

Thermal Energy


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Kinetic Molecular Theory

- All things are made of particles
- Particles always move.
- more movement = more energy

Motion → Translational 

→ Rotational 

→ Vibrational 

Thermal Energy: total movement energy within an object

What has more thermal energy?

cup of tea

or

iceberg

↑
higher temperature

↑
way more particles
more energy

Temperature: average kinetic energy of the particles within an object.

Thermal Energy concentration

Heat: the transfer of thermal energy → ΔE

→ Q = symbol for heat

$$Q = m c \Delta T$$

↑ mass
↓
↑ specific heat capacity
↑ change in temperature

Specific Heat Capacity:

The amount of energy required to raise kg of mass 1°C .

Specific Heat Capacities
medium 1 C

| Units of Temperature.

Specific Heat Capacities

Medium	C
Water	4180 J/kg°C J/kgK
Carbon	720
Iron	460
Copper	390
Lead	130

Units of Temperature.

°C

0°C → water
Freezes
100°C → water
boils

~~K~~ K → Kelvin → Same scale
as °C

$$0\text{K} = -273^\circ\text{C}$$

↑
Absolute Zero

$$0^\circ\text{C} = 273\text{K}$$

A 530g cup of water cools from 37°C to 15°C. How much thermal energy did it lose? ← transfer of energy → Heat

$$Q = mc\Delta T$$

$$m = 530\text{g} = 0.530\text{kg}$$

$$c = 4180\text{J/kg}^\circ\text{C}$$

$$Q = 0.530(4180)(-22) \quad \Delta T = T_f - T_i = 15^\circ\text{C} - 37^\circ\text{C} = -22^\circ\text{C}$$

$$Q = -48738.8 = \boxed{-49000\text{J}}$$