Relations

Physical phenomena are defined by certain quantities and the how those quantities are *related* to each other.

Example: A Chemical Reaction

Quantities:

- Mass of reactants
- Mass of products
- Heat energy absorbed (endothermic) or emitted (exothermic)
- Time

Relations:

- How much product has been produced by a given time?
- How much time has passed when a certain amount of product has been produced?
- How much energy has been released when a certain amount of a reactant has been consumed?

Example: The Flight of an Aircraft

Quantities:

- Distance traveled
- Altitude
- Airspeed
- Time

Relations:

- What is the aircraft's altitude at a given time?
- At what times (multiple answers) is the aircraft at a particular altitude?
- What is the aircraft's speeds (multiple answers) at a given altitude?

When time is involved a phenomenon is called *dynamic*. Otherwise, it is called *static*. Note that static problems may initially be dynamic, but the focus is on the *steady state*.

Example: Ideal Gas in a Container

$$PV = nRT$$

Quantities:

- Number of molecules
- Volume of container
- Pressure inside container
- Temperature of the gas

Relations:

- What is the pressure for a given temperature?
- What temperature is required for a desired pressure?