Procedures

The "Procedures," often called the "Methods," discusses how the experiment occurred. Documenting the procedures of your laboratory experiment is important not only so that others can repeat your results but also so that you can replicate the work later, if the need arises. Historically, laboratory procedures have been written as first-person narratives as opposed to second-person sets of instructions. Because your audience expects you to write the procedures as a narrative, you should do so.

Achieving a proper depth in laboratory procedures is challenging. In general, you should give the audience enough information that they could replicate your results. For that reason, you should include those details that affect the outcome.

Consider as an example the procedure for using a manometer and strain indicator to find the static calibration of a pressure transducer. Because calibrations are considered standard, you can assume that your audience will have access to many details such as possible arrangements of the valves and tubes. What you would want to include, then, would be those details that might cause your results to differ from those of your audience. Such details would include the model number of the pressure transducer and the pressure range for which you calibrated the transducer. Should you have any anomalies, such as unusual ambient temperature, during your measurements, you would want to include those. When the procedure is not standard, the audience would expect more detail including theoretical justification for the steps.

Given below is such a procedure--this one for an experiment devised to determine whether the frictional torque associated with a multi-turn film potentiometer is strictly the Coulomb friction between the slider and the film [Counts, 1999].

Sample Procedure:

The test performed on the potentiometer was accomplished by winding a string around the potentiometer shaft, attaching a mass to the string, and letting the mass fall. The change in resistance of the potentiometer with time indicated the acceleration of the mass. In this experiment it was assumed that the constant Coulomb friction torque was the only friction affecting the potentiometer. If this assumption were true, the friction force from the torque would be $F_f = T/r$ (where T is the torque and r is the radius of the potentiometer's shaft). Likewise, the gravity force would be $F_g = mg$ (where m is the mass tied to the string and g is the gravitational acceleration). A force balance then gives

$$T = mr\,(g-a),$$

where a is the acceleration of the mass. If the assumption holds that the only friction affecting the potentiometer was constant Coulomb friction, then each mass would undergo a constant acceleration.

The potentiometer measured voltage versus time for the masses as they dropped, but the measurement of interest to us was position versus time. For that reason, a 'calibration' was performed before we measured any data. In the calibration, the potentiometer's initial voltage was measured. Then the string was pulled a set distance (2 inches), and the voltage was recorded. This process of pulling the string a set distance and recording the voltage continued another two times (see Appendix A for the results). To determine the relationship between voltage and position, the differences in the voltages were averaged and divided by the length. The resulting relationship was 0.9661 volts/inch.

Five different masses were used to test the assumption of constant acceleration. For each mass, the string was rolled up on the shaft, the oscilloscope was triggered, and the shaft was released. As each mass dropped, the oscilloscope collected the potentiometer's voltage versus the time. After obtaining plots for each mass, we used the voltage-position relationship, mentioned above, to convert the data from the form voltage versus time to the form position versus time squared. The residuals of the data determined whether the assumption of constant acceleration was valid.

http://www.writing.eng.vt.edu/workbooks/laboratory.html#procedures.