Chapter 1 — Nature of Science

Updated: 9/6/12

1

What is Science?

"Having Knowledge"

2

What is the Scientific Method?

Steps to solve problems and carry out research

1. State **P**roblem
2. Gather info
3. Form **H**ypothesis
4. Test hypothesis (**E**xperiment/**O**bservation)
5. Accept or reject hypothesis
6. Do something with the results (**C**onclusion)

3

Variables & Controls

Variables—factors that change in an experiment

- Independent Variable: the variable you want to test. (It's what is different in the experiment)
- Dependent Variable: variable being measured.
- Constants—the variable you do not change in the experiment.

Control Group—standard to which your results can be compared.

4

An Example of Variables: Soil Experiment

Suppose you want to design an experiment to find out what kind of soil is best for growing cactus plants. What would be your variables and constants in the experiment?

Independent variable: kind of soil (variable that will change.)

Dependent variable: size and health of the cactus plants at the end of the experiment. (variable being measured)

Constants: type, size, and health of plants at the beginning of the experiment (you want all of them to be the same at the beginning) You also want each to receive the same water, temperature, etc.

5

Theories and Laws

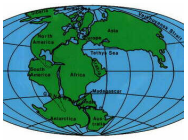
- Theory: an explanation backed by results from repeated experiments or observations.

Law: scientific rule that describes behavior of something in nature, but doesn't explain why something will happen in a given situation.

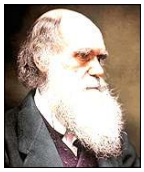
6

Other Theories we will study

Examples:



"Theory of Continental Drift"



"Theory of Evolution" by Charles Darwin (1859)

7

Other Laws we will study

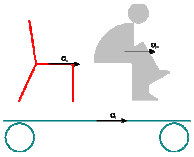
Hammer Feather Experiment

"Law of gravity"

What if you drop an elephant and a feather from the top of a skyscraper?

Video--Elephant & Feather (Resistance)

Video--Elephant & Feather (No Resistance)



Video--ladder

"Newtons First Law of Motion" an object will continue in motion or remain at rest until it's acted upon by an outside force.

8

What are the **four major areas of science**?

A. Chemistry—The science that deals with the composition, properties, reactions, and the structure of matter.

B. Physics—The study of matter and energy and the interactions between them.

C. Life Science—the study of living organisms

D. Earth Science—the study of Earth and space

9

What are the **4 areas of Earth Science**?

- Geology
- Meteorology
- Astronomy
- Oceanography

10

Geology

Study of Earth, it's matter, & processes that form & change Earth

Examples:

Fossils

Volcanoes

Mountains & glaciers

11

Career Ops:

Oil Companies

12

Meteorology

Is the study of weather & forces that cause it.

Examples:

- Snow (Precipitation)
- Lightning
- Tornadoes

13

Career Ops:
Meteorologist

N.O.A.A.=**N**ational **O**ceanic **A**tmospheric **A**dministration

- **NWS**=National Weather Service (Issue Warnings & watches about severe weather.)

14

Astronomy

Study of objects in space including stars, planets, & comets

Pics are of Hale Bopp Comet in 1997 (Yerkes Observatory) It was visible for 18 months and is also referred to as the "Great Comet of 1997"

Other examples:

15

Career Ops: N.A.S.A.

National Aeronautics Space Administration

Dr. Sally Ride: 1st American woman in space

Commercial

16

A Special Tribute

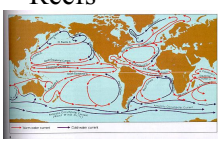
- http://www.youtube.com/watch?v=QvvIGvh7dk4

17

Oceanography

Is the study of earths oceans

- Currents
- Tides
- Reefs



18

Career Ops:

SCUBA Diving (Self Contained Underwater Breathing Apparatus)

19

Who is this famous person?

- Jacques Cousteau
- He invented S.C.U.B.A.

20

Career Ops:

NOAA—National Oceanic Atmospheric Administration

Ex. Exxon Valdez—NOAA was called to help save wildlife and clean up

Commercial

Ex. Shrimp Industry & other aquatic farming industries—NOAA monitors regulations

21

What's technology?

- Application of scientific discoveries
- Can contribute to problems & solve problems

???? GOOD VS. BAD ????

22

What does it mean for "technology to be transferable?"

- *Can be applied to new situations*
- WW II—Sonar & Radar
- See LAB: how waves helped win the war.
- Uses today?

23

XIII. Measurement

*International System of Units (SI)

- French *Le Système International d'Unités (1960)*
- Base 10

24

XIV. LENGTH

SI Unit: meter

MEMORIZE: 10 mm = 1 cm
100 cm = 1 m
1000 m = 1 km

History

1771—1 meter was equal to 1 ten millionth (10^{-7}) the distance of Earths Meridian traveling through Paris.

1983—length of the path traveled by light in a vacuum during a time interval of 1/299,792,458 of a second.

What is the difference?

25

XV. MASS

SI Unit: kilogram

- Measure of the amount of matter in an object.
- Depends on number of atoms.
- Doesn't change with gravity!!
- Based on a comparison.

History

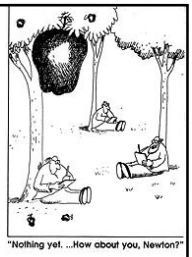
- 1889—based on prototype of platinum-iridium.

26

XVI. Weight

SI Unit: Newton

- Measure of gravitational force on an object.
- Gravity on the moon is 1/6 that of Earth.



Gravity on the moon is 1/6 that of Earth.

- How does this effect your weight?.

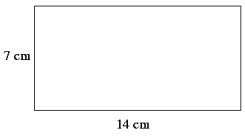
27

XVII AREA

SI Unit = square meters (m^2)

The amount of surface within a set boundary .

Area (A) = Length (L) x Width (W)



7 cm x 14 cm = 98 cm^2

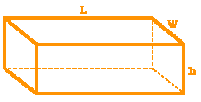
28

XVIII. VOLUME

SI Unit = cubic units (cm^3, km^3, m^3)

Measure of how much space an object occupies.

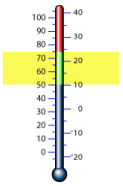
Volume (V) = Length (L) x Width (W) x Height (H)



29

XIX. Temperature

SI Unit = Kelvin (K)



Measure of how hot or cold.

Conversions:

Celsius to Kelvin	C + 273 = K
Fahrenheit to Celsius	(F-32) x (5/9) = C
Celsius to Fahrenheit	(9/5)(C) + 32 = F

30

XX. Density

SI Unit = g/cm^3

Amount of matter in a given space
Density of freshwater = 1.0 g/cm^3
Density of ice = 0.9 g/cm^3

31