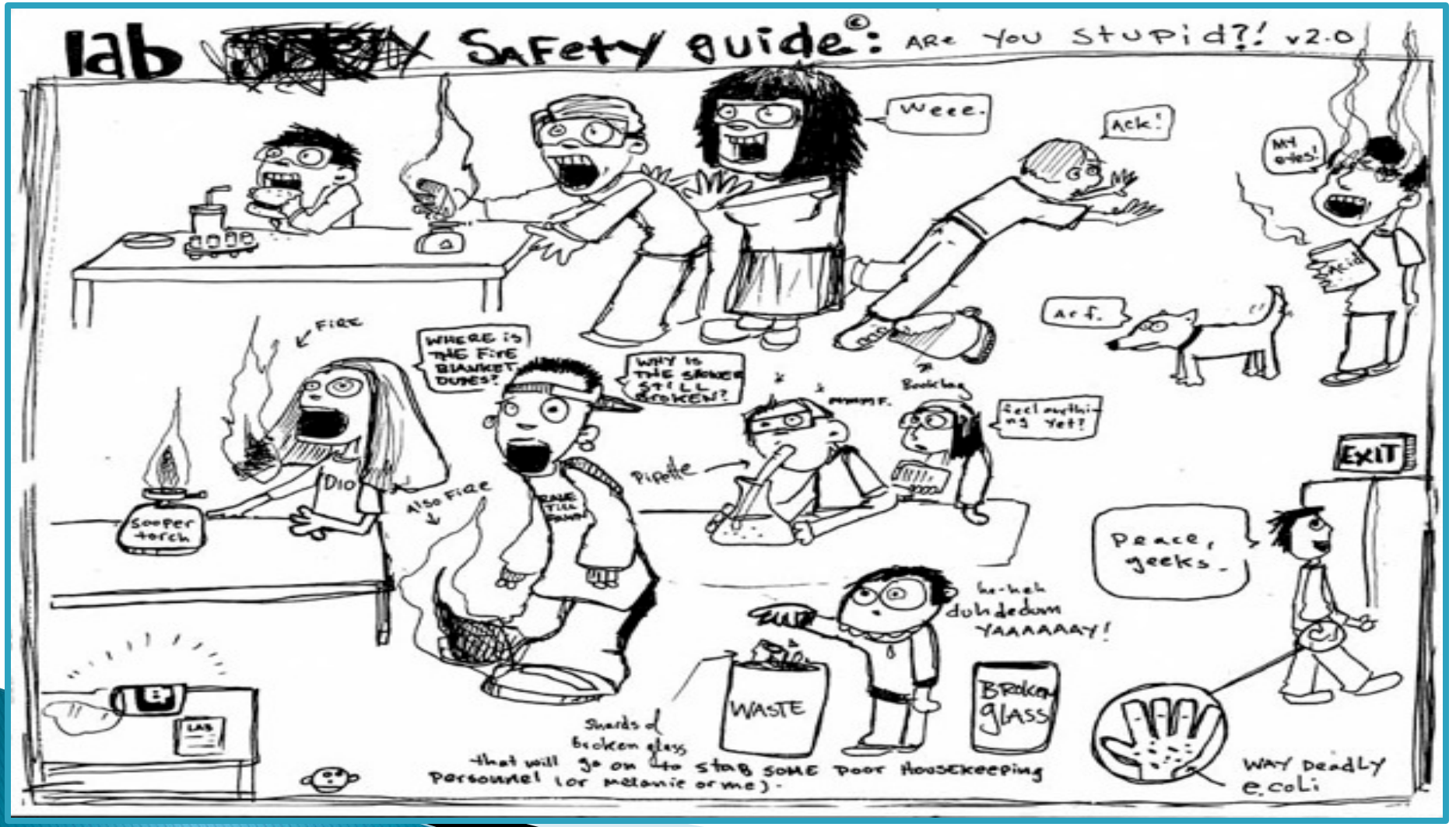
Unit 1 Mix Matter & Flow

Topic 1 – Lab Safety & WHIMS
And the Wonderful World of Fluids

Lab Safety

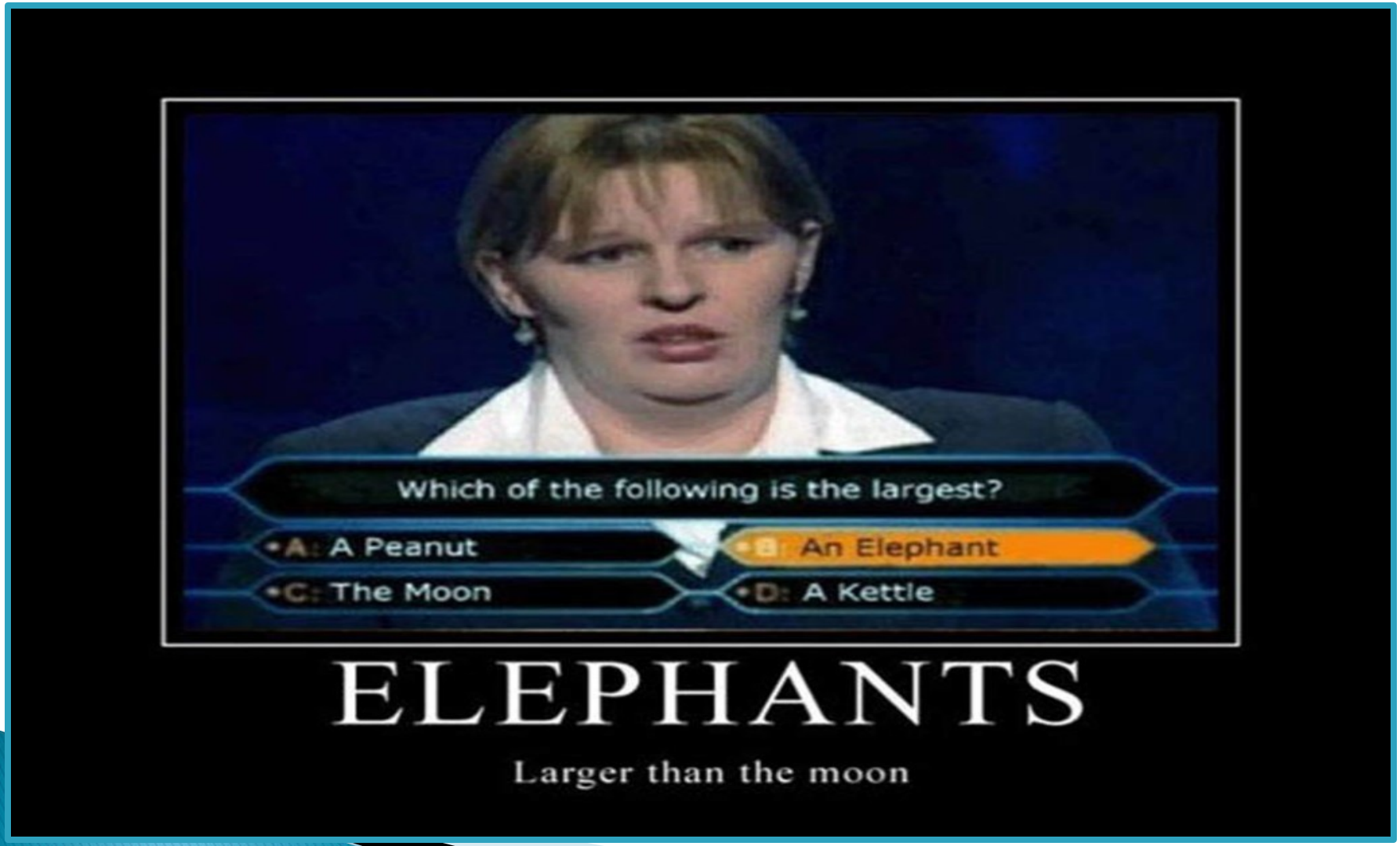
- Let's talk some general lab safety …



Lab Safety

- General rules here …The “Do Not’s”.
  - Do Not running in the lab
  - Do Not food in the lab (especially during experiments)
  - Do Not drinks in the lab. (water is OK)
  - Do not taste chemicals or use other lab devices unless told
  - Do not taste anything without permission
  - Do not stick your face above a liquid and inhale
  - Be respectful
  - Always follow directions
  - Let me know if you break something – glass for sure!

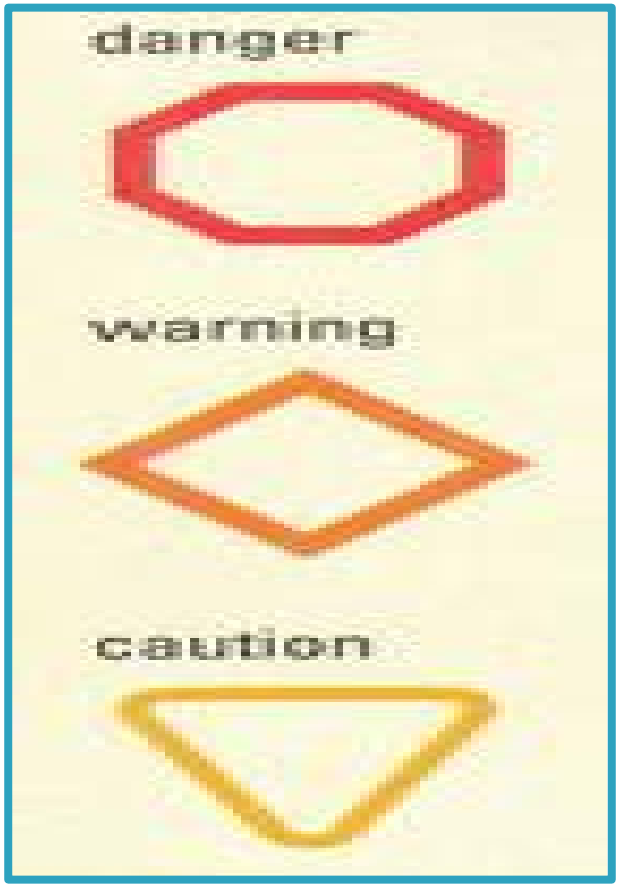
Let's Science!



Hazardous Materials

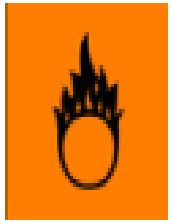
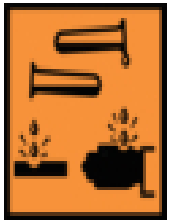
- 1st Component – Shape

- The shape of the HHS symbol tells you how dangerous a material is



Hazardous Materials

- 2nd Component – Picture
- The picture tells you what the danger is…

Explosive	Highly/Extremely flammable	Oxidising	Corrosive	Toxic/Very Toxic	Harmful/Irritant	Dangerous for the environment
						

- The above are the most common

WHMIS

- WHMIS stands for …
  - Workplace Hazardous Materials Information System
- Fancy talk for …
  - …what dangers/potential dangers a material possesses
- These are commonly found in the workplace where you would interact with chemicals

WHMIS Question …

- Here is a question for you …
- If you were to get hired at a fast food place, do you think they will make you take a mini WHMIS training course?

WHMIS Symbols

Compressed Gas

Flammable

Oxidizer

Poisonous

Toxic

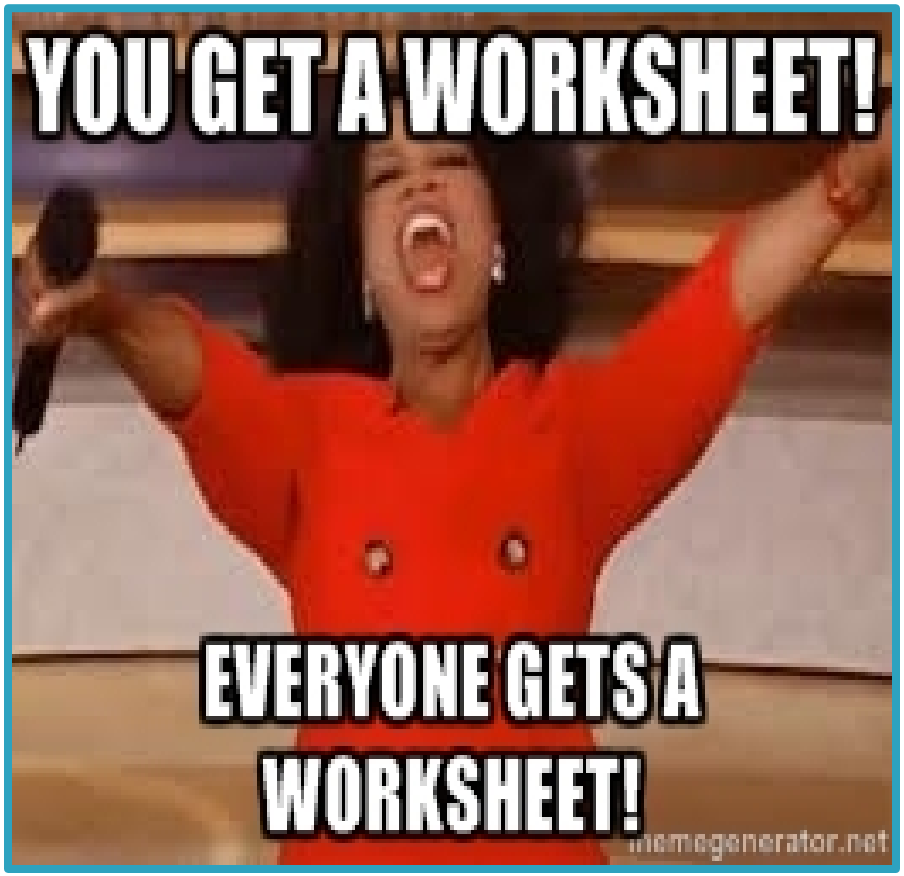
Biohazard

Corrosive

Reactive

WHMIS

- Time for some intense WHMIS and Hazard Symbol Trivia …
- …time for a WHMIS Fun-Sheet!



Now that we are safe…

- It is time to talk Fluids!
- So what is a fluid?
  - Discuss what fluids you see around you right now!
- So how do you define a fluid?
  - Anything that has no fixed shape and can flow
  - Usually it is a **liquid**, or a **gas**

Fluid = Powerful

- Fluids = Easier To Use Material
  - Fluids move materials, even if they are solids
- Slurries
  - A mixture of water and a solid (i.e.:dirt and water) is called a **slurry**
- Slurry technology
  - Slurries are very useful in industry
  - One of these is mining in the Oil Sands…
    - Syncrude originally used conveyor belts to move the oil sand from the mine to the processing plant, but found it was too expensive
    - It is now pumped to the plant by way of a slurry pipeline

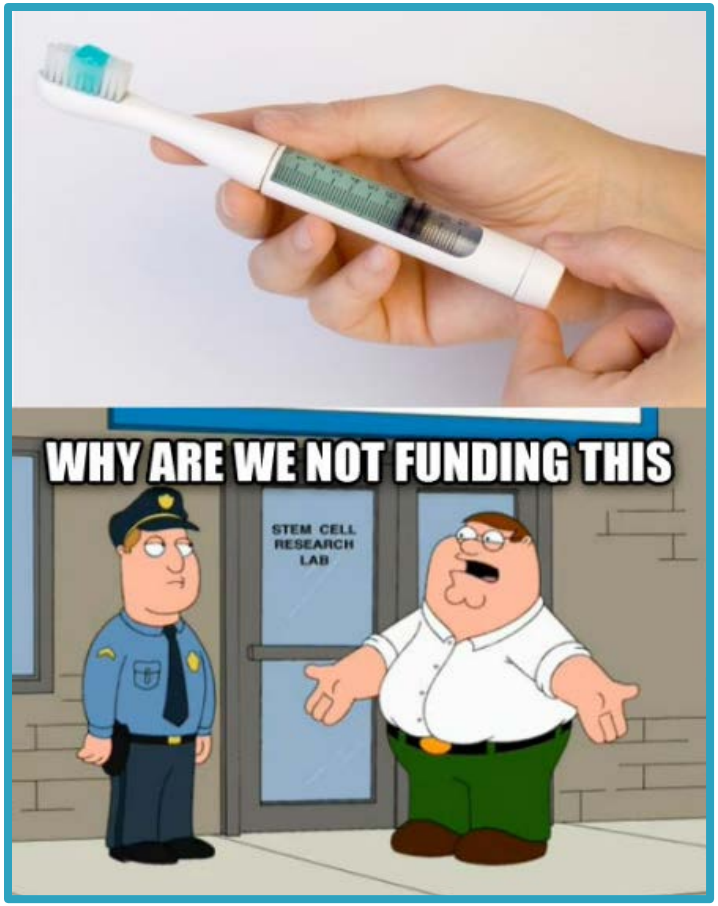
Fluids … There Is More?!

- Fluids Become Solids
  - Fluids take the shape of their containers
- Many solid materials are originally prepared as fluids
  - I.e.: Glass, Steel and concrete are examples
- Where the solids are processed as liquids to shape them easier, so then they cool or dry as a solid they are in the form they should be

Even More Fluids!

- Fluids Can Hold Other Materials
  - The ability of fluids to *flow* and *carry* other materials makes them useful in many different ways.

- Applications
  - Toothpaste has a ‘binder’ (which is made from wood pulp) that keeps all of the ingredients together.



Unit 1 Mix Matter & Flow

Topic 2 – Properties of Fluids &
A Whole ‘Lotta Science Fun!

Substance vs. Mixture

- All pure substances have their own unique set of properties or characteristics

- All mixtures contain two or more pure substances which have their own distinct properties (some of which may be hidden)

Break it down…

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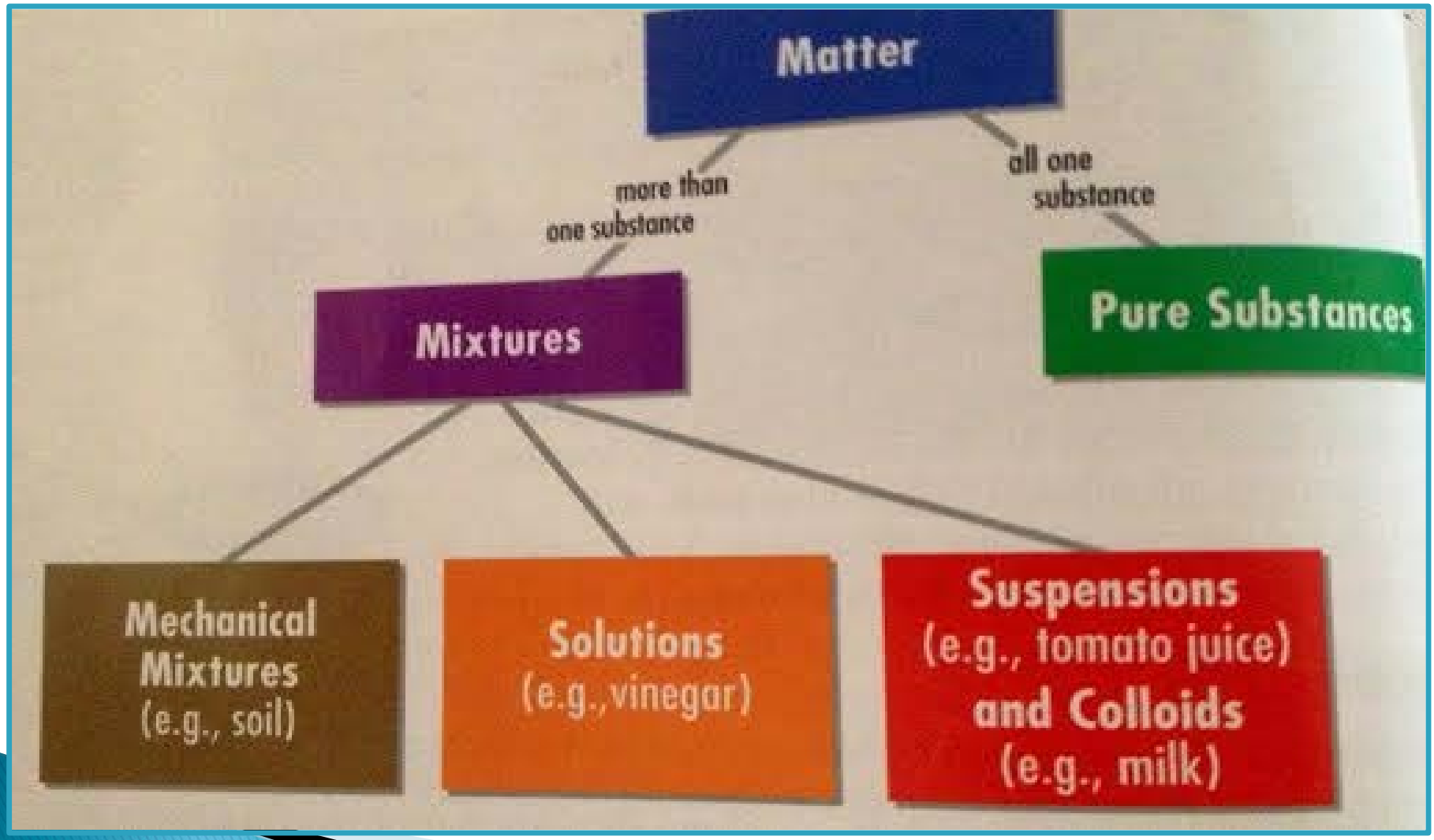
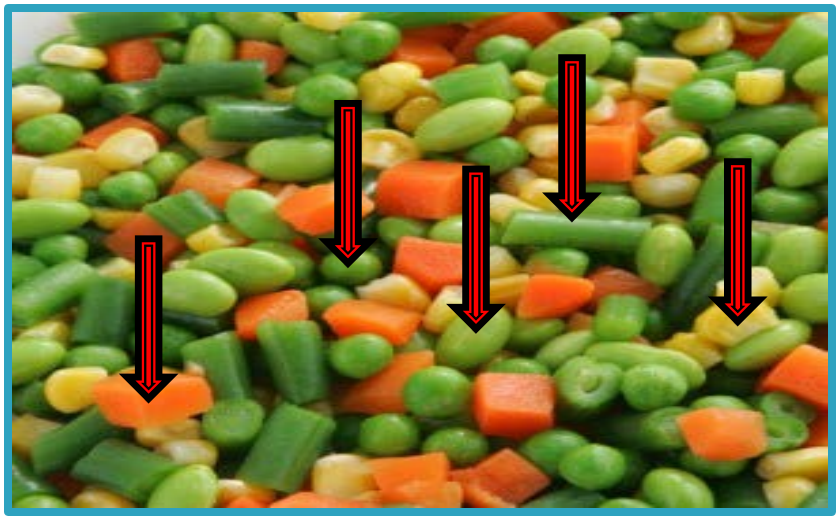


Break it down more…

- Matter
  - Everything! (Essentially anything that takes up space)
- Mixture
  - Combination of two, or more, pure substances
- Mechanical Mixture
  - You can see the different substances that make up the mixture
    (i.e.: mixed vegetables)



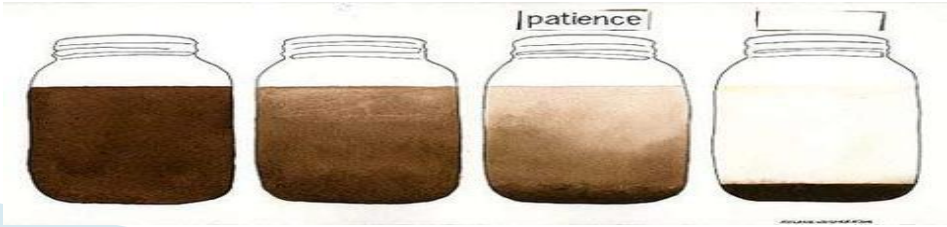
A.K.A. **Heterogeneous Mixture**

Break it down even more…

- Mixtures where you *cannot see* the different parts are called **homogeneous mixtures**

- Solutions
  - Looks as if it is all one substance

- Suspensions
  - Cloudy mixture in which droplets or tiny pieces of one substance are held within another
  - If you let it settle out you will see the pieces begin to separate out



Break it down to the end…

- Colloids
  - Also a cloudy mixture
    - Difference?
  - The droplets or tiny pieces are so small that they do not separate out easily
    - (i.e.: Homogenized milk … actually tiny cream droplets in whey)

Activity Time!

- Time to see if you get this at all …

Fluid	Pure Substances	Heterogenous	Solution	Suspension	Colloid
Pop					
Milk					
Water					
Vinegar					
Apple Juice					
Windshield Washer Fluid					

Activity Time (Part 2)!

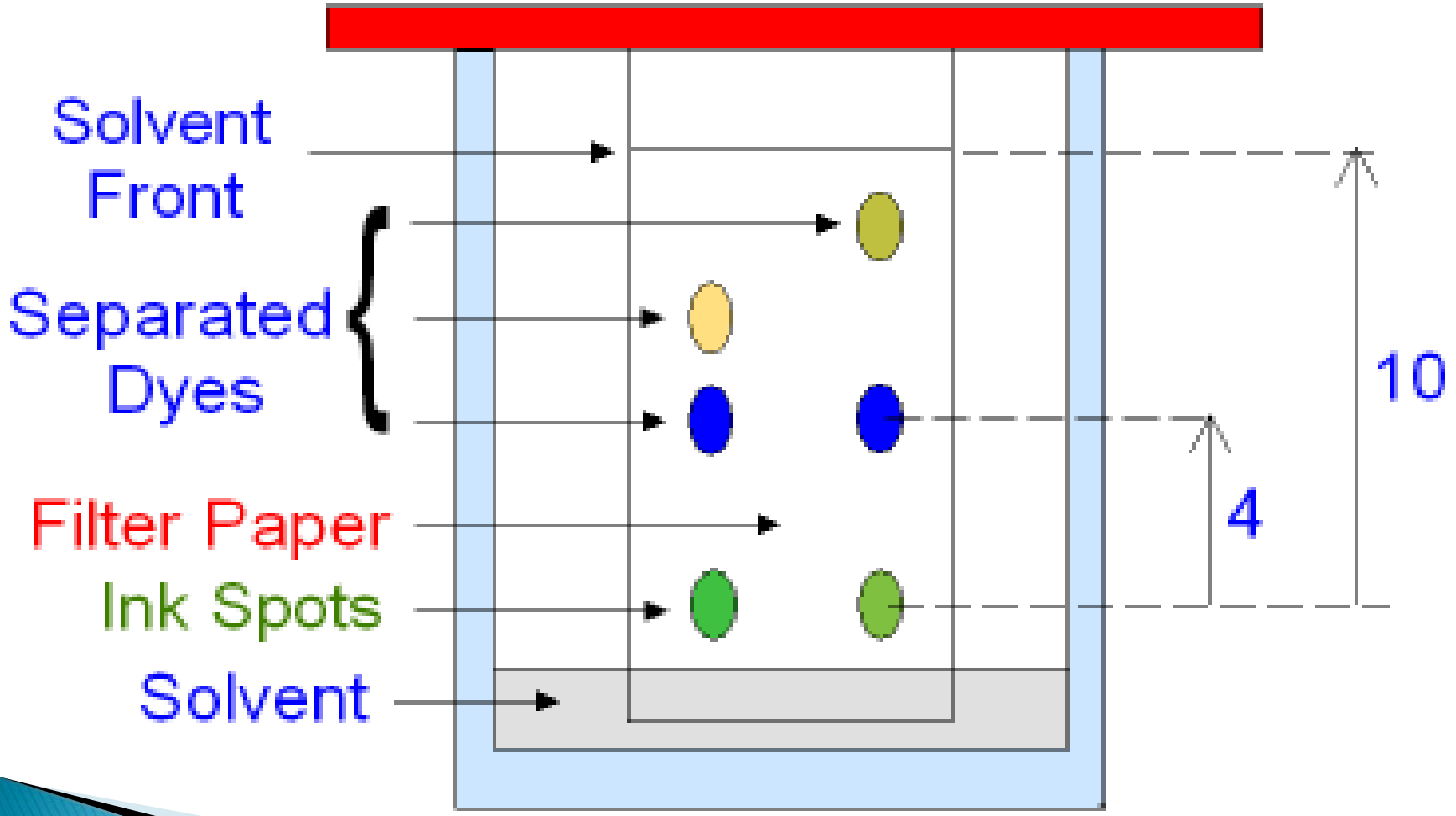
- Time to see if you get this at all …

Fluid	Pure Substances	Heterogenous	Solution	Suspension	Colloid
Styrofoam					
Juice in box that you must shake.					
Salt					
Sugar					
Air					
Ketchup					

Paper Chromatography

- What is that?
- A paper chromatography test can be used to determine if a substance is pure or a solution
- A filter paper is placed partially in a solution if the fluid moves up to only one level it is a pure substance
- If it moves up to multiple levels showing each substance, then it is a solution

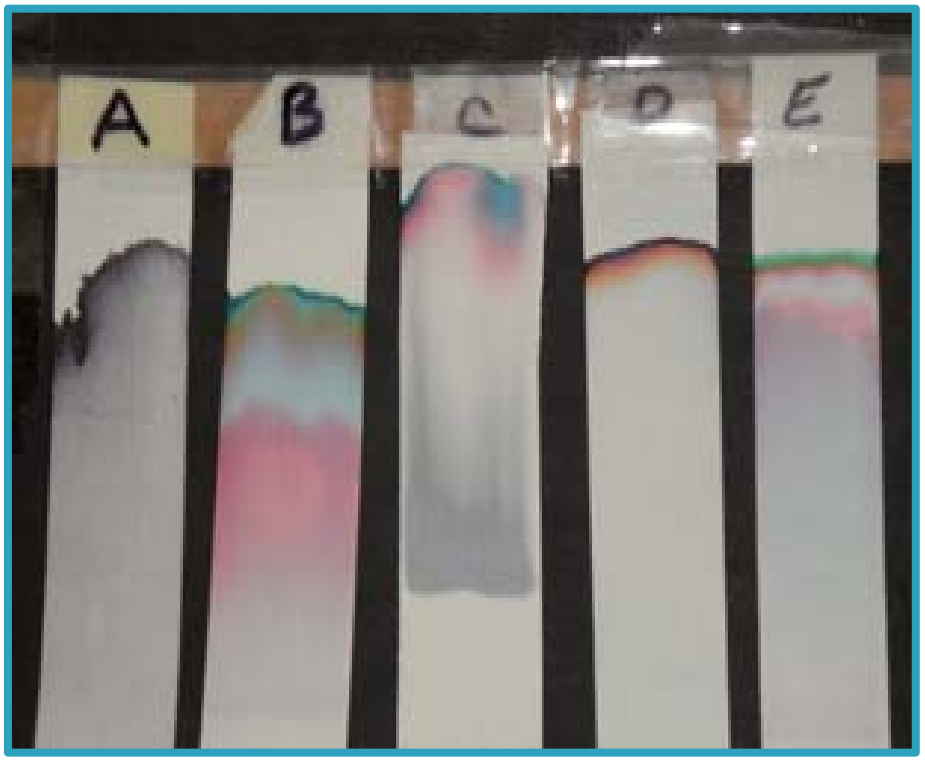
Paper Chromatography



Chromatogram?

- The filter paper used for this test is called a **chromatogram**

- Coffee filters will work just fine for this as well



What colour is black?

- Time to see what colour(s) black is actually made up of … if at all!

- Mini Experiment time!

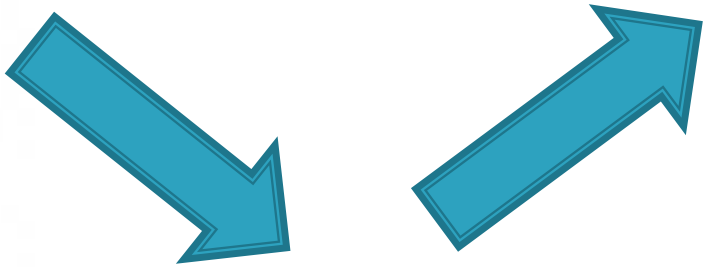
Concentration & Solubility

- Forming a solution by mixing two or more materials together is called **dissolving**

- The **solute** is the substance that dissolves in a **solvent**
- The **solvent** is the substance that dissolves the solute to form a **solution**
- Soluble means to be able to be dissolved in a particular solvent
- Solutes and solvents can be gases or liquids

How does it work?

Solute



Solvent

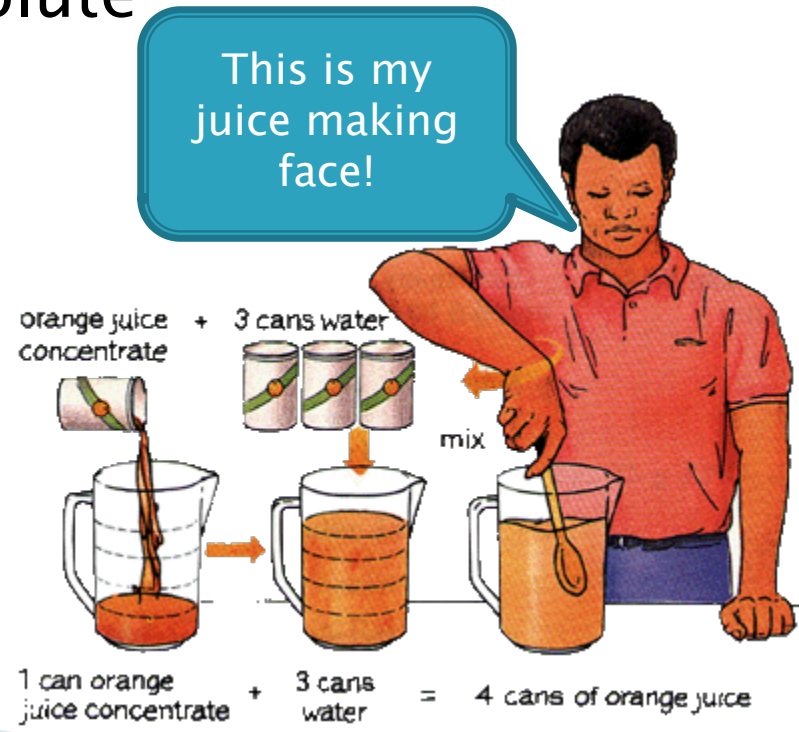
Solution

Dilution

- This is a term you may have heard before
- What does it mean?

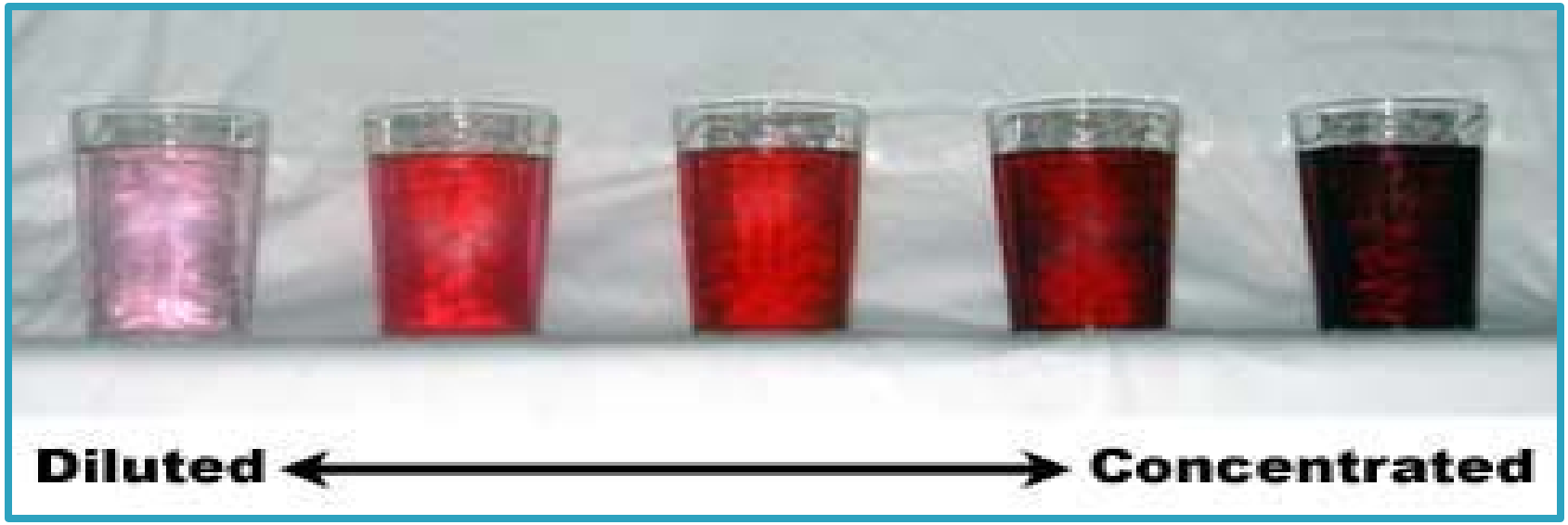
- Concentrated solutions have tons of solute compared to solvent while diluted solutions have tons of solvent compared to solute

- When you add a concentrated solute to a solvent you are diluting that solute
(adding more solvent)



Dilution Example…

Video Fun



Measuring Concentration

- Concentration is the exact measurement of how much *something* is in *something* else

- Example?

50 g

100 ml

50g/100ml

Calculating Concentration

- Before I explain … let me test you …

- Find a partner and tell me which of the following solutions has the highest concentration…

6g in 25ml

15g in 100ml

10g in 50ml

Comparing Concentrations

- In order to compare concentrations you need the same amount of solvent!
- Example:
  - 10g / 50ml vs 25g in 100ml
- Keep it simple bring 50ml to 100 by x2
  - … 20g in 100ml now and 25g in 100ml
- Which is more concentrated?

Go back and try the previous question with this new information!

Saturated vs. Unsaturated

- As you add a solute to a solvent it will begin to dissolve in to the solvent
- As long as the solute keeps dissolving the solution is **unsaturated**
  - …that is to say it has room for the solute in it!

- If you kept adding the solute into the solution until it could no longer be dissolved then you would have a **saturated** solution
  - …that is to say nothing more can be dissolved in it

Unsaturated vs. Saturated

- How about a picture representation?

Saturated

Unsaturated

Solubility

- Now, there is a catch to this!
- Saturation is directly related to the temperature of the solvent … why?

- So ***every solution*** has a ***different saturation point*** at any given temperature!

Factors Affecting Solubility

- The most common solvent in the world is water
- No, no Mr. Meme… water not coconut water.
- In conclusion coconut water is gross
- What the?!

Factors Affecting Solubility

- Back to it … regular ol' water is the universal solvent
  - **Life tip**: If you see "Aqueous Solution" on a label it means water is the solvent because *Aqua* is Latin for water)
- Remember our conversation on fluids? Solutions are not always a liquid …

Whoa!

Solute	Solvent	Solution
Gas	Gas	Air *(Oxygen & Gases in Nitrogen)*
Gas	Liquid	Soda Water *(CO2 in Water)*
Liquid	Liquid	Antifreeze *(Ethylene Glycol in Water)*
Liquid	Solid	Rubber Cement *(Benzene in Rubber)*
Solid	Liquid	Seawater *(Salt in Water)*
Solid	Solid	Brass *(Zinc in Copper)*

Things That Make Me Laugh

Solubility & Temperature

- For most substances, ***solubility increases as the temperature increases***
  - Ex: At 25°C you can dissolve 36.2g of salt in 100mL of water but at 100°C you can dissolve 39.2g

- Interestingly enough the Opposite is true for gasses!
- As temperature increases the solubility ***of a gas in a liquid solvent decreases***

- Why does this matter?

Thermal Pollution

- Many industrial plants use water as a coolant and usually this water comes from nearby lakes or rivers
- The water gets hotter as it is used by the plant and before it is returned to the original water source it is to be cooled in a cooling pond
- Do you think this always happens?
- Heck no!

Thermal Pollution: Part Two

- If water temperature increases its ability to carry gasses decreases
  - Ex: Hotter water = less oxygen
- Life Tip: Oxygen is important!
- Essentially aquatic life could drown … in water?!
- WHAT?!

Particle Model & Behaviours

- Particle Model of Matter – The 4 Points!

1. All matter is made up of tiny particles and different substances are made of different particles

Particle Model & Behaviours

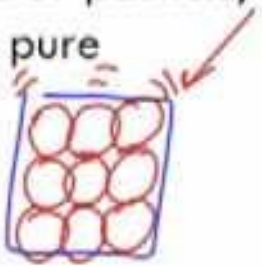
- The 4 Points

Particle Theory of Matter

i. All matter is made up of extremely tiny particles

ii. Each pure substance has its own kind of particle, different from the particles of other pure substances

iii. Particles attract each other



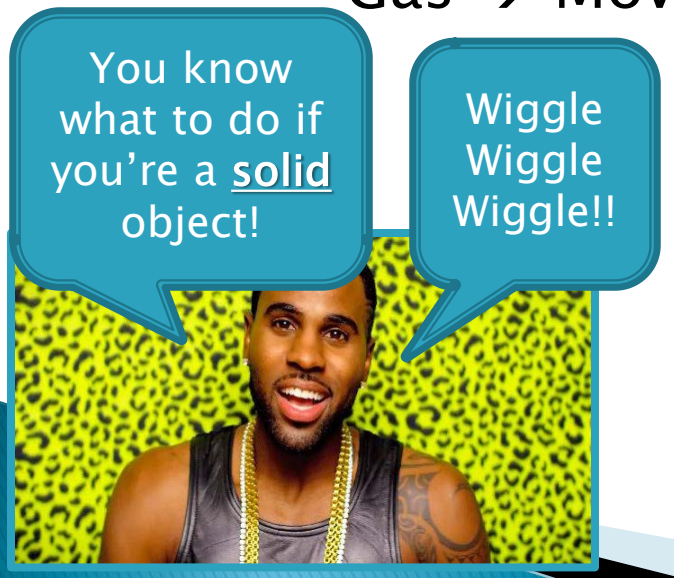
iv. Particles are always moving

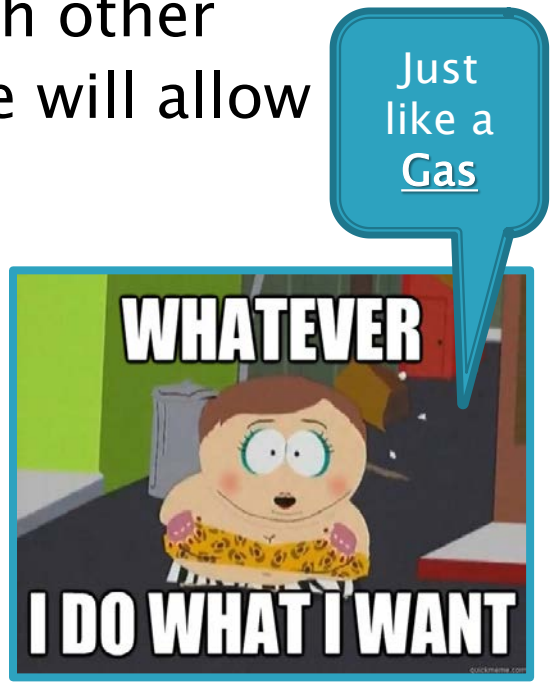
v. Particles at a higher temperature move faster on average than particles at lower temperature

Particle Model & Behaviours

- Particle Model of Matter – The 4 Points!

1. The tiny particles are always moving
   - Solid → Wiggle in 1 place
   - Liquid → Sliding around over each other
   - Gas → Moving as far as the space will allow





Particle Model & Behaviours

- Particle Model of Matter – The 4 Points!

1. The particles in matter may be attracted to each other or bonded together
   - Ex: Water has more attraction to salt

Particle Model & Behaviours

- Particle Model of Matter – The 4 Points!

1. The particles have spaces between them!

Double back …

- Looking back at the water & rubbing alcohol problem … can you explain it?

- Did you figure it out?

Particle Model & Mixing

- Water & Rubbing Alcohol are different
  - …this means they are made up of different particles or different sizes!

- The smaller particles take up the space between the larger particles … like this!

Particle Model & Mixing Cont…

- This model also explains why substances dissolve!
- Particles of one substance can/are more attracted to particles in other substances
- When I put sugar in water the sugar was more attracted to the water particles and went to "hang out". Sugar loves water and so it breaks up to split up and hang out with all of the different water molecules.
- This is the science behind **dissolving**!

Particle Model & Mixing Cont…

- When you add sand to water, the sand does NOT dissolve.
- Why?
- Because sand hates water. The sand particles do not want to break apart to go hang out with the water particles. Instead they huddle together and support one another from their evil enemy….water.

Rate of Dissolving

- There are 3 major ways you can affect the rate of dissolving that occurs in a solution

- 1) Temperature
  - Particles of the solvent are moving faster and they bump into the solute particles faster

Rate of Dissolving

- There are 3 major ways you can affect the rate of dissolving that occurs in a solution

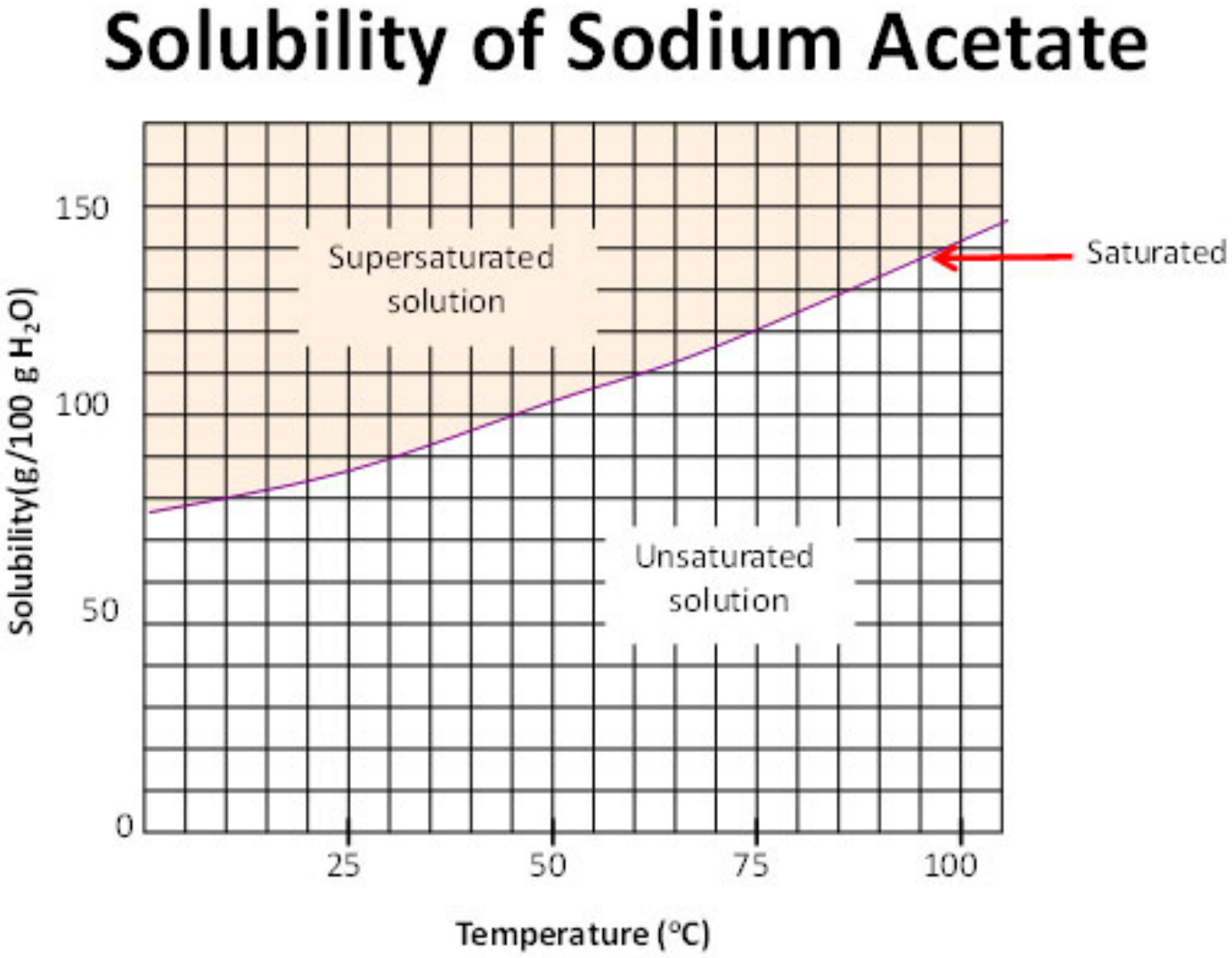
- 2) Size of Particles
  - Small pieces dissolve quickly compared to larger pieces because there is more surface area for the solvent to work with!

Rate of Dissolving

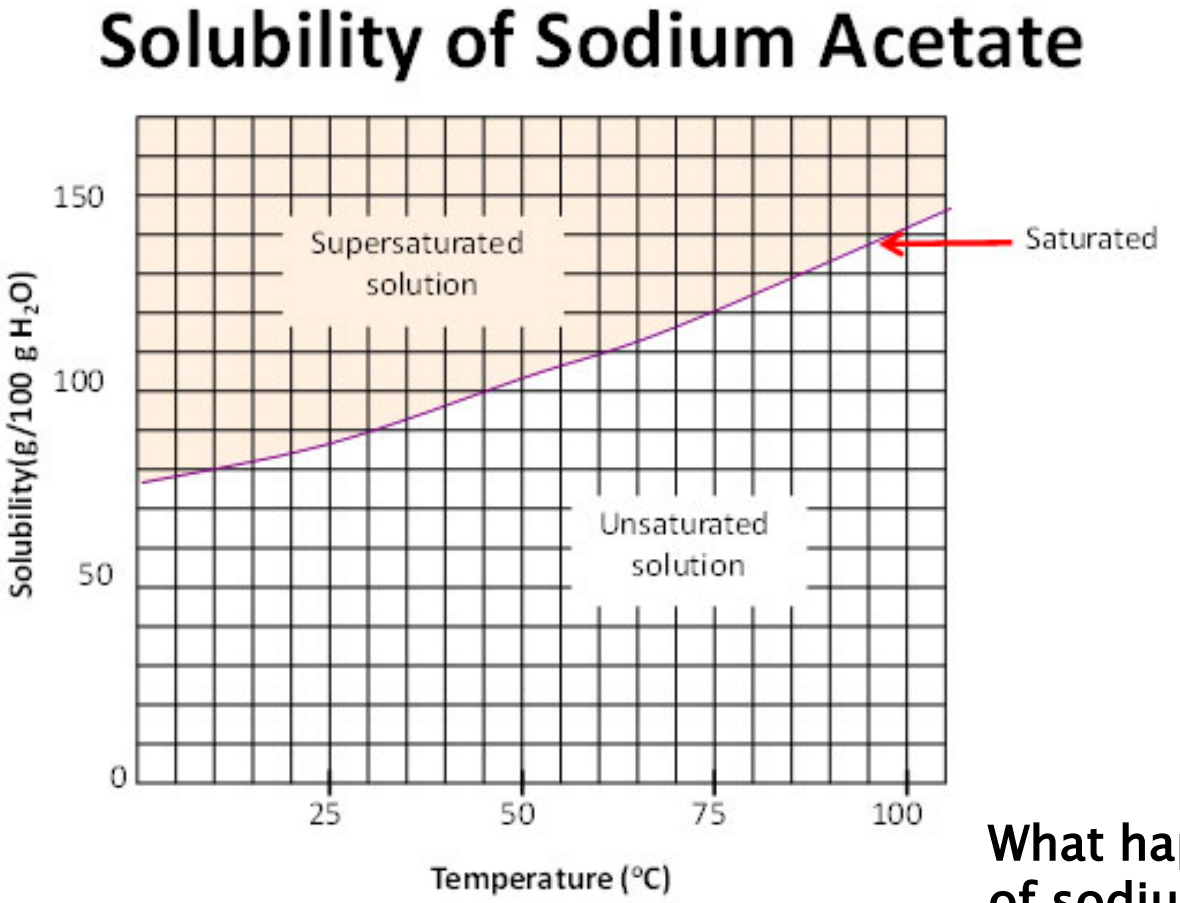
- There are 3 major ways you can affect the rate of dissolving that occurs in a solution

- 3) Stirring
  - Stirring the particles moves them around and the solvent particles bump into them

Saturation Graphs



Now, let me test you…



What is the maximum amount of sodium acetate that can dissolve in 100g of water that is at:

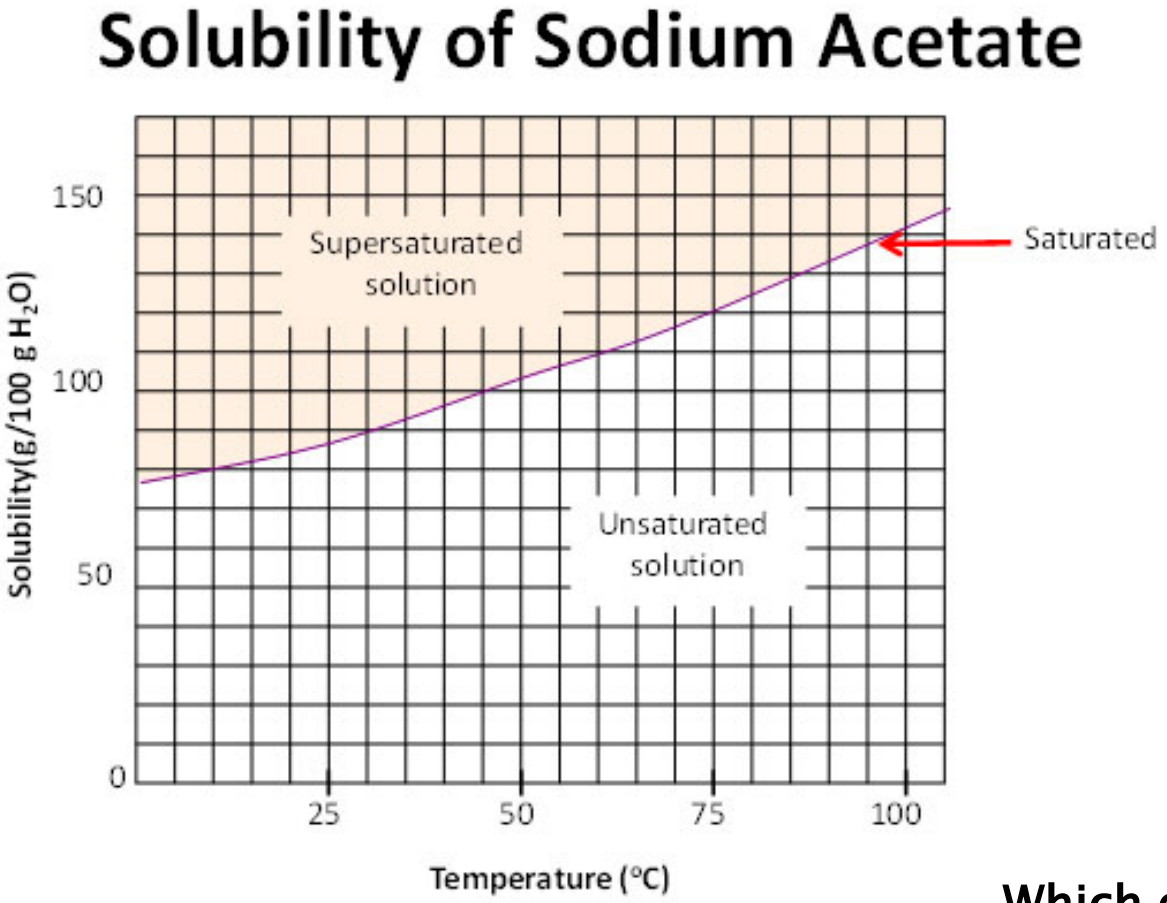
75^0C?

25^0C?

5^0 C?

What happens to the solubility of sodium acetate as the temperature of water increases?

Now, let me test you…



What happens if you try to dissolve 100g of sodium acetate in 100g of water at:

75^0C?

25^0C?

5^oC?

Which of the mixtures above are supersaturated and which is unsaturated?

Game on…

- That's 2 Topics down … Remember education is important!!