GUIDANCE ON USING PRACTICAL TERMINOLOGY (EXTRACTS)

Using apparatus

A variety of apparatus can be used to collect individual **readings** or **measurements** which make up the set of **data** for an experiment or investigation.

When selecting apparatus, it is important to consider how the choice made can affect the data collected. For example, temperature could be measured with a thermometer with **graduations** (scale markings) which are 1°C apart, or ones that are 0.5°C apart; and a volume of 25cm^3 could be measured using a measuring cylinder, or a pipette. Using apparatus with finer graduations is more likely to produce data that is **precise** (due to a smaller spread) – but may also give a final result that is more **accurate**. The term **precise** has been extended in previous International GCSE specifications to apply to the apparatus itself e.g. a thermometer with 0.5°C graduations is more precise than one with 1°C graduations. Although this does not agree with the ASE guidance (where the recommended terminology is that the apparatus has a 'greater resolution'), it may still be encountered in International GCSE papers and resources.

Many pieces of apparatus are adjusted or **calibrated** before use. Calibration may involve making sure that the apparatus gives the correct reading for a known reference object e.g. a balance shows the correct mass for a reference object of known mass. More often, the apparatus is adjusted so that the measuring **scale** is set to zero before measurements are taken. When measuring the mass of an object, a balance that is set to zero before taking a measurement is described as being **tared**.

When reading the scale on a piece of apparatus, it is often possible to take a reading between the graduations. For example, a burette is graduated in 0.1 cm^3 divisions, but is always read to the nearest 0.05 cm^3. This is probably not possible if the scale is already finely divided e.g. a millimetre scale on a ruler.

When reading any scale, care should be taken not to view the scale at an angle. This avoids introducing errors due to **parallax**.

For measurements of time, it is worth noting that human reaction time is around one-third of a second, so the recording of a time to the nearest 0.01 s is difficult to justify, even with a digital stop clock. It is sufficient to record times to no greater precision (or resolution) that the nearest 0.1 s. Indeed, for most practical purposes, recording time to the nearest 0.5 s will be more than adequate.

Data which does not fit the expected pattern is usually considered to be **anomalous**. In some cases, **anomalies** are spotted in data and are removed before the data is processed e.g. if voltage is measured across the same resistor as 5.0 V, 5.1 V, 4.9 V and 12.6V then the final reading is removed before calculating the average voltage as 5.0 V. In other cases, an anomalous point may not be evident until the data is processed and presented. This will be seen most frequently in a graph, where an anomalous point does not fit the **line of best fit**.