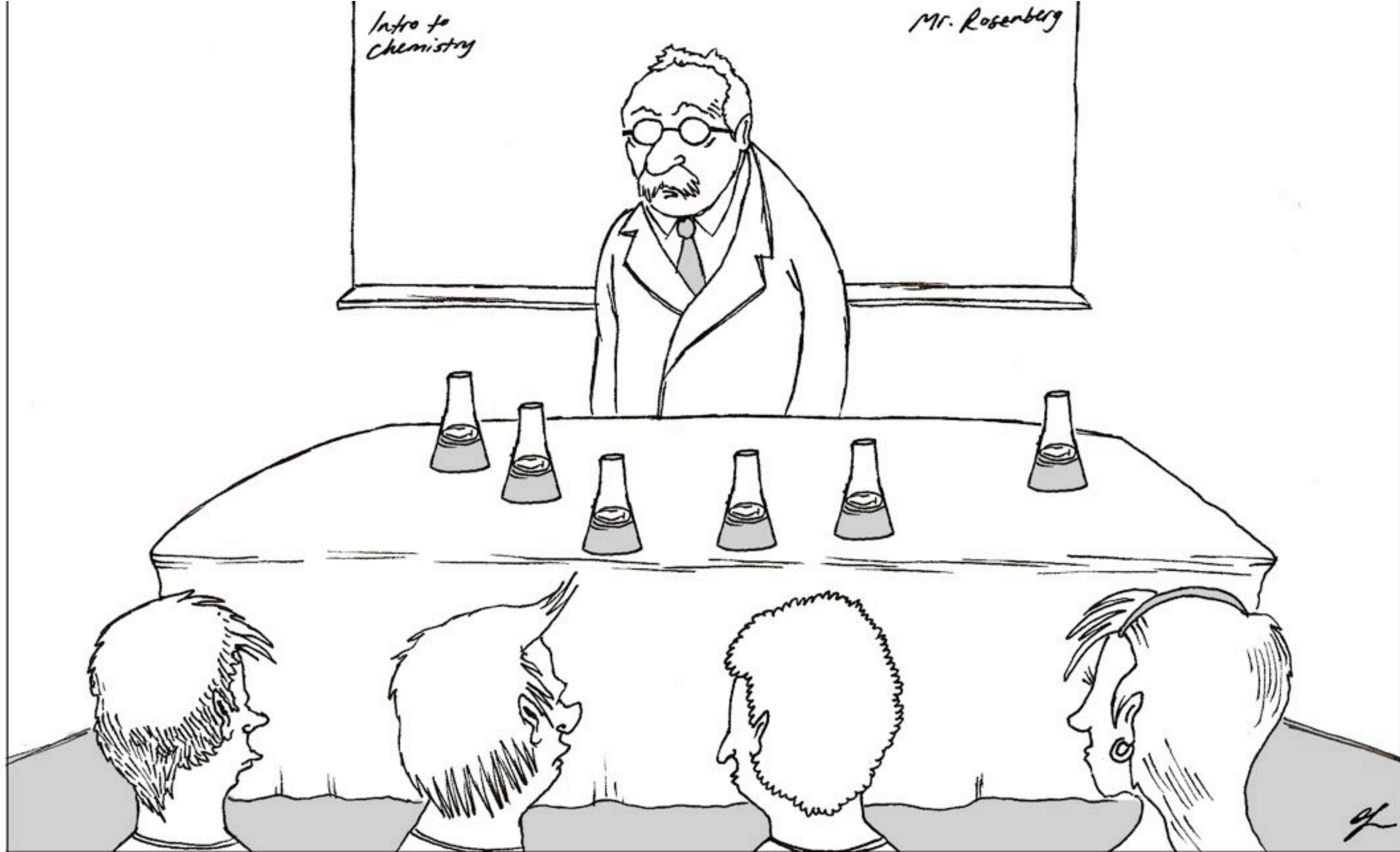# Measurement & Data Processing

Unit 1 - IB Material

"Good morning, class. Today we'll be studying some of the chemicals that three of your desks have been pre-treated with. Put your heads down at your own peril."

- In science experiments, is it ever possible to have results that are 100% accurate? Why or why not?

- If your results are not accurate, how do you record that in your data?
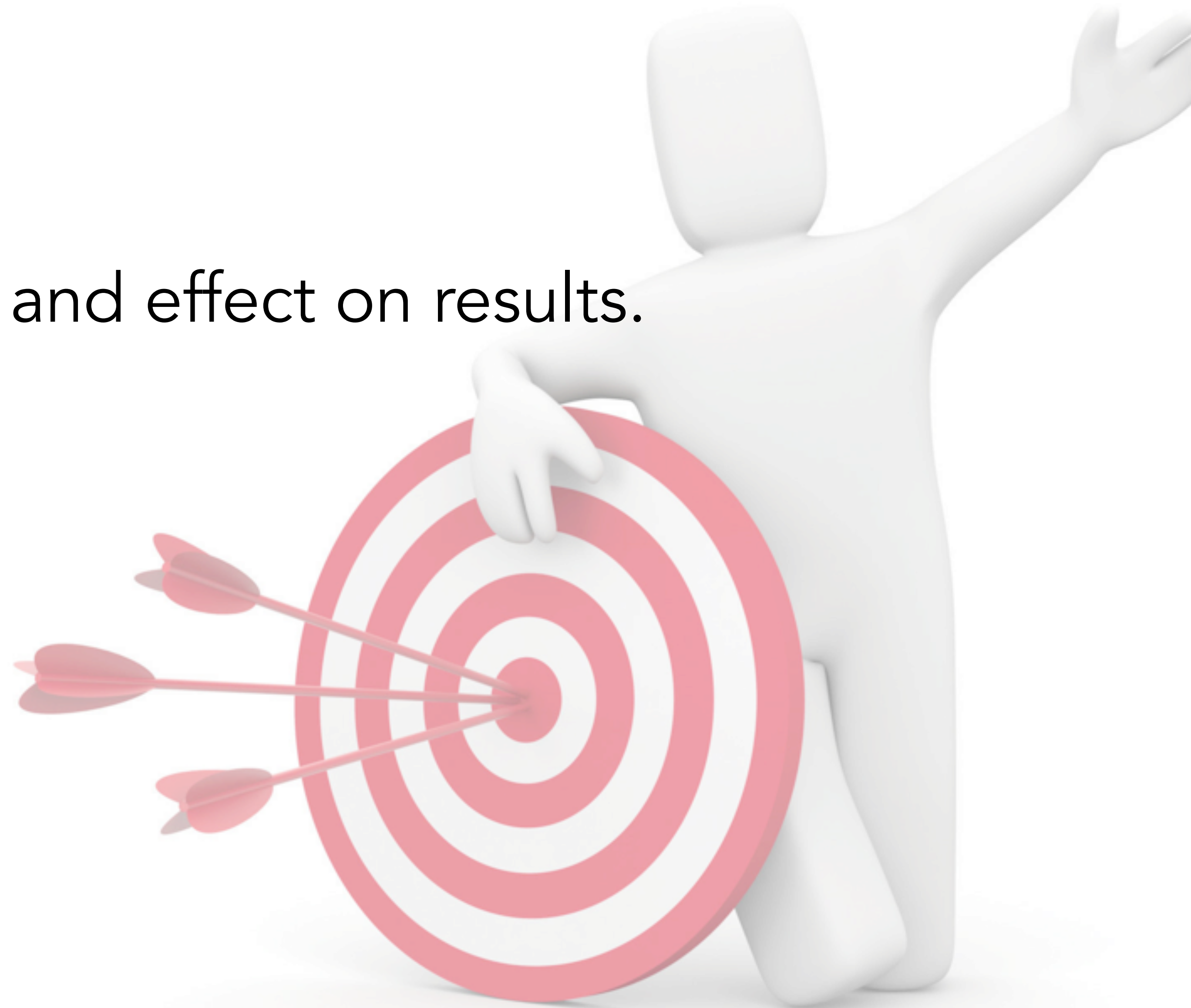
Units of Measure

NY Regents	IB
mL	cm^3
L	dm^3
mol/L	$mol\ dm^{-3}$

Error & Uncertainty

- Error is ALWAYS present.

- We need to assess magnitude and effect on results.

- Accuracy vs. Precision

- Systematic vs. Random Error

Accuracy

- The accuracy of a result is a measure of how close the result is to an accepted literature value. (*How close to Perfect*)

$$\text{Percentage deviation} = \left| \frac{\text{Experimental value} - \text{Accepted value}}{\text{Accepted value}} \right| \times 100$$
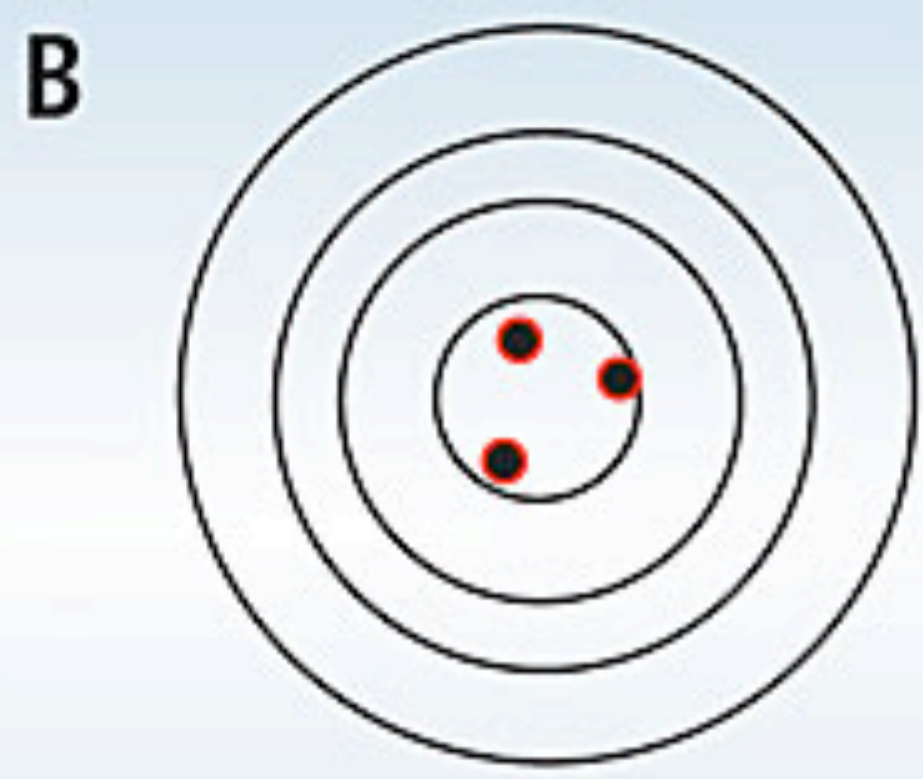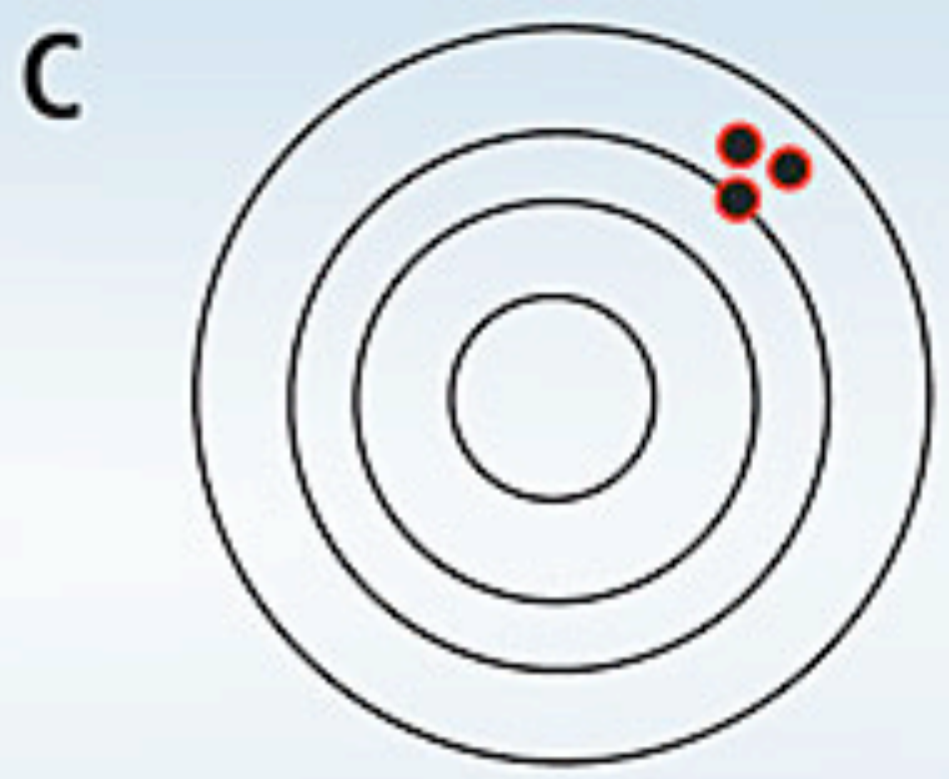
Precisio

○ The precision is a me

Precision

- How close the repetitions will be to each other. (Repeatable)
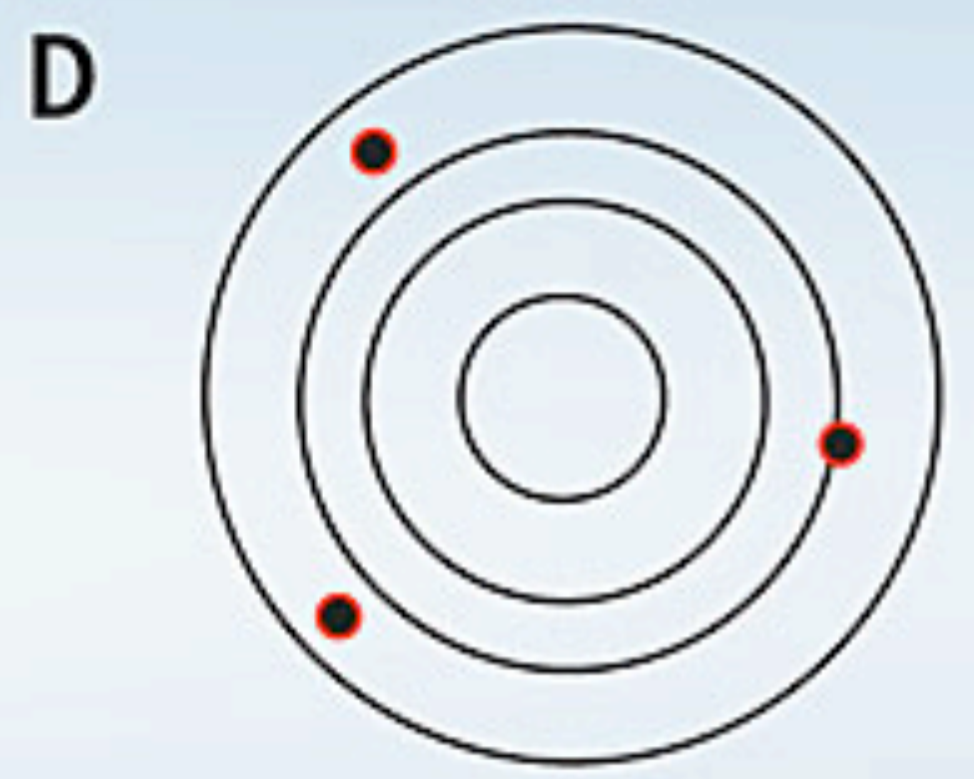
Random Uncertainties

- Limitations of the instrument or the way a measurement is made.

- Make a measurement less precise, but *not in any particular direction.*

- Written as an uncertainty range (42.20 ± 0.05 cm³)

- 43.6, 43.5, or 43.7 mL?

- We are saying that the value is closer to 43.6, but not quite 43.65 mL, so we should record our value to be 43.65 ± 0.05 mL.
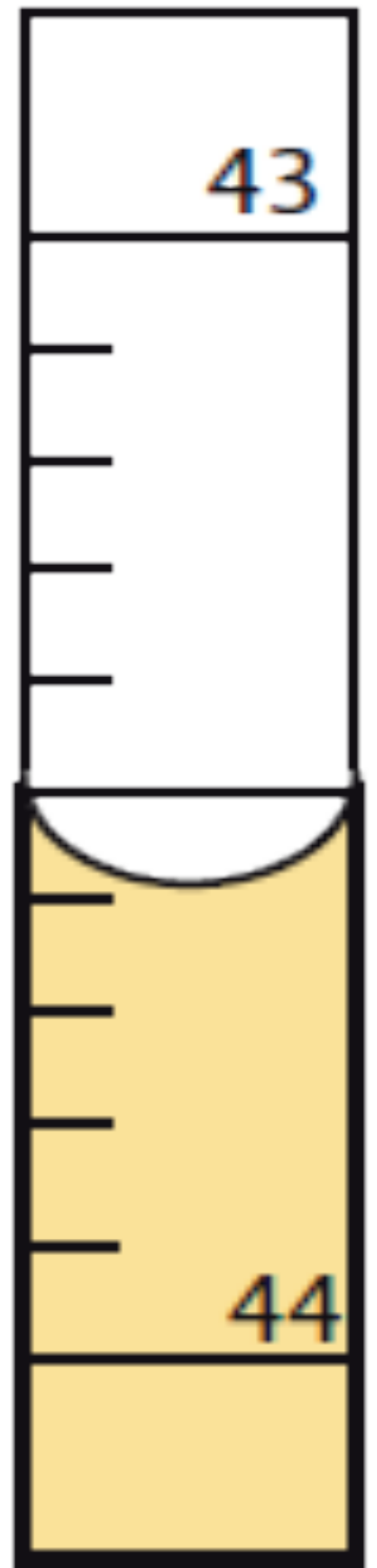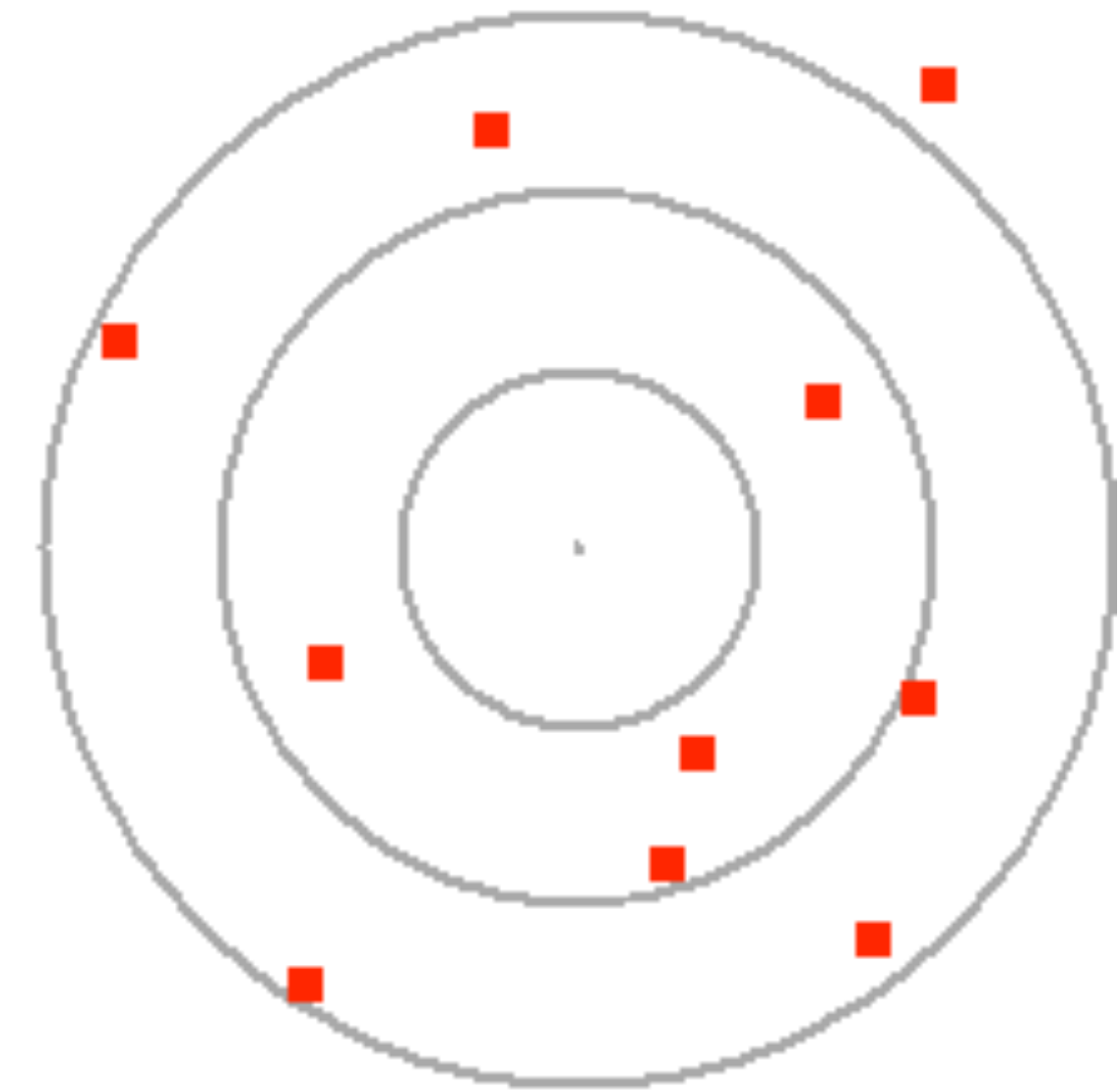
Systematic Uncertainties

- Due to identifiable causes. Instrument error.

- Always affect error in a particular direction (smaller or larger).

- Cannot be reduced by repeating readings.
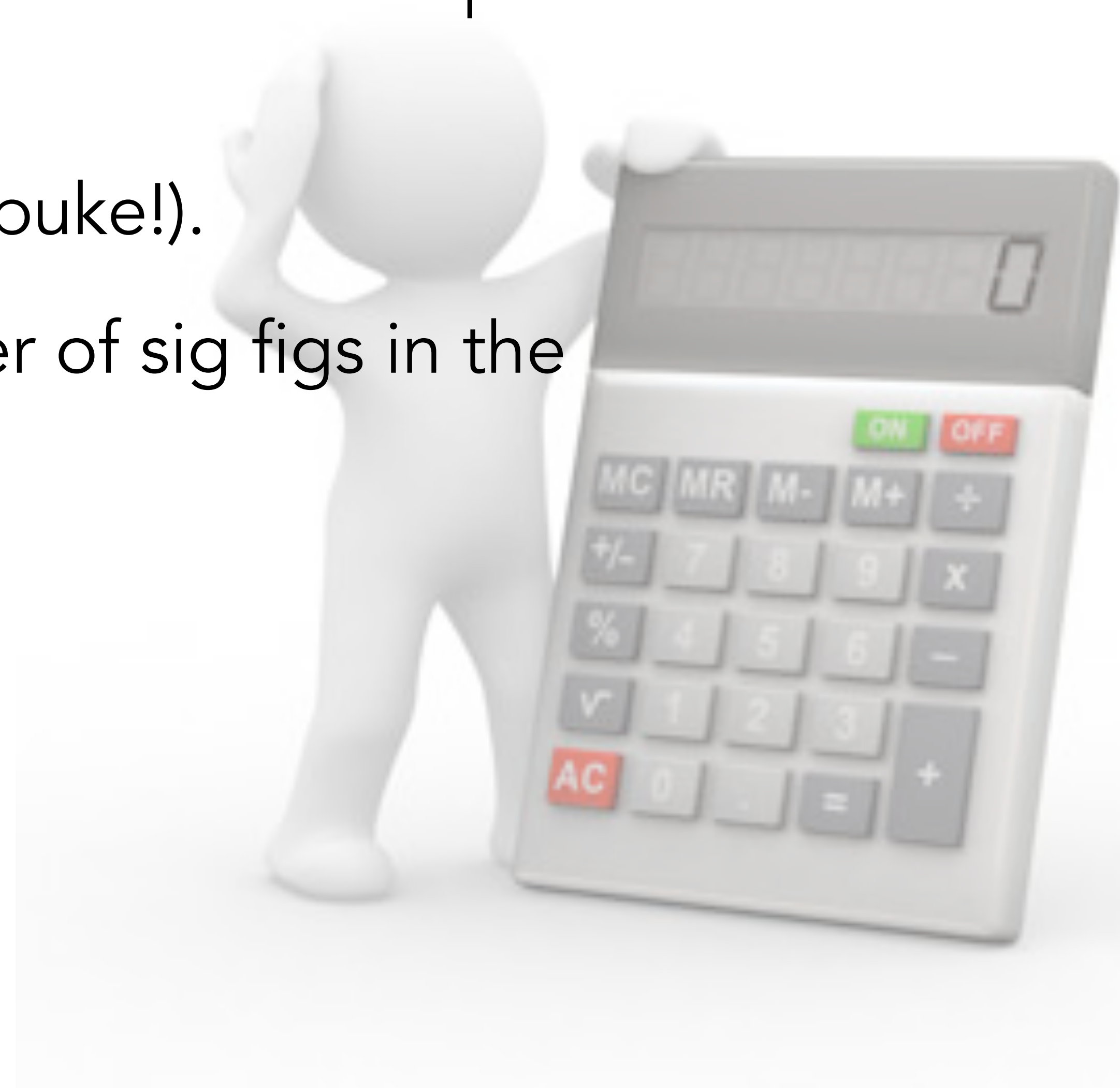
- Measure of **Accuracy**.
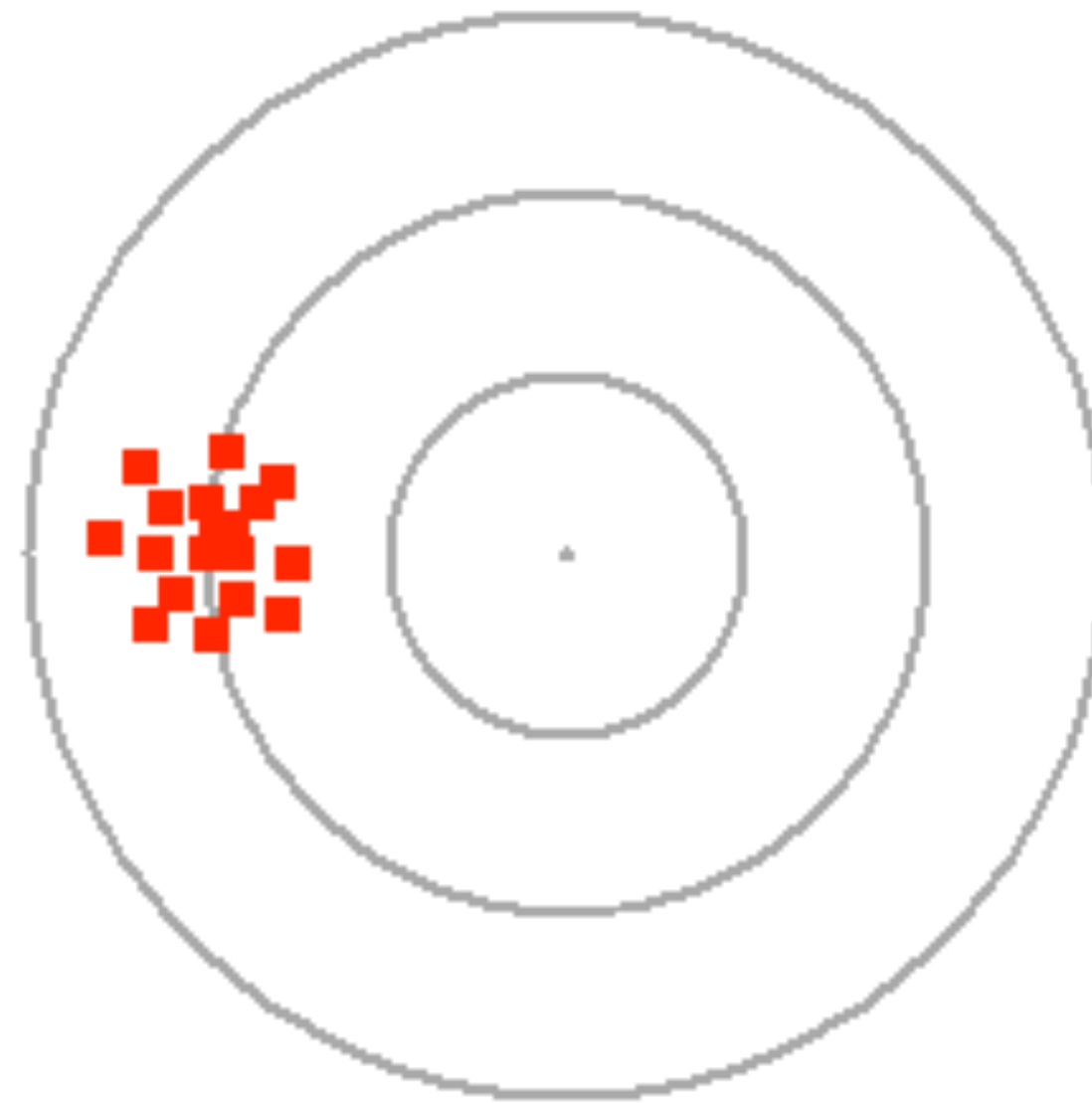
Systematic Error

Random Error

Uncertainties in Calculated Results

Addition / Subtraction

- Calculated value cannot be more precise than the least precise quantity used in the calculation.

- 7.939 + 6.26 + 11.1 = 25.299 (calculator puke!).

- Answer should be 25.3 due to the number of sig figs in the problem.

Uncertainties in Calculated Results

Multiplication / Division

- The number of sig figs in the final calculated value will be the same as that of the quantity with the **fewest** number of sig figs used in the calc.

- (27.2 x 15.63)/1.846 = 230.3011918 (calculator puke). Answer should be 230. due to sig figs (rounded down).