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Collecting Data

Each time an experiment or investigation is conducted, data is collected. The data may be quantitative or qualitative.

There are many ways to collect data during a scientific investigation. Collecting data can be as simple as asking several people the same question. For example, a student could ask his or her classmates what their favorite subjects are.

Data can also be collected by measuring. Measuring can be done with many different kinds of lab tools, such as rulers and thermometers. Different lab tools measure different things. For example, if a scientist wanted to determine the effect that water has on the growth of a plant, the scientist could measure the plant's growth with a ruler.

Data can also be collected by reading books or observing something and writing down how it looks or acts. Writing down the information you find is an important part of collecting data.

Making Observations

An observation is any information gathered by one of the five senses (seeing, hearing, touching, tasting, or smelling). They can be either qualitative or quantitative.



Quantitative Observations

Quantitative observations include measurements or numbers. Mass, length, and volume are all quantitative observations.

All of these are examples of quantitative observations:

- o Amy is 4 feet tall

Qualitative Observations

Qualitative observations are made using only the senses. They describe the properties of an object, such as color, shape, appearance, or relative size.

All of these are examples of

○ Amy is 4 feet tall.

- The temperature of a liquid is 28°C.
- The mass of a paperclip is 0.5 grams.
- The length of a table is 4.5 meters.
- Frank has eight marbles.

All of these are examples of qualitative observations:

- Charles is taller than Ciara.
- The liquid in the beaker is cold.
- The bowling ball is heavy.
- The flask is hard and smooth.
- The chemical smells like rotting eggs.

Learning More by Doing Something to an Object

Sometimes, it might be necessary to do something to an object before data can be collected. For example, a box might need to be shaken in order to find out if it is empty, an unknown substance might need to be weighed to determine whether it is heavy, or the fruit of a plant might need to be cut to find out what is inside.



Making Measurements

Scientific tools can be used to make precise, accurate measurements during investigations. These tools can include tape measures, scales, thermometers, and beakers.



Units of Measurement

The following table lists the most commonly used SI units of measurement, organized by the property of matter being measured.

Property	Definition	Common Units
mass	the amount of matter in an object	milligram (mg), gram (g), kilogram (kg)
weight	the force exerted upon an object due to gravity	Newton (N)
length	the measure of how long an object is	millimeter (mm), centimeter (cm), meter (m), kilometer (km)
volume	the amount of space an object takes up	milliliter (mL), liter (L)
temperature	a measure of the average kinetic energy of particles	degree Celcius ($^{\circ}\text{C}$)
density	the amount of matter in an object per unit volume	g/mL, kg/L

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