ACCURACY AND PRECISION

accuracy

a description of how close a measurement is to the correct or accepted value of the quantity measured

precision

the degree of exactness of a measurement

Because theories are based on observation and experiment, careful measurements are very important in physics. But no measurement is perfect. In describing the imperfection, one must consider both a measurement's **accuracy** and a measurement's **precision.** Although these terms are often used interchangeably in everyday speech, they have specific meanings in a scientific discussion. A numeric measure of confidence in a measurement or result is known as *uncertainty.* A lower uncertainty indicates greater confidence. Uncertainties are usually expressed by using statistical methods.

Error in experiments must be minimized

Experimental work is never free of error, but it is important to minimize error in order to obtain accurate results. An error can occur, for example, if a mistake is made in reading an instrument or recording the results. One way to minimize error from human oversight or carelessness is to take repeated measurements to be certain they are consistent.

If some measurements are taken using one method and some are taken using a different method, a type of error called *method error* will result. Method error can be greatly reduced by standardizing the method of taking measurements. For example, when measuring a length with a meterstick, choose a line of sight directly over what is being measured, as shown in **Figure 10(a).** If you are too far to one side, you are likely to overestimate or underestimate the measurement, as shown in **Figure 10(b)** and **(c).**

Another type of error is *instrument error.* If a meterstick or balance is not in good working order, this will introduce error into any measurements made with the device. For this reason, it is important to be careful with lab equipment. Rough handling can damage balances. If a wooden meterstick gets wet, it can warp, making accurate measurements difficult.

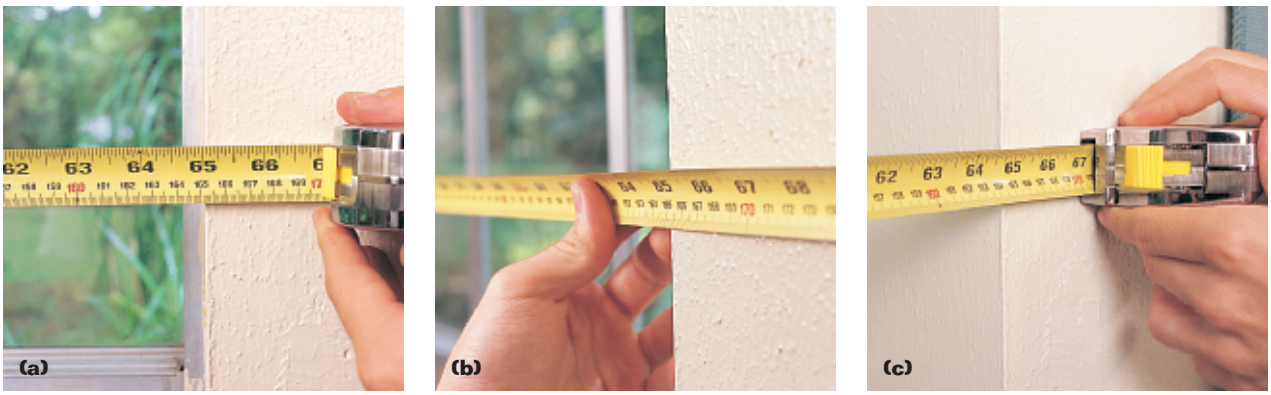

Figure 10
If you measure this window by keeping your line of sight directly over the measurement **(a),** you will find that it is 165.2 cm long. If you do not keep your eye directly above the mark, as in **(b)** and **(c),** you may report a measurement with significant error.