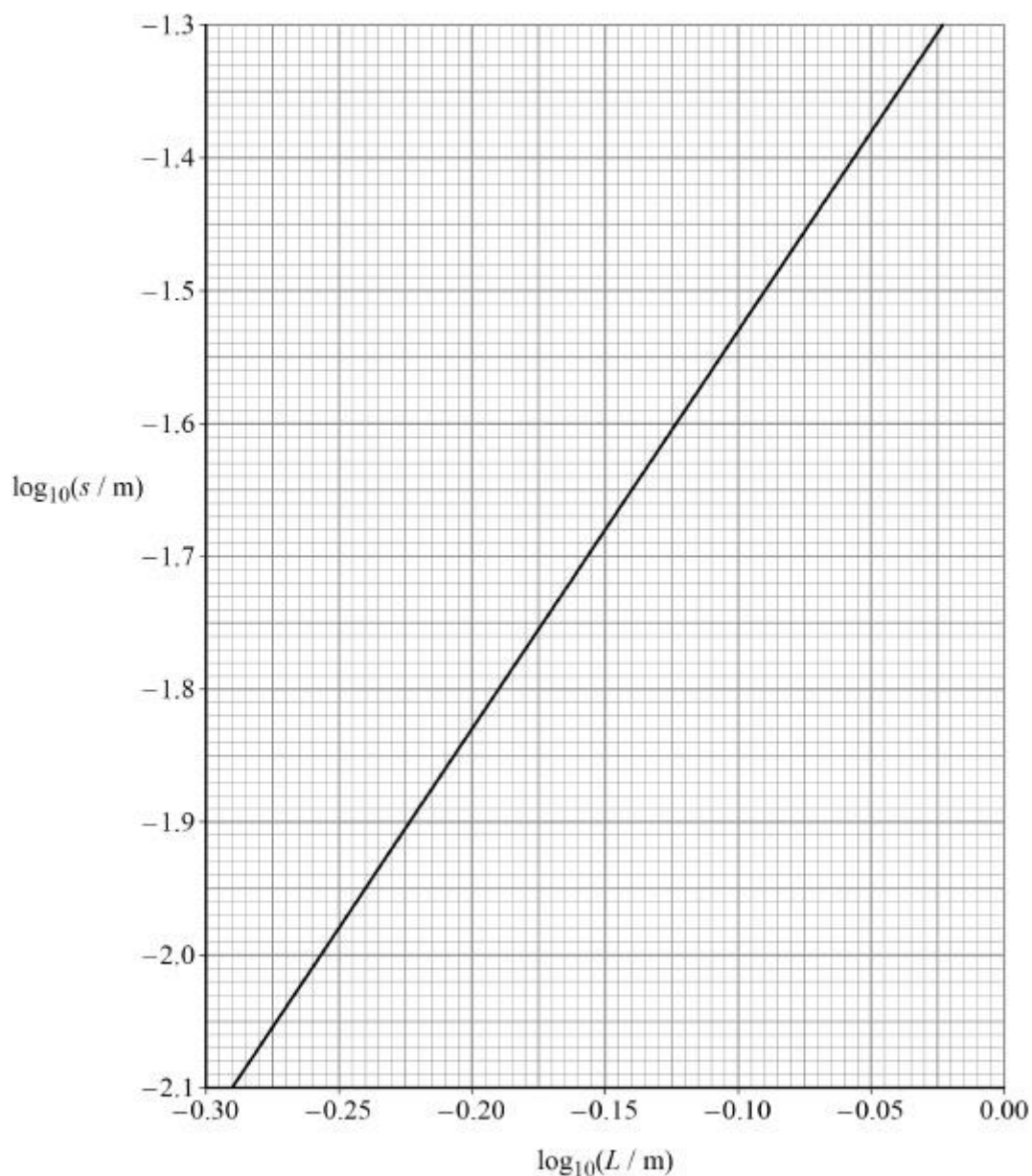


Figure 5 shows that $\log_{10}(s / \text{m})$ varies linearly with $\log_{10}(L / \text{m})$.

State what this shows about the mathematical relationship between s and L . You do **not** need to do a calculation.

(1)

- (f) Deduce, using **Figure 5**, the value of s when $L = 80$ cm.

$$s = \text{_____} \text{ m}$$

(2)

- (g) Determine M using **Figure 4**.

$$M = \text{_____} \text{ kg}$$

(1)

(Total 13 marks)

Q2.

- (a) Draw a ray diagram for a Cassegrain telescope.
Your diagram should show the paths of **two** rays up to the eyepiece lens.
The rays should initially be parallel to the principal axis.

_____ principal axis

(2)

- (b) A spacecraft passes Pluto at a distance of 12 500 km. The telescope on board has an aperture of diameter 0.21 m and operates at a wavelength of 450 nm.

Discuss whether this telescope is suitable for studying a crater with a diameter of approximately 1 km on Pluto.

(3)

(c) The Hubble telescope has an aperture of diameter 2.4 m.

Compare the collecting power of the Hubble telescope with the telescope on the spacecraft in part (b).

(2)

(d) An astrophysicist had to decide whether to use a reflecting telescope or a refracting telescope on the spacecraft in part (b).

Discuss which type of telescope to use.
