

Chapter 15

Warm Up

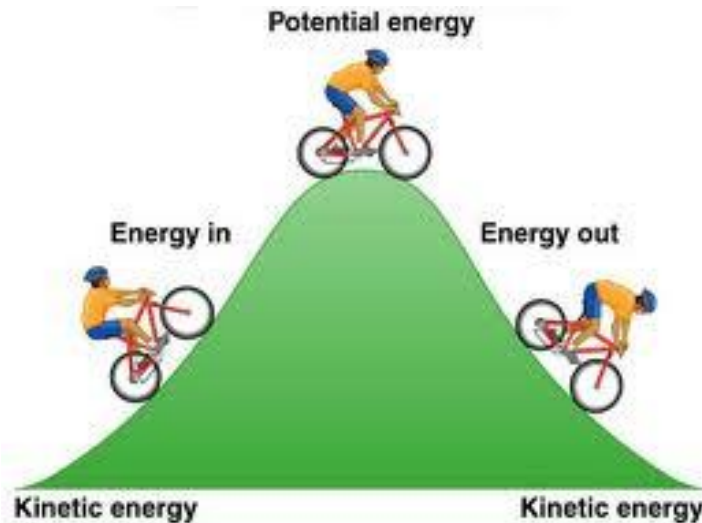
- If you put ice into warm water, what would happen to the ice?
- What would happen to the water?
- How is energy conserved in this exchange?

Agenda

- QOTD: What is the difference between potential and kinetic energy and how is energy transferred in a reaction?
- Potential and Kinetic energy
- Chemical energy
- Heat exchange
- Homework due **Wed**: Chapter 15- 54-78 evens

Energy

- Ability to do work or produce heat!

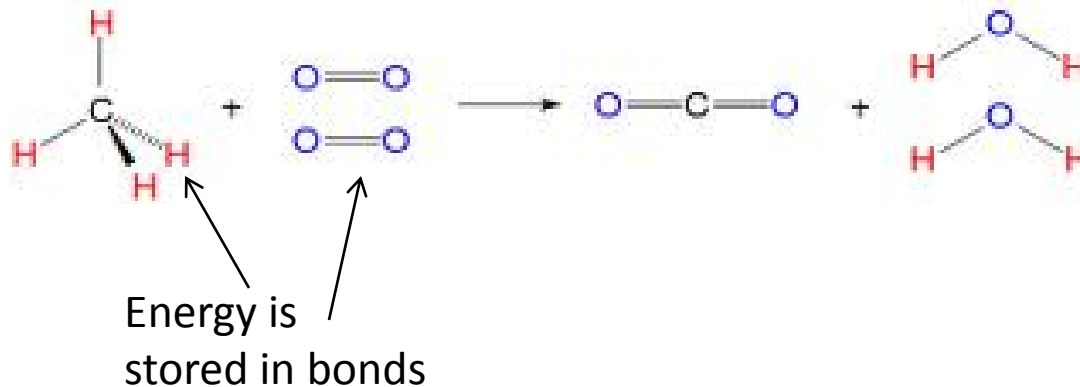


FIRST LAW OF THERMODYNAMICS

- Conservation of energy –energy can be converted NOT destroyed.

Chemical Potential Energy

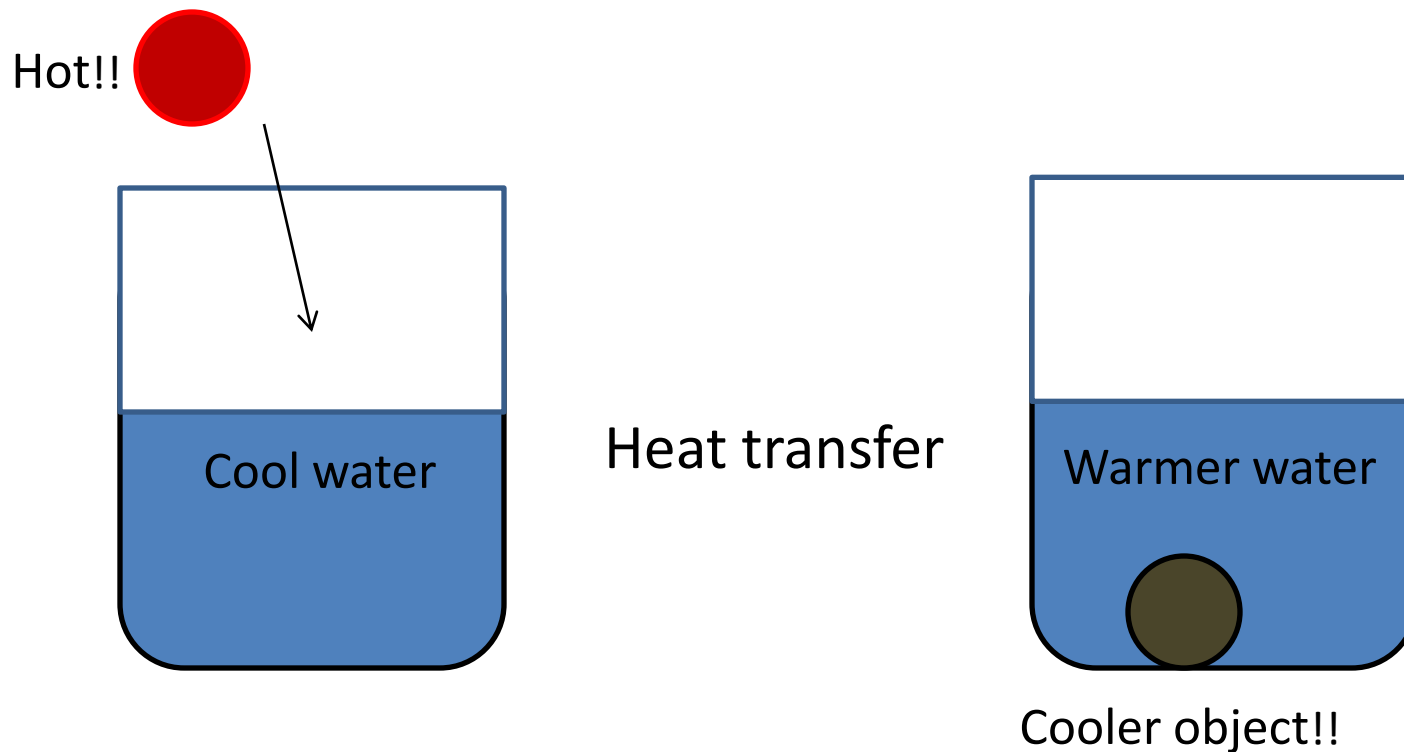
- Energy that is stored in a substance because of its chemical composition.



Combustion creates heat energy due to the breaking and forming of bonds!

Heat (q)

- Heat flows from warmer objects to cooler ones.



Endo vs. Exothermic

- Endo – requires heat (heat is absorbed) $+q$
- Exo – gives off heat (heat is released) $-q$

Give an example of each!

Heat (q)

- The energy required to raise the temperature of one gram of water by 1 °C – calorie (cal)
- Food calories are Calories (actually kcal)
- SI unit for heat = joule (J)

$$1 \text{ cal} = 4.184 \text{ J}$$

Convert!

- You have cereal with milk and some orange juice for breakfast and consume 230 food Calories. How many joules is this??

(remember that food Calories is different than calories)

Specific Heat

- Every substance requires a specific amount of energy to raise the temperature 1 °C.
(It's not always 1 cal, like water)!



Hot sand, cool water!



Heat Calculations

$$q = mc\Delta T$$

q = heat absorbed or released

m = mass of sample **in grams**

c = specific heat

ΔT = change in temp ($T_{\text{final}} - T_{\text{initial}}$)

Hot Sand, Cool Water?

- Imagine the temp of 5 kg of sand increases by 6°C . If the specific heat of sand is $0.830 \text{ J/g}^{\circ}\text{C}$, how much heat was absorbed?
- Imagine the temperature of 5 kg of water increases by 6°C . If the specific heat of water is $4.184 \text{ J/g}^{\circ}\text{C}$, how much heat was absorbed?
- Which requires more energy???

Calculate Specific Heat

- In the construction of bridges and skyscrapers, gaps must be left between adjoining steel beams to allow for the expansion and contraction of the metal.

The temperature of a sample of Iron with a mass of 10 g changed from 50.4 °C to 25 °C with the release of 114 J of heat. What is the specific heat of iron?

Warm Up!

- A piece of metal with a mass of 4.68 g absorbs 256 J of heat when its temperature increases by 182 K. What is the specific heat of the metal?

Today's Agenda

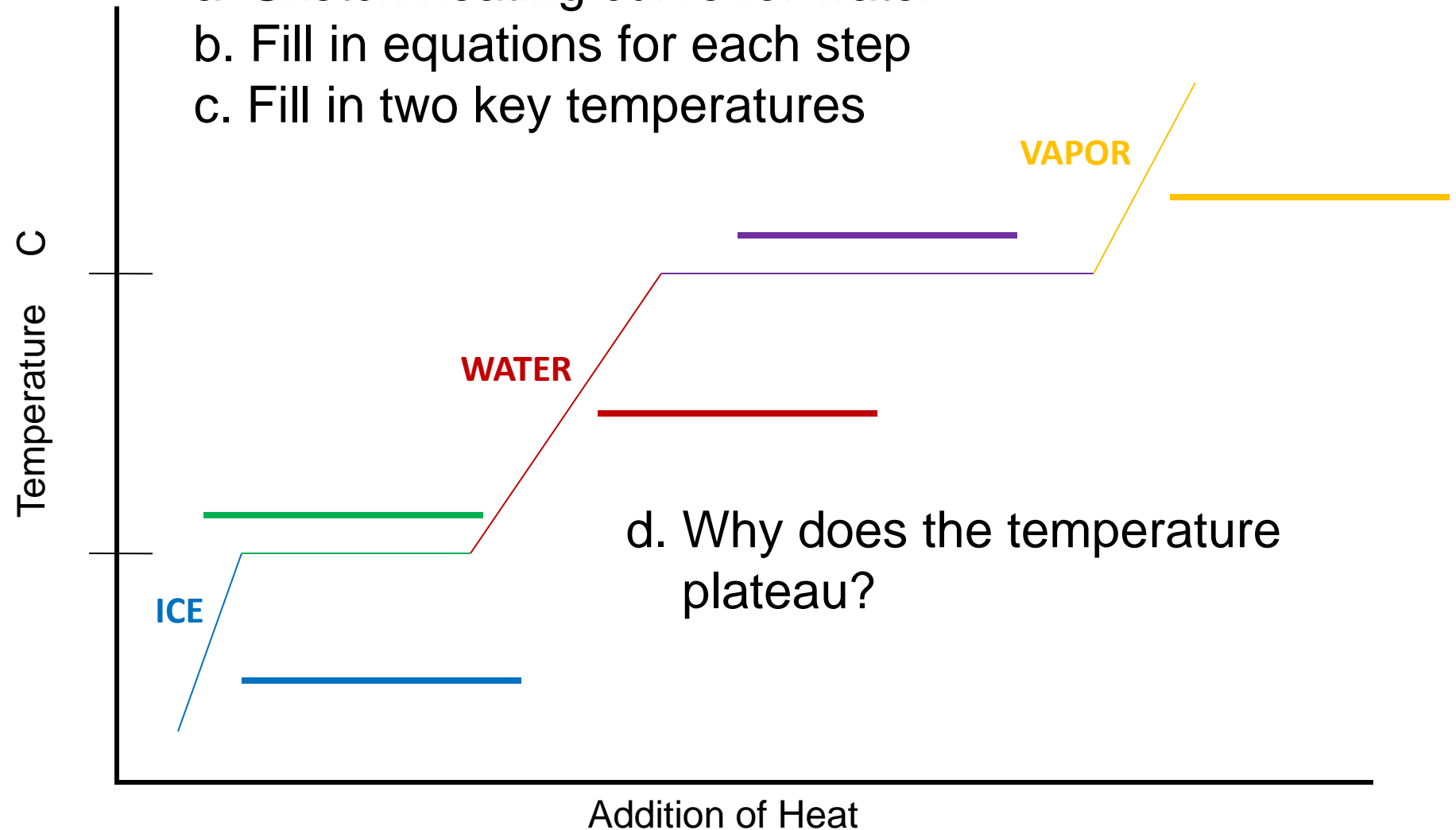
- QOTD: How can we use the heating curve of water to solve thermochemical problems?
- Heating curve of water
- Total energy problems
- Finding mass problems (get ready for some algebra!)
- Lab books due Thursday!!

Practice

- A swimming pool 20 m wide and 12.5 m long is filled to a height of 3.75 m of water. How much heat must be added to change the temperature from 18.4 °C to 29 °C?
- When 10.2 g of canola oil at 25 °C, is placed on a stove, 3.34 kJ of heat is required to raise the temperature to 196.4 °C. What is the specific heat of the oil?

Warm Up!

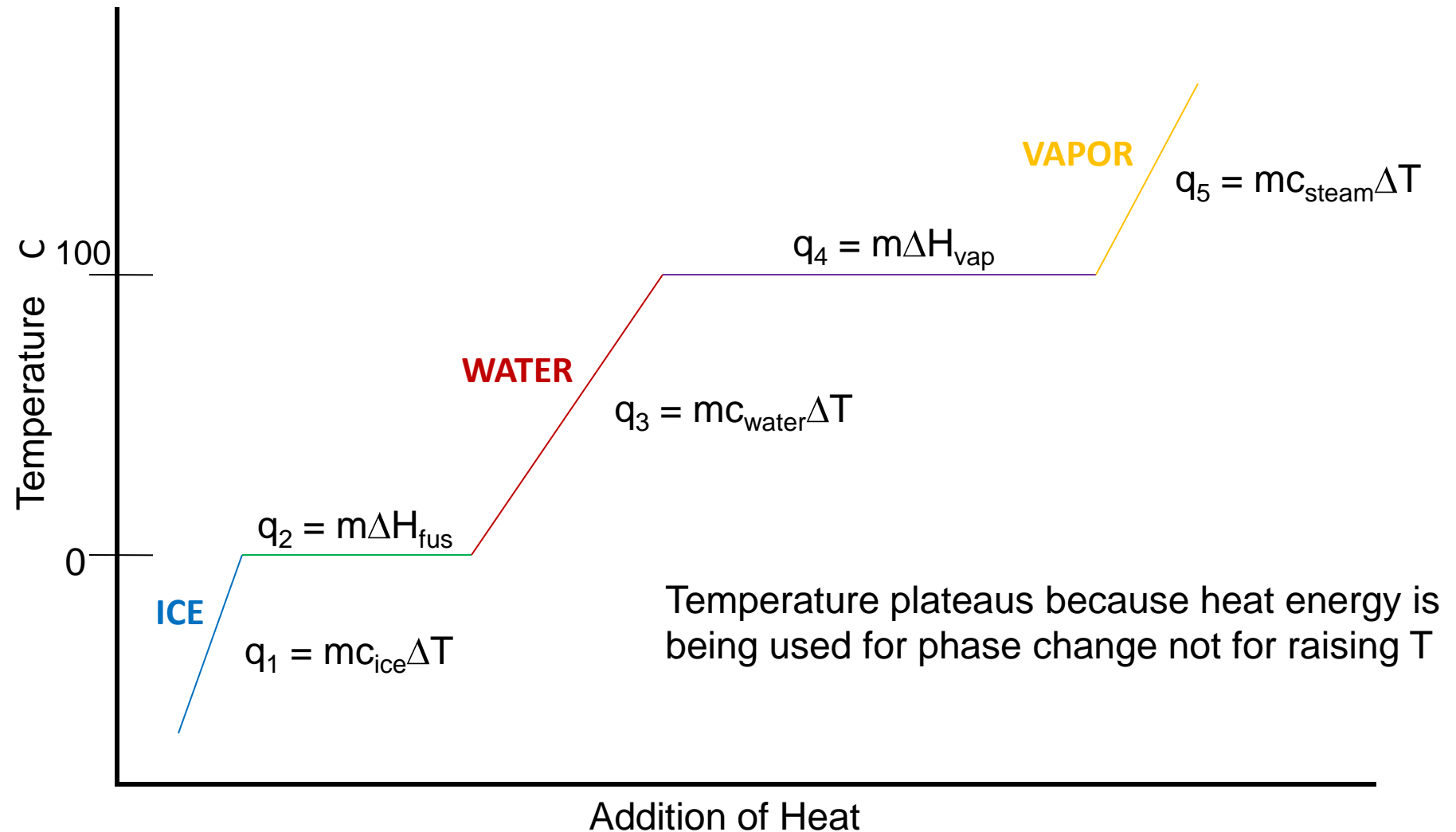
- Sketch heating curve for water
- Fill in equations for each step
- Fill in two key temperatures



Today's Agenda

- QOTD: How do we use the heating curve to find mass, and determine final temperatures?
- Solving for mass
- Determining final temperatures given q_t
- Percent conversions
- Homework: Worksheet

Heating Curve for Water @ 1 atm



Warm Up!

- What is the **total energy** absorbed by 25 g of ice to change the temperature from $-23\text{ }^{\circ}\text{C}$ to $135\text{ }^{\circ}\text{C}$? (Sketch a heating curve!)
- If the q_t calculated in the previous problem was able to raise the temperature of a sample from $-5\text{ }^{\circ}\text{C}$ to $214\text{ }^{\circ}\text{C}$, **what is the mass** of the sample?

Today's Agenda

- QOTD: How do you determine the percent water converted in a phase change and what is calorimetry?
- % Conversion problems
- Calorimetry problems
- Worksheet due tomorrow, lab books due TODAY!

Quiz Review Warm Up

1. What is the total energy required to heat a 8.25 g piece of iron metal from 18 °C to 250 °C if the specific heat of iron is 0.46 J/g°C
2. A piece of silver metal at 250 °C is added to 250 mL of 23 °C water. The water temperature increases to 30.5 °C. What is the mass of the silver? ($c_{\text{Ag}} = 0.23 \text{ J/g}^\circ\text{C}$)
3. If 50 g of water is heated from 15 °C to 168 °C, how much energy is used?

Today's Agenda

- Review
- Quiz tomorrow!
 - Phase changes of water
 - Calorimetry
- Quiz review worksheet due tomorrow!