

# Bell Ringer

1. What kind of light is absorbed best by the Ozone layer?
2. What are the four things that can happen to light as it passes through the atmosphere?
3. What is Albedo?



# Heat capacity lab

# Heat transfer and Heat capacity

# Thermal Energy

## Temperature vs Heat?

**Temperature is related to the average kinetic energy (energy of motion) of the particles in a substance.**

The atoms in an object are in constant motion.



**A** When the horseshoe is hot, the particles in it move very quickly.



**B** When the horseshoe has cooled, its particles are moving more slowly.

The universal unit for temperature is **Kelvin**

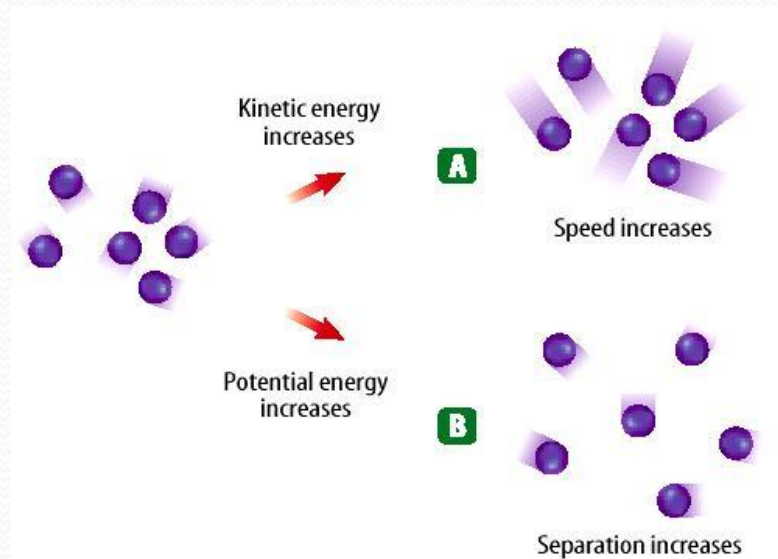
$$K = C + 273 \quad (10C = 283K)$$

$$C = K - 273 \quad (10K = -263C)$$

$$F = (9/5 C) + 32 \quad (10C = 50F)$$



**Thermal Energy** is the total of **all** the kinetic energy of all the particles in a substance.



## **Thermal energy** relationships

→ As temperature increases, so does thermal energy (because the kinetic energy of the particles increased).

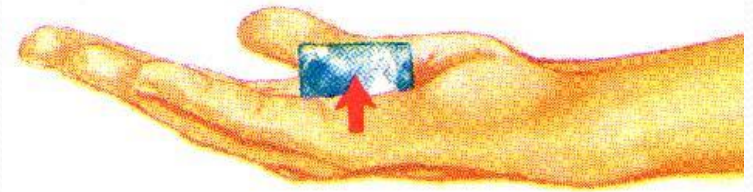
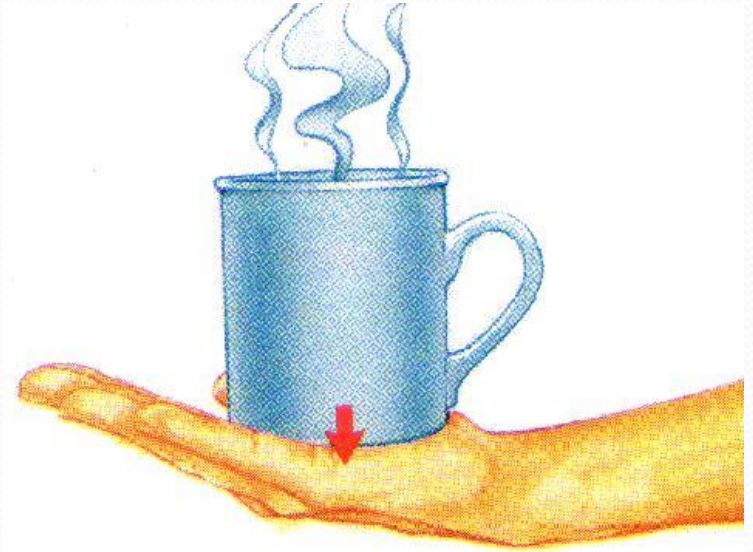
→ If the temperature stays the same, the thermal energy in a more massive substance (more particles) is **higher** (because it is a **total** measure of energy).

# Heat

The **flow** of thermal energy from one object to another.

Heat always flows from **warmer** to **cooler** objects.

Cup gets cooler while hand gets warmer



Ice gets warmer while hand gets cooler

# Specific Heat

Things **heat up** or **cool down** at different rates (sometimes quickly, sometimes slowly)



Land heats up and cools down faster than water, and aren't we lucky for that!?



Specific heat is the amount of heat required to raise the temperature of 1 kg of a material by one degree (C or K, they're the same size).

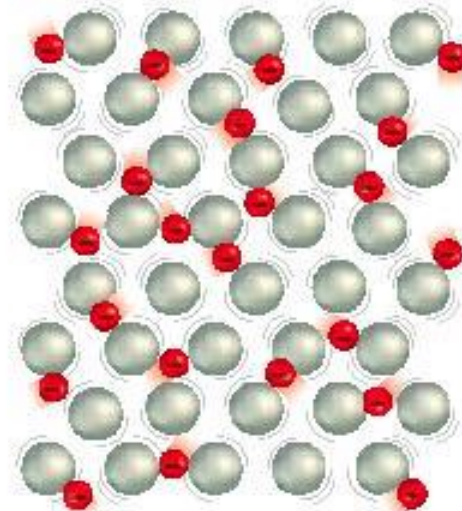
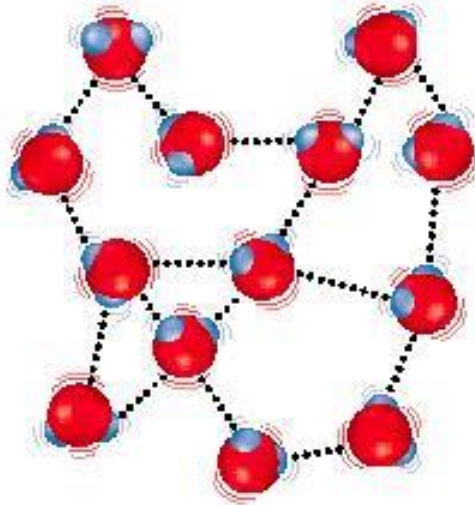
$C_{\text{water}} = 4184 \text{ J / kg C}$  (“holds” its heat)

$C_{\text{sand}} = 664 \text{ J / kg C}$  (less E to change)

This is why land heats up quickly during the day and cools quickly at night and why water takes longer.

# Why does water have such a high specific heat?

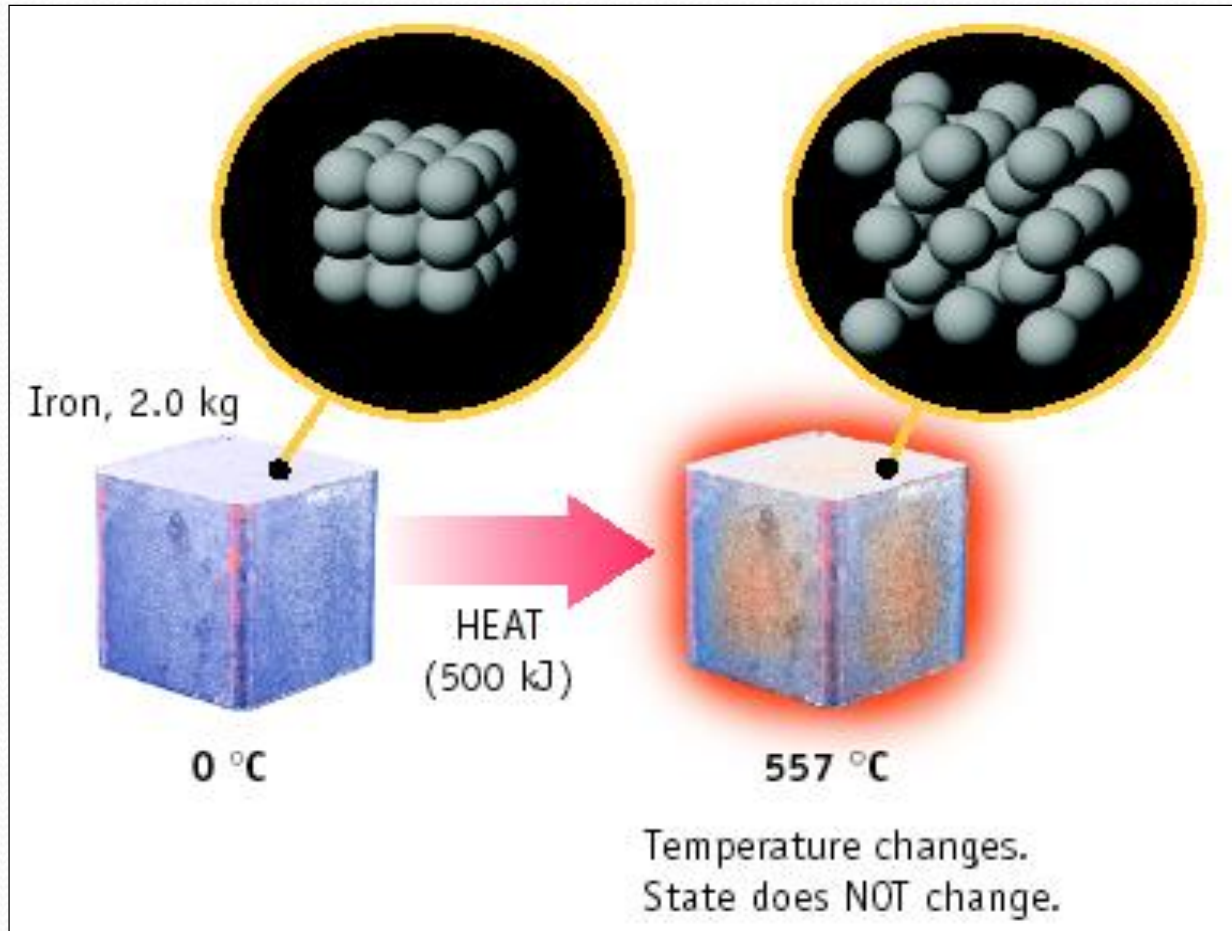
water



metal

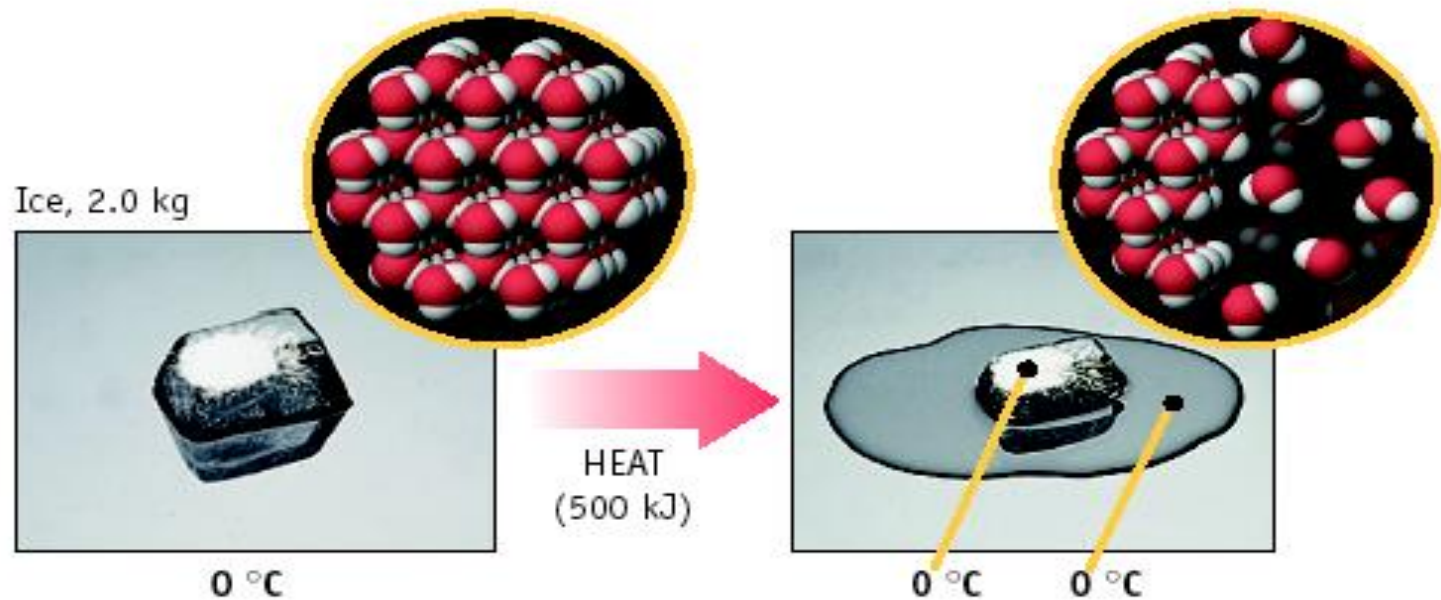
Water molecules form strong bonds with each other water molecule so it takes more heat energy to break the bonds. Metals have weak bonds and do not need as much energy to break them.

# Heat can be Transferred even if there is No Change in State



# Or... Heat Transfer can cause a Change of State

Changes of state involve energy at a constant temperature: Ice + Energy -----> Liquid water



Temperature does NOT change.  
State changes.

# Heat Transfer and Changes of State

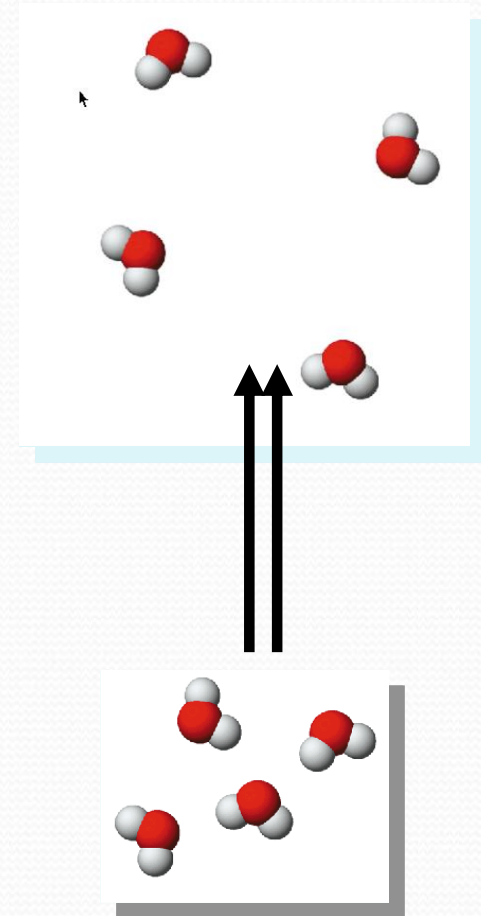
Liquid (l)  $\rightarrow$  Vapor (g)

Requires energy (heat).

Why do you...

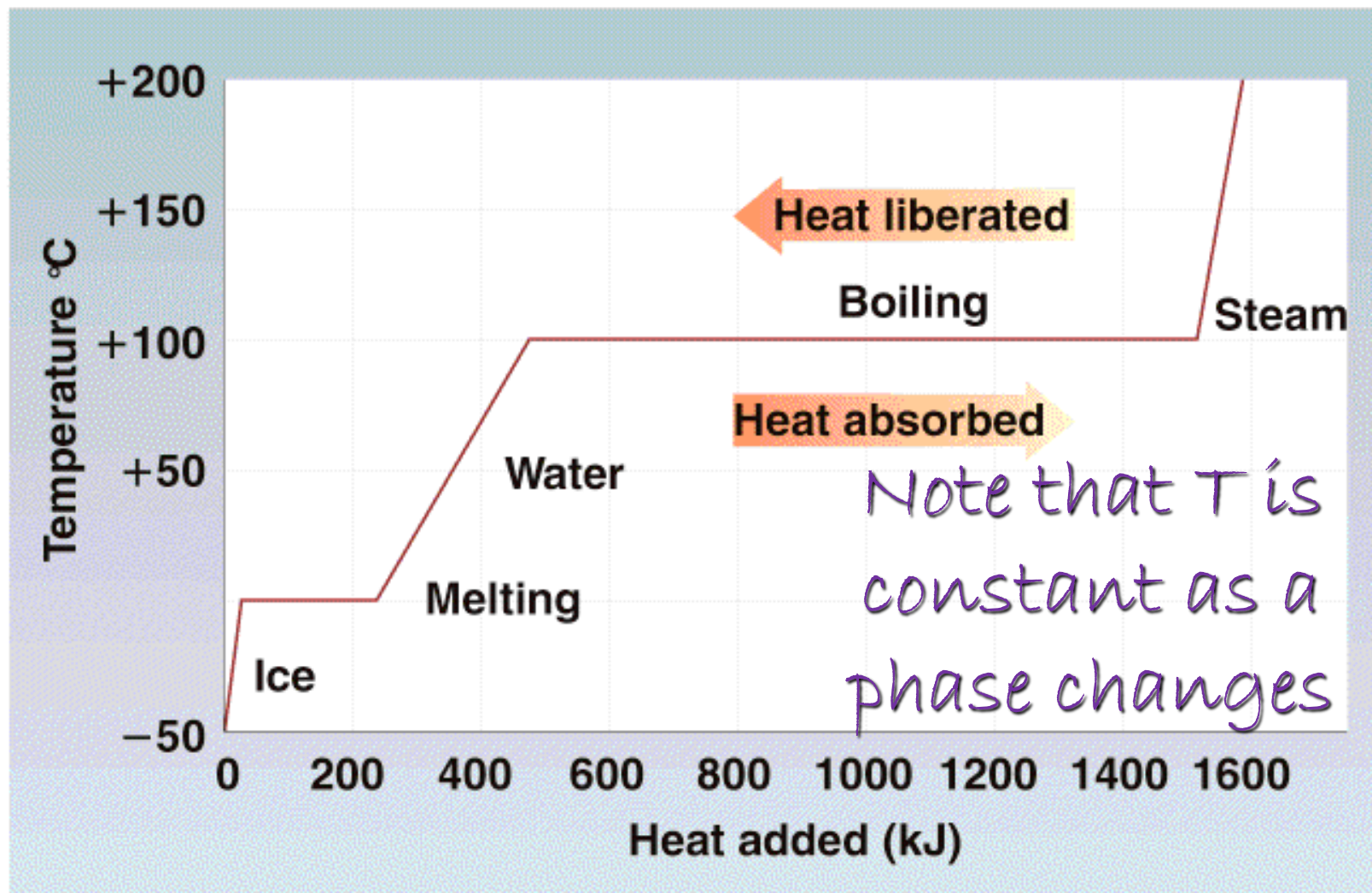
cool down after  
swimming ???

use water to put out a  
fire ???



# Heating/Cooling Curve for water!

Kotz: Chemistry & Chemical Reactivity, 4/e  
Figure 6.9





**Bill Nye – (Next time, sorry guys)**