CONCEPT: ENTROPY (SIMPLIFIED)

- **Entropy (S)** is the measure of disorder (randomness, chaos) in a system, surroundings, and universe.
  - □ **The Second Law of Thermodynamics:** states that the *Entropy* of the universe is always _____.
  - □ All Spontaneous reactions involve an _____ in Entropy of the universe.

EXAMPLE: The second law of thermodynamics leads us to conclude:

a) the total energy of the universe is constant

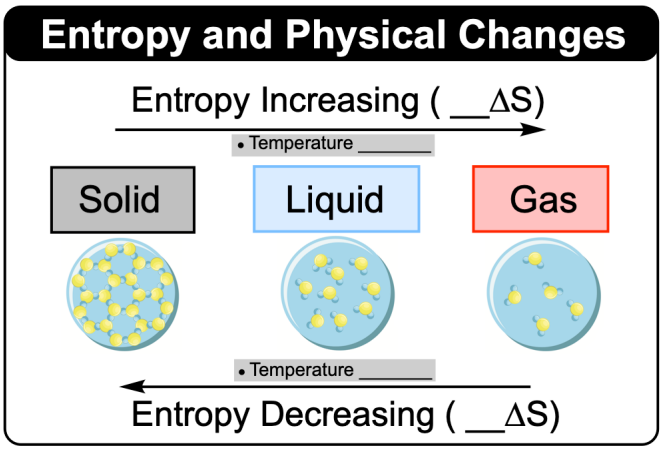
b) the disorder of the universe is increasing with the passage of time

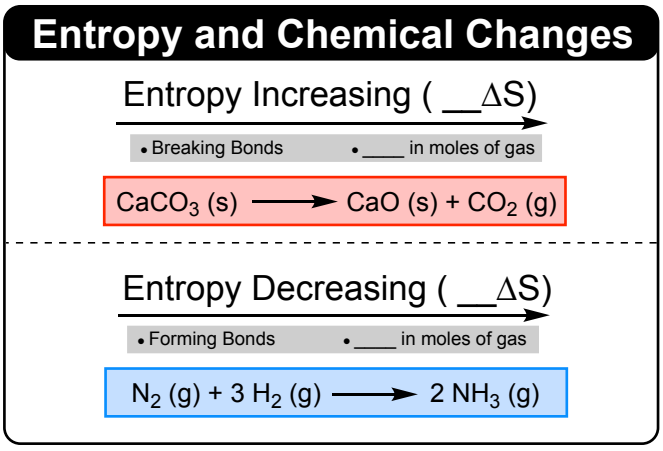
c) the total energy of the universe is increasing with time

d) the total energy of the universe is decreasing with time

Entropy: Physical and Chemical Changes

- We can determine the sign of *Entropy change (ΔS)* in a system by examining physical & chemical changes.
  - □ **Entropy change (ΔS):** a measure of _____ or _____ in disorder due to chemical or physical changes.





EXAMPLE: Which one of the following processes produces a decrease in the entropy of the system?

a) boiling water to form steam

b) melting ice to form water

c) mixing of two gases into one container

d) freezing water to form ice

e) dissolution of solid KCl in water

CONCEPT: ENTROPY (SIMPLIFIED)

PRACTICE: Predict how the entropy of the substance is affected in the following processes:

CH_4 (g, 125°c) $\rightarrow$ CH_4 (g, 200°C)

a) increases b) decreases c) remains the same

PRACTICE: Which reaction is most likely to have a positive ΔS of system?

a) SiO_2 (s) + 3 C (s) $\rightarrow$ SiC (s) + 2 CO (g)

b) 6 CO_2 (g) + 6 H_2O (g) $\rightarrow$ $C_6H_{12}O_6$ (s) + 6 O_2 (g)

c) CO (g) + Cl_2 (g) $\rightarrow$ $COCl_2$ (g)

d) 3 NO_2 (g) + H_2O (l) $\rightarrow$ 2 HNO_3 (l) + NO (g)

PRACTICE: Which of the following processes shows a decrease in entropy of the system?

a) $NaClO_3$ (s) $\rightarrow$ Na^+(aq) + ClO_3^- (aq)

b) CH_3OH (l) $\rightarrow$ CO (g) + 2 H_2 (g)

c) H_2O (l) $\rightarrow$ H_2O (g)

d) 2 NO (g) + O_2 (g) $\rightarrow$ 2 NO_2 (g)

e) $COCl_2$ (g) $\rightarrow$ CO (g) + Cl_2 (g)