

1.1

Science is the knowledge obtained by observing the natural world in order to discover facts and formulate laws and principles that can be verified or tested. \succ 1) Scientists start by asking questions. Scientists then must investigate to find the answers to their question. > 2) Scientists use different ways to find the answers to their questions: research, observation, experimentation.



- Research is when you look up the answer to your question.
- Sources (places you look for your answer)
 - 1) Textbooks
 - 2) Encyclopedias
 - 3) Magazines
 - 4) Ask a person knowledgeable in that area.
 - 5) Internet
 - 6) Report of an experiment



- > 3) Observation is when you watch.
- >4) Conclusions from observations are not always correct.
- >5) To verify our observations we must do experiments.
- Science has helped in way like fight diseases and saving natural resources.
- Vaccines developed had wiped out Polio in most of the world.
- Recycling aluminum is cheaper, cleaner, and uses less energy than mining aluminum.

Sometimes scientists work many years before they are able to find the answer to their question.

- Scientists appear in many different places:
 - Zoologist
 - Geochemist
 - Mechanic
 - Oceanographer
 - Volcanologist



≻6) A zoologist is a person who studies the lives of animals.

- By studying animals we are able to protect animals from becoming extinct.
- >7) A geochemist is a person who specializes in the chemistry of rocks, minerals, and soil.
- A geochemist can determine the value of these materials.



Mechanics works on engines from the one in your car to the one on the space shuttle.



>>8) An oceanographer studies the ocean.

Oceanographers study:

- Ocean waves and currents.
- Plants and animals that live in the oceans.
- The sea floor and how it forms.



>9) A volcanologist studies volcanoes.
 > By studying volcanoes, we hope to better predict when volcanoes will erupt.





1.2

 \succ 1) Scientific methods are the ways in which scientists follow steps to answer questions and solve problems. Steps to the scientific method 1) Ask a question 2) Form a hypothesis 3) Test the hypothesis 4) Analyze the results 5) Draw a conclusion 6) Communicate the results

- 2) The scientific method starts with either asking a question or making an observation.
- Any information that you gather through your senses is an observation.
- Observations may be: length, volume, time, speed, loudness, color, shape, or behavior.
 Observations are only useful if they are
 - accurately made and recorded.



>4) A hypothesis is a possible explanation or answer to a question.

- A good hypothesis is based on observation and can be tested.
- Scientists can have different hypothesis for the same question.
- 5) A prediction is a statement of cause and effect that can be used to set up a test for a hypothesis.
- A prediction is usually in the form of an ifthen statement.



An example of an if-then statement is: If sunlight is important for a plant to live then a plant will die if it does not receive sunlight.

To test the hypothesis, scientists try to design experiments that will clearly show whether a particular factor caused an observed outcome.

6) A factor is anything that can influence the experiment's outcome.

A controlled experiment tests only one factor at a time and consists of a control group and one or more experimental groups. ≻7) The variable is the one factor that differs between each of the groups.

Since the variable is the only difference between the groups, any differences between the groups must be because of that factor.

Scientists try to test many individuals to be sure that differences between the control group and the experimental groups are caused by the variable and not by differences between individuals. Scientists test a result by repeating the experiment.

- If they get the same results each time, they can be more certain about the variable's effect on the outcome.
- Scientists keep clear, accurate, honest records of their data so that other scientists can repeat the experiment and verify the results.



>>9) After the experiment, scientists must analyze the results.

- Scientists use charts and graphs to organize their data.
- Scientists then draw conclusions from the experiment.
- Did the results support the hypothesis?
 If so then the hypothesis is correct.
 If not then the hypothesis is wrong and
 - there must be another explanation.
- >10) Scientists learn from experiments either way.

- 11) Scientists share the results of experiments to other scientists.
- Sharing results helps with:
 - 1) Other scientists may repeat the experiments to verify the results.
 - 2) The information can be considered by scientists of similar interests.
 - 3) New information can strengthen hypotheses.
 - 4) New information can show that hypotheses may need to be altered.





- 1) A model is a representation of an object or system.
- > 2) There are three types of models:
 - 1) Physical
 - 2) Mathematical
 - 3) Conceptual
 - A model volcano or a model of a sky scraper are examples of physical models.

- A mathematical model may be made up of numbers, equations and other forms of data.
- > Examples of a mathematical model:
 - 1) An equation to figure net profit for a retail store.
 - 2) To graph the path of a missile and where the missile will hit.

- 5) A conceptual model is a system of ideas or it compares unfamiliar things with familiar things to help explain unfamiliar ideas.
- Examples of conceptual models: 1) The idea that the universe was formed from a spinning disk of gas. 2) To classify the behavior of animals. Models are used to represent things that are small, large, or complicated. \succ Models are used to represent things that do not exist like dinosaurs.

► Models are not perfect.

Models are not the real thing, so they can not demonstrate every aspect of the original.

A theory is an explanation that ties together many hypotheses and observations.

≻6) Theories are used to explain observations and to predict what might happen in the future.

>7) A law is a summary of many experimental results and observations and tells how things work. >8) A law tells you what will happen while a theory tells you what should happen. New data and ideas take time to be accepted as facts, theories, or laws. Scientists should always test new ideas by using scientific methods. \succ New facts, theories and laws are still being discovered today.



1.4

- 1) A tool is anything that helps you do a task.
- Tools and what they measure:
 - A stopwatch measures time
 - A graduated cylinder measures volume
 - A thermometer measures temperature.
 - A balance measures mass



In the 1700's the French Academy of Science formed a global measurement system called International System of Units, or SI.

- >2) Basic SI units of measurements
 - Meter measures length
 - Mass is kilogram
 - Temperature is Celsius or Kelvin



The area of an object is measured in square units: m^2 , cm^2 , in^2 , ft^2 , yd^2 , etc. >3) Mass is the measure of the amount of matter in an object. \succ The kilogram is the basic unit of mass. >4) Volume is the measure of the size of a body in three-dimensional space. > Volume is measured in cubic units: $\overline{m^3}$, cm³, in³, ft³, yd³



Temperature is the measure of how hot or cold something is.

- >5) Density is the amount of matter in a given volume.
- >6) Density = Mass / Volume
- What is the density of an object that has a mass of 450 kg and a volume of 5 m³?



≻7) Density determines whether or not an object floats or sinks.

If an object is denser than water it sinks, if it is less dense than water it floats.

