

SYSTEM, CONSERVED vs CONSTANT and ANALOGY EXAMPLES

SYSTEMS:

- **System:** A system is a group of objects of interest. The objects can interact with each other, which we call *internal interactions*. Objects that are not a part of the system can also interact with the system objects. We call these interactions *external interactions*.
- **Conserved:** Remains the same in the system
- **Constant:** Does not change for the particular object

Example: in all cases decide what is the system? What quantities are constant? Conserved?

Mass:

- The mass of an object can change (experiment with paper in beaker burning on scale)
 - Campfire burns with time, mass of log decreases
 - Mass of seed planted increases as plant grows
- **Conservation of mass:** mass is conserved → cannot be created nor destroyed. Just because mass is conserved, does not mean it is always constant. Look at the burning experiment we just did: conserved, but not constant.
- In order to observe conservation of mass we must choose an *isolated* system, otherwise a portion might leave the system during experiment or may join the system.
- In a situation where mass is *not* constant it is still conserved. For example, if mass decreases in a system that is not isolated, it increases someplace else. Mass is conserved in the universe even if not constant in the individual parts (systems) of the universe.

Analogy: exchange of money: Who goes grocery shopping?

Grocery Store and Money

- Money in pocket decreases so not constant
- Money in supermarket increases so not constant
- However, total amount of money in the world does not change because you bought groceries, it is conserved.
- Now: you and supermarket as system: amount of money is constant
- You are the system: amount of money is not constant.

→ Money is conserved no matter how you choose the system, but only constant if you choose you and the supermarket as the system

Unlike mass, many physical quantities are not conserved (time and temperature are two examples). To say that a particular physical quantity is conserved means there is no system in which the value of the particular physical quantity remains constant during a particular process.

Why are we interested in whether or not a physical quantity is conserved? If we know the quantity is conserved, we can use the system method to define initial and final states of a situation and solve for some unknown quantity without having to know how the change in the system occurred.