

## 24/7 Chemistry Notes: Water Basics and Heat Curve

Draw the Lewis dot structure of water.

Shape \_\_\_\_\_

Bond Polarity \_\_\_\_\_

Molecule Polarity \_\_\_\_\_

Intermolecular Force \_\_\_\_\_

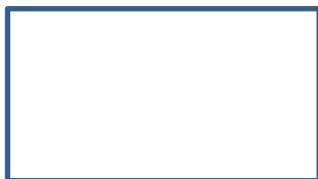
Water is unique due to its intermolecular forces (hydrogen bonding). They are why water floats when it freezes, why water droplets are round, and why water's specific heat is so high.

There are many concepts and new words in this unit. Any time you see a word you do not know, it is recommended you make a note card to study the word and meaning.

**Surface tension:** The inward force, or pull, that tends to minimize the surface area of a liquid.

- This is the reason why water droplets are round.
- Causes water's vapor pressure to be low. (Vapor pressure is the force exerted by gas or vapor released by a liquid substance).

Penny demo:

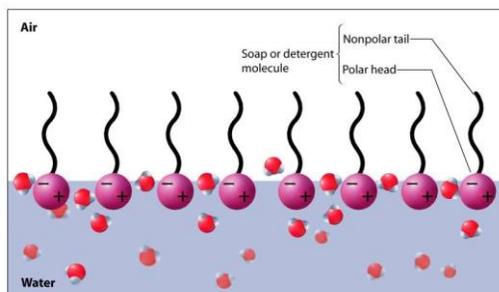


Penny with water



Penny with isopropyl alcohol

**Surfactant:** A substance that breaks down hydrogen bonds and reduces surface tension.



Water has a:

High heat of vaporization

High specific heat

High surface tension

Low vapor pressure

due to hydrogen bonding!

### Thermochemistry Review

Equations:

$$q = mc\Delta T$$

$$q = mH_f$$

$$q = mH_v$$

Variables you need to know:

q = heat ( J or cal)

m = mass (g)

C = specific heat ( $\frac{cal}{g^{\circ}C}$  or  $\frac{J}{g^{\circ}C}$ )

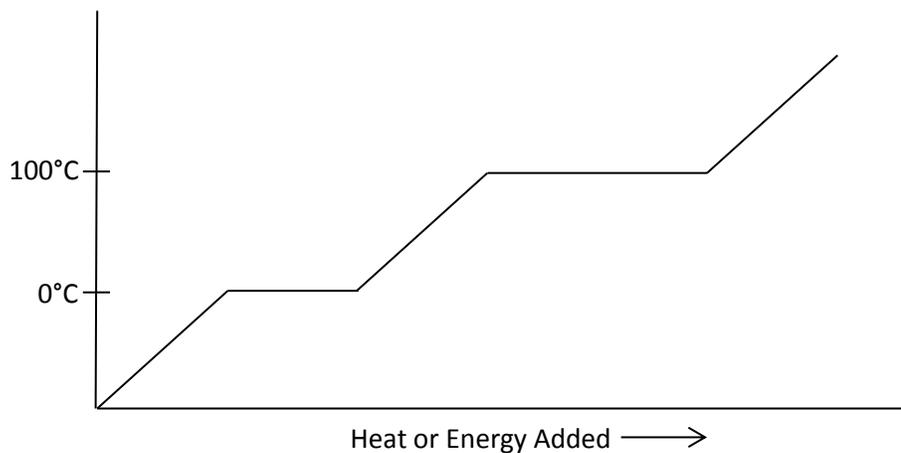
$\Delta T$  = change in temperature (  $^{\circ}C$ )

$$\Delta T = T_{final} - T_{initial}$$

$H_f$  = heat of fusion (334 J/g for water)

$H_v$  = heat of vaporization (2260 J/g for water)

Heating/Cooling Curve of H<sub>2</sub>O



When water freezes, the water molecules slow down enough that their hydrogen bonds are able to form into hexagonal patterns. This causes them to spread apart. Calculate the density difference below and show mathematically why ice floats on water.

Calculate the density of a cube of water that has a mass of 1.00 g and a volume of 1.00 mL.

Once that cube of water freezes, the volume changes to 1.07 mL. What is the new density?

**Heat curve problems:**

Calculate the amount of energy required to melt 2.4 g of ice.

How much energy is required to heat 2.5 g of water at 23°C to steam at 100°C?

How many joules of energy would be necessary to heat 7.41 g ice at -17°C to water at 84°C?