Chapter One: The World of Science
Teacher Notes

Lesson One: Asking About Life

Life Science-The study of living things

It All Starts with a Question

-Some Questions may include: How does the organism get its food? Where does it live? And Why does it behave in a particular way?

Life Scientists

-Anyone can investigate the world around us so anyone can be a life scientist.
-Anywhere – may include a lab, farms, forests, ocean, space, businesses, hospitals, government agencies, universities (many are teachers)
-Anything-what a life scientist studies is determined by their interests and curiosity

-may include how an organism functions or behaves, how they interact with other organisms and their environment, how organisms reproduce and pass on traits, they may study ancient origins and how they have changed.

Why Ask Questions

-To fight diseases-

-One disease cured by research and questions – Polio
-One disease that is still being researched – AIDS

-Understanding Inherited Diseases

-Scientists study codes to understand genetic disorders and stop diseases

-Protect the environment

Study environmental problems to protect resources, pollution

Lesson Two: Scientific Methods

What Are Scientific Methods?

-Ways in which scientists follow steps to answer questions and solve problems
-Steps (are always the same but not always in the same order)

-Ask a question
-Make observations
-Form a hypothesis
-Test the hypothesis
-Analyze the results
-Draw conclusions
-Communicate results

Ask a Question

-Make observations; what did the students in MN observe?

-counted the number of deformed frogs and normal frogs, photographed frogs, took measurements, wrote descriptions of frogs, collected other organisms, conducted tests on water, measured acidity

-Accurate Observations

-Information gathered through senses – observation

-Observations may be measurements, describe the object, or record behavior

-Standard tools are used to make sure observations are accurate (rulers, microscopes, thermometers are all examples)

Form a Hypothesis

Hypothesis -A possible explanation or answer to a question.

-A good hypothesis is based on observation that can be tests

-Think logically and creatively; consider what you already know

-Must be testable; is testable if an experiment can be designed to test the hypothesis

-Doesn't have to be wrong if it can't be tested

-Many hypothesis may be formed for the same problem.

Predictions-need to be made before a hypothesis can be tested

-A prediction is a statement of cause/effect to test hypothesis

-Usually stated in an "if/then" format

-More than one prediction may be made

Test the Hypothesis

Factor-Anything that can influence an experiment's outcome

Under Control

-Controlled Experiment-tests only one factor at a time and consists of a control group and one or more experimental groups.

-Variable-The one factor that differs

Designing an Experiment

-requires planning; everything should be considered

Collecting Data

-test many individuals

-if the same results are produced again and again scientists can be certain of the results.

Analyze the Results

-Organize data (table or graph)

-helps to focus on effects of the variable

Draw Conclusions

-Decide whether the results of experiments support hypothesis

-If it isn't supported; scientists try to come up with another answer

Communicate Results

-Share with other scientists – Why?

-So other scientists can repeat the experiment

-To be considered by other scientists with similar interests

Lesson Three: Scientific Models

Models – A representations of an object or a system.

-explains how something works; never exactly the same

Types of Models

Physical Model-look like the thing they model; is useful because they represent something to help you understand. They may not look or act exactly like the object.

Example-Model of a human

Mathematical Models-may be made of numbers, equations, or other data. These are used to make predictions.

Example-Computers make many charts and graphs that are mathematical models.

Conceptual Models-may represent systems of ideas. May also compare unfamiliar things with familiar things.

Benefits of Models

-Used to represent very large or small things

-Represent things that are very complicated or that no longer exist.

-May be a kind of hypothesis and can be tested.

Building Scientific Knowledge

Scientific Theories-An explanation that ties together many hypothesis and observations. This tells what happens and why.

Scientific Laws-A summary of many experimental results and observations; a law tells how things work. States what will happen.

Lesson Four: Tools, Measurement, and Safety

Computers and Technology-allows scientists to find information and solve problems in new ways.

-Technology-the application of science for practical purposes.

-Example-Computers-used to create graphs, solve complex equations, and analyze data. Also help scientists to share data. Did you know that the web was designed as a way for scientists to share information?

Tools for Seeing

-Compound Light Microscope-Light passes through the specimen and produces a flat image.

-used for small items that can't be seen easily. Has three main parts-a tube with 2 or more lenses, a stage, and a light. The lens at each end magnify the specimen.

-Transmission Electron Microscope-Electrons pass through the specimen and produce a flat image.

-Use electrons to produce an image. Images are clearer and more detailed than light microscopes. Living things can't be viewed.

-Scanning Electron Microscope-Electrons bounce off the surface of the specimen and produce a three-dimensional image.

-Use electrons to produce an image. Images are clearer and more detailed than light microscopes. Living things can't be viewed.

-Measurement

-The International System of Units (SI)-In 1700s the French Academy of Sciences began to form a global measurement system.

-Most scientists and almost all countries use SI

-Helps scientists share observations and results

-Almost all units are based on ten making conversion easier.

-Length-standard unit is the meter

-Area-a measure of the size of a surface or a region.

-Volume-a measure of the size of a body or region in 3-D space; standard unit is the cubic meter.

-Mass-Measure of the amount of matter in an object; standard unit is the kilogram.

-Temperature-Measure of how hot or cold something is. Actually temp. is a measure of how much energy is in something.

-Different temperature scales

-Fahrenheit (used in the US)

-Celsius (commonly used by scientists and many other countries around the world)

-Kelvin (SI base unit)