An experiment should:

* Be valid. **V**ery (Valid)
* Be reliable. **R**eliable (Reliable)
* Have repeat trials to minimize random error. **R**abbits (Repeat trials)
* Identify and eliminate sources of random error. **R**ead (Random error)
* Be precise. **P**recisely and (Precise)
* Be accurate. **A**ccurately (Accurate)

Validity:

* A valid experiment **tests what it aims to test**.
* Was the experiment well designed?
* Does the experiment clearly show that one variable **caused** the change in another?

Reliability:

* A reliable experiment produces the **same results** that **can be replicated** by another observer in a different lab using the same experimental setup.
* A reliable experiment **returns to the same answer** regardless of who conducts the experiment and where it’s conducted.

Random error:

* Caused by **unknown and unpredictable changes** in an experiment.

Examples – **E**lectronic noise in the circuits of electronic equipment; **i**rregular changed in air pressure, temperature, humidity, etc in the experiment area; **p**arallax error (always viewing from a slightly different angle); **s**ampling (selecting a sample rather than testing the whole population); **e**stimating a value between graduations.

**P** Parallax error.

**I** Irregular changes.

**E** Electronic noises.

**S** Sampling.

**S** Estimating a value.

Systematic error:

* Usually caused by the **measuring equipment or experimental design**.

Examples – Incorrectly zeroing a scale and parallax error (constantly viewing from the same angle).

**I** Incorrectly zeroing a scale

**P** Parallax error

(Ip Man).

Precision:

* Size of spread in repeat measurements; **high precision = small range**.
* Related to the **fineness of the scale** of the instrument.

\*The absolute uncertainty for a time interval is often 0.2s.