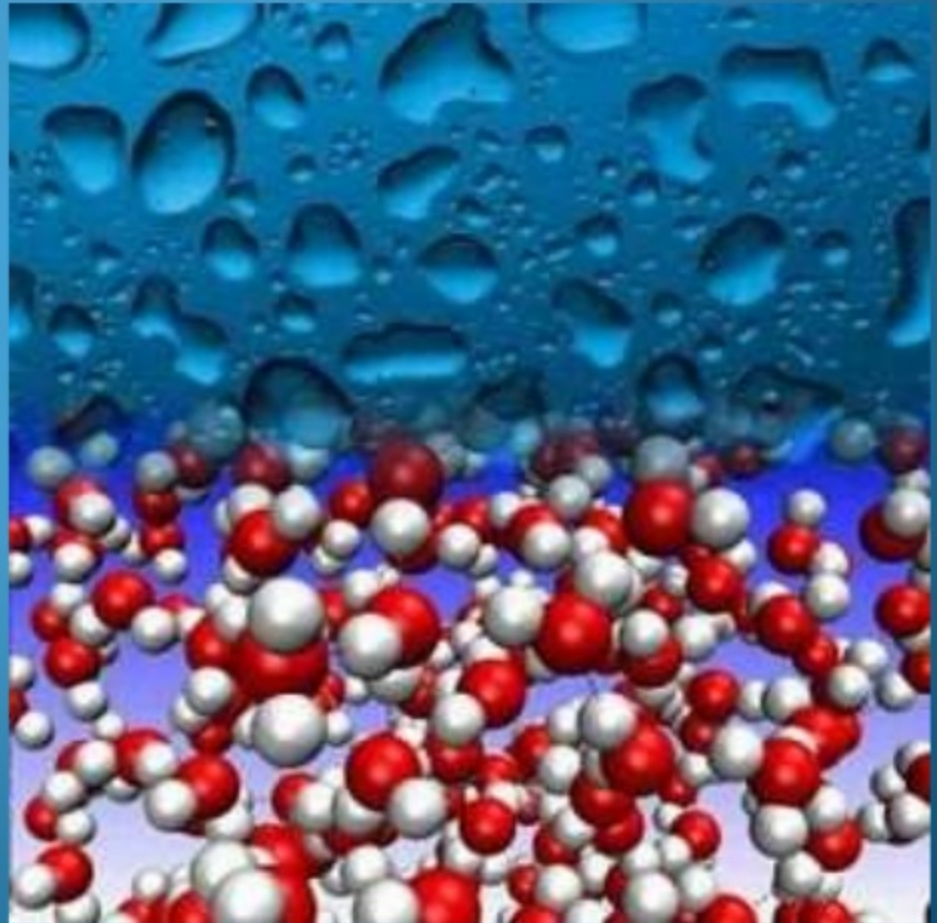


# Chapter 3

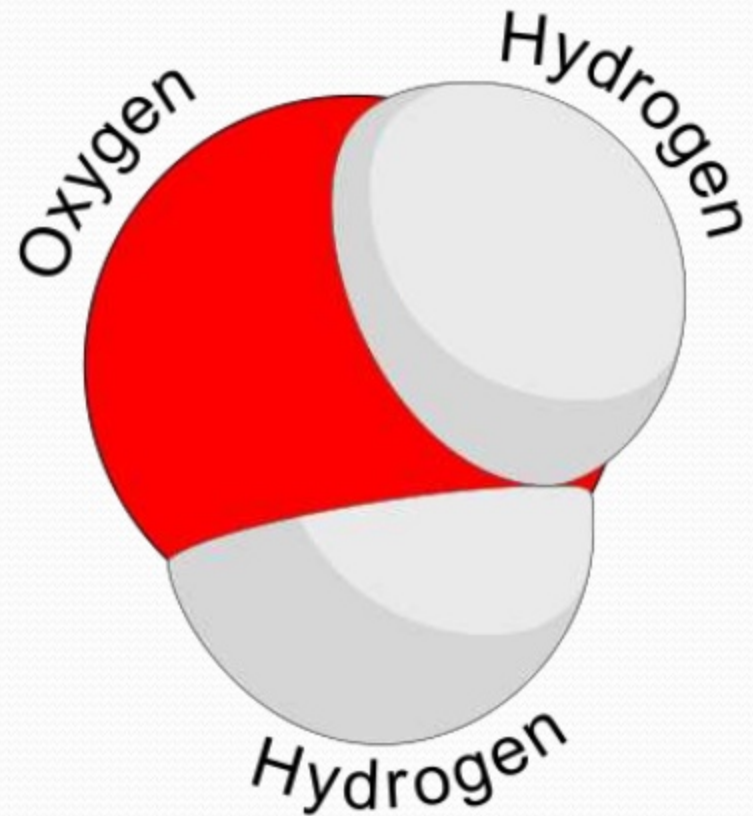
chemical and physical features of seawater and the  
world ocean

# The Unique Nature of Pure Water



# The nature of water

- Atom: The basic unit of matter
- The smallest unit into which an element can be divided and still retain its properties





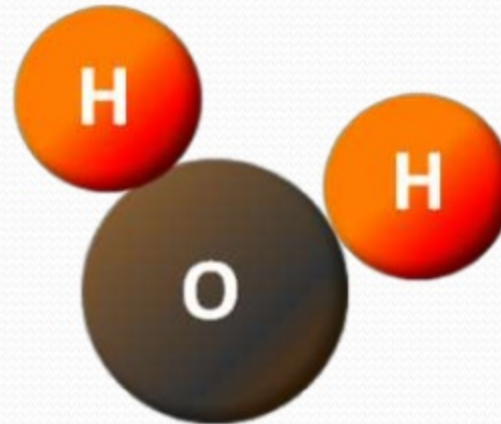
# The nature of water

- Element: A substance composed entirely of one type of atom

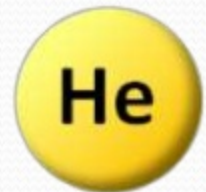
Q1.



Q2.

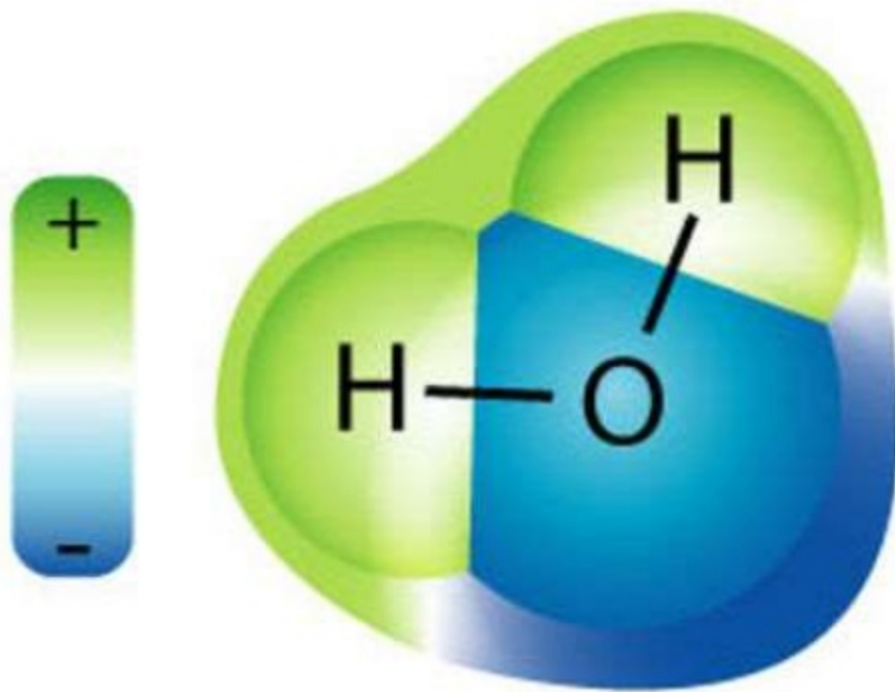


Q3.



- Molecule: Larger particle composed of two or more atoms chemically bonded together

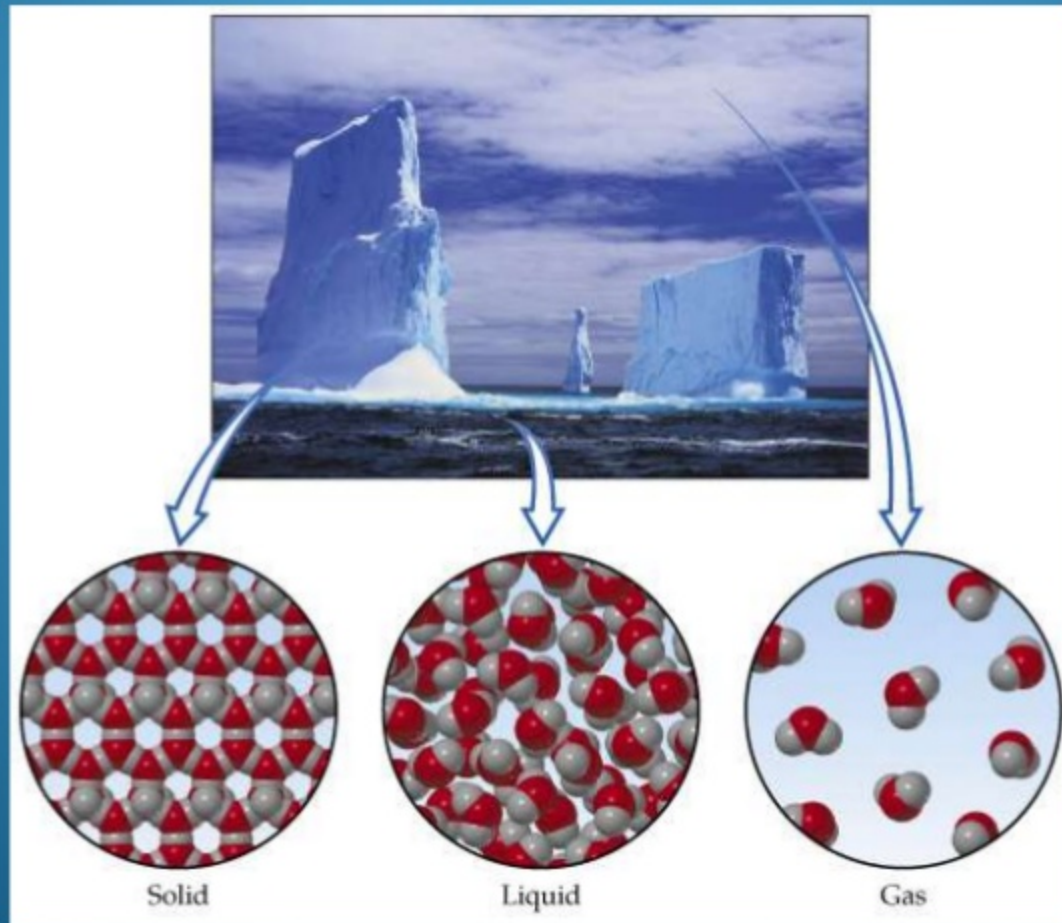
# The nature of water



- Hydrogen bonds: Weak bonds between polar molecules
- polar molecule: a molecule with uneven distribution of charge
  - The reason for water's unique properties



# States of Water



# States of Water

- Liquid, Gas/Vapor, and Solid/Crystalline
- Water is the only substance that naturally occurs in all three forms



SOLID



LIQUID

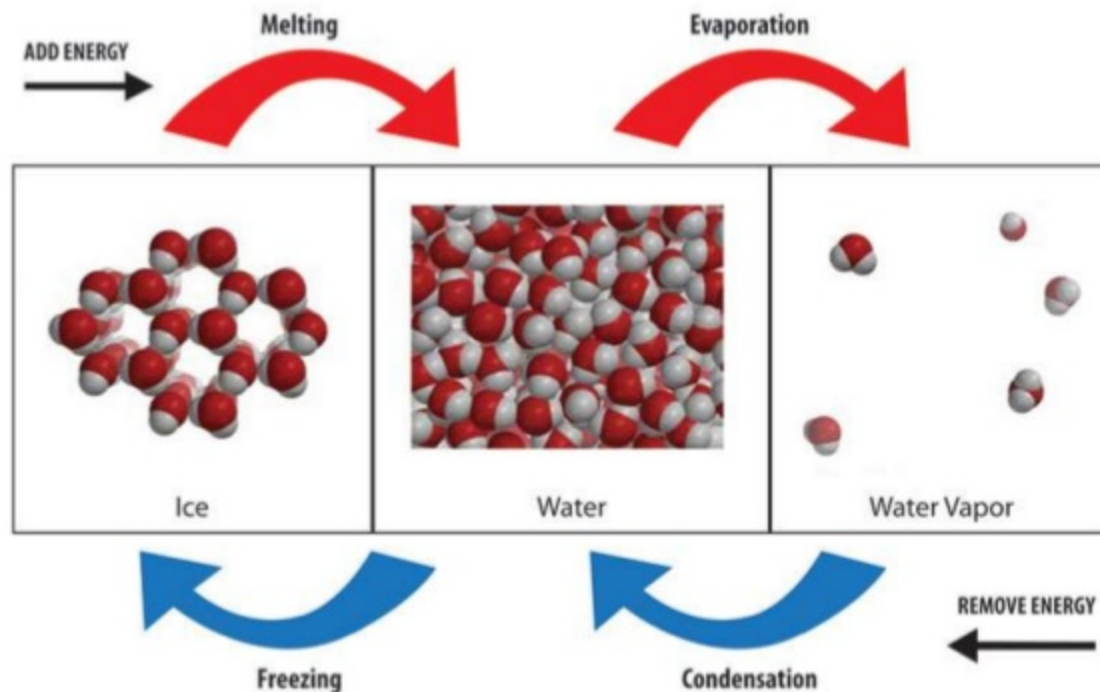


GAS



# States of Water

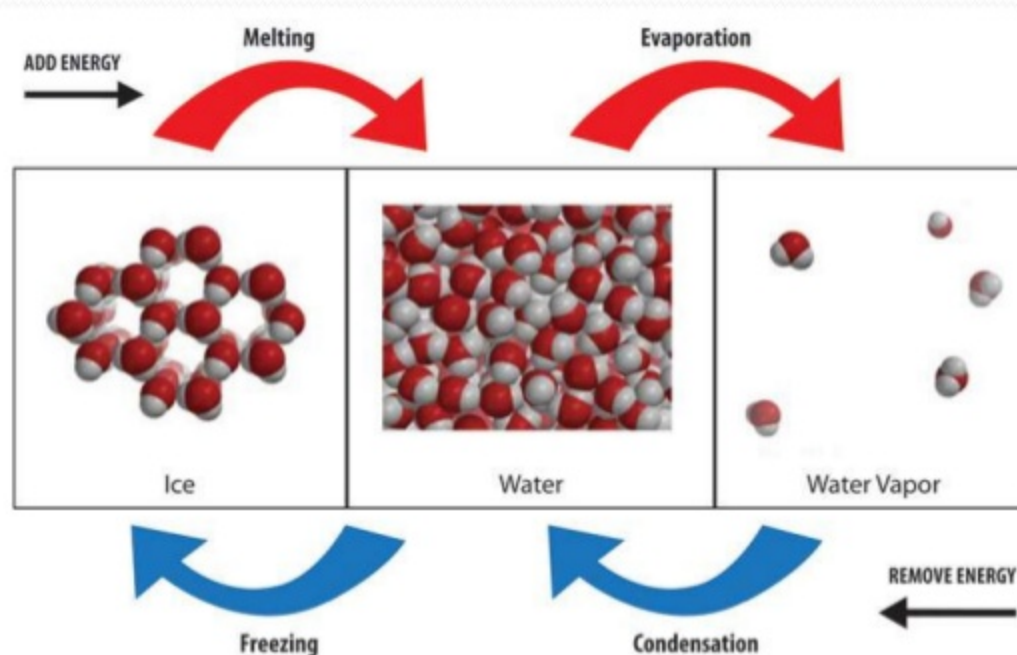
- Liquid → Gas/Vapor
- Evaporation: The breaking of hydrogen bonds allows water to change from the liquid phase into the gaseous phase



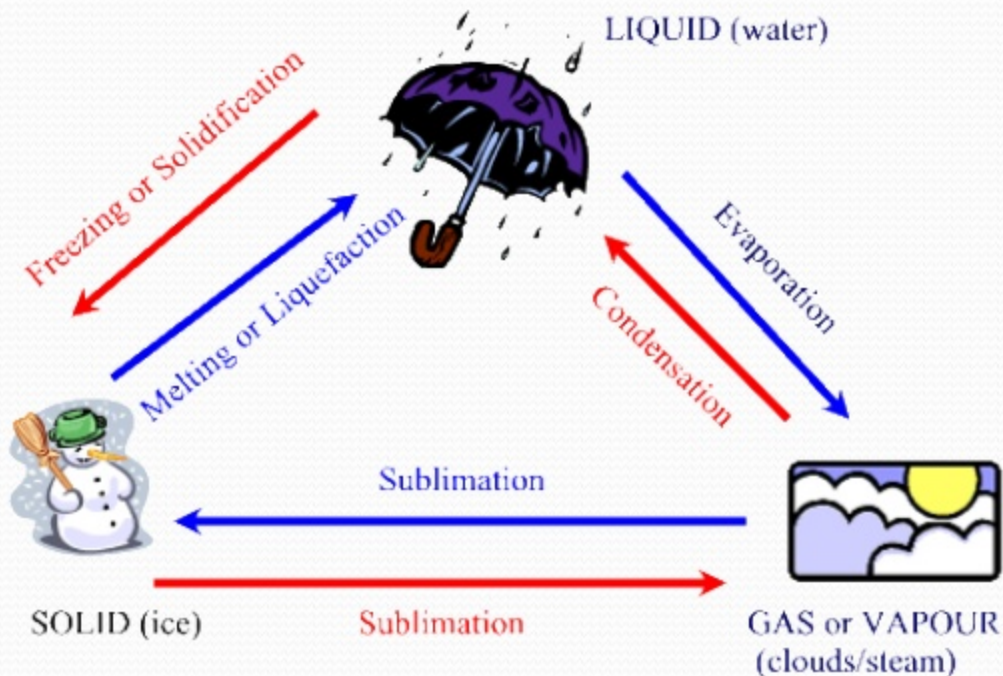


# States of Water

- Gas/Vapor -> Liquid
- Condensation: The formation of hydrogen bonds allows water molecules to come together and change from a gaseous phase to a liquid phase



# States of Water



- Solid  $\rightarrow$  Gas/Vapor
- Sublimation: The direct change in phase from a solid to a gas without a change in phase to a liquid in between



# States of Water



Condensation is a gas changing into a liquid.



Liquids evaporate into gases.



Freezing turns a liquid into a solid.



Solids melt to become liquids.



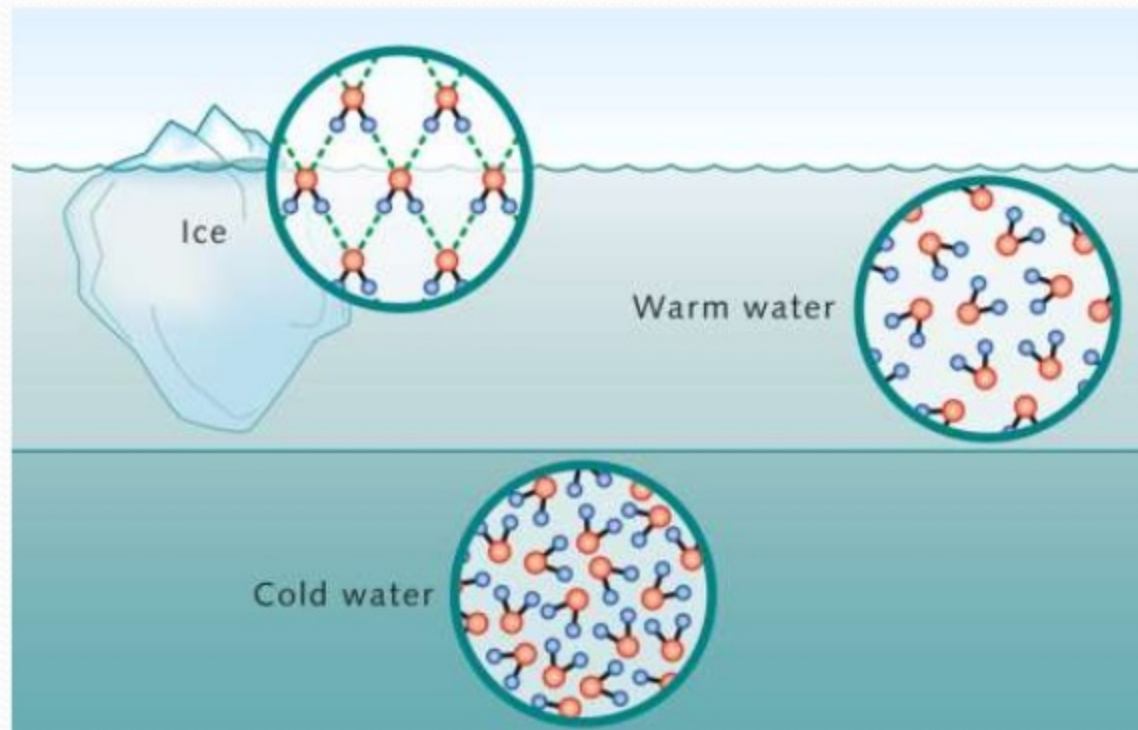
Sublimation is a solid changing into gas.



A gas becomes solid through frost formation.

# States of Water

- Density = Mass/Volume
- Water is the only known substance that is less dense as a solid than it is as a liquid



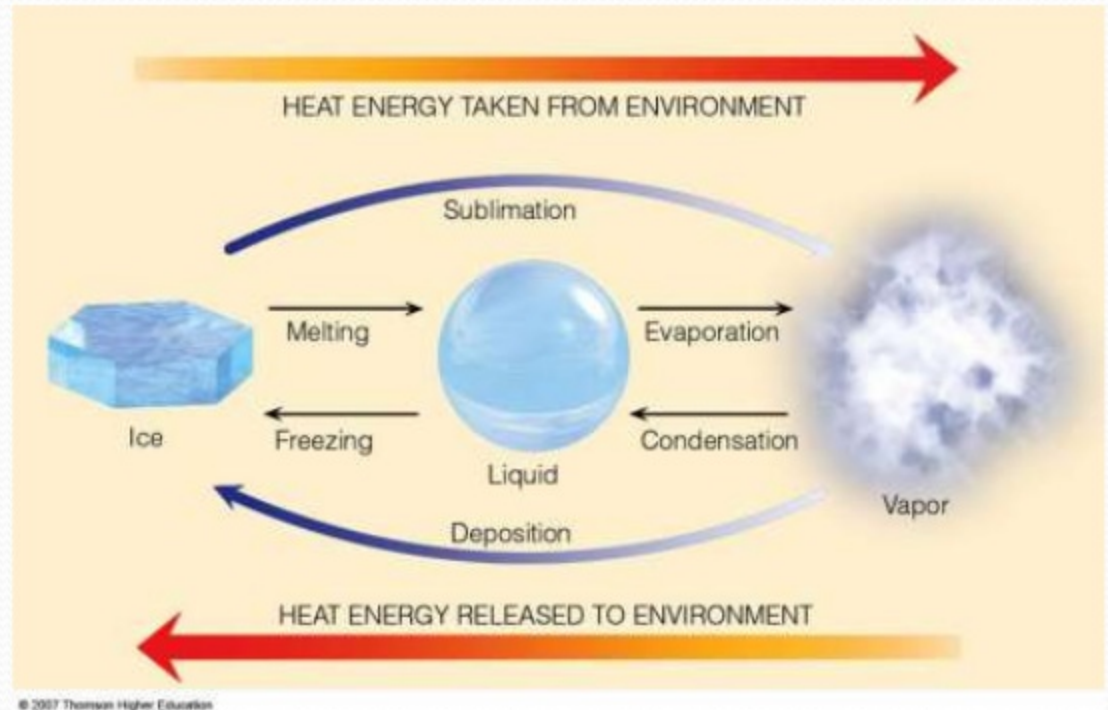


# Heat and Water



# Heat and Water

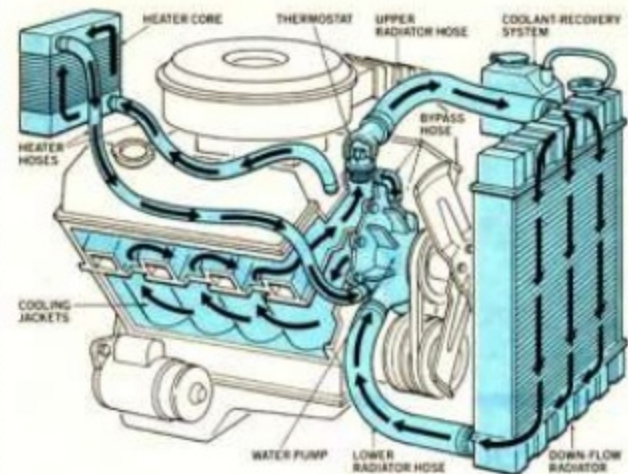
- Latent heat of melting:  
The amount of heat required to melt a substance
  - highest among common substances
  - due to hydrogen bonding





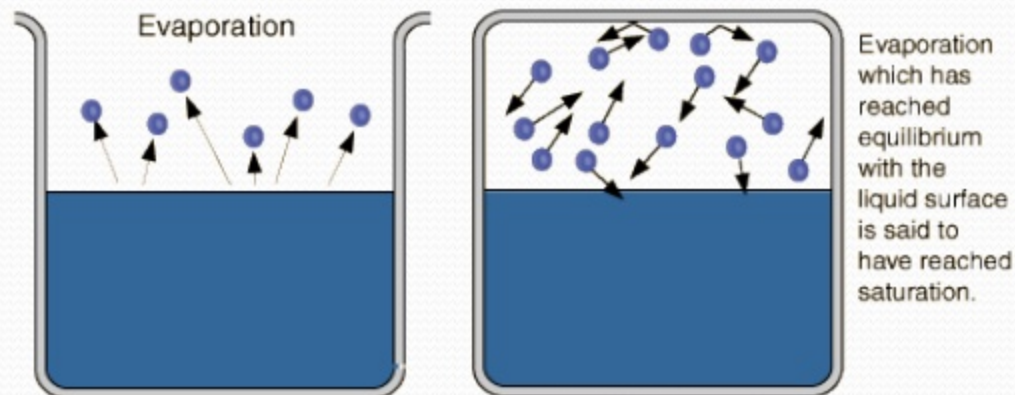
# Heat and Water

- Heat capacity: The amount of heat needed to raise a substance's temperature by a given amount
  - reflects how much heat a substance can store
  - water can absorb large amounts of heat without altering much
- why water is used a common coolant
  - ex. car engines



# Heat and Water

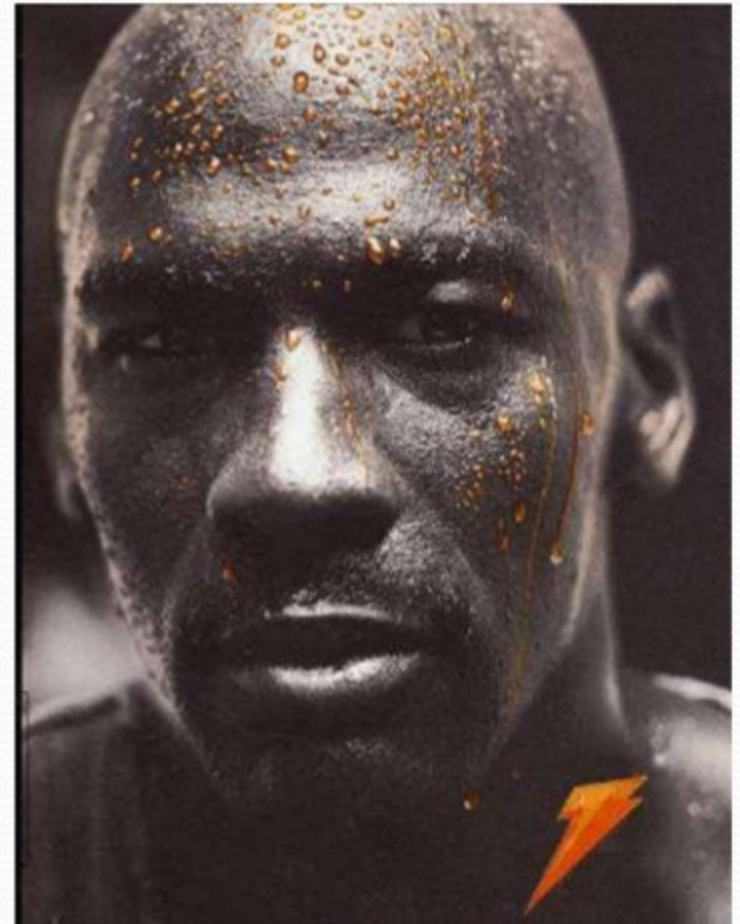
- Latent heat of evaporation: the amount of heat energy that is needed to evaporate a substance
  - water has a high latent heat of evaporation
  - also due to hydrogen bonding
- Only fastest moving bonds are broken, allowing those molecules with more energy to evaporate
  - lower energy molecules are left behind





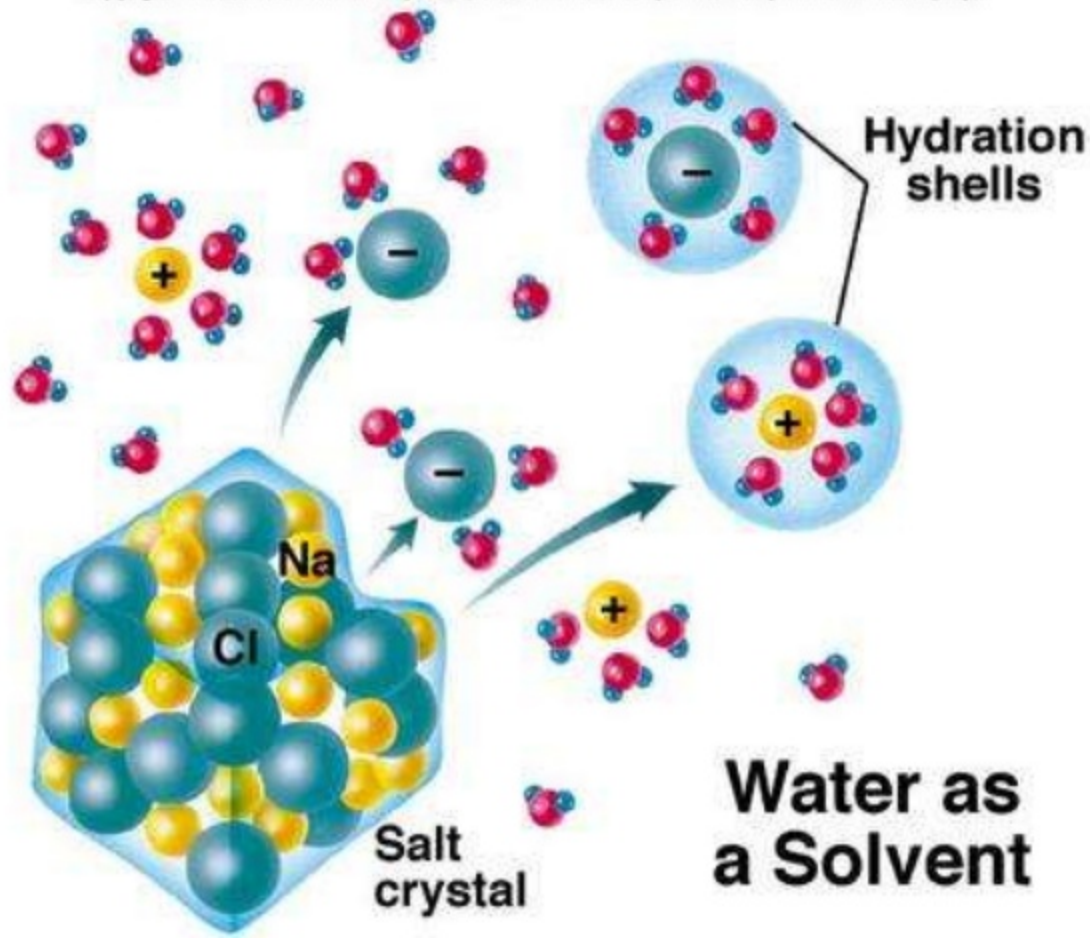
# Heat and Water

- Evaporative cooling: the lower speed and therefore lower temperature of molecules remaining in the liquid phase after evaporation of the fastest molecules
  - how evaporating sweat cools our skin



# Water as a Solvent

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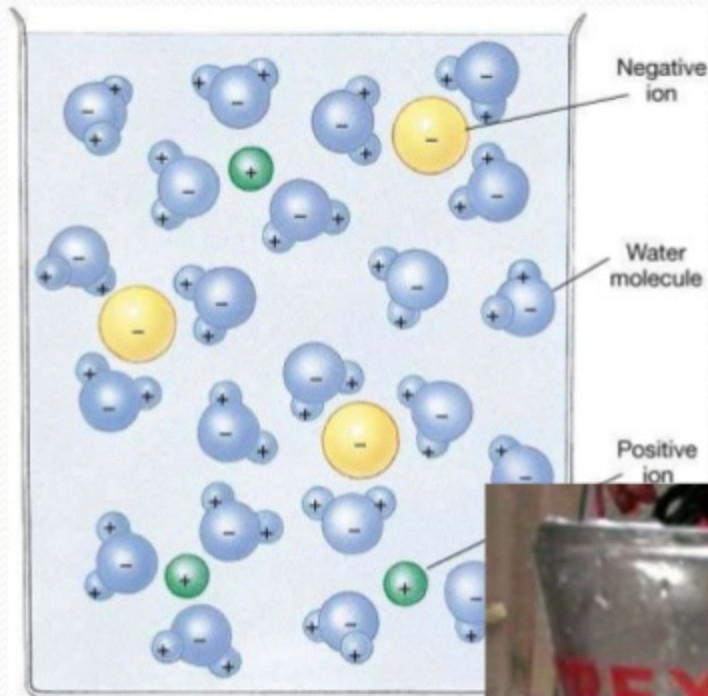


# Water as a Solvent

- Seawater is a solution: A mixture consisting of two parts a solvent and a solute which is evenly dissolved throughout the mixture
- The solute is the substance being dissolved
- The solvent is the substance that causes the dissolving



# Water as a Solvent



- Often considered the “Universal solvent”
- can dissolve more things than any other natural substance