

**b) An ability to design and conduct experiments, and to analyze and interpret data.**

| Criterion  | Initial   | Emerging   | Developed  | Excellence  |
|--|---|--|--|---|
| <b>Design Experiments: identifies the variables; the mathematical models; defines ranges of variation of parameters; plans and describes the experiment.</b> | Has difficulty to identify the variables or the relationship between them in the process. | Identifies and relates the variables involved in the problem.                              | Raises objectives. Identifies the input and output parameters of the experiment and measuring ranges.                      | Identifies the variables to be measured, the measurement range and the equations that relate the parameters to be compare. Describes the equipment to use, the way to vary the parameters and raises hypotheses about the expected results. |
| <b>Makes experiments: follow the procedure, analyzes the effect of the variables on the process; synthesizes theory and raises hypothesis.</b>               | Has difficulties to understand the procedure or protocol given to run an experiment.      | Successfully perform the experiment; but prior report is deficient.                        | Makes the experiment and prepares the report; but the conclusions are not related to the objectives. No raises hypothesis. | The conclusions relate to the objectives of the experiment, proposes new hypotheses and raises the procedure to verify them.  |
| <b>Analyzes and interprets data: classifies, processes and relates the experimental data with the hypothesis; proposes and develops experiments</b>          | Has difficulties to understand the experimental data.                                     | Classifies data, performs calculations, tabulates the results, but without analyzing them. | Tabulates results but the analysis is not based on the hypothesis of the experiment.                                       | In the conclusion, relates the results with the hypothesis, checking them. Raises new hypotheses and proposes the procedure to verify them.   |