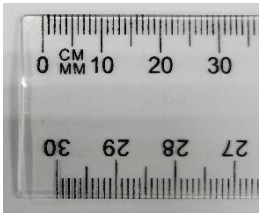
Motion, forces and energy

P1.1 Physical quantities and measurement techniques

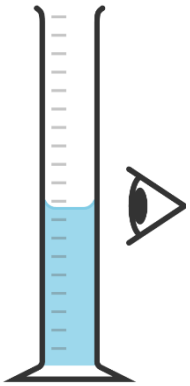
Measuring Length and Volume

Rulers



- Place ruler flat against object. Read from zero mark (not end of the ruler).
- Keep eye level with scale to avoid parallax error.
- Record to nearest mm (0.1 cm).

Measuring Cylinders



- Place on flat surface. Read volume at the bottom of the meniscus (the curve of the liquid).
- Eye level must be horizontal with the liquid level.

Measuring Time Intervals

Clocks / Stopwatches

- Analogue clocks - read in minutes/seconds.
- Digital timers - more precise, often to 0.01 s.
- Start / stop as close as possible to the event (reaction time can cause error).

  Examples of time intervals:
  - Time for an object to travel a set distance.
  - Reaction time tests.
  - Period of a pendulum (time for one complete swing).

Determining Average Values

- For short distances or times, single measurements may not be accurate. Instead, measure a multiple:
  - Distance: line up 10 ball bearings, measure and divide by 10. Measure a stack of 20 coins, then divide by 20.
  - Time: record time for 10 swings of a pendulum, then divide by 10.
- This reduces the effect of random error and makes the average more reliable.