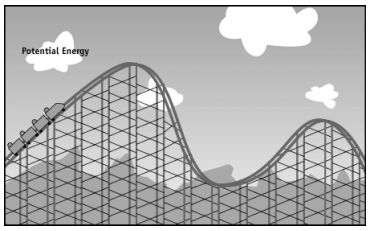
Energy



Energy

- _____ – the ability to do work or produce heat
- Energy exists in two different forms – _____ energy & _____ energy

Potential Energy

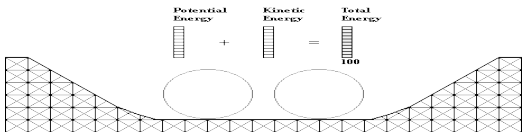
- _____– energy due to composition or position of an object
- Potential energy is _____ energy that results from the attractions or repulsions of other objects

Kinetic Energy

- _____– energy of motion
- Kinetic energy depends on as objects _____ & its _____

Energy

- A roller coaster at the top of a hill has a great amount of potential energy.
- As the rollercoaster begins to speed down the hill, the potential energy is turned into kinetic energy



Energy

- The SI unit for energy is the _____ (J)
- 1 J = 1 Kgm^2 / s^2
- Another unit of energy is the _____
- _____– amount of energy required to raise 1 g of water 1°C
- 1 cal = 4.18 J

Energy

- The calories that you eat are actually kilocalories or Calories (with a big C)
- 1000 calories = 1 Kilocalorie = 1 Calorie

Energy Conversions

- Convert 15,500 joules into Calories

Formulas – Kinetic Energy

- $KE = ½ mv^2$
- KE = kinetic energy (joules)
- m = mass (must be in Kg)
- V = velocity (must be in m/s)

Formulas – Potential Energy

- PE = mgh
- PE = Potential Energy (J)
- m = mass (Kg)
- g = gravitational constant = 9.8 m/s^2
- h = height (m)

Formulas - Work

- Work (w) – the energy used to move an object against a force
- Force (f) – a push or pull on an object
- W = mgd = fd = PE
- Work and potential energy can be looked at in the same light

Examples

- A bowler lifts a 5.4 kg bowling ball 1.6m and then drops it to the ground.
- How much work was required to raise the ball?

Examples

- How much potential energy does that ball have at this height?

Examples

- If the bass is dropped and we assume that all of the potential energy is turned into kinetic energy, at what velocity will the bowling ball hit the ground?

More examples

- What is the kinetic energy of 1 atom of Ar moving at 650 m/s?

1st Law of Thermodynamics

- 1st Law of Thermodynamics – energy is conserved

1st Law of Thermodynamics

- Since energy can neither be gained nor lost, the change in E can be calculated using:
- $\Delta E = E_f - E_i$
- In a chemical reaction i indicates reactants and f indicated products

ΔE

- ΔE has 3 parts:
  1. A # indicating the magnitude
  2. A sign (+/-) indicating the direction
  3. A unit

Thermochemistry

- _____ is the study of heat changes that accompany chemical reactions and phase changes.
- The _____ is the specific part of the universe that contains the reaction or process you wish to study.

Thermochemistry

- Everything in the universe other than the system is considered the _____ .
- Therefore, the _____ is defined as the system plus the surroundings.

Relating ΔE to heat & work

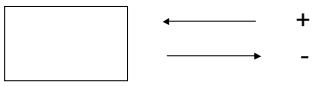
- The system can exchange energy with its surroundings in 2 ways: as heat or work
- ΔE = q + w
- ΔE = change in energy
- q = heat
- w = work

q & w

- Don't forget q & w must have signs
- In order to get the sign you must look at the system as a box and the surroundings as everything else

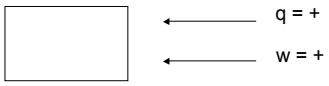
q & w

- Anything going INTO the box will be +
- Anything going OUT of the box will be –



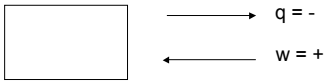
q & w

- If heat is transferred from the surroundings to the system and work is done on the system what are the signs for q & w?



q & w

If heat is lost to the surroundings and work is done on the system what are the signs for q & w?



Summary for q & w

- q + = heat into system
- q - = heat into surroundings
- w + = work done on the system
- w - = work done on the surroundings

Examples

- A system loses 1150 J of heat to the surroundings and does 480 J of work on the surroundings. Calculate ΔE.

Examples

- A system absorbs 140 J of heat from the surroundings and does 85 J of work on the surroundings. Calculate ΔE.

Endothermic & Exothermic

- _____
  - system absorbs heat
  - Heat flows into the system
  - Temperature goes down
- _____
  - Heat flows out of the system and into the surroundings
  - Temperature goes up
- Only look at heat (q) to determine if the system is endo or exo