

Unit 1

Introduction to Science

Lesson Overview:

- The 3 major elements of the study and practice of Science.
- Science Process Skills:
 - ✓ Observation
 - ✓ Classification
 - ✓ Communication
 - ✓ Measure
 - ✓ Predict
 - ✓ Infer
 - ✓ Estimate
- Construction of a valid Hypothesis
- Identifying Variables in an experiment:
 - ✓ Independent variable
 - ✓ Dependent variable
 - ✓ Control variable
- Safety rules in the laboratory
- Benefits and Abuses of Science and Technology
- Limitations of Science

1 What is Science?

Science is the systematic study of nature and how it affects us and the environment.

The study and practice of science involves 3 major elements.

- Attitudes
- Processes or methods.
- Products.

Attitude:

Science encourages us to develop positive attitudes.

- Curiosity
- Perseverance
- Positive approach to failure
- Open-mindedness
- Cooperation with others
- Tolerance
- Impartiality
- Healthy skepticism
- Integrity
- Refusal to believe superstitions

Science Process Skills:

Science process skills refer to the different types of skills needed for scientific investigation.

Science Process skills can be broadly divided into basic process skills and integrated process skills.

Basic process skills includes:

Observation – to use our senses to obtain information about objects, events and changes.

Classification – to group objects or events according to common properties.

Communication – to transmit and receive information presented in various forms; verbal, written, tabulated, graphical or pictorial.

Measure – to measure physical properties (e.g. length, area and mass) with the help of measuring instruments.

Predict – to make an educated guess of how things may turn out based on previous experience or knowledge.

Infer – to draw conclusion from observation.

Estimate - to approximate.

Question:

What are the basic processes involved in the following examples?

1. A pupil says that her house is about 2 km away from school. **Estimation**
2. A pupil says that her pet cat is sick because it looks lethargic. **Observation and Inference**
3. A teacher divides her pupils according to their abilities. **Classification**
3. A pupil plot a graph to show how the density of water changes with temperature. **Communication**

Integrated process skills:

Integrated process skills require thinking at a higher level. They combine several of the basic process skills to form better ways of solving problems.

For example, to carry out experiments to test a hypothesis. Integrated process skills are used. They includes

- Observing carefully and measuring accurately.
- Communicate effectively; skills involve recording observations or measurements in appropriate forms such as table, graph and etc..
- Making inferences and developing a hypothesis.
- Planning or designing experiments to test the hypothesis.

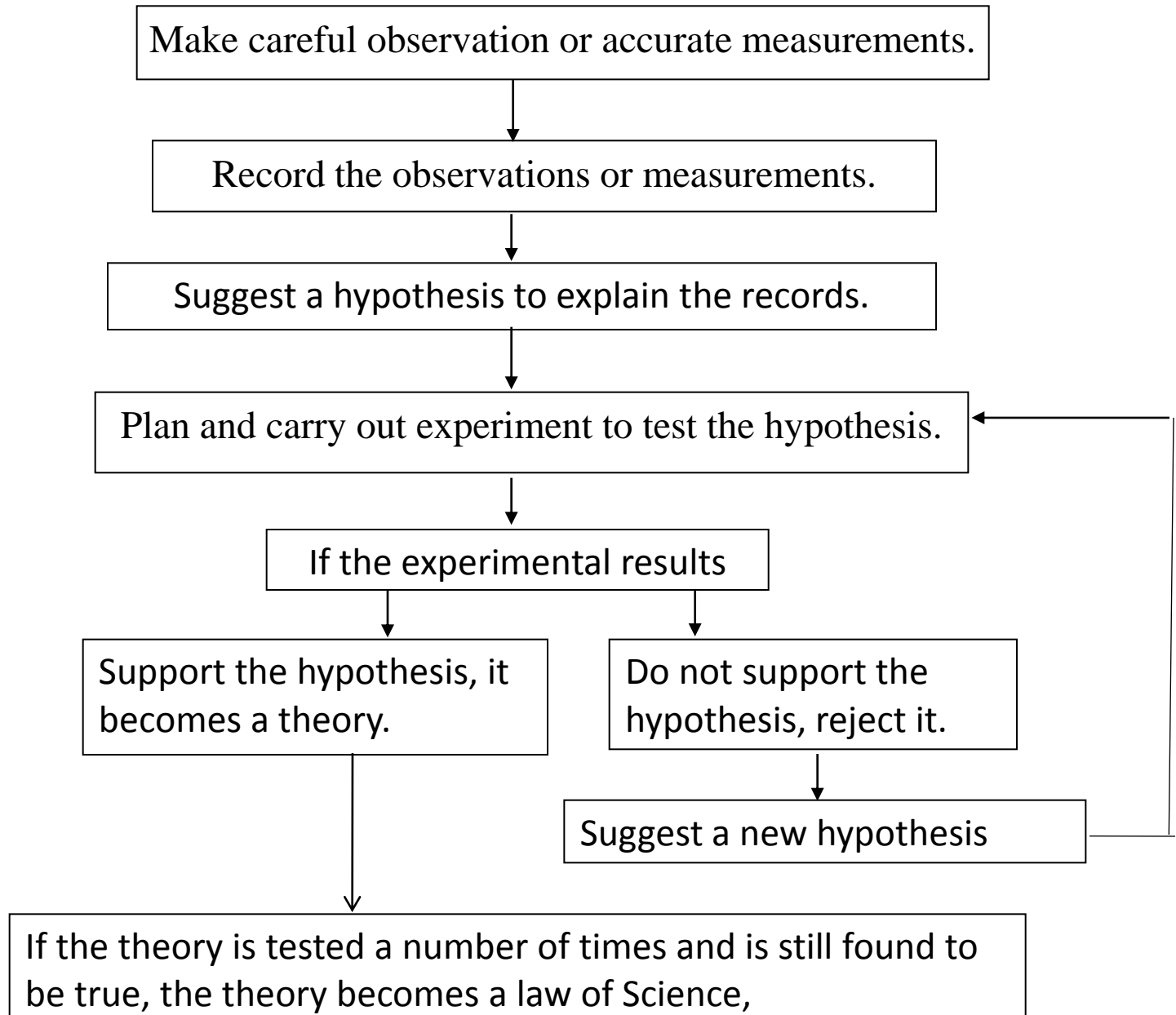
Products of Science:

The information and ideas of Science that have been recorded as scientific knowledge are called product.

The Scientific Methods:

All scientists share the common method of investigation.

The Scientific Methods:



Hypothesis

- is a tentative statement that proposes a possible explanation to some phenomenon or event.
- is a testable statement which may include a prediction.
- is based on some previous observation
- A hypotheses should not be confused with a theory.

Example

If skin cancer is **related** to **ultraviolet light** , **then** *people with a high exposure to uv light will have a higher frequency of skin cancer.*

If leaf color change is **related** to **temperature** , **then** *exposing plants to low temperatures will result in changes in leaf color.*

Variables

Independent variable – the variable you change in an experiment

Dependent variable – the variable you are going to observe as a result of changing the independent variable

Controlled variable – variables that are constant throughout the experiment.

Example

skin cancer – dependent variable; exposure to UV light – independent variable

Leaf colour – dependent variable; temperature – independent variable

Classroom Exercise

State why the following hypothesis are *not* valid.

1. If skin cancer is related to radiation, then people who are exposed to high amount of radiation will have a higher frequency of skin cancer.
2. If skin cancer is related to UV radiation, then people who are exposed to high amount of UV radiation will be more likely to have skin cancer.
3. If skin cancer is related to UV radiation, then the more people having skin cancer are people who are exposed to high amount of UV radiation.

Safety rules in the laboratory:

- Do not enter the laboratory without the teacher's permission.
- Open all doors and windows unless otherwise instructed by your teacher.
- Do not carry out any test or experiment without the teacher's permission.
- Read the instructions first and understand them before starting your experiment. If in doubt, always ask your teacher.
- Handle all apparatus and chemicals carefully and correctly. Always check the label on the container before using the substance it contains.
- Do not pour any unused chemicals back into its container to avoid contamination.
- Do not taste any chemicals unless otherwise instructed by the teacher.
- Do not eat, drink or play in the laboratory.

- Do not tamper with the electrical mains and other fitting in the laboratory.
- Work tidily. Wash up all used apparatus and dispose of the waste correctly.
- Return the apparatus to their proper storage places after cleaning.
- Do not remove any apparatus or chemical from the laboratory.
- Wash your hands after all laboratory work.
- When accidents occur,
 - Report all accidents, injuries, breakage and spillage to your teacher immediately.
 - Should a chemical get into your mouth, spit it out into a basin and rinse your mouth with plenty of water. Similarly, if any chemical comes into contact with other parts of your body or clothing, wash thoroughly with plenty of water and report to your teacher.

Benefits and abuses of Science and Technology:

The way scientific discoveries and inventions are used by people is called technology. For examples, the internet, cloning of animals, video conferencing are all products of technology.

Benefits:

Technology has greatly benefited mankind as it enables us to grow more food, make our homes more comfortable, explore outer space, and communicate faster and better and travel from place to place easily.

The discovery of new medicines helps us to prevent or cure diseases.

Abuses:

People, unfortunately, have at time misused scientific discoveries and technology. For example, the invention and the use of weapons of mass destruction.

The abuse of science and technology has caused pollution.

Limitations of Science:

Science has helped us in many ways. However, it has its limitations. Science cannot be used to find an answer to all our questions or to solve all our problems. For example, we cannot prevent natural disasters such as earthquakes, hurricanes and tsunami from occurring.

Question:

Can you think of other examples to show the limitations of science?

Internet Resources

<http://atheism.about.com/od/philosophyofscience/tp/ScienceDefinedPhilosophy.htm>

<http://sciencezine.net/science/method>

http://sciencefairproject.virtualave.net/scientific_method.htm