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# HEAT CONTENT

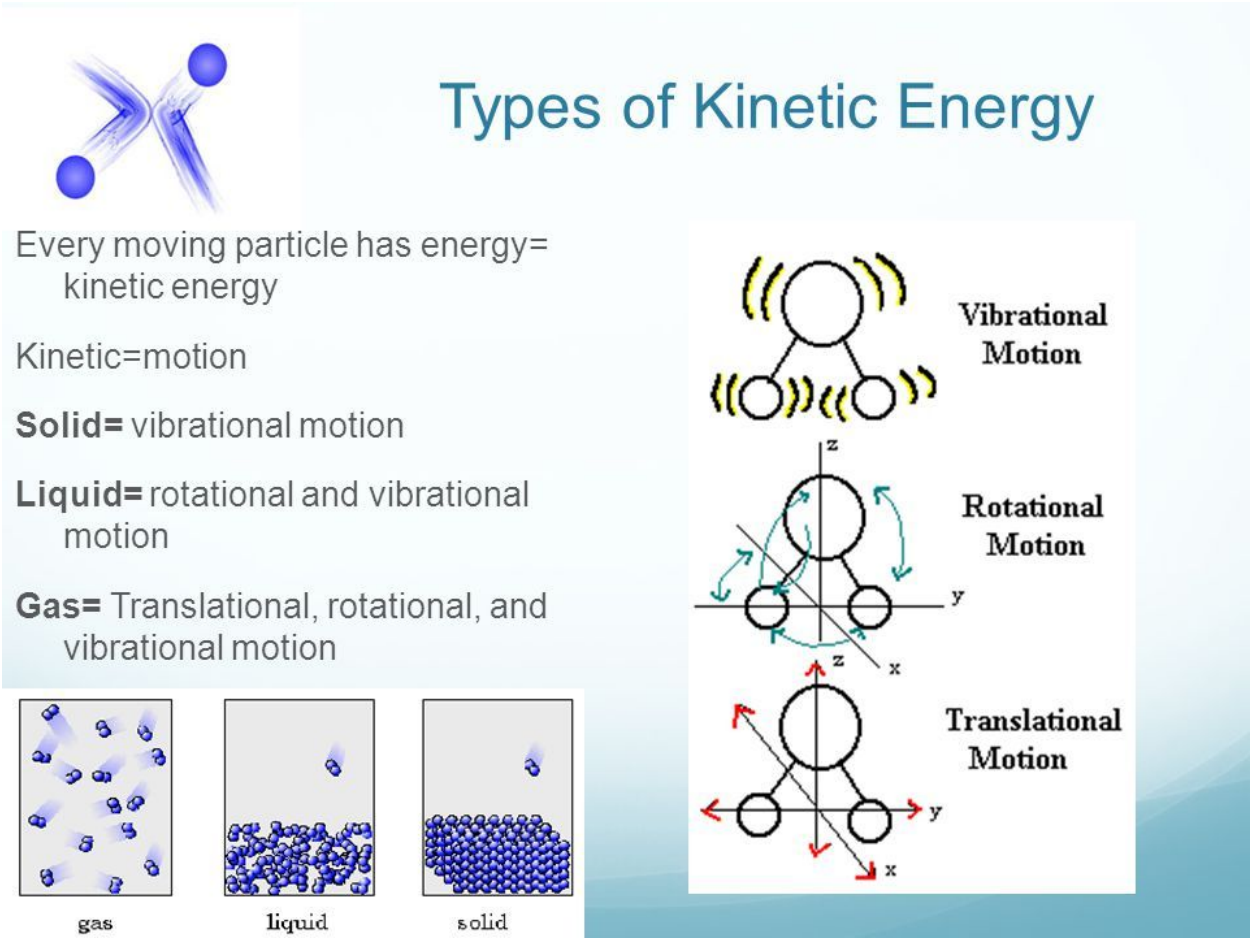
Heat content is the total energy possessed by a molecule. It is the sum of all the forms of potential and kinetic energy associated with it.

**1) Potential Energy**: Energy associated with bonding.

a) Intermolecular Bonds (bonds between molecules) weakest
b) Intramolecular Bonds (bonds between atoms) ↓
c) Nuclear Forces (binding forces in the nucleus) strongest

**2) Kinetic Energy:** Energy associated with molecular motion.

a) Translational Energy (motion from place to place)
b) Rotational Energy (tumbling motion)
c) Vibrational Energy (back and forth motion)



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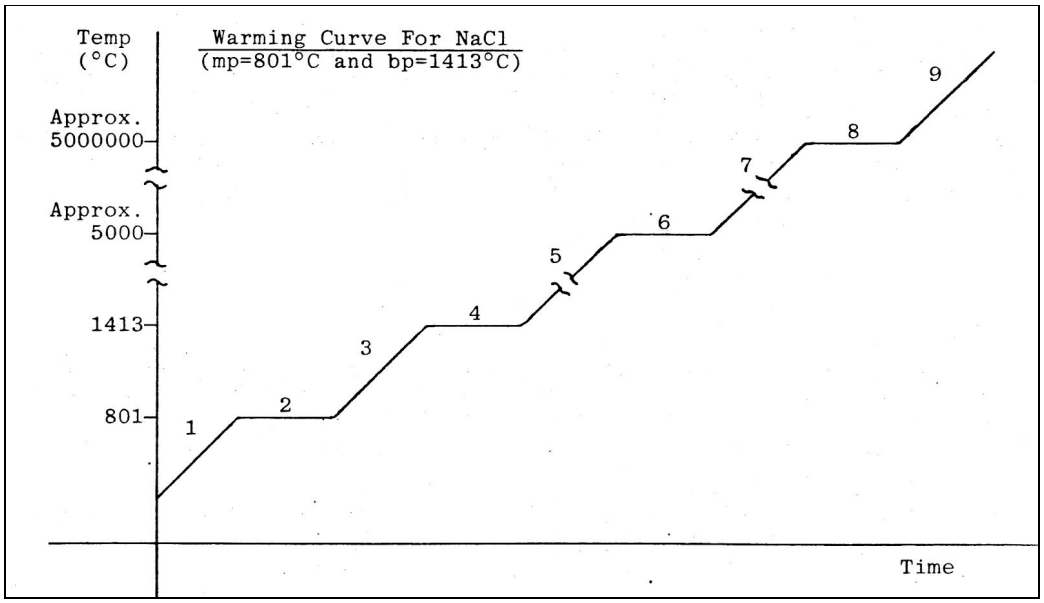
## CHANGES IN HEAT CONTENT OF A SUBSTANCE

The heat content can be changed by heating or cooling it. A heating curve for sodium chloride illustrates the changes that occur.




As a sample of sodium chloride is heated from room temperature:

1) SOLID STATE – vibrational energy increases only
2) SOLID → LIQUID (Melting Point) – intermolecular bonds weaken (801°C)
3) LIQUID STATE – vibrational, translational and rotational energies increase
4) LIQUID → GAS (Boiling Point) – intermolecular bonds break (1413°C)
5) GAS STATE - vibrational, translational and rotational energies continue to increase
6) GASEOUS MOLECULES -→ GASEOUS ATOMS – intramolecular bonds break (≈ 5000°C)
7) GASEOUS ATOMS – only rotational and translational energies increase
8) GASEOUS ATOMS → PLASMA – free protons, neutrons and electron (≈5,000,000°C)
   - nuclear forces overcome
9) PLASMA - only rotational and translational energies increase

## COMPARISON OF ENERGY INVOLVED IN VARIOUS REACTION TYPES

Energy involved in PHASE CHANGES **<<** Energy involved in CHEMICAL REACTIONS **<<<** Energy involved in NUCLEAR REACTIONS