Energy Bar Charts

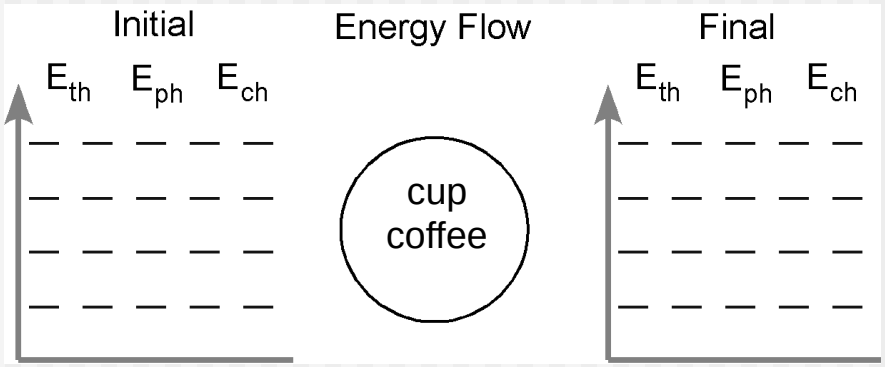
How to represent the role of energy in physical change

Constructing an Energy Bar Chart

Consider this example

A cup of hot coffee cools as it sits on the table.

- 1. Determine what is in the system



  - Everything else makes up the surroundings

Decide whether E_{ch} is involved

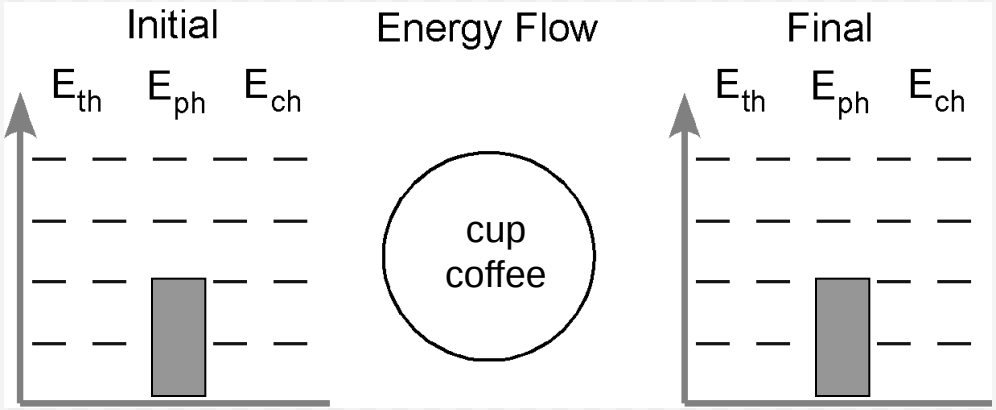
- In this case, you start with coffee and end with coffee; particles are not rearranged to form new substances
- So, ignore E_{ch} for now.

Assign values to E_{ph}

- Due to interactions between particles, the energy stored due to the arrangement of particles is ranked:
  solids < liquids < gases
- We choose to represent these phases by using:
  - Solids = 1 bar
  - Liquids = 2 bars
  - Gases = 4 bars

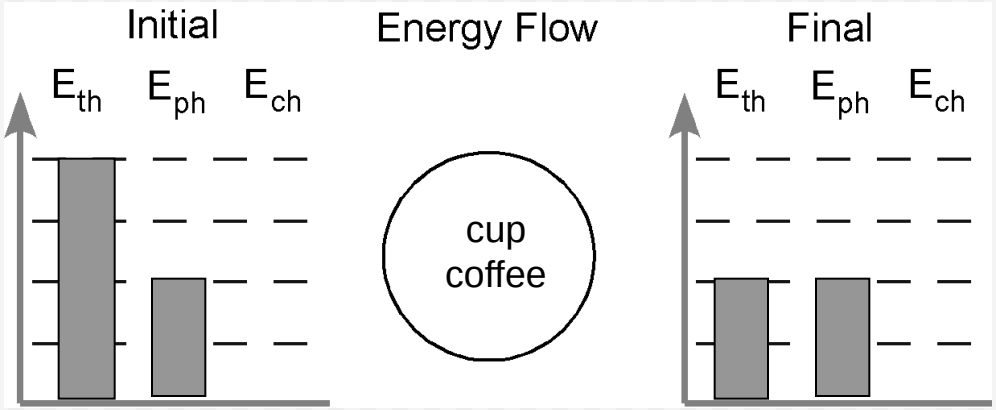
Assign values to E_{ph}

- Use two E_{ph} bars before and after



Choose bars for E_{th} depending on temperature

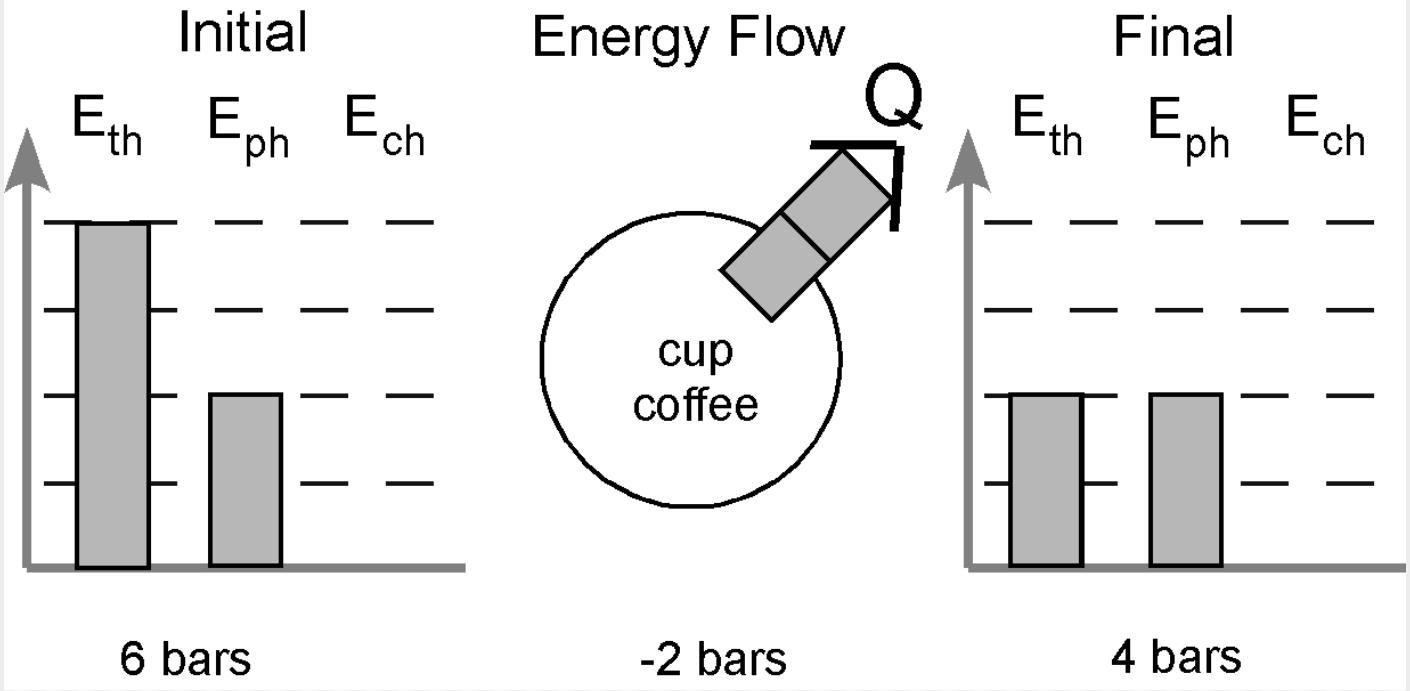
- Use 4 bars for hot coffee and 2 bars for room temp coffee



  - Other values might also work; try to be consistent in your representations

Now show energy transfer

- Final situation has 2 less bars of E than initial; 2 bars had to leave the system

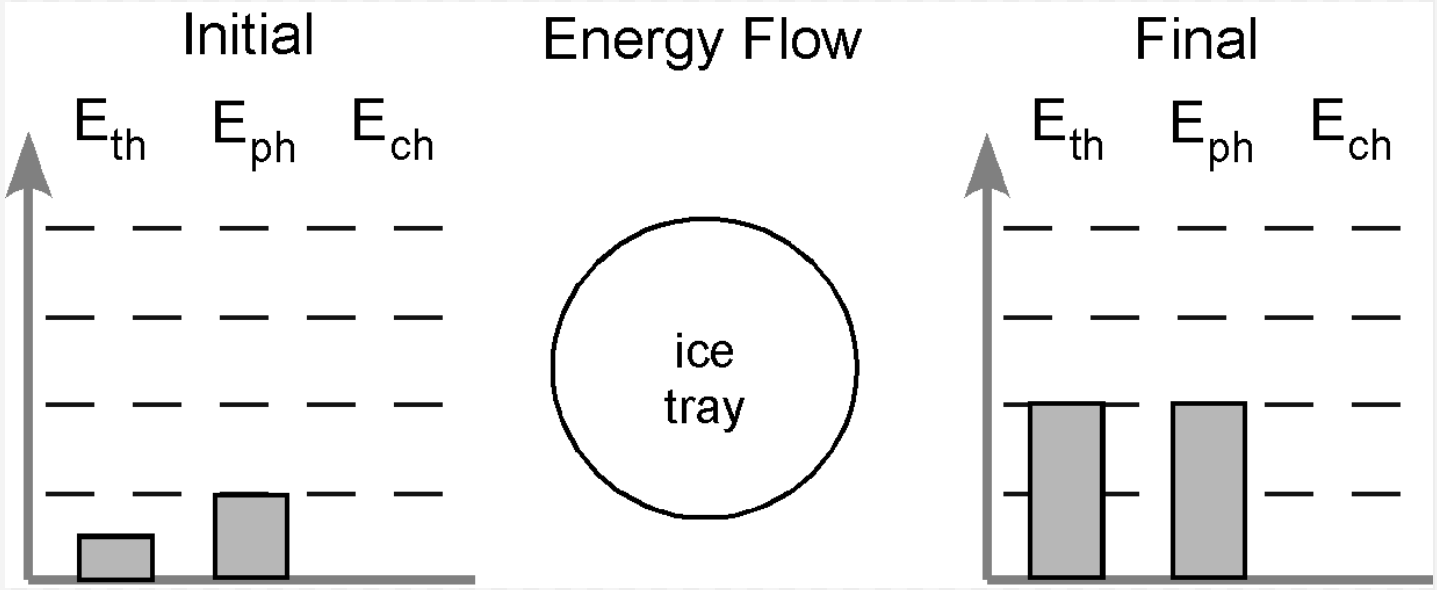


Now, consider phase change

- A tray of ice cubes (-8 ˚C) is placed on the counter and becomes water at room temperature
- What do we know about the situation?
  - The system is the tray of ice cubes.
  - The solid water turns to liquid water - no change in E_{ch}
  - The E_{ph} increases (solid→liquid)
  - The E_{th} increases (temp rises)
- Now represent these changes in bar graph.

Initial & Final States

- Choice of bars for E_{th} arbitrary, but consistent.
  - We generally use 2 bars for room temp and one bar for cold liquid
  - □-8˚C should be < 1 bar.



Account for Energy

- Energy must flow into system via heating