

॥ नमस्ते ॥

# INTRODUCTION TO ENTROPY

# WHAT IS ENTROPY?

- Recall that the simple definition of energy,  
It is the ability to do work.
- **Entropy is a measure of how much energy is not available to do work.**
- Although all forms of energy are interconvertible, and all can be used to do work, it is not always possible, even in principle, to convert the entire available energy into work.
- That unavailable energy is of interest in thermodynamics, because the field of thermodynamics arose from efforts to convert heat to work.

- We can see how entropy is defined by recalling our discussion of the Carnot engine. We noted that for a Carnot cycle, and hence for any reversible processes,

$$\frac{Q_C}{Q_H} = \frac{T_C}{T_H}$$

- Rearranging terms yields

$$\frac{Q_C}{T_C} = \frac{Q_H}{T_H}$$

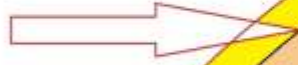
for any reversible process.  $Q_c$  and  $Q_h$  are absolute values of the heat transfer at temperatures  $T_c$  and  $T_h$ , respectively.

This ratio of  $\frac{Q}{T}$  is defined to be the *change in entropy*  $\Delta S$  for a reversible process,

$$\bullet \Delta S = \left( \frac{Q}{T} \right)_{rev}$$

- where  $Q$  is the heat transfer, which is positive for heat transfer into and negative for heat transfer out of, and
- $T$  is the absolute temperature at which the reversible process takes place.
- The SI unit for entropy is joules per kelvin (J/K).

**Total Energy**

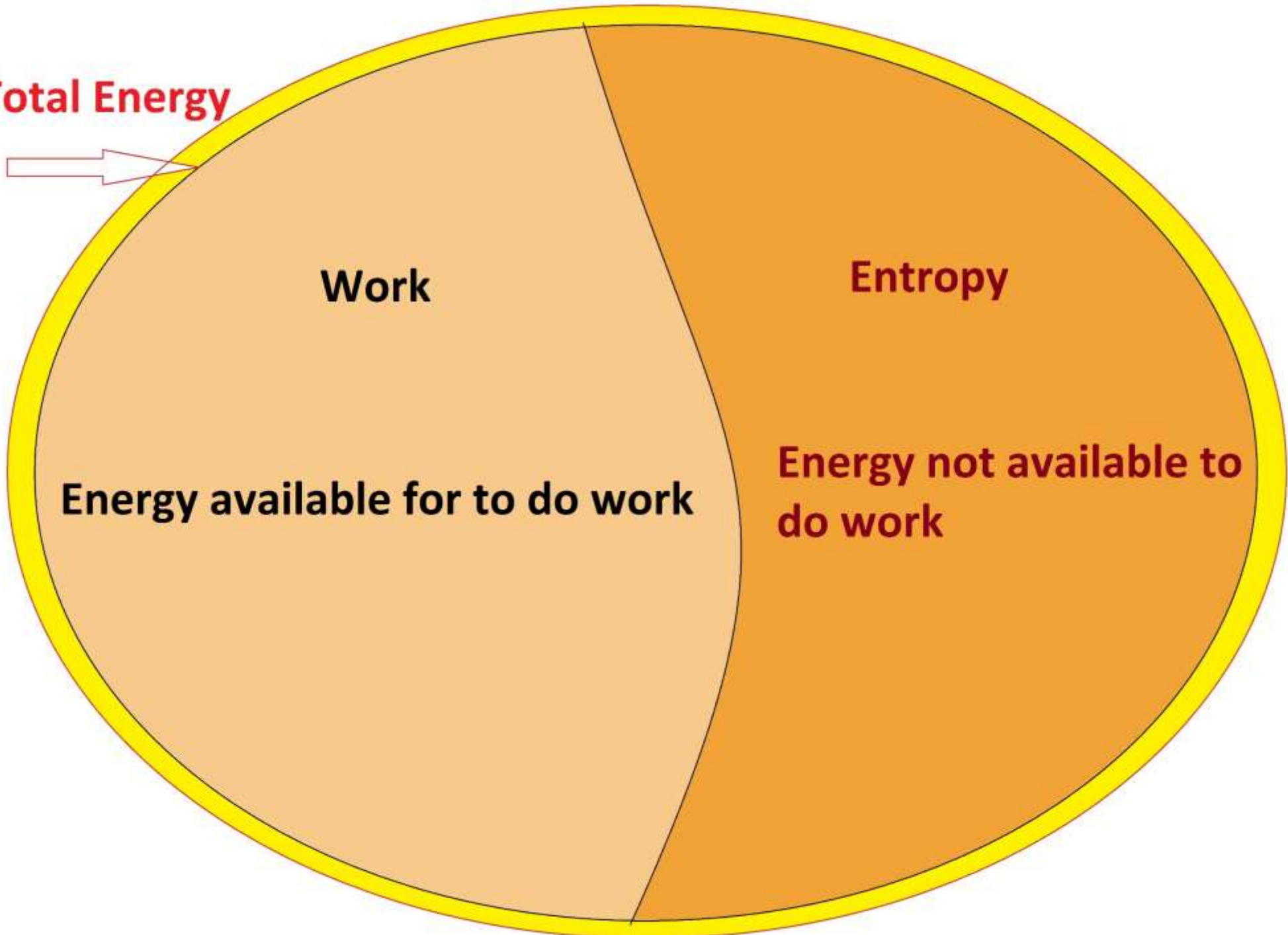


**Work**

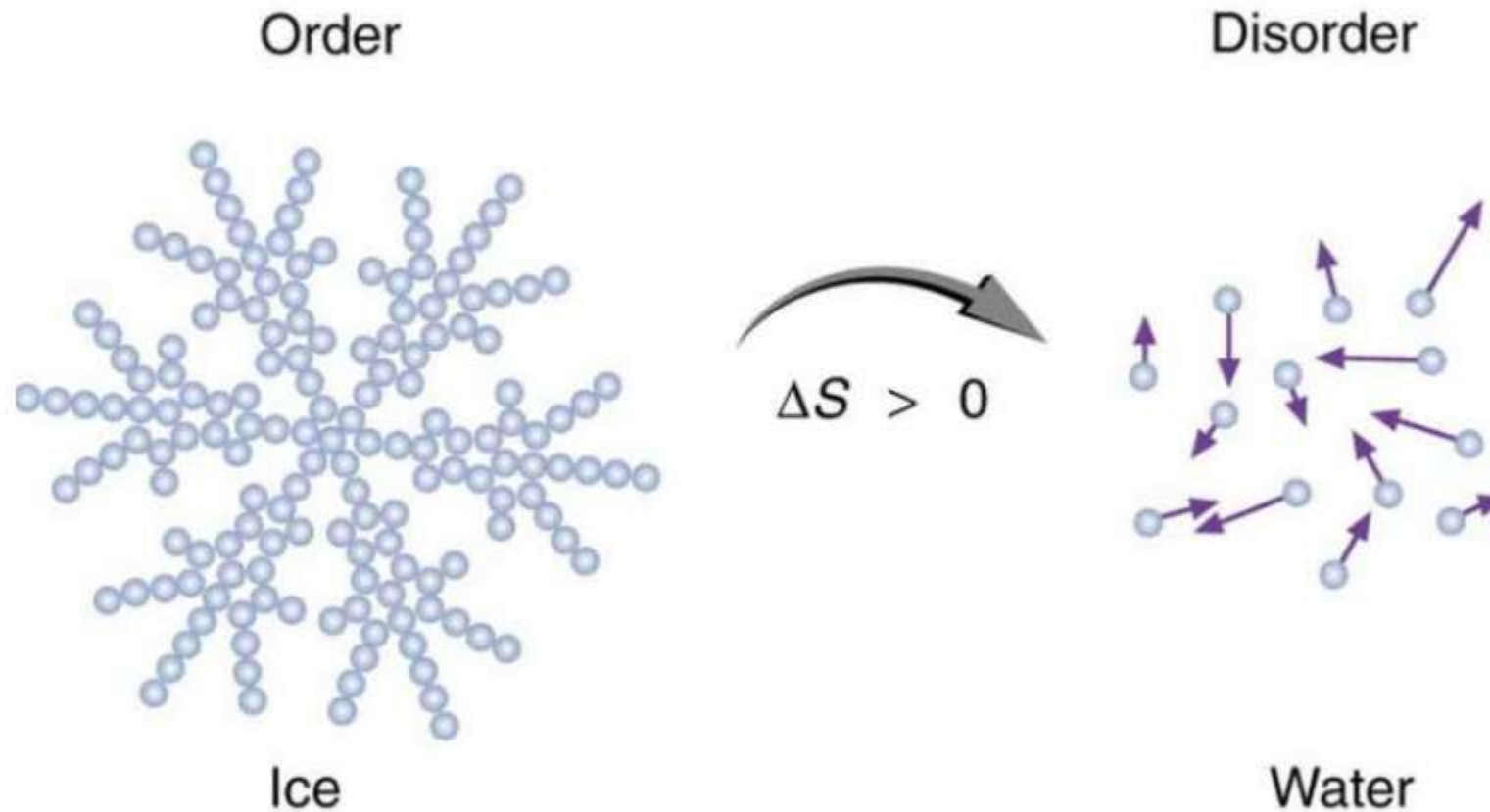
**Entropy**

**Energy available for to do work**

**Energy not available to do work**



- Entropy increases in a closed system, such as the universe.
- Entropy increases in an irreversible (real) process
- Heat transferred at high temperature then small change in entropy then large work produced
- Heat transferred at low temperature then greater change in entropy then less work is produced



When ice melts, it becomes more disordered and less structured. The systematic arrangement of molecules in a crystal structure is replaced by a more random and less orderly movement of molecules without fixed locations or orientations. Its entropy increases because heat transfer occurs into it. Entropy is a measure of disorder.



**ANY QUESTION?**

# Today's Amazing Fact!!



**This is How Baby Elephants Drinks water  
They don't know how to use their trunks until they are 9 month old.**

# धन्यवाद

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