Sec 3 Physics Practical 01
Measurement of Length
Marking Scheme

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1. Half-metre rule: (About 1.6 cm)

Diameter d recorded to zero d.p in mm / 1 d.p in cm / 3 d.p in m with correct unit.

2. Digital Calipers (About 1.60 cm)

Table of **d**
- All readings and average consistently tabulated to 2 d.p in cm.
- Values are accurate.

3. Micrometer Screw Gauge (About 1.651 cm)

Table of **d**
- All readings tabulated to 3 d.p in **cm**.
- Values are accurate.

4. Tabulation of data (object A: a white acrylic block)

- 2.0 cm x 1.5 cm x 0.6 cm
- OR 2.2 cm x 1.3 cm x 0.8 cm
- Values recorded to correct d.p.
- Values of **V** recorded to the correct number of s.f. E.g. 3 (should be minimum 2 sf), 2.1 and 2.13
- Values calculated are accurate.

Object	Measuring Instrument	*l* / cm	*b* / cm	*h* / cm	*V* / cm^3
A	Half-metre rule	2.2	0.7	1.4	**2.2**
A	digital calipers	2.20	0.73	1.37	**2.2**
A	digital micrometer screw gauge	2.199	0.725	1.376	**2.19**

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Note that for any given measuring instrument (such as the Digital Calipers circled above) the readings will always have the **same number of d.p.**. It is determined by the instrument being used.

Object	Measuring Instrument	*l* / cm	*b* / cm	*h* / cm	*V* / cm^3
A	Half-metre rule	2.2 2 s.f.	0.7 1 s.f.	1.4 2 s.f.	**2.2** **2 s.f.**
A	digital calipers	2.20 3 s.f.	0.73 2 s.f.	1.37 3 s.f.	**2.2** **2 s.f.**
A	digital micrometer screw gauge	2.199 4 s.f.	0.725 3 s.f.	1.376 4 s.f.	**2.19** **3 s.f.**

The final column of values are obtained from calculations. They will be following the lowest number of s.f. of the values used to calculate them.

e.g. 2.199 x 0.725 x 1.376 = 2.193722…

But as this is calculated from multiplying a (4 s.f. number) by a (3 s.f. number) by a (4 s.f. number) we will only state it to 3 s.f. (ie the lowest s.f. of the numbers).

For the half-metre rule, although the loest s.f. of a value is 1 s.f., we still give the answer to 2 s.f., as we will never round off a number to one s.f.

Questions :

1 The one calculated with measurements made by the digital micrometer screw gauge is most precise.

It has the most s.f. OR it has the least measurement uncertainty in its value.

2 Object may not be of uniform length / breadth / height
hence the measured values may not reflect the average value
OR
There may be human judgment error in estimating the length of the object, as the markings on the ruler are visually large,
thus the measured values for *l*, b and h would all have some random errors

3 Take more readings (at different points along each side) and calculate the average.