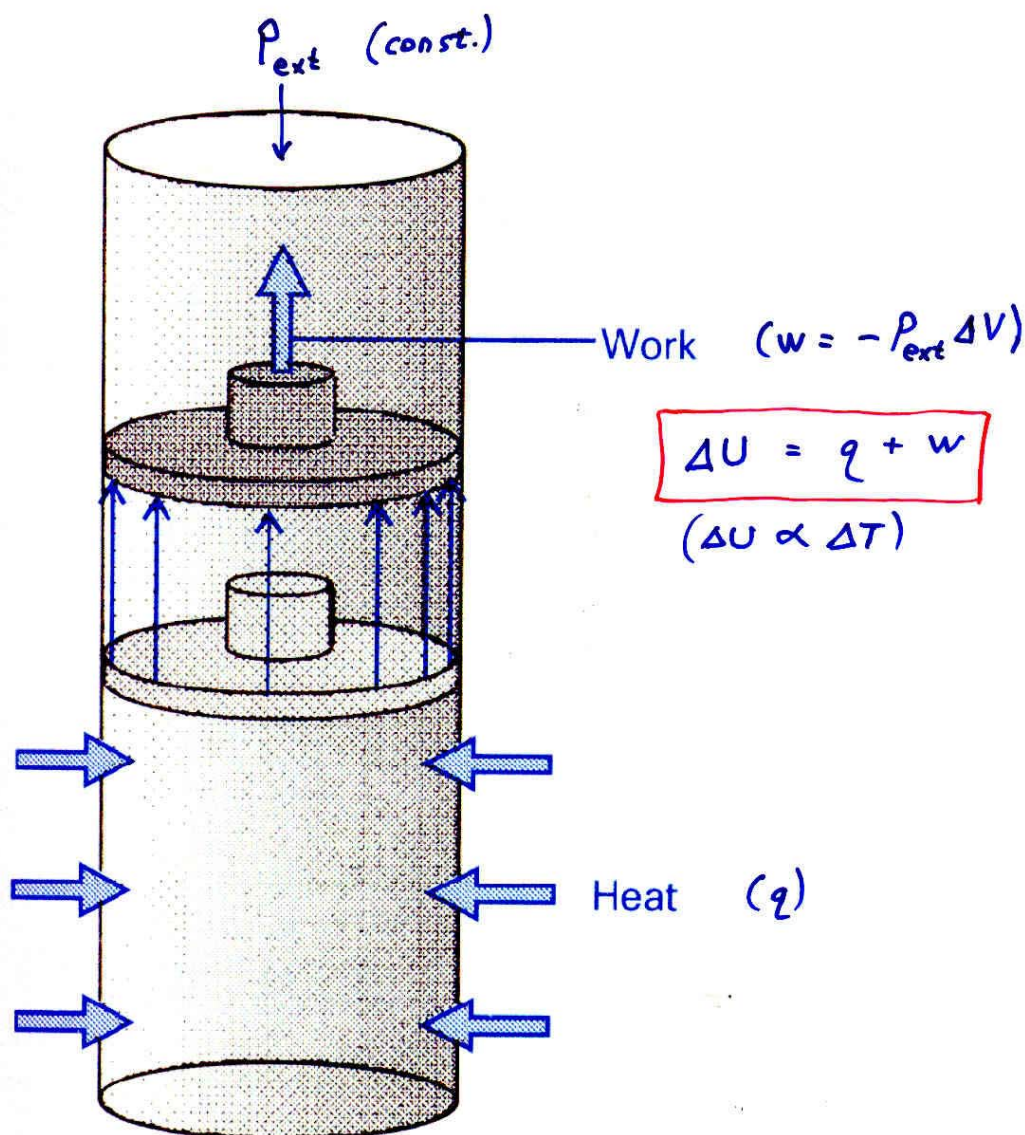


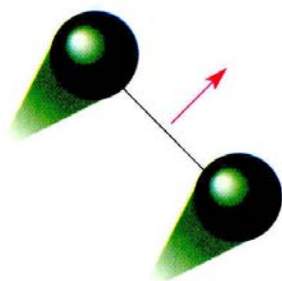
Topic 4B - Internal Energy

The First Law of Thermodynamics



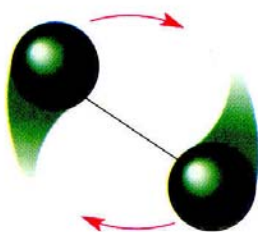
2.14 When a system is subjected to constant pressure and is free to change its volume, then some of the energy supplied as heat may escape back into the surroundings as work. In such a case, the change in internal energy is smaller than the energy supplied as heat.

Contributions to Internal Energy



(a)

Translational Kinetic Energy
(~ 4 kJ/mol at 300 K for N_2)



(b)

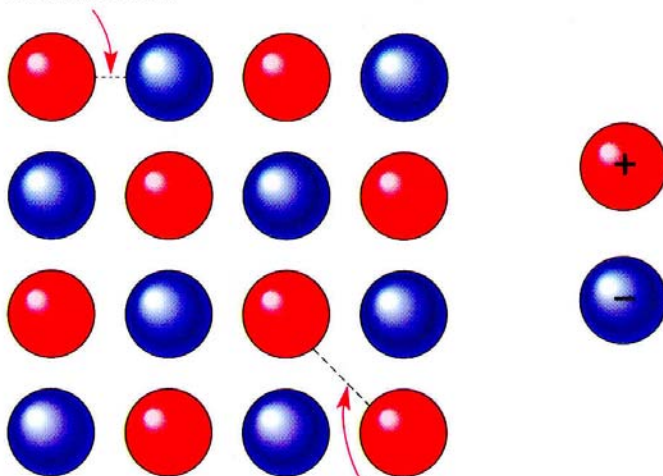
Rotational Kinetic Energy
(~ 2.5 kJ/mol at 300K for N_2)



(c)

Vibrational Kinetic Energy
(~ 0.5 kJ/mol at 300K for N_2)

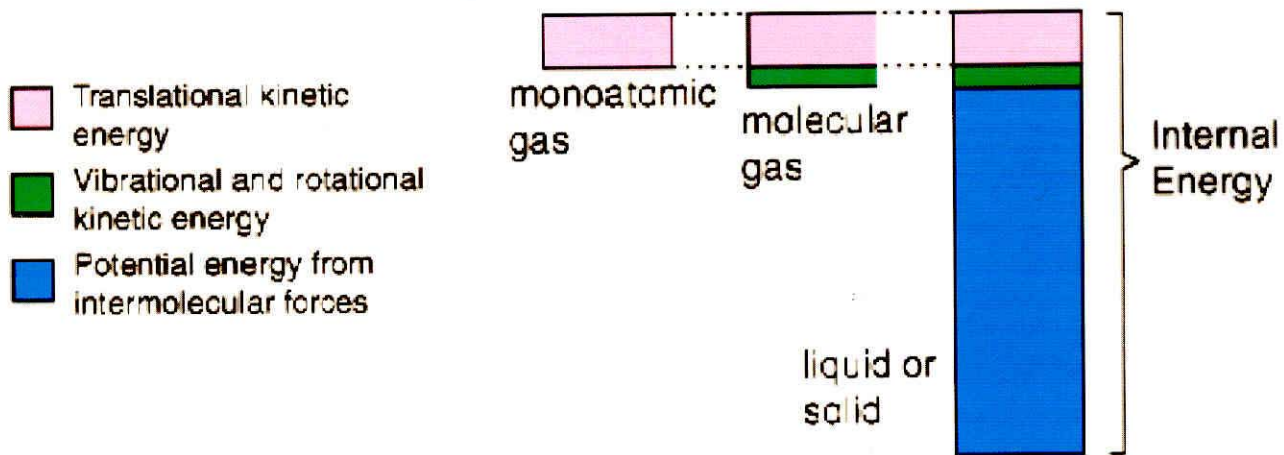
Attraction



Repulsion
(d)

Potential Energy

Systems with the same temperature



What is the same and what is different?

1 gram of water at 0°C



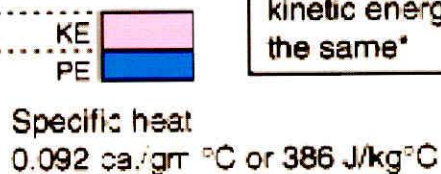
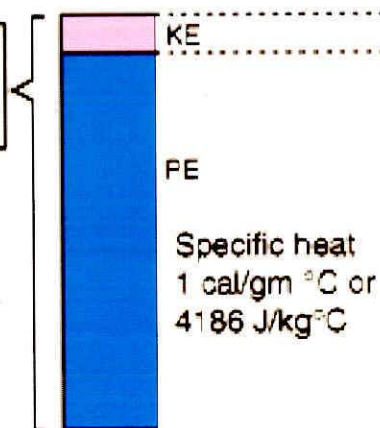
1 gram of copper at 0°C



The same temperature implies that the average molecular kinetic energy is the same*

The internal energy is not the same.

Why is the specific heat of water more than 10 times that of copper?!



Specific heats are not the same.

* More precisely, the translational kinetic energies are the same. The rotational and vibrational kinetic energies are neglected in this simplified illustration.