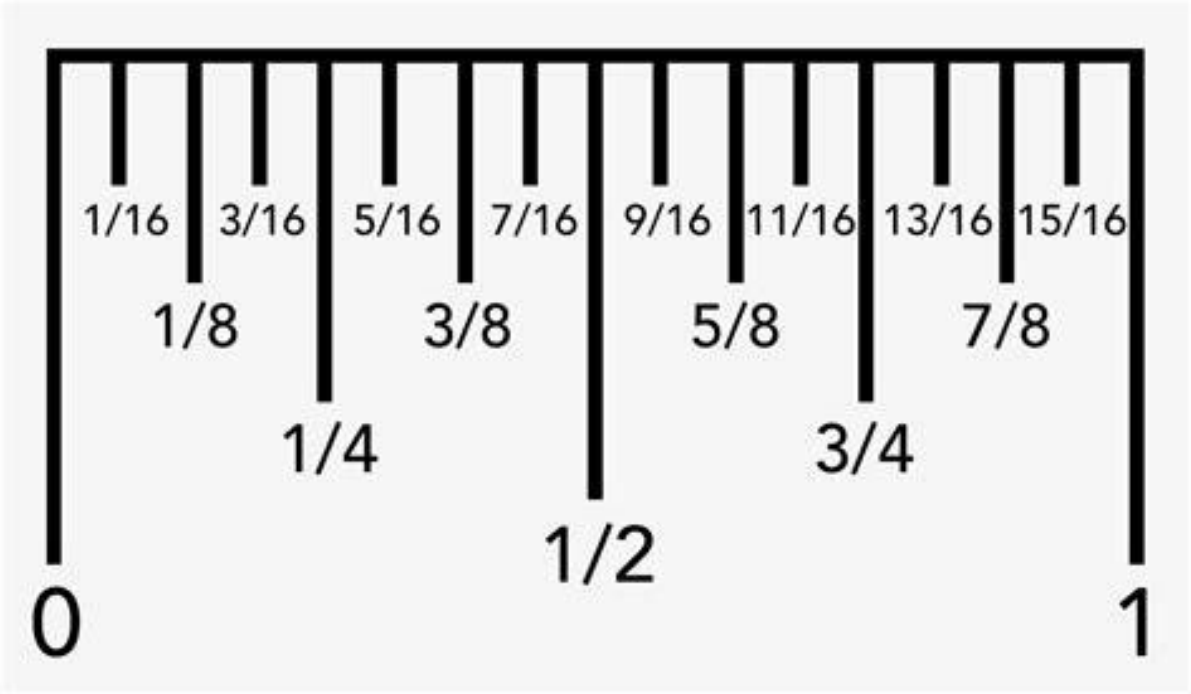
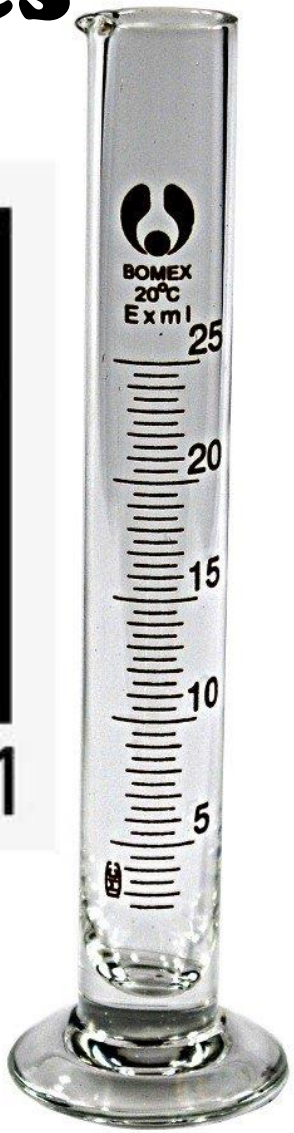
[5.4] Reading Scales and Experimental Uncertainty

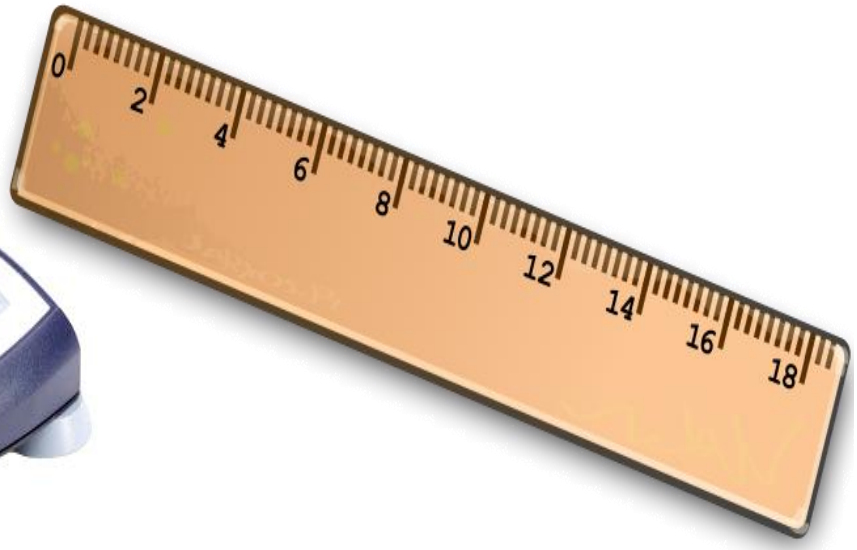
Reading Scales

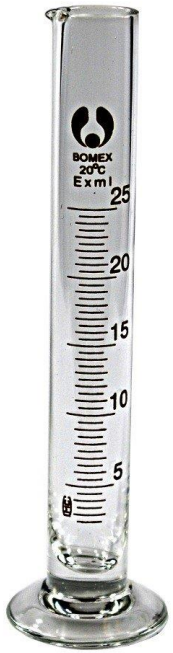




Scales

- Scales are **laboratory equipment** that provides us meaningful information about a certain substance being studied
- All scales provide information in a different way and it is important to be able to read scales appropriately

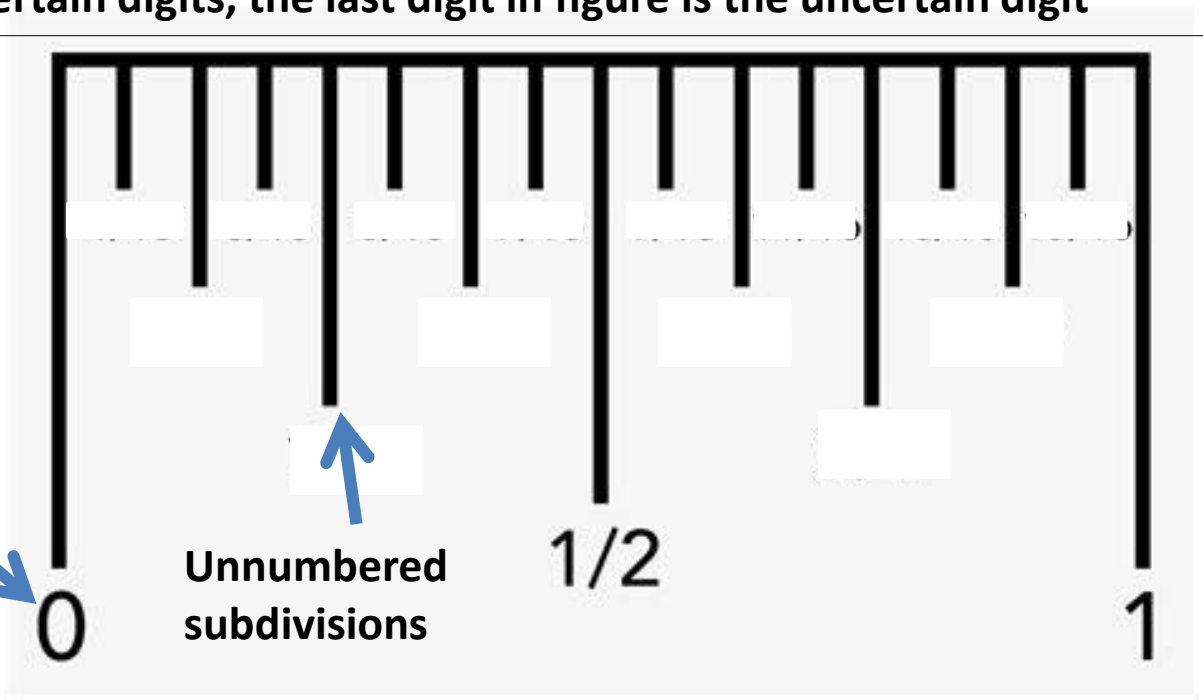




Reading and Recording

- In reading and recording measurements of **experimental values:**
- **the # of significant figures = # of certain digits + 1st uncertain digit**

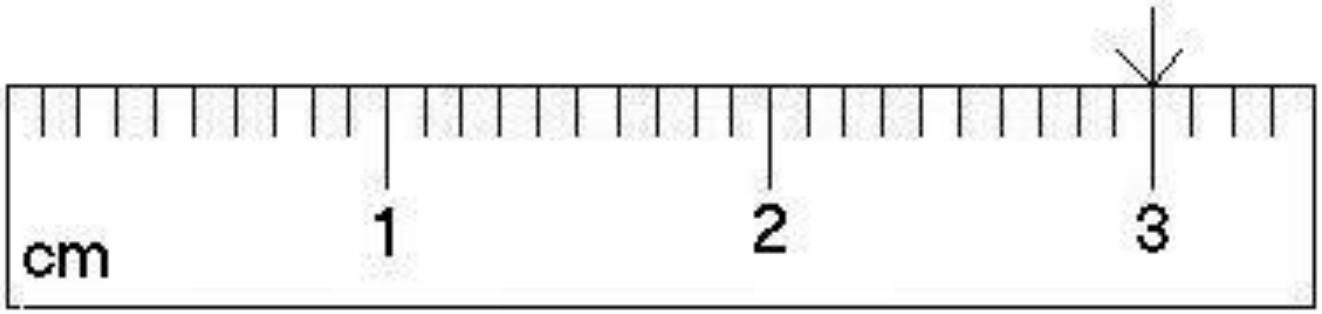
Both the numbered subdivisions and unnumbered subdivisions are called certain digits, the last digit in figure is the uncertain digit



Reading and Recording

- What is the number of significant figures in the following rulers?

- What is the uncertain digit?



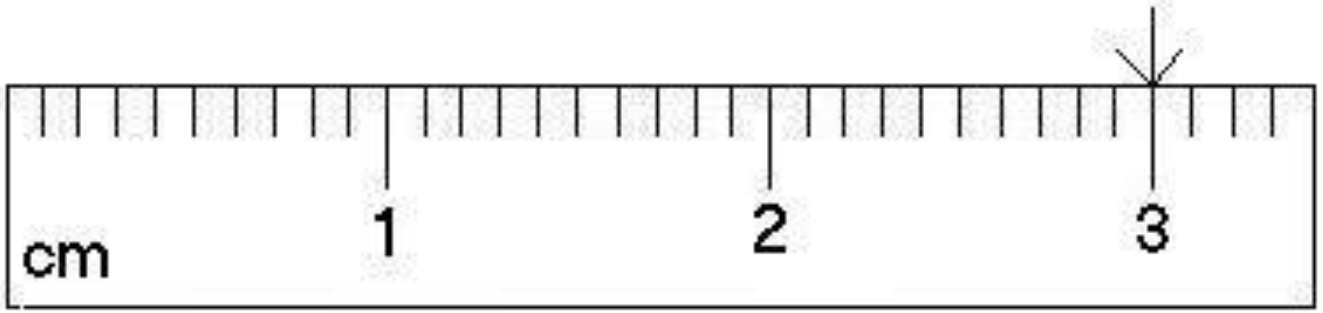
Practice Reading and Recording

- What is the number of significant figures in the following rulers?

3.00 cm

- What is the uncertain digit?

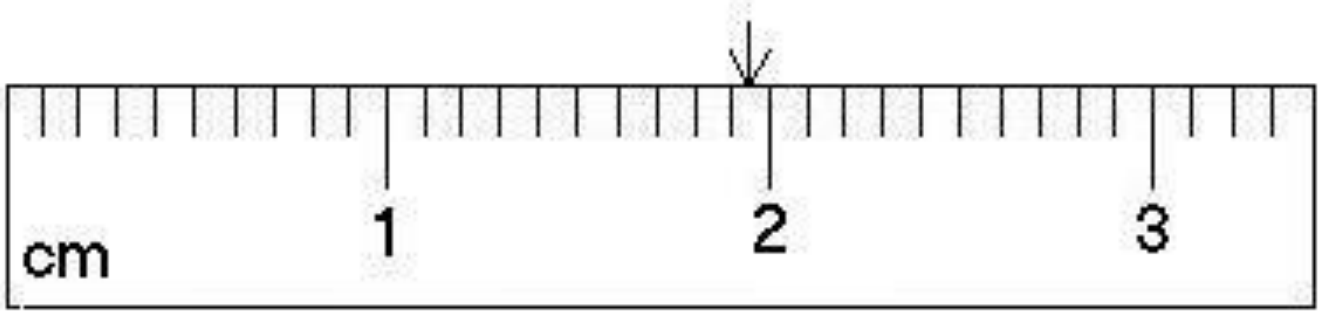
0



Practice Reading and Recording

- What is the number of significant figures in the following rulers?

- What is the uncertain digit?



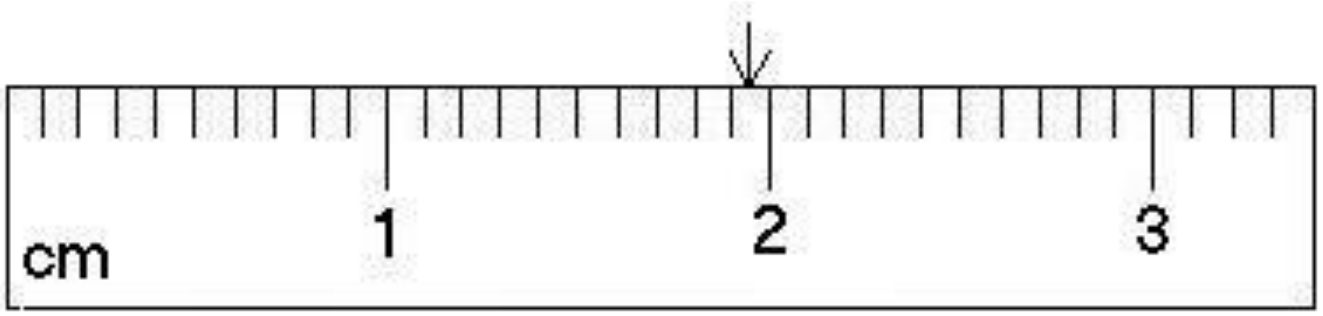
Practice Reading and Recording

- What is the number of significant figures in the following rulers?

1.95 cm

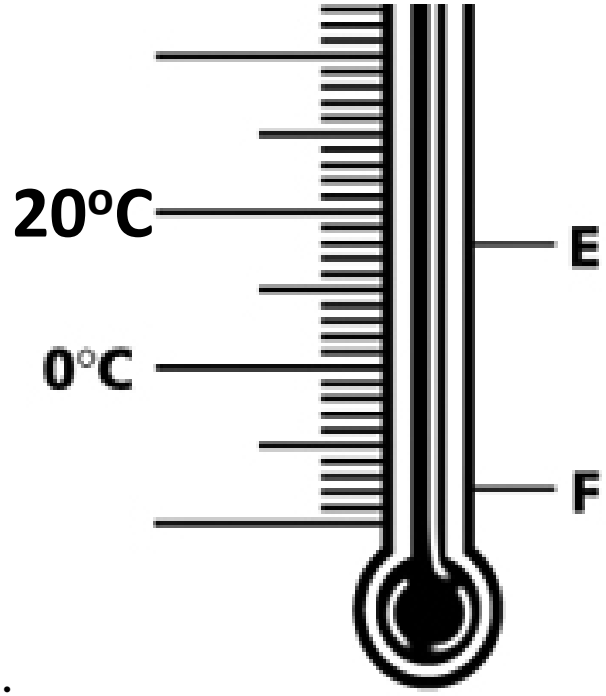
- What is the uncertain digit?

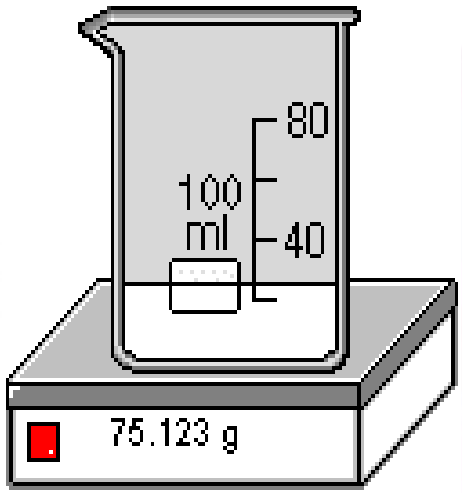
5

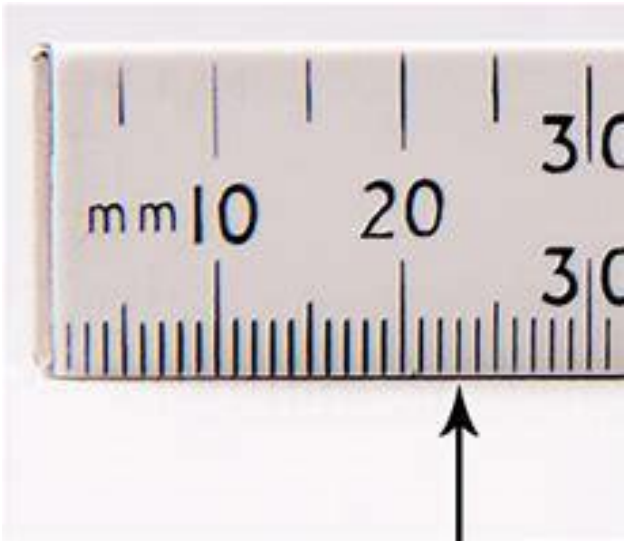


Practice Reading and Recording

For the following: write down the value then circle the digit that is uncertain.





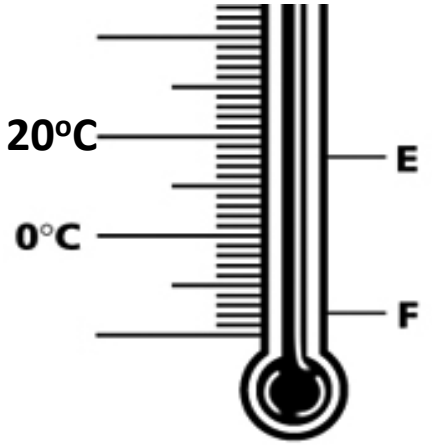


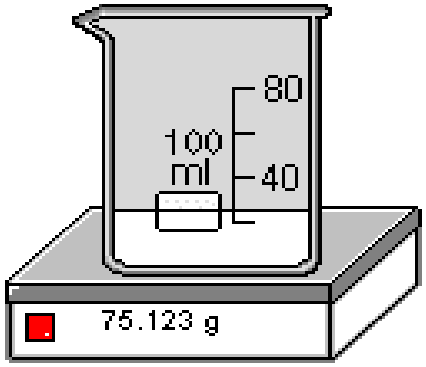
E: _____

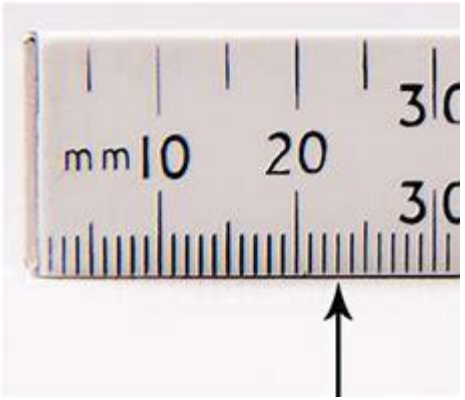
F: : _____ _____ _____

Practice Reading and Recording

For the following: write down the value then circle the digit that is uncertain.





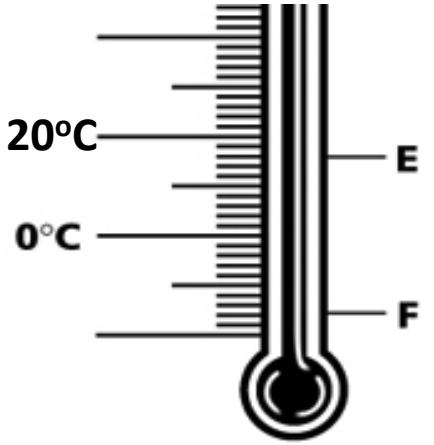


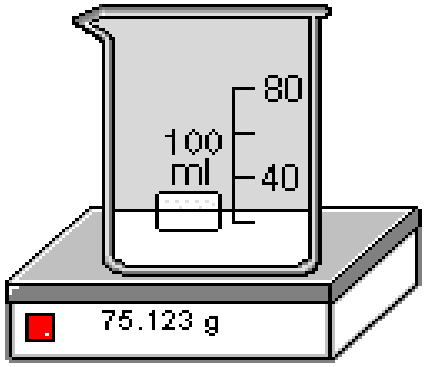
E: **16.0 °C**

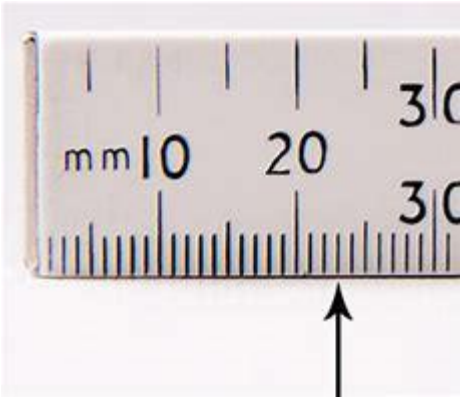
F: : **-14.5 °C** **75.123 g** **23.0 mm**

Practice Reading and Recording

For the following: write down the value then circle the digit that is uncertain.







E: 16.0 °C

F: : -14.5 °C

75.123 g

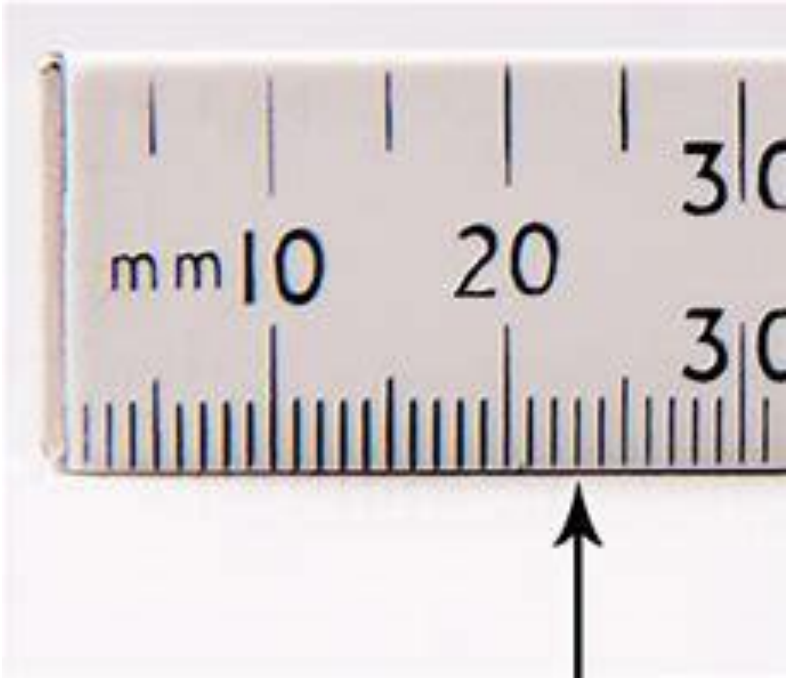
23.0 mm

Experimental Uncertainty

- **Experimental uncertainty** - the **<u>estimated</u>** amount by which a measurement might be in error.

- The uncertainty goes **between the number and the unit**.
- Eg. 23.00 ±0.01 mm

- **Note: experimental uncertainty and the uncertain digit should be in agreement to the same place**



Experimental Uncertainty

For each of the following measurements state the measurement with its uncertainty

- A ruler has an uncertainty of 0.01 cm. The measurement reads 12.28 cm:

_____

- A burette has an uncertainty of 0.02 mL. It reads 25.45 mL.

_____

Experimental Uncertainty

For each of the following measurements state the measurement with its uncertainty

- A ruler has an uncertainty of 0.01 cm. The measurement reads 12.28 cm:

  12.28 ± 0.01 cm

- A burette has an uncertainty of 0.02 mL. It reads 25.45 mL.

  25.45 ± 0.02 mL

Range

- **Range -** A range includes the set of possible values in a measurement.

- Range: Expressed as the **lowest value & unit** to the **highest value & unit**.
- Eg. **25.10 cm -25.25 cm**

Range

For each of the following measurements state the measurement as a range.

- A ruler has an uncertainty of 0.01 cm. The measurement reads 12.28 cm.

  Range: _____

- A 10 mL burette has an uncertainty of 0.02 mL. It reads 25.45 mL.

  Range: _____

Range

For each of the following measurements state the measurement as a range.

- A ruler has an uncertainty of 0.01 cm. The measurement reads 12.28 cm.

  Range: 12.27 cm - 12.29 cm

- A 100 mL burette has an uncertainty of 0.02 mL. It reads 25.45 mL.

  Range: 25.43 mL - 25.47mL

Precision

- **Precision** describes the **reproducibility** of a result
- If you measure a quantity **several times and get the same answer**, it is precise
- Precise measurements also have **more significant digits**

precise,
but not accurate

accurate,
but not precise

precise
and
accurate

Accuracy

- **Accuracy** describes how close a measured value is to the "**true**" value.
- If a known standard is available, accuracy is how close your value is to the known value.

HOMEWORK

Textbook :

- **p. 29 #44 - 46**
- **p. 32 #48 (ii and iii),**
- **p. 33 #49,**
- **p. 34 #50,**
- **p. 35-36 #51-52**