Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section A(Practical Skills Set-1)

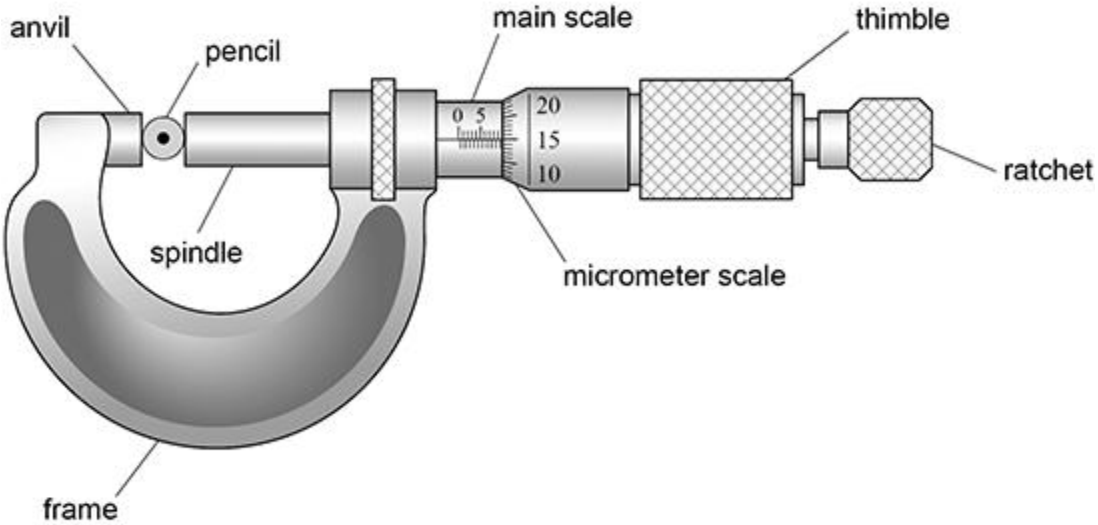
Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

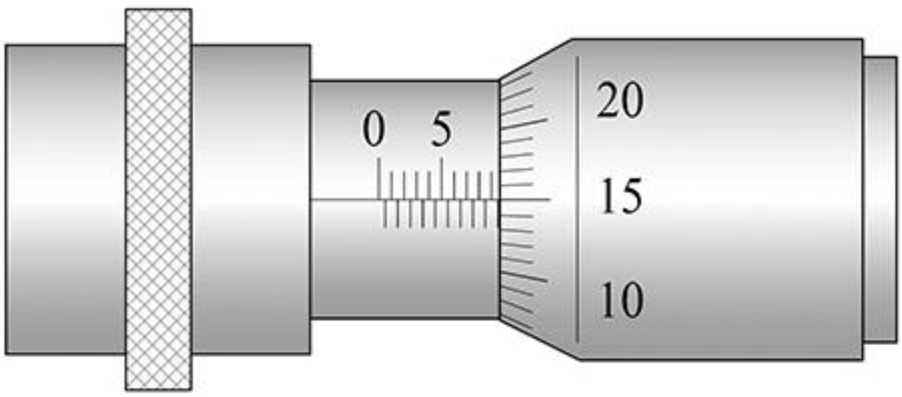
Name of the Student:____

Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

The figure below shows a micrometer screw gauge used to measure the diameter of a pencil.





main scale and micrometer scale
shown enlarged

(a) State the reading on the micrometer.

reading = _______________ unit = __________

(1)

(b) The micrometer has a zero error.

Describe how to determine an accurate measurement for the diameter of the pencil using this micrometer.

____

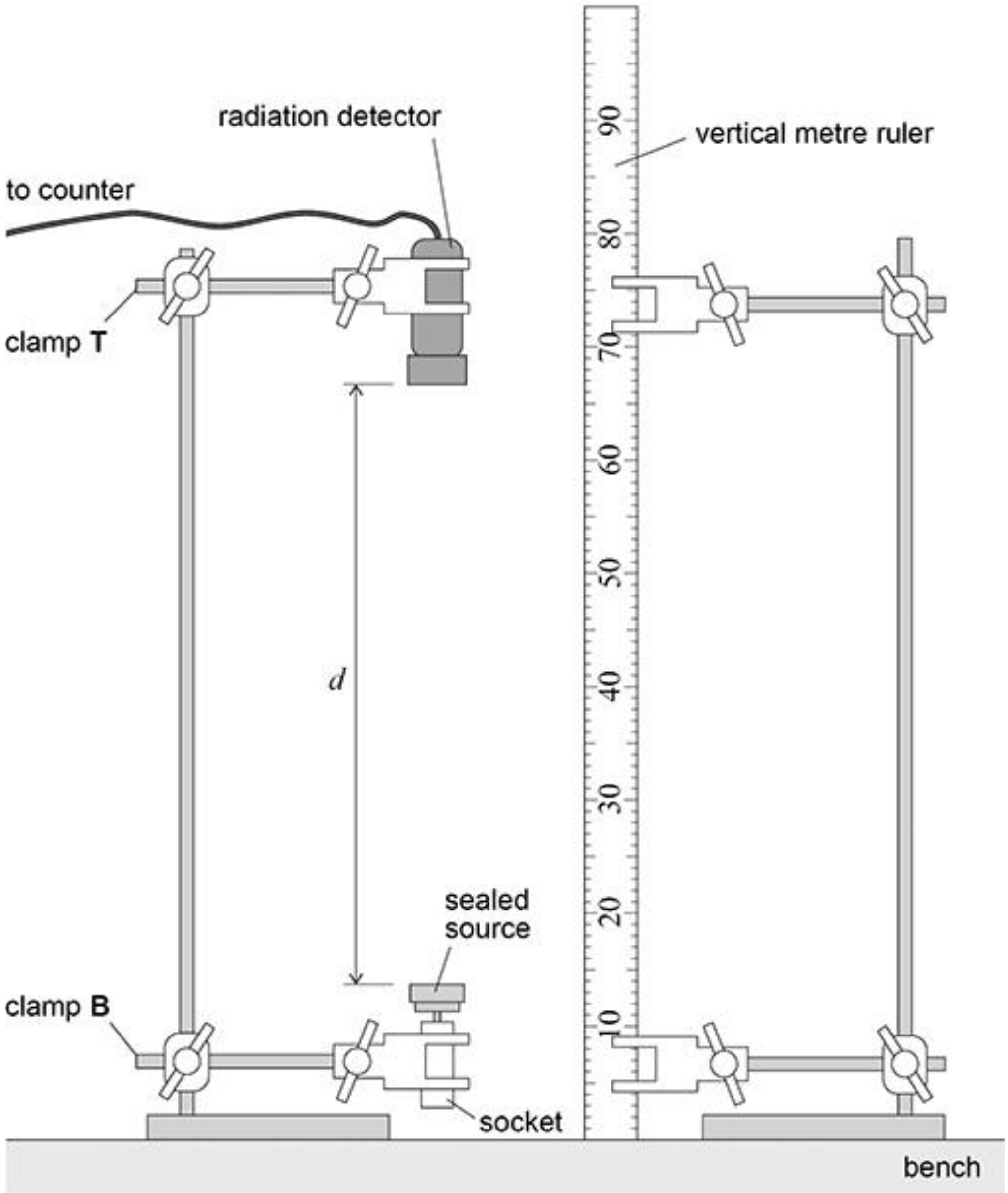
(2)

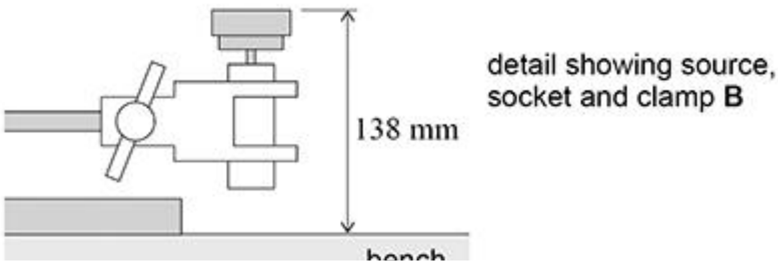
(Total 3 marks)

Q2.

Figure 1 shows apparatus used to investigate the inverse-square law for gamma radiation.

Figure 1





A sealed source that emits gamma radiation is held in a socket attached to clamp **B**. The vertical distance between the open end of the source and the bench is 138 mm. A radiation detector, positioned vertically above the source, is attached to clamp **T**.

A student is told **not** to move the stands closer together.

(a) Describe a procedure for the student to find the value of d, the vertical distance between the open end of the source and the radiation detector.

In your answer, annotate above the figure to show how a set-square can be used in this procedure.

(2)

(b) Before the source was brought into the room, a background count C_b was recorded.

C_b = 630 counts in 15 minutes

With the source and detector in the positions shown in the figure above, d = 530 mm. Separate counts C_1, C_2 and C_3 are recorded.

C_1 = 90 counts in 100 s
C_2 = 117 counts in 100 s
C_3 = 102 counts in 100 s

R_C is the mean count rate corrected for background radiation.

Show that when d = 530 mm, R_C is about 0.3 s^{-1}.

(2)

(c) The apparatus is adjusted so that d = 380 mm.
Counts are made that show R_C = 0.76 s^{-1}.

The student predicts that:

$$R_C = \frac{k}{d^2}$$

where k is a constant.

Explain whether the values of R_C in parts (b) and (c) support the student's prediction.

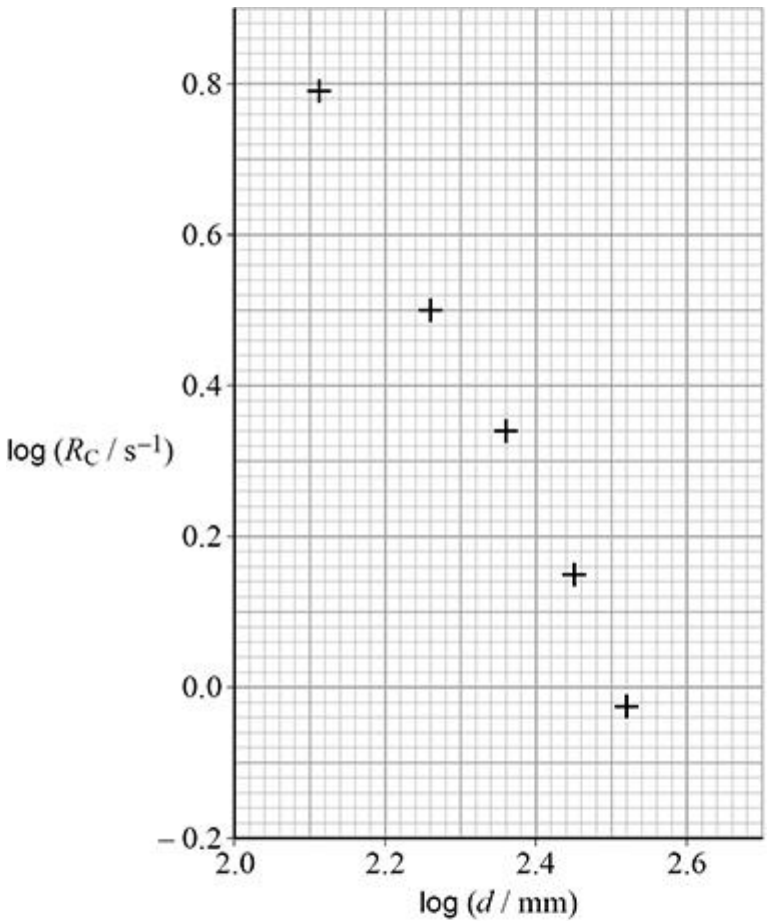
(2)

(d) Describe a safe procedure to reduce d. Give a reason for your procedure.

(2)

The student determines R_C for further values of d.
The values of d change by the same amount Δd between each measurement.
Figure 2 shows these data.

Figure 2



(e) Determine Δd.

Δd = _______________ mm

(2)

(f) Explain how the student could confirm whether the graph above supports the prediction:

$$R_C = \frac{k}{d^2}$$

No calculation is required.

____

____

____

____

____

____

____

____

____

(3)

When a gamma photon is detected by the detector, another photon cannot be detected for a time t_d called the dead time.

It can be shown that:

$$t_d = \frac{R_2 - R_1}{R_1 \times R_2}$$

where R_1 is the measured count rate
R_2 is the count rate when R_1 is corrected for dead time error.

(g) The distance between the source and the detector is adjusted so that d is very small and R_1 is 100 s^{-1}.
On average, two of the gamma photons that enter the detector every second are not detected.

Calculate t_d for this detector.

t_d = ________________ s

(1)

(h) A student says that if 100 gamma photons enter a detector in one second and t_d is 0.01 s, all the photons should be detected.

Explain, with reference to the nature of radioactive decay, why this idea is **not** correct.

____

____

____

____

____

____

(2)

(Total 16 marks)