

February 10, 2020

Sit anywhere at a table

Measuring your Molecular Kinetic Energy

- How are you doing today?
- How was your weekend?
- Any big plans for the week or long weekend ahead?

Entry: Answer the following in your Notebook

- What is a Thermodynamic System?
- What are the 3 types of Thermodynamic Systems and what is allowed to transfer in each system?
- What do you remember about the conservation of energy law?
- What is one impact of climate change that most intrigues/alarms you?

Housekeeping

- Problem Set #9 due Thursday (A/B), Friday (C/D)
- Honors Assignment #5 out
- Honors Sign-Up/Drop-Out deadline Wednesday
- Inconvenient Sequel makeup viewing this Thursday and Friday morning at 8:30 AM
- Reminders from Ms. Abdullah
 - Update Naviance
 - Check Portals
 - FAFSA
- Office Hours:
 - Tuesday and Thursday after school 3:30-4:30 PM
 - Tuesday at lunch 11:40 AM-12:30 PM

Zeroth Law of Thermodynamics

If two systems are in thermal equilibrium with a third system, then they are in thermal equilibrium with one another

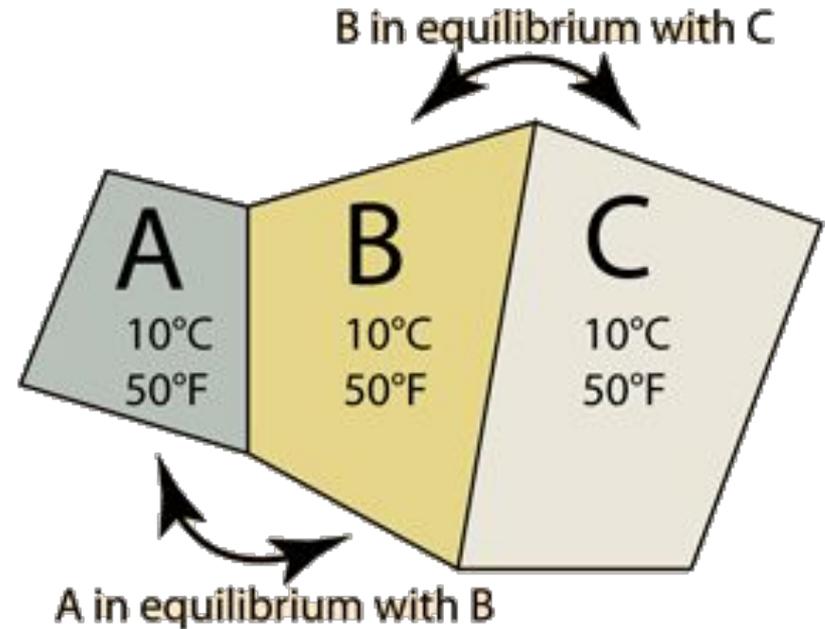
Temperature of A = Temperature of B

and

Temperature B = Temperature C

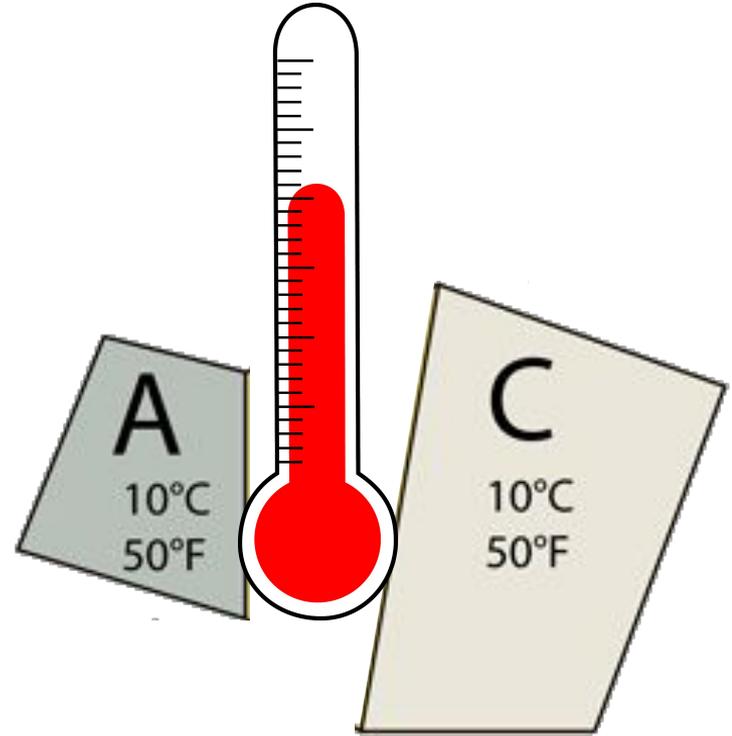
then

Temperature of C = Temperature of A



Zeroth Law of Thermodynamics

What if we replace object B with a thermometer....



How do we Measure Temperature - Scales

Fahrenheit

Created by Physicist Daniel Gabriel Fahrenheit in 1724

0°F is the freezing point of an ice/water/ammonium chloride solution

Celsius

Created by Astronomer Anders Celsius in 1742.

0°C is the freezing point of water, 100°C is the boiling point of water

Kelvin

Created by Physicist William Lord Kelvin, and is based off of the Celsius scale

0 K is Absolute zero and is where all molecular movement stops (-273.15°C)

First Law of Thermodynamics

This is basically conservation of energy

Formally it states that the total energy of an isolated system is constant.

It can also be stated....

The change in internal energy of a system is equal to the heat added to the system minus the work done by the system.

$$\Delta U = Q - W$$

Change in
internal
energy

Heat added
to the system

Work done
by the system

Whats internal Energy?

The internal energy of a system is the energy of everything in it.

It is the sum of all the microscopic energies such as:

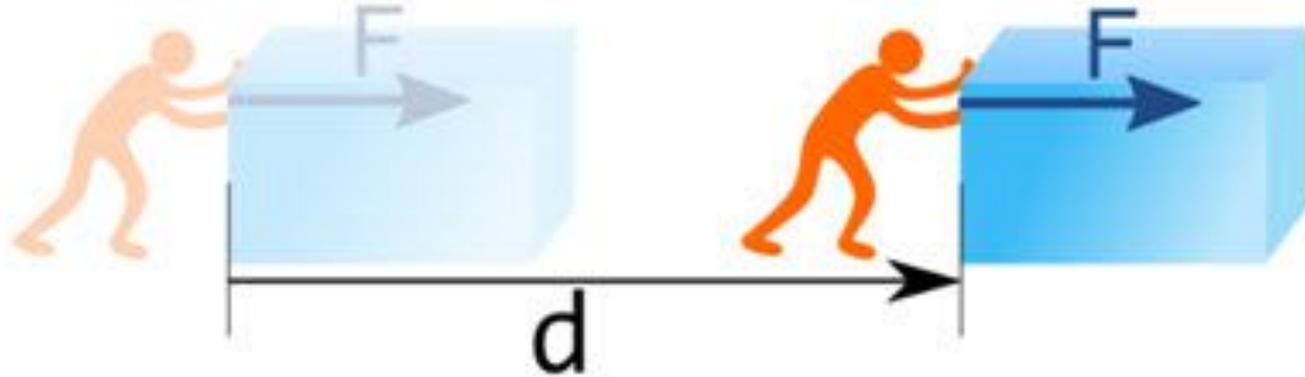
- translational kinetic energy
- vibrational and rotational kinetic energy
- potential energy from intermolecular forces

This is a lot to keep track of in a system, which is why we talk about
CHANGE in Internal Energy

Things to Note..

- A system contains ONLY internal Energy
- a system does NOT contain energy in the form of heat or work
- Heat and work only exist during a change in the system
- Internal energy is a state function

Reviewing work



Work = Force x Distance

$$W = F \cdot d$$

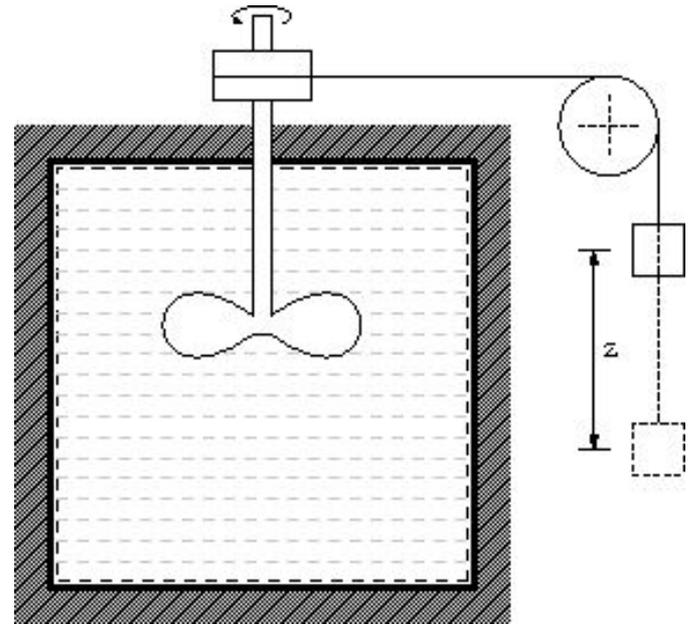
Thermodynamic Work

James Joule (yes that Joule)

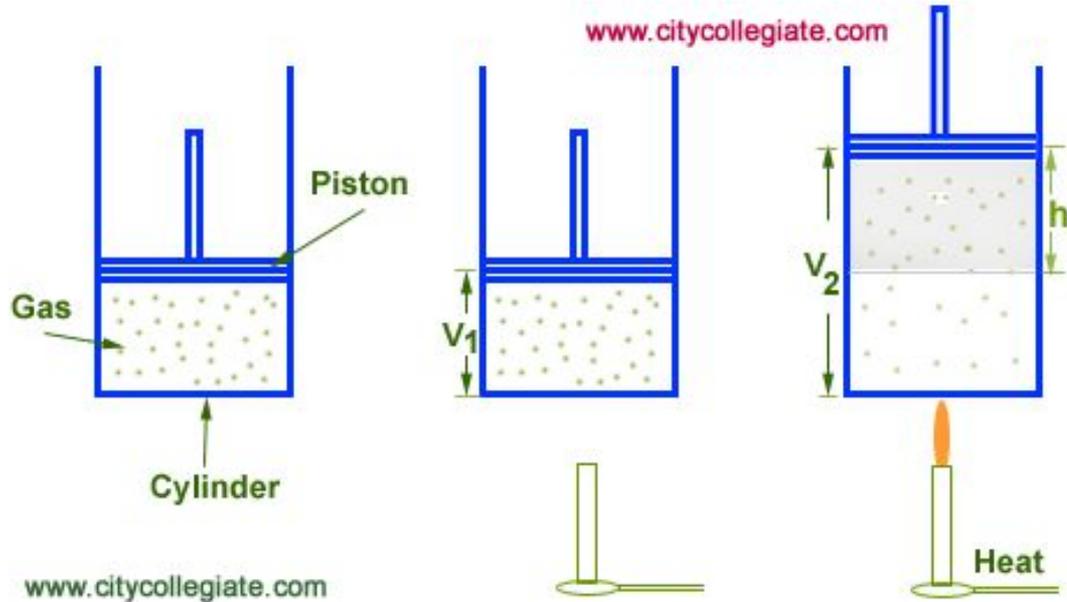
Mechanical work to Heat

Work refers to forms of energy transfer, which can be accounted for in terms of changes in the large physical variables of the system

Heat energy carried into or out of the system in the form of transfers in the *microscopic* thermal motions of particles.



Thermodynamic Work



Change in Work Energy = Pressure * Change in Volume
$$W = P \Delta V$$