

## STATEMENTS OF THE SECOND LAW OF THERMODYNAMICS

### **Clausius:**

A Transformation whose only final result is to transfer heat  $q$  from a body at a given temperature ( $T_1$ ) to a body at a higher temperature ( $T_2$ ) with no work  $w$  done is *impossible*.

### **Kelvin/Planck:**

A transformation whose only final result is to transform into work  $w$ , heat  $q$  from a source which is at the same temperature  $T_2$  throughout is *impossible*.

### **Clausius:**

Temperature  $T$  is an integrating factor for reversible heat  $\delta q_{\text{rev}}$  which leads to a state function defined by

$$dS = \frac{\delta q_{\text{rev}}}{T}$$

For a system at equilibrium,

$$dS = 0$$

This state function, entropy, has the property that for a transformation *in an isolated system*,

$$\Delta S \geq 0$$

where the equality holds if the process is reversible.