*Kinetics&Thermodynamics &Phase transformation

Exothermic Reactions

- produce products with
  - –low PE
  - –few bonds
  - –stable (don't react easily)
  - –negativeΔH

Endothermic Reactions

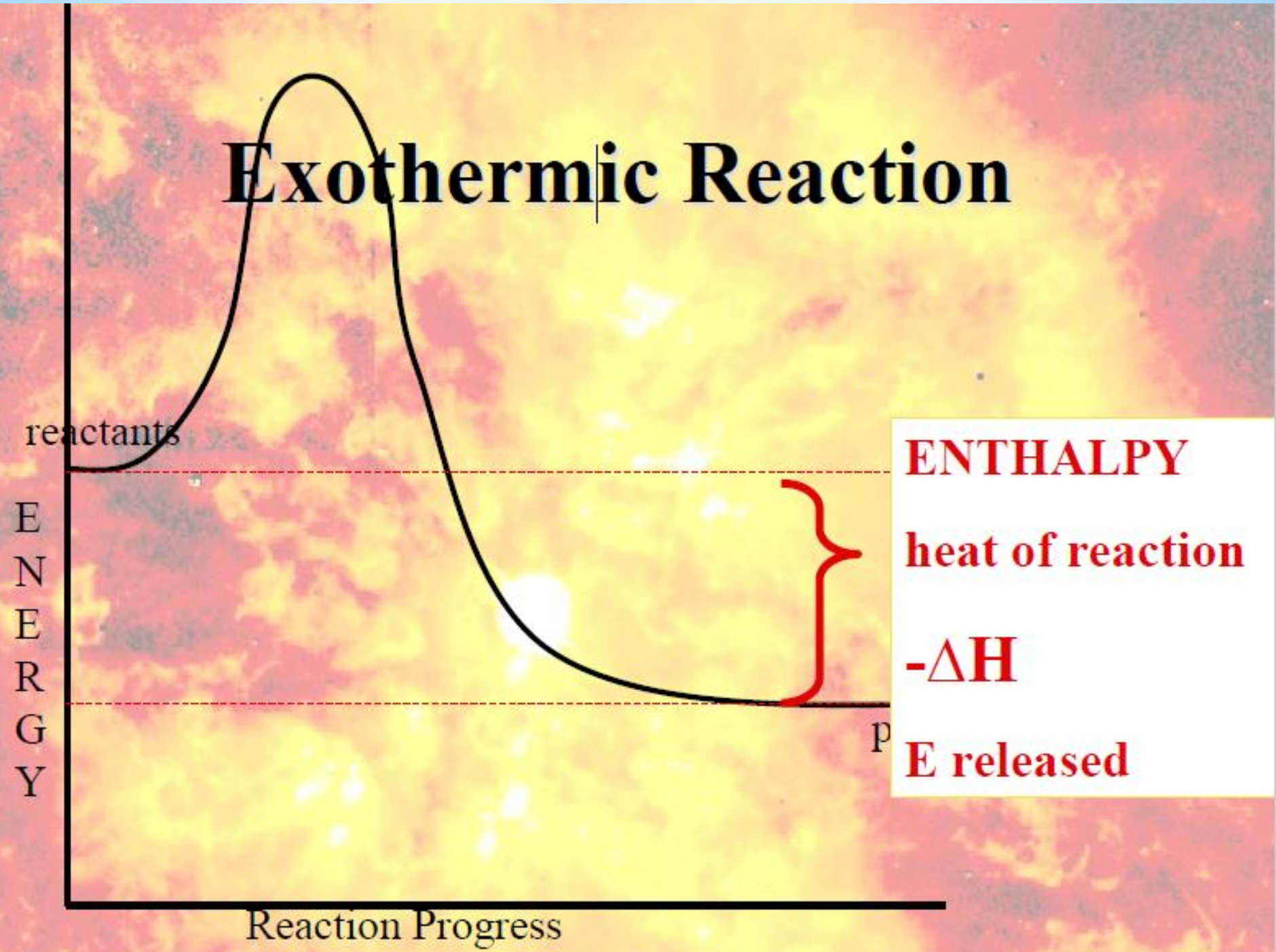
- produce products with
  - –high PE
  - –more bonds
  - –unstable (react easily)
  - $+\Delta H$

Example:

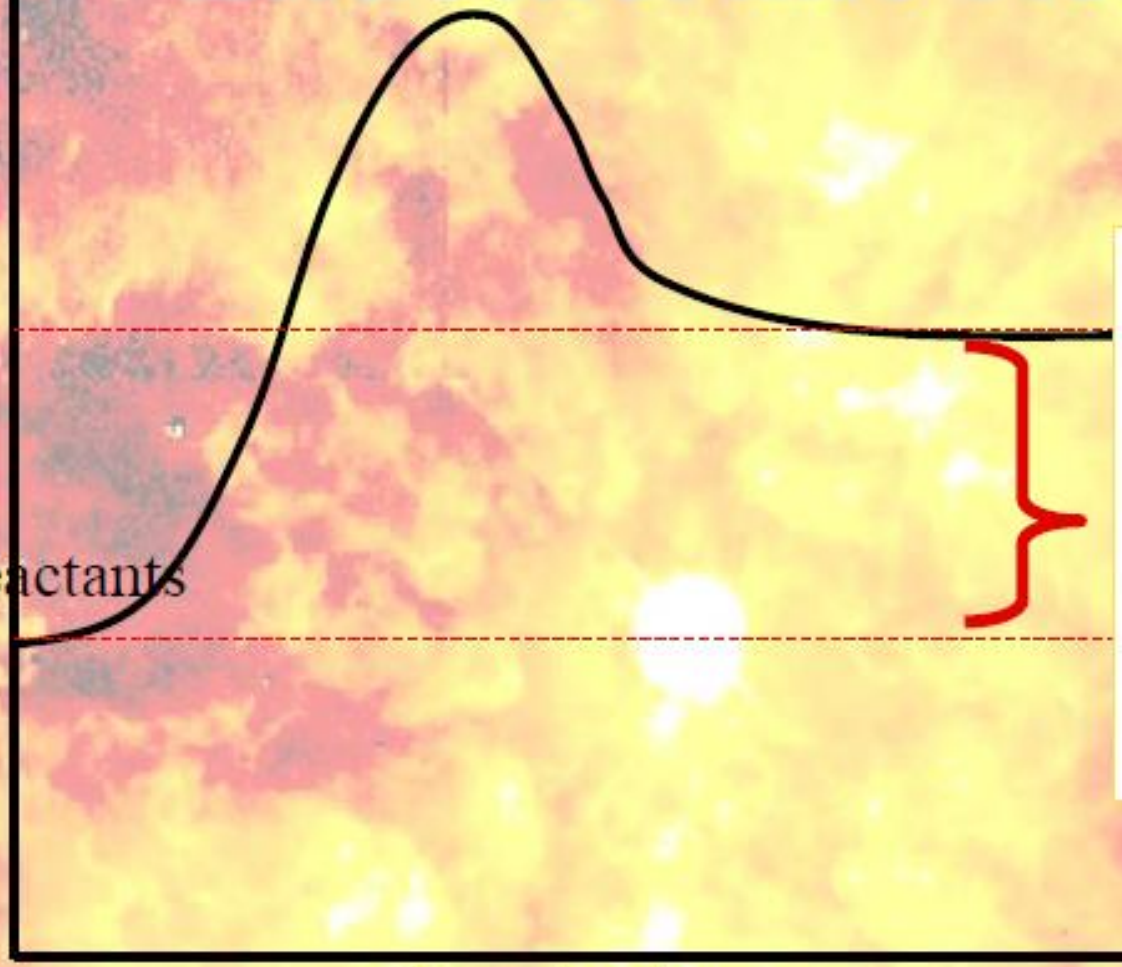
$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g) + 91.8\ kJ$$

- What type of reaction?
- What is ΔH?
- What is the heat of reaction for 1 mole of $NH_3(g)$?

Exothermic Reaction



Endothermic Reaction



ENTHALPY

heat of reaction

+ ΔH

E absorbed

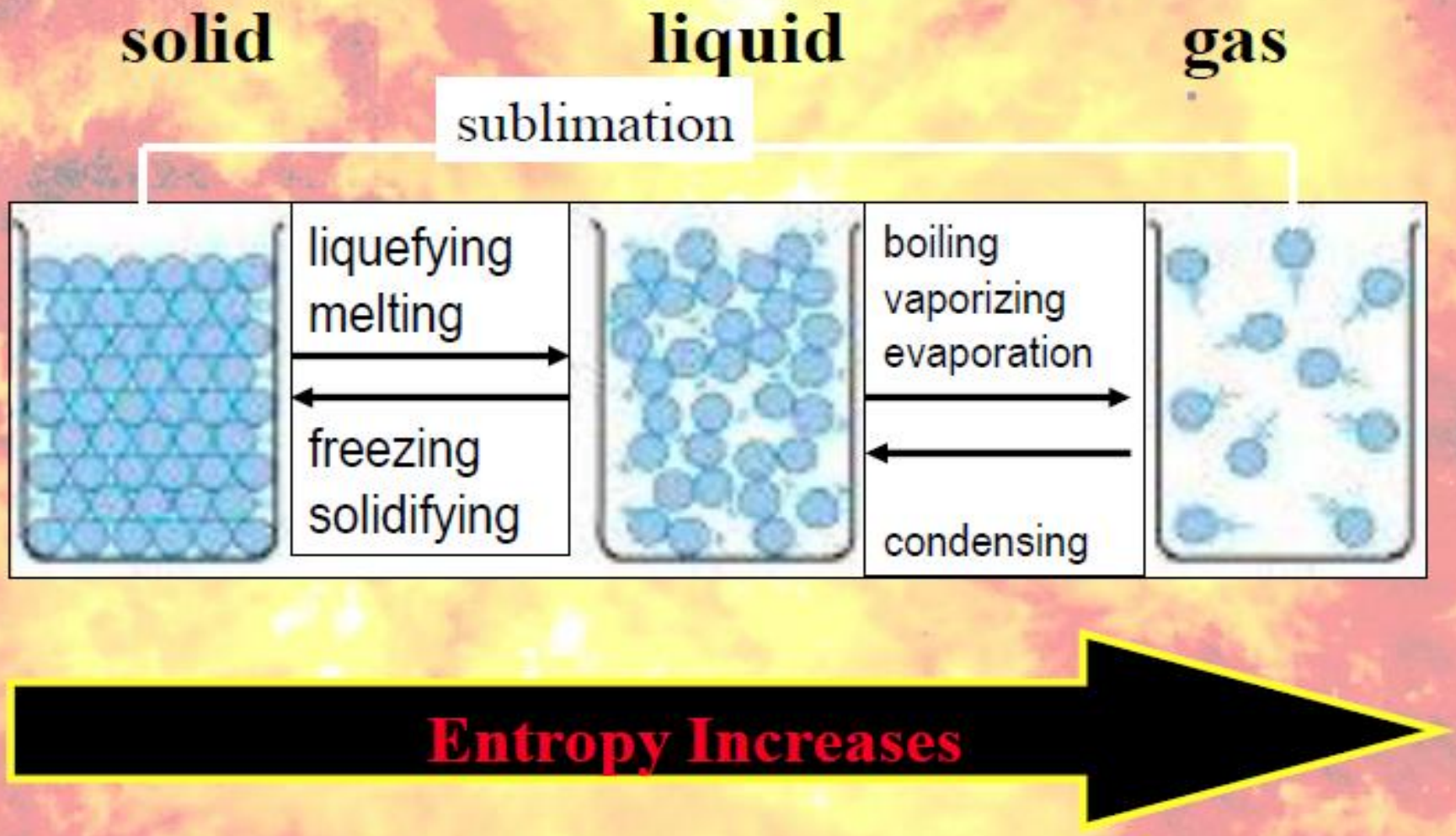
*Salt

An example of an exothermic reaction is the mixture of sodium metal and chlorine gas which yields table salt.

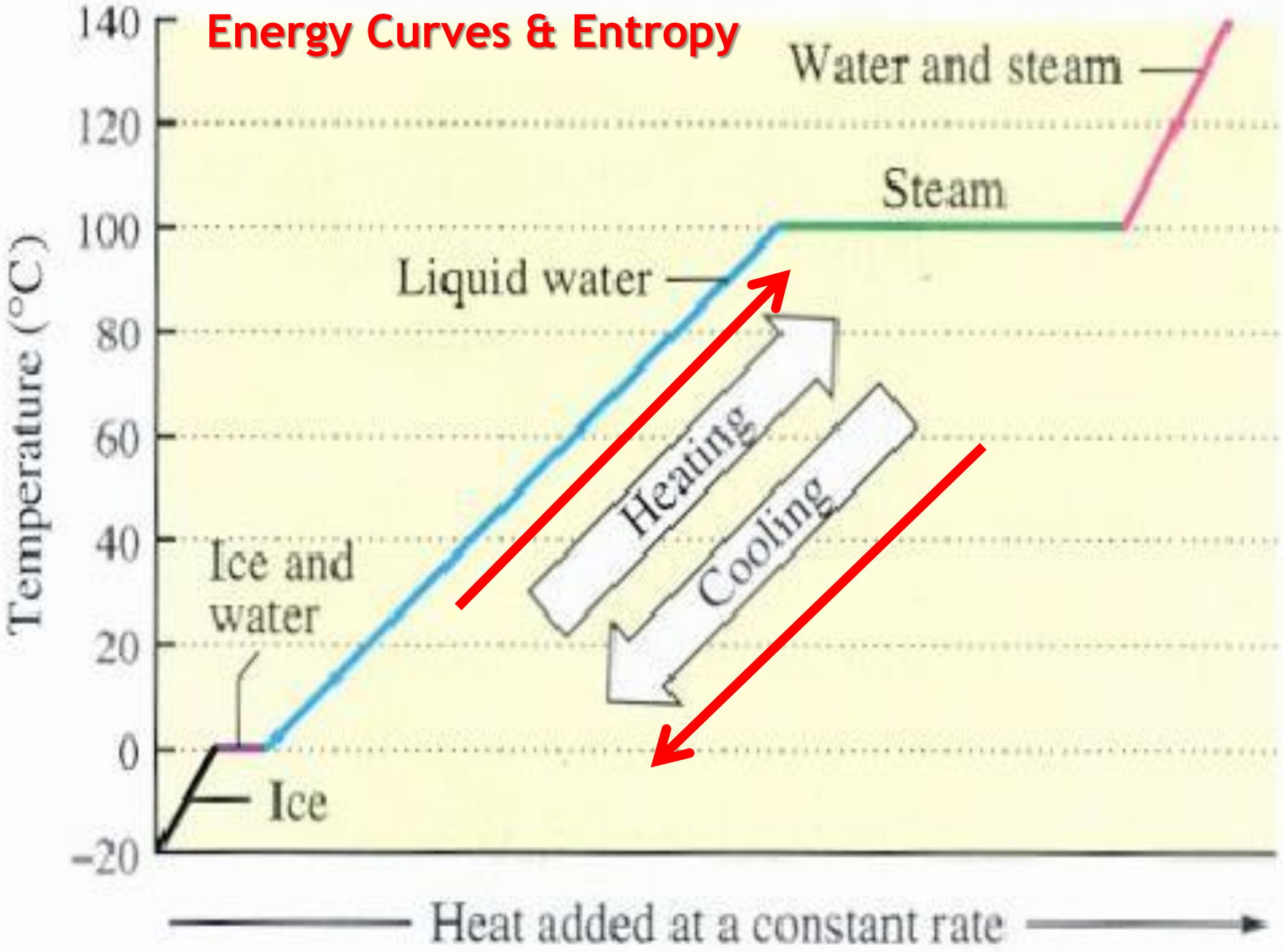
$$2Na(s) + Cl_2(g) \rightarrow 2NaCl(s) + energy$$

Entropy

- **Measure of disorder or randomness of a system**

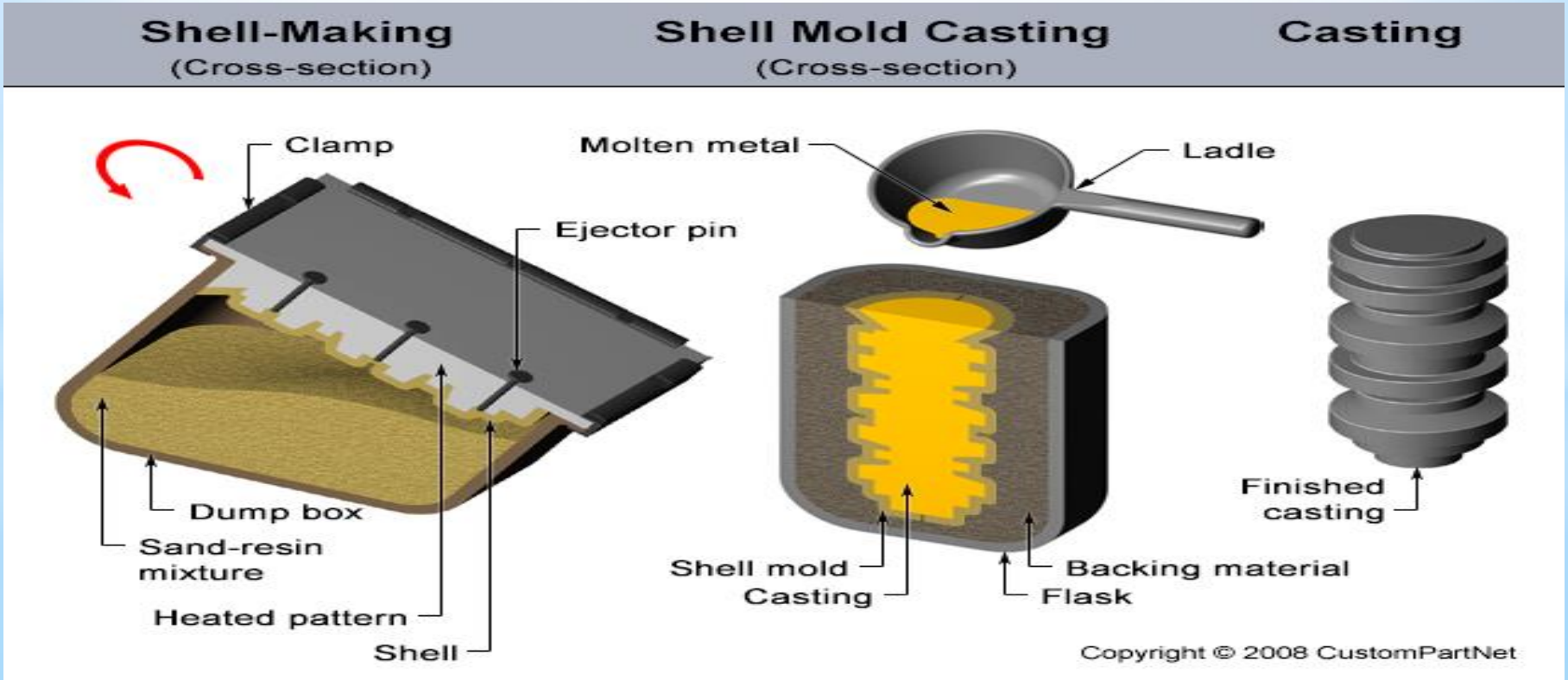


Energy Curves & Entropy



Solidification of Metals

- The solidification of metals and alloys is an important industrial process since most metals are melted and then cast into semifinished of finished shape.
- When molten alloys are cast, solidification starts at the wallls of the mold



* Solidification of Polycrystalline Material

* During Solidification the atomic arrangement changes from a random or short-range order to a long range order or crystal structure.
* Nucleation occurs when a small nucleus begins to form in the liquid, the nuclei then grows as atoms from the liquid are attached to it.
* **Two steps of solidification:**

1. **Nucleation:** Formation of stable nuclei in the melt
2. **Growth:** Crystals grow until they meet each other

* Solidification of Polycrystalline Material