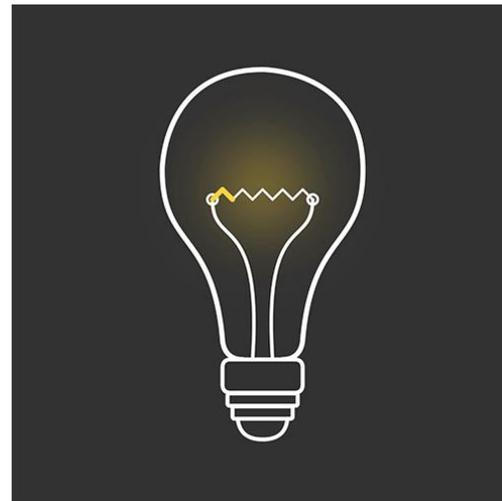


Heat & Temperature

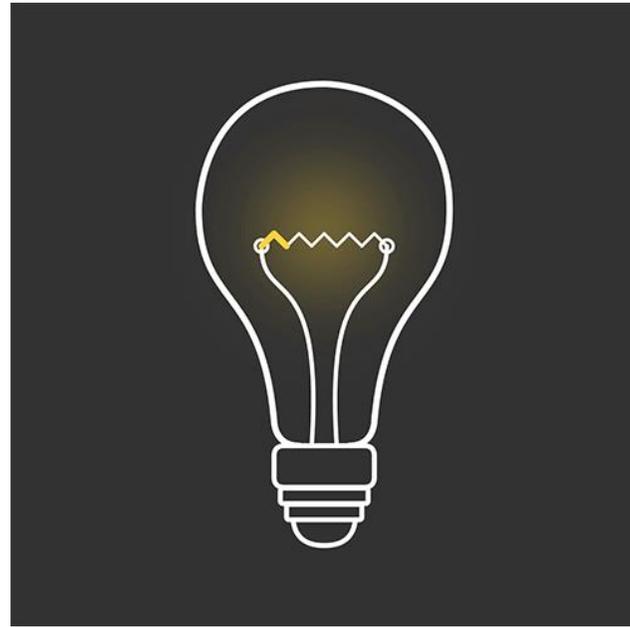
Recall

- ▶ One of the electrical functions in a circuit is:
 - ▶ **Energy transformation**
 - ▶ E.g.: light bulbs, speakers, heating elements, etc.



Recall

- ▶ Problem is **not all** of the energy is usually **transformed** into the form we want



Recall

- ▶ Ex: when you turn on a light bulb **only some** of the **electrical energy** is transformed into **radiant (light) energy**
- ▶ A lot of it is actually converted into **thermal energy (heat)**
 - ▶ In fact, with an incandescent light bulb, only about **5%** of the electrical energy ends up as light energy

Heat

- ▶ Definition: is the amount of **thermal energy** that is **transferred** from one place to another because of **temperature difference**.

What is the
difference between
heat and
temperature?

Heat

- ▶ Has 2 variables:
 - ▶ Number of particles
 - ▶ Less mass, means less heat
 - ▶ Degree of agitation (in other words the movement) of particles
 - ▶ This is what temperature is!

Temperature

- ▶ Definition: **degree of agitation** of atoms/molecules
 - ▶ High agitation = **high temperature**
 - ▶ Low agitation = **low temperature**
- ▶ Also generally used as a **measure of heat**

Temperature

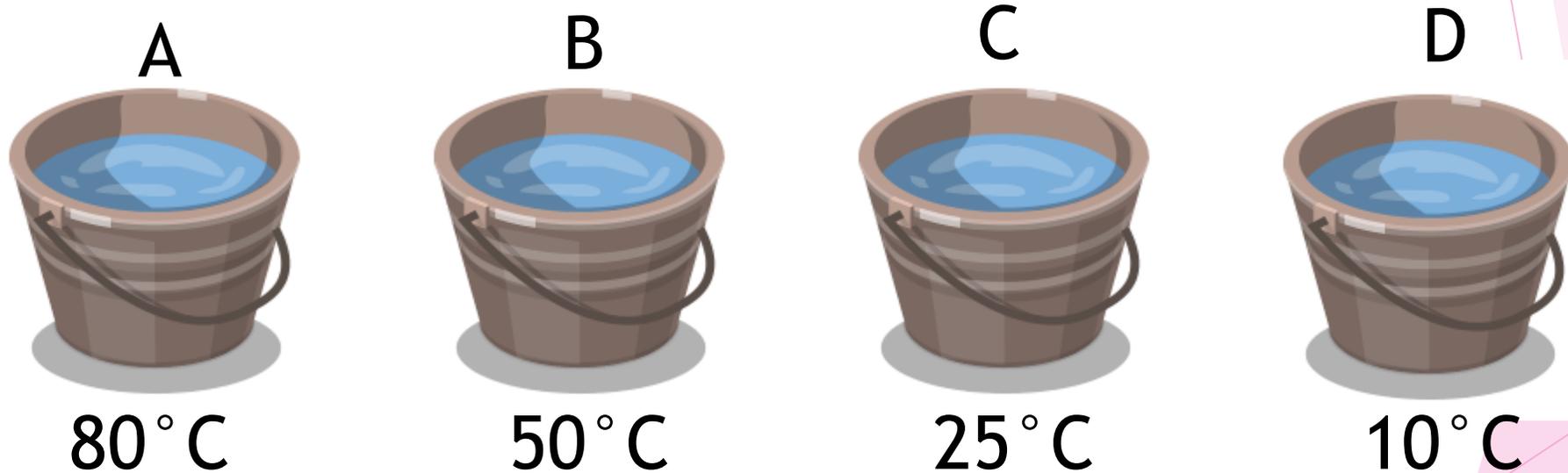
- ▶ Mass **does NOT** affect temperature
 - ▶ Big or small, 37°C is 37°C

Heat Transfer

- ▶ Cold energy **does NOT** exist
 - ▶ Cold is merely the **absence of heat**
- ▶ Heat is always transferred from areas of **high energy to low energy**
 - ▶ So move from **warm to cold**

Example

- Imagine you have 4 buckets; each with the same amount of water but at different temperatures



Example



80°C



50°C



25°C



10°C

- ▶ What would happen if you mixed buckets A and C together; and buckets B and D together?

Temperatures would average out

$$(80+25) \div 2 = 52^{\circ}\text{C}$$

$$(50+10) \div 2 = 30^{\circ}\text{C}$$

Example



80°C



50°C



25°C



10°C

► Which buckets lost heat? Gained heat?

A and B lost heat

C and D gained heat

Recap

- ▶ Heat depends on:
 - ▶ Mass
 - ▶ Particle agitation
(temperature)

Recap

- ▶ You **transfer heat**, but you measure the **temperature**
- ▶ You **CANNOT transfer cold**; only lose heat