Significant Figures (Precision) in Volume Measurements

- 250-mL volumetric flasks: As printed on them, most of them have the volume uncertainty of ±0.12 mL or ±0.24 mL, depending on a manufacturer. This means the volume error is in the first decimal place. Therefore, any time you fill this flask to the mark, you can assume that you have **250.0 mL** (where the last zero is still significant but already uncertain).

- 100-mL volumetric flasks: Some of them have the volume uncertainty of ±0.16 mL. Some others have ±0.08 mL but we will consider that this is sufficiently close to ±0.1 mL. This means the volume error is in the first decimal place. Therefore, any time you fill this flask to the mark, you can assume that you have **100.0 mL** (where the last zero is still significant but already uncertain).

- 25-mL volumetric pipets: Most of them have the volume uncertainty of ±0.03 mL. This means the volume error is in the second decimal place. Therefore, any time you fill this pipet to the mark, you can assume that you have **25.00 mL** (where the last zero is still significant but already uncertain).

- 10-mL volumetric pipets: Similarly, **10.00 mL**.

- 50-mL burets: Precision is determined by your ability to visually divide the gap between the nearest ticks. In these burets the nearest ticks are 0.1 mL apart, and you can visually divide the gap by 5 steps, thereby estimating the level to **0.02 mL** increments. Record your volumes with **two decimal places**, e.g. 5.42 mL, or 18.42 mL, or 18.40 mL.

- Graduated cylinders: Precision is determined by your ability to visually divide the gap between the nearest ticks. For example, a small 10-mL graduated cylinder has its nearest ticks 0.2 mL apart, and they are very close visually. Because of that, you can visually divide this gap by 2 steps, thereby estimating the level to **0.1 mL** increments. Therefore, for the 10-mL cylinder, record your volumes with one decimal place, e.g. 5.1 mL, or 5.0 mL. Larger graduated cylinders will be even less precise, that is why they are rarely used for analytical measurements.