

# The Way of Water

# Needful things (Bruce)

- ❖ W-1: stale bread, water bottle
- ❖ W-2 petri dishes, water, staples
- ❖ OW-0: marbles, waters
- ❖ OW-1: wax paper, Al foil, P-1000, tips, oil, H<sub>2</sub>O
- ❖ OW-2: balloons, beaker H<sub>2</sub>O; beaker oil
- ❖ OW-3: pepper, water, detergent
- ❖ A-1: small test tubes, racks, beakers of alpha, Q, 7
- ❖ On hand: salt, small weigh boats

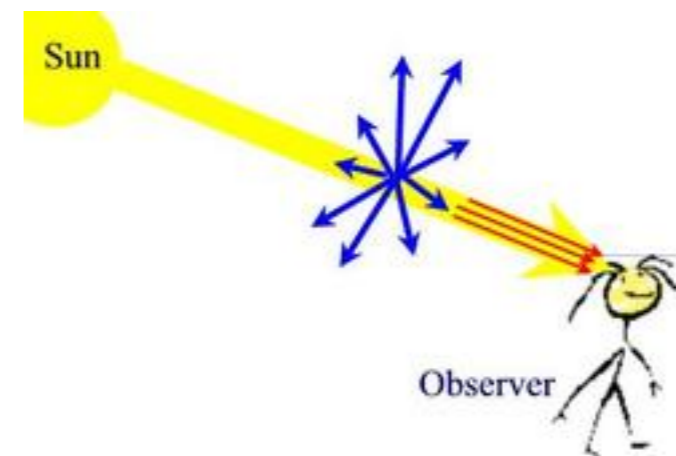
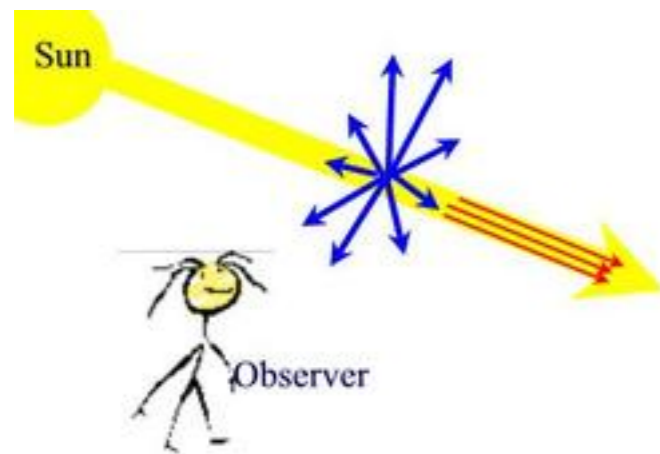
# Observation



# Logical assembly

Sky blue; sunsets red

<https://serc.carleton.edu/sp/library/conceptmodels/index.html>



# Labels vs. explanations

"[For example, we will explain]...why the turtle goes to the sea after laying its eggs by saying that's an 'instinct'.... that's just a name that feels explanatorily soothing to us... we very often feel like we've explained something when we've just uttered a magic word to make the puzzle feel like it goes away."

--Prof. Jeffrey Kasser

- ❖ A *label* is the (hopefully correct) term or 'pointer' for an object or phenomenon
  - ❖ I can teach a parrot or a tape-recorder *labels*
- ❖ *You*, will always generate *understandings* and *explanations*
  - ❖ you can 'buy' a label by providing an *explanatory* definition... that is free of labels!

# A tool for today

<http://bit.ly/BioStruct>

[https://thinkbio.guru/3D\\_Directory/Flotsam\\_and\\_Jetsam/SparkleBiomolecules/biomolecules.php](https://thinkbio.guru/3D_Directory/Flotsam_and_Jetsam/SparkleBiomolecules/biomolecules.php)

- ❖ *Menus* at right select molecules for display
- ❖ *Buttons* at bottom manipulate the view
- ❖ Atom color codings are shown
- ❖ 'Calc surface' is a fancy view we won't need, but you're welcome to investigate

# Water alone

# Bread and Water **W-I**

- ❖ I'm coming at you with murder in mind, bearing a 2-week old loaf of French bread
- ❖ You have no bread available
- ❖ How do you disarm me from afar?
- ❖ (Bruce has sample weaponry)





# Water & a staple **W-2**

- ❖ Very lightly place a staple horizontally on a drop of water
- ❖ What do you *observe*?
- ❖ Hypotheses?
- ❖ Tests?

# Practical magic

- ❖ (both structures available in BioStruct viewer => 'Interesting' menu)
- ❖ I tried a hot pepper--too hot. The heat comes from capsaicin. Should I drink lots of milk or water to cool my mouth?
- ❖ Oops! I walked into poison ivy (urushiol). Should I lure it away from my skin with grease or water?

# Test your understanding

- ❖ What is 'siphoning'? Why can you siphon over a greater height with a hose full of *water* vs. *gasoline* ( $C_8H_{18}$ )
- ❖ Inspiration
- ❖ beading, meniscuses

# Oil and water

# Oil, water... oil & water OW-0

- ❖ what do you 'know' about oil & water?
- ❖ *hypothesize* why this is so
  - ❖ => Remember *labels vs. explanations*
- ❖ Visit Bruce & borrow the Box of Toys. Develop an explanation for the design of the water (plastic) and oil (marble)
- ❖ Predict what will happen if you mix them, then gently shake the box for a while
- ❖ test. Return box to Bruce & discuss

# Oil, water, wax paper, aluminum foil <sup>I4</sup>

## OW-1

Mineral oil is incredibly thick  
Pipet VERY slowly!!

- ❖ Cut a 2x2" square of wax paper and one of aluminum foil
- ❖ *Observing carefully*, slowly create the smallest (area) drop of each liquid you can onto each substrate
- ❖ Create a *descriptive table* of behaviors
- ❖ Create & justify/explain a "who enjoys whom/who dislikes whom" explanation. Remember, *self* is a whom!

# Oil, water, & static electricity OW-2

- ❖ what is 'static electricity'?
- ❖ Get a balloon--inflate, 'static it up'
  - ❖ if this fails, get magic wand from Bruce
- ❖ thin stream of water v. close to static
- ❖ thin stream of oil v. close to static
- ❖ *conclusions?*

# Pepper, water, detergent OW-3

- ❖ fill disk 1/2 full with water. Sprinkle pepper liberally on the top
- ❖ Pepper is only a *marker* for water surface. THAT IS ALL
- ❖ LOOK UP detergent in BioStruct viewer
  - ❖ Describe its parts/their properties
  - ❖ PREDICT detergent interactions with water
- ❖ Touch detergent with finger; touch finger to center of water
- ❖ Create MODEL for what is happening



# In between things

# Three alcohols A-1

- ❖ You'll be provided with 3 tubes labeled 'alpha', 'Q' and '7'
- ❖ ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ )
- ❖ isopropanol ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ )
- ❖ butanol ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ )
- ❖ Observations of difference (thinkBio home => 3D SmallMol => Sugars & Energy)
- ❖ *Design a test to distinguish them based on how you predict their properties differ*
  - ❖ *Discuss your ideas with Bruce*

# Evaporation

- ❖ What is to evaporate?

# Ice & Snowflakes

- ❖ <http://biomodel.uah.es/en/water/index.htm>