FIRST LAW OF THERMODYNAMICS

$$Q = \Delta U + W$$

Heat added to a system = increase in internal energy
+ external work done by the system.

human metabolism

$$Q = \Delta U + W$$

$$Q < 0$$

heat flows out of the body

cyclic process
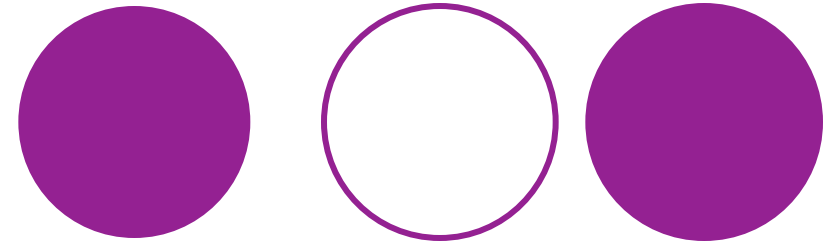
$$Q = \boxed{\Delta U} + W$$

$$\Delta U = 0$$

$$Q = W$$

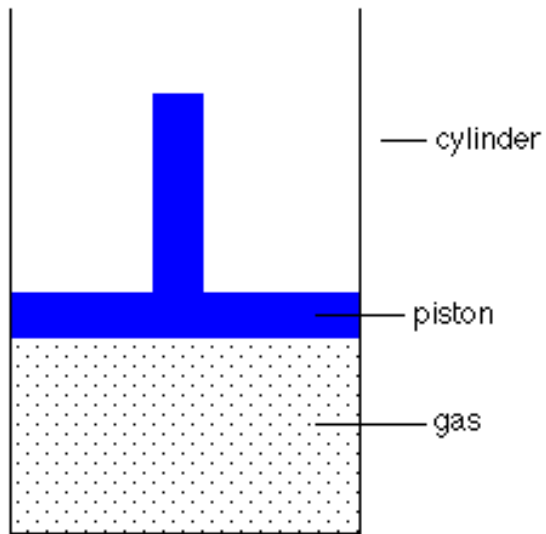*system goes back to initial state

isochoric

$Q = \Delta U + \boxed{W}$

$W = 0$

$Q = \Delta U$

Example:

heating an airtight can filled with air on a hot stove

4

gas in cylinder with movable piston

- cylinder
- piston
- gas

$$Q = \Delta U + \boxed{W}$$

$$W \neq 0$$
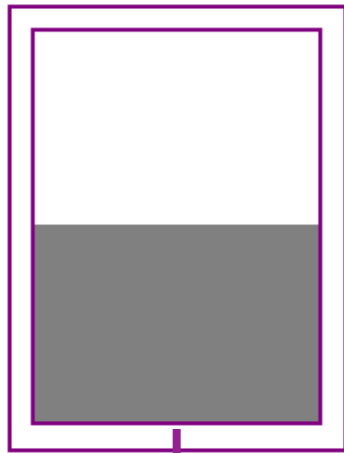
heat gained results to less increase in temperature

popcorn in a pot

$$Q = \Delta U + W$$

Q > 0

W → system does work to lift the lid of the pot

free expansion

insulated

$$Q = \Delta U + W$$

$Q = 0$ $W = 0$

$\Delta U = 0$

adiabatic

$$\boxed{Q} = \Delta U + W \qquad 0 = \Delta U + W$$

$Q=0$

compression: $W<0$
➔ increase in U

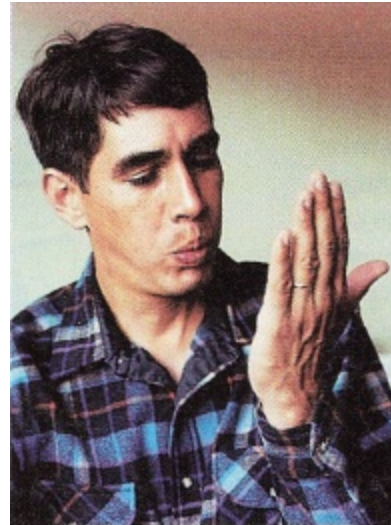**expansion**: $W>0$
➔ decrease in U

Adiabatic Expansion

- Adiabatic expansion of air
- Air quickly leaking out of a balloon
- Blowing on your hand

Adiabatic Compression

- Adiabatic compression of air
- Rapidly pumping up a bicycle tire