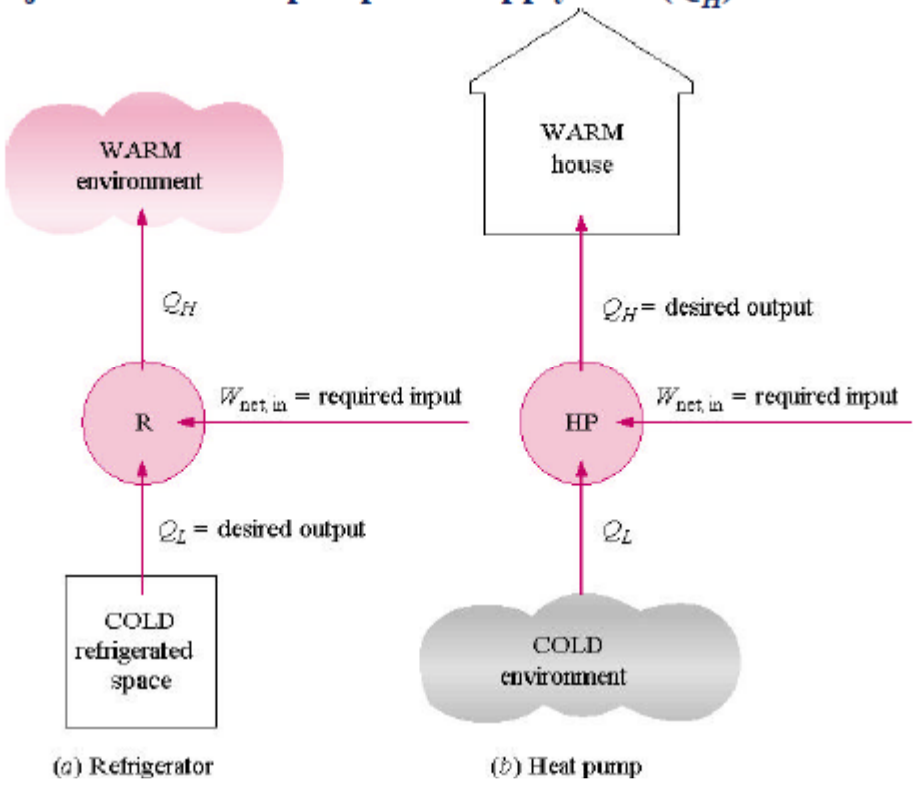
Refrigerator and Heat Pump Objectives

The objective of a refrigerator is to remove heat (Q_L) from the cold medium; the objective of a heat pump is to supply heat (Q_H) to a warm medium



Some Basic Definitions

- The transfer of heat from lower temperature regions to higher temperature ones is called *refrigeration*.
- Devices that produce refrigeration are called *refrigerators*, and the cycles on which they operate are called *refrigeration cycles*.
- The working fluids used in refrigerators are called *refrigerants*.
- Refrigerators used for the purpose of heating a space by transferring heat from a cooler medium are called *heat pumps*.

Coefficient of Performance

- The performance of refrigerators and heat pumps is expressed in terms of *coefficient of performance* (COP), defined as

$$COP_R = \frac{\text{Desired output}}{\text{Required input}} = \frac{\text{Cooling effect}}{\text{Work input}} = \frac{Q_L}{W_{net,in}}$$

$$COP_{HP} = \frac{\text{Desired output}}{\text{Required input}} = \frac{\text{Heating effect}}{\text{Work input}} = \frac{Q_H}{W_{net,in}}$$

Carnot Refrigerator and Heat Pump

- **A refrigerator or heat pump that operates on the reversed Carnot cycle is called a *Carnot refrigerator* or a *Carnot heat pump*, and their COPs are**

$$COP_{R,Carnot} = \frac{1}{T_H / T_L - 1} = \frac{T_L}{T_H - T_L}$$

$$COP_{HP,Carnot} = \frac{1}{1 - T_L / T_H} = \frac{T_H}{T_H - T_L}$$