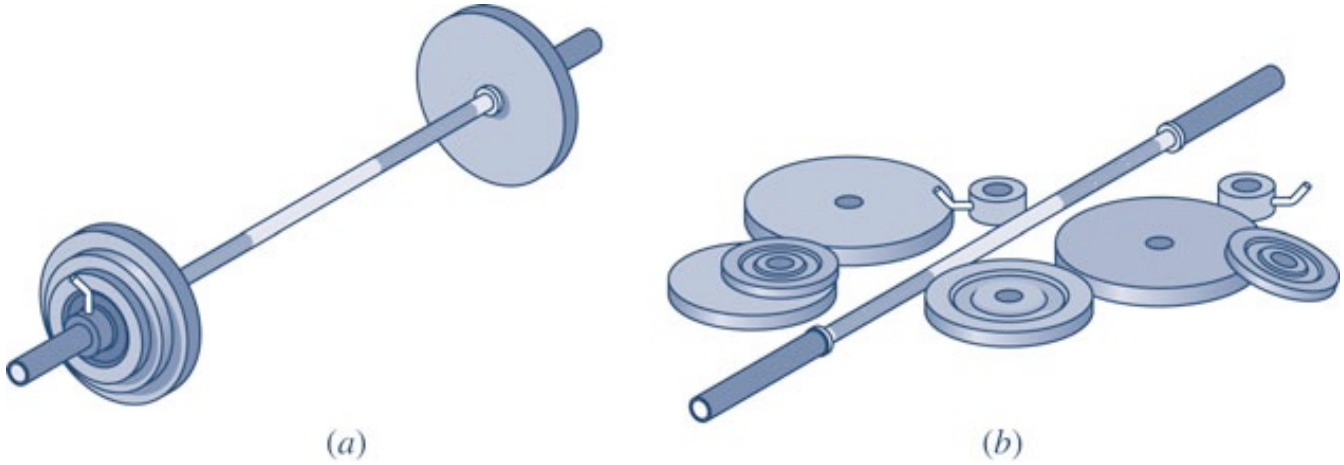
# Extensive Property

- Depends on the size or extent of a system.
- Examples: mass, volume, energy., 熵, 动量
- Its value for an overall system is the sum of its values for the parts into which the system is divided.




- Its value may vary with time but not position.

# Intensive Property

- Independent of the size or extent of a system.
- Examples: pressure, temperature.
- Its value is not additive as for extensive properties.
- May vary from place to place within the system at any moment – function of both position and time.

# Equilibrium

►When a system is isolated, it does not interact with its surroundings; however, its state can change as a consequence of spontaneous events occurring internally as its intensive properties such as temperature and pressure tend toward uniform values. When all such changes cease, the system is at an **equilibrium state**.

►Equilibrium states and processes from one equilibrium state to another equilibrium state play important roles in thermodynamic analysis.

# Units (1 of 2)

- A unit is any specified amount of a quantity by comparison with which any other quantity of the same kind is measured (e.g., meter, kilometers, feet, and miles are all *units of length*).
- Two systems of units:
  - SI (Système International d'Unités)
  - English Engineering units.

# Units (2 of 2)

**TABLE 1.3** Units for Mass, Length, Time, and Force

| | SI | | English | |
|---|---|---|---|---|
| **Quantity** | **Unit** | **Symbol** | **Unit** | **Symbol** |
| mass | kilogram | kg | pound mass | lb |
| length | meter | m | foot | ft |
| time | second | s | second | s |
| force | newton | N | pound force | lbf |
| | (= 1 kg · m/s$^2$) | | (= 32.1740 lb · ft/s$^2$) | |

**In these unit systems, mass, length, and time are base units and force has a unit derived from them using,**

$$F = ma \qquad \text{(Eq. 1.1)}$$

**SI:** $1\ \text{N} = (1\ \text{kg})(1\ \text{m/s}^2) = 1\ \text{kg·m/s}^2$ **(Eq. 1.2)**

**English:**

$$1\ \text{lbf} = (1\ \text{lb})(32.1740\ \text{ft/s}^2) = 32.1740\ \text{lb·ft/s}^2 \qquad \text{(Eq. 1.5)}$$