A. VARIABLES:

Progress in science always depends on well-planned experiments that yield communicable results. The scientific method involves tasks like asking a question, researching it, making a hypothesis and then testing the hypothesis. Let us discuss the controlled variable in detail.

The experiment should be a fair test in which we change only one variable. A variable may be a factor, trait or condition. Understanding the three basic kinds of experimental variables which are dependent, independent and controlled variables will help make the experiment a success.

TYPE 1: Independent Variables

The variable that the scientist changes during their experiment are the independent variable. For example, take the experiment as a "cause and effect" exercise.

Here the independent variable is the "cause" factor. An independent variable is a variable that we can change or control in a scientific experiment. It will represent the cause or reason for an outcome.

Therefore, independent variables are the variables which the experimenter changes to test their dependent variable. A change in the independent variable will directly cause a change in the dependent variable. However, we can measure and record the effect of the dependent variable.

Independent Variable Examples:

Suppose a scientist is conducting an experiment for the effect of light and dark on the behaviour of moths. He is doing this by continuously turning a light on and off. Thus here the independent variable is the amount of light and the moth's reaction is the dependent variable.

This is the study to determine the effect of temperature on plant pigmentation. Here the independent variable (cause) is the temperature, while the amount of pigment or colour is the dependent variable (the effect).

TYPE 2: Dependent Variables

A dependent variable is the one which we can test in a scientific experiment, in order to get its values. The dependent variable is obviously 'dependent' on the independent variable.

Hence as the experimenter changes the independent variable, we can now observe and record the change in the dependent variable. So while taking data in an experiment, the dependent variable is the one being measured.

Dependent Variable Examples
A scientist is testing the effect of light and dark on the behaviour of the moths by turning a light on and off. Here the independent variable is the amount of light and the moth's reaction is the dependent variable.

A change in the independent variable i.e. amount of light directly causes a change in the dependent variable i.e. moth behavior.

TYPE 3: Control Variables

A controlled variable is one which the scientist holds constant (controls) during an experiment. Thus we also know the controlled variable as a constant variable or sometimes as a "control" only.

However, the control variable is not part of an experiment, but it is important because it can have an effect on the results. Remember that it is not the same thing as a control group.

Any given experiment will have numerous control variables. It's important for a scientist to try to hold all the variables constant except for the independent variable.

If a control variable changes during the experiment, it may invalidate the correlation between the dependent and independent variables. Whenever it is possible, control variables should be identified, measured, and recorded.

Examples of Controlled Variables
Temperature is a much common type of controlled variable. Because if the temperature is held constant during an experiment, it is controlled. Some other examples of controlled variables could be the amount of light or constant humidity or duration of an experiment etc.

Importance of the Control Variables
Although control variables may not be measured as they are not recorded, yet they can have a significant effect on the outcome of an experiment.

Therefore, the lack of awareness of control variables may lead to faulty results or what is called "confounding variables". So, recording control variables makes it easier to reproduce an experiment and to establish the relationship between the independent and dependent variables.

For example, suppose we are trying to determine whether a particular fertilizer has an effect on plant growth. Here, the independent variable is the presence or absence of the fertilizer, whereas the dependent variable is the height of the plant or rate of growth.

If we don't control the amount of light, for example, we perform some part of the experiment in the summer and some part during the winter, we may skew our results.

Type 4: Extraneous Variables

The independent variables which are not directly related to the purpose of the study but affect the dependent variables are known as extraneous variables. For instance, assume that a researcher wants to test the hypothesis that there is a relationship between children's school performance and their self-confidence, in which case the latter is an independent variable and the former, a dependent variable. In this context, intelligence may also influence school performance.

However, since it is not directly related to the purpose of the study undertaken by the caused by the extraneous variable(s) on the dependent variable is technically called the 'experimental error'. Therefore, a research study should always be framed in such a manner that the influence of extraneous variables on the dependent variable/s are completely controlled, and the influence of independent variable/s is evident.