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THE NATURE OF SCIENCE

I. Science All Around
   A. **Science** – a process of observing, studying, and thinking about things in the world to gain knowledge.
      1. branches of science:
         a. **Earth science** - study of Earth and space, including rocks, fossils, climate, volcanoes, land use, ocean water, earthquakes, and objects in space.
         b. chemistry - study of elements and matter.
         c. physics - study of how energy and matter are related.
         d. life science - study of living things.
   B. S**cientific methods** - series of problem-solving procedures.
      1. steps of the scientific method:
         a. identify the problem or question
         b. gather information (research)
         c. form a **hypothesis –** an educated guess
         d. test the hypothesis (experiment)
            1). **variables** – different factors that can be changed in an experiment.
               a). **independent variables** –factors that change in an experiment.
                  (1). are the things that you change on purpose.
                  (2). on data tables, are entered into the first column.
                  (3). on graphs, are listed on the horizontal or *x-axis*.
               b). **dependent variables** –factors being measured in an experiment.
                  (1). depends on the independent variable; often involves numbers.
                  (2). on data tables, are entered into the second column.
                  (3). on graphs, are listed on the vertical or *y-axis*.
            2). **constant** – variable that does not change in an experiment.
            3). **control –** standard for comparison in an experiment.
         e. analyze the results.
         f. draw conclusions.
      2. repeating the experiment many times and confirming the original results makes the conclusion more valid and reliable.

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C. **Technology** – use of scientific discoveries for practical purposes, making people's lives easier and better.

II. Scientific Enterprise

A. Scientific knowledge is subject to modification as new information challenges prevailing theories.

1. modification results from development of new technologies
   a. new and improved scientific instruments. Ex. weather instruments
   b. new and improved testing procedures
2. **scientific theory** – explanation that is supported by results from repeated experimentation or testing. Ex. theory on the composition of a comet.
3. **scientific law** - rule that describes the behavior of something in nature; usually describes what will happen in a situation but not why it happens. Ex. Newton's Laws of Motion
4. new knowledge can result in modifications of scientific theories and scientific laws

B. Limits of science – some matters cannot be examined usefully in a scientific way, i.e. they do not contain variables that can be observed, measured, and tested. Ex. problems that deal with ethics and belief systems.

1. **ethics** – study of moral values about what is good or bad.
2. belief systems – systems that deal with religious and/or other beliefs.

C. Scientific credibility

1. experiments must be designed so that **bias**, a personal opinion, does not affect the observations.
2. accurate record keeping, openness, and replication are essential for maintaining credibility with other scientists and society.