NOTES – NOS.2

Nature of Science – Scientific Explanations
Lesson 2 – Measurement and Scientific Tools

Description and Explanation

How would you write a description of a squirrel's activity?

Q: What is a description?
A: a spoken or written summary of observations

Your description might include information such as the squirrel buried five acorns near a large tree or that the squirrel climbed the tree when a dog barked.

There are **2** types of **descriptions** – qualitative and quantitative

A qualitative description uses your senses (sight, sound, smell, touch, taste) to describe an observation.

Ex. a large tree

A quantitative observation uses numbers to describe the observation and measuring tools, such as a ruler, a balance, or a thermometer

Ex. 5 acorns

How would you explain the squirrel's activity? An explanation is an interpretation of observations. You might explain that the squirrel is storing acorns for food at a later time or that the squirrel was frightened by and ran away from the dog. When you describe something, you report what you observe.

The International System of Units

Suppose you observed a squirrel searching for buried food. You recorded that it traveled about 200 feet from its nest. Someone who measures distances in meters might not understand how far the squirrel traveled. The scientific community solved this problem in 1960. It adopted an internationally accepted system for measurement called the International System of Units (SI).

Today, we use the SI system worldwide. Why?

2 reasons –

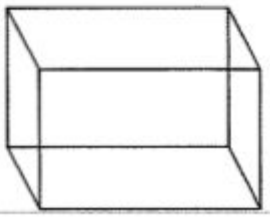
- All scientists can share and compare the same results.
- All units are based on the # 10. Therefore, conversions from 1 unit to another are easy to do.

There are **4** commonly used **SI Units** –

1. Length – How long? – the distance b/w 2 points
   - Basic Unit = meter (m) → the SI unit for length
   - Tools used → metric ruler or meterstick

   Ex. 1 meter = the length of a baseball bat

2. Volume – the amount of space an object occupies
   - Basic Unit = liter (L) → the SI unit for volume of a liquid
   - Basic Unit = cubic meter (m^3) → the SI unit for volume of a solid
   - Tools used → graduated cylinder (liquids)
   - Tools used → by equation (solids)
     - V = L x W x H for regular shaped items
       Volume = length x width x height
     - H_2O displacement for irregular shaped items



3. **Mass** – the amount of matter in an object → never changes! (Earth vs. moon)

- Basic Unit = gram (g) → the SI unit for mass
- Tools used → triple beam balance

Ex. 1L of H_2O = 1 kg or 100 g = 1 medium apple

4. **Temperature** – a measure of hot (or cold) of an object

- Basic Unit = ^{o}C → the SI unit for temp°
- Tools used → thermometer

Derived Quantities – quantities formed from combining other measurements (length, mass and volume)

There are **3** commonly used **Derived Quantities** –

1. **Density** – mass per unit volume; the amount of matter in a given space

- Basic Unit = g/cm^3
- Tools used → $D = m \div v$ OR $D = m / v$

2. **Perimeter** – the distance around the outside of any figure

- Basic Unit = m (meter)
- Tools used → meterstick or ruler

3. **Area** – a measure of how much surface an object has

- Basic Unit = m^2, cm^2, km^2 → the SI unit for area
- Tools used → $A = L \times W$

Converting the SI UNITS

King	Henry	Died	By	Drinking	Chocolate	Milk
kilo- (k)	hecto- (h)	deka- (da)	gram(g) meter(m) liter(L)	deci- (d)	centi- (c)	milli- (m)

mm
mL
mg

Step 1 – Identify your starting point.

1 letter → start in the middle Ex. m, L, g
2-3 letters → start with the 1st letter Ex. mL, kg, dag

Step 2 – Read the problem and rewrite the # on the left below the problem and write the decimal point after to show its place.

Ex. 34 m = _____ cm
34.

Step 3 – Identify what unit you are converting to & count the # of units between each unit.

Converting from m → cm.

Step 4 – The # of units between each unit = the # of places you move the decimal place in the direction you counted!

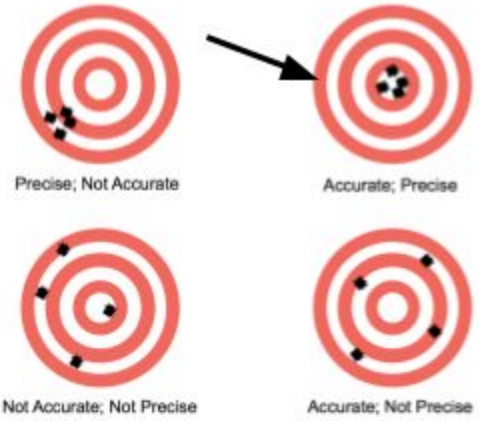
m → cm =’s 2 places
Move the decimal 2 places to the right.

Ex. 34 m = _____ cm
34.

Precision and Accuracy

Q: What is a precision?
A: a description of how similar or close measurements are to each other

Q: What is accuracy?
A: a description of how close a measurement is to an accepted or true value



Scientific Tools

science notebook

Used to record descriptions, explanations, plans, and steps used in Scientific Inquiry.

triple beam balance

Used to measure mass in grams(g).

thermometer

Used to measure the temperature of substances in degrees Celsius (°C).

glassware

Used to hold, pour, heat, and measure liquids in milliliters(mL). Includes – graduated cylinders, beakers, and Erlenmeyer flasks.

microscopes

Used to observe small objects that you cannot observe with just your eyes.

computer

Used to compile, retrieve, and analyze data for reports; to create reports and other documents; to send information to others, and to research information.

Tools Used by Life Scientists

hand lens

Used to magnify, or enlarge, an image of an object.

slides & coverslips

Used to observe items under a microscope.

dissecting tools

Used to examine tissues, organs, or prepared organisms.

pipette

Used to draw up and transfer liquids.