Pure Substances and Mixtures Review

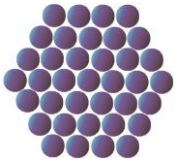
Classifying Matter

Matter: anything that has mass and takes up space

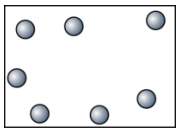
Chemistry: the study of matter and its changes

The Particle Theory of Matter

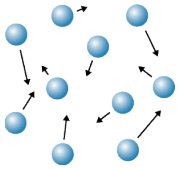
1. All matter is made up of tiny particles



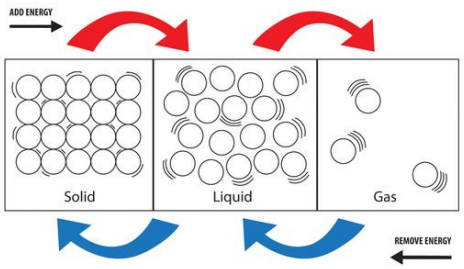
2. Particles have empty spaces in between them



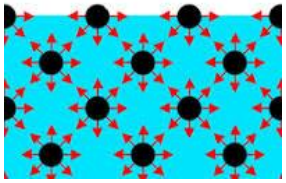
3. Particles are moving randomly all the time



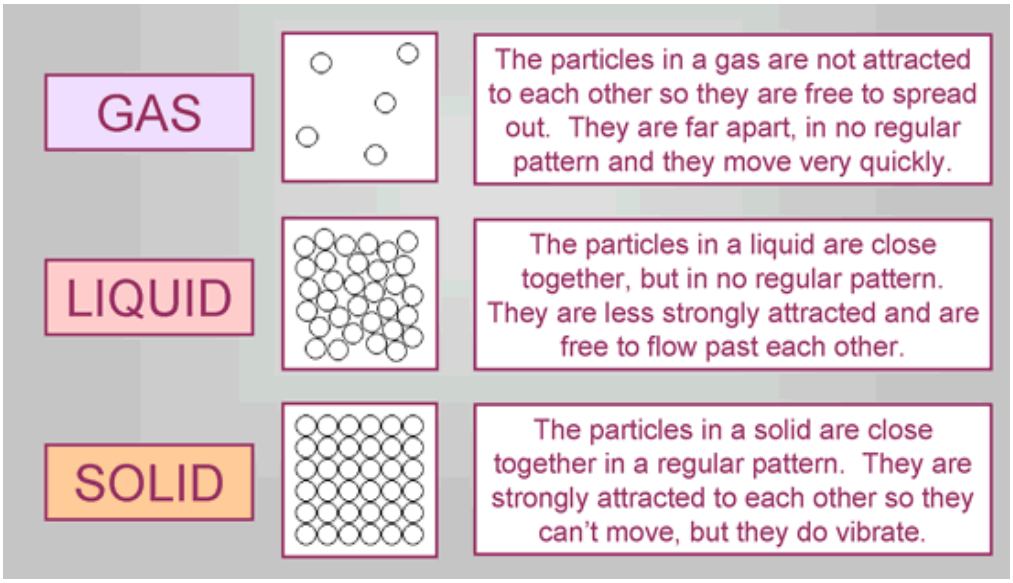
4. Particle move faster and spread further apart when they are heated



5. Particles attract each other, so they tend to stay together instead of flying apart



Three States of Matter



Solids stay in the same shape.

Liquids can flow and fill the containers they occupy.

Gases have lots of energy and move fast in all directions. They can even leave the container they are in if it isn't sealed.

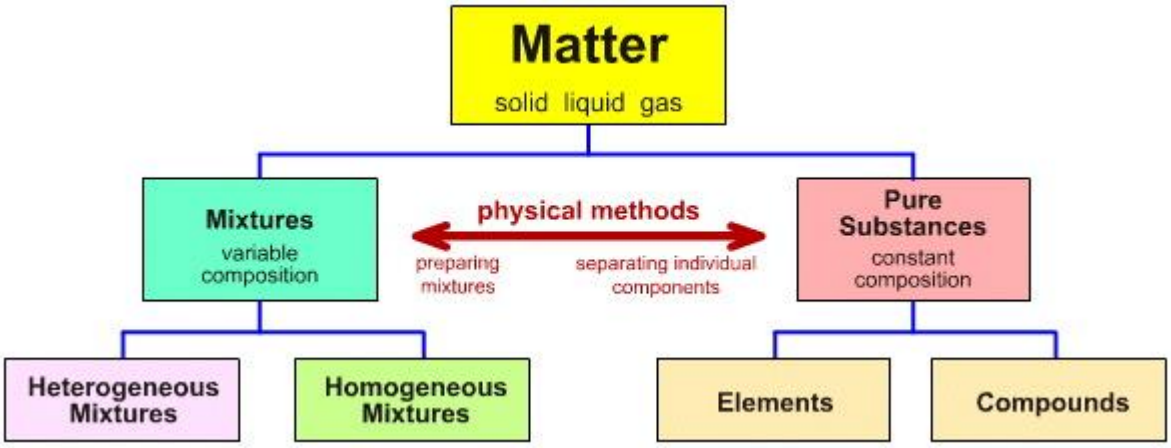
Pure Substance: matter that contains only one kind of particle

Mixture: matter that contains two or more pure substances.

Mechanical (Heterogenous) Mixtures: a mixture with different parts you can see

Solutions (Homegenous Mixtures): a mixture that looks like a single pure substance – a uniform mixture of two or more substances

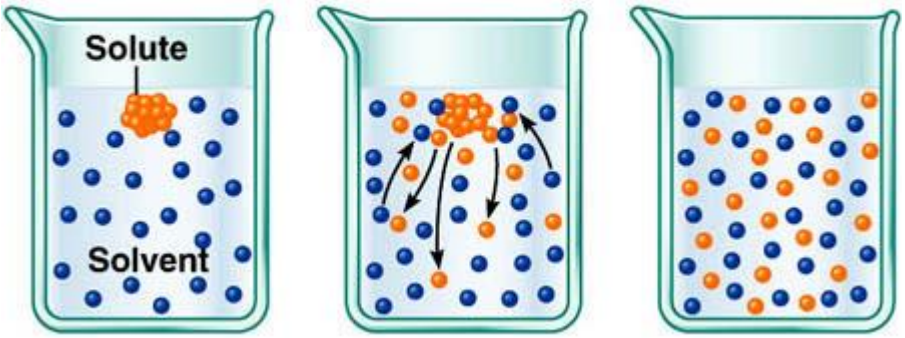
Classifying Matter



Solutions

Dissolve: to mix one type of matter into another type of matter to form a solution

Solutions can be either **solid** (like steel), **liquid** (like Koolaid), or **gas** (like the air we breathe).



Solute: the smaller part of a solution – the part of a solution that dissolves in the solvent

Solvent: the larger part of a solution – the part of a solution into which the solute dissolves

If a solute dissolves in a particular solvent, we say that it is ***SOLUBLE***.

If a solute does not dissolve it is ***INSOLUBLE***.

Concentrated Solution: a solution with a large number of solute particles in a given volume of solution

Dilute Solution: a solution with a small number of solute particles in a given volume of solution

Calculating Concentration: finding the quantity of solute in a certain volume (100mL) of solution

$$\text{concentration} = \frac{\text{mass of solute in grams}}{\text{100 mL of solution}}$$

The following Sample Problem shows how to calculate the concentration of a solution.

SAMPLE PROBLEM: Calculate Concentration

Suppose a solution contains 6.0 g of sugar in 200 mL of sugar-and-water solution. What is the concentration of the sugar-and-water solution?

Given: mass of solute = 6.0 g
volume of solution = 200 mL

Required: concentration of the solution

Analysis: $\text{concentration} = \frac{\text{mass of solute in grams}}{\text{100 mL of solution}}$

Solution: $\text{concentration} = \frac{6.0\ \text{g}}{200\ \text{mL}}$

Remember to divide both the numerator and the denominator by 2 to get concentration per 100 mL.

$\text{concentration} = \frac{3.0\ \text{g}}{100\ \text{mL}}$

Statement: The concentration of the sugar-and-water solution is 3.0 g/100 mL.

Practice: Calculate the concentration of a solution made by mixing 4.5 g of baking soda in enough water to form 50.0 mL of solution. (Remember that the formula calculates the concentration of 100 mL of solution, so you may have to change the volume in your calculation.)

Saturated Solution: is a solution where the maximum amount of solute has been dissolved (you can't dissolve any more into it)

Unsaturated Solution: is a solution that still has room for more solute to dissolve

Solubility: is a measure of how much solute can dissolve in a certain solvent to form a saturated solution (at a particular pressure and temperature)

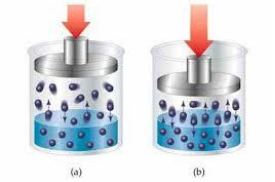
$$\text{solubility} = \frac{\text{maximum mass of solute that will dissolve, in grams}}{\text{100 mL solvent at a certain temperature}}$$

Factors Affecting Solubility

1. **Temperature** (warmer increases how fast it dissolves, EXCEPT for gases in liquids, they dissolve faster when the liquid is cooler)

2. **Stirring** (stirring speeds up dissolving)

3. **Pressure** (increased pressure increases dissolving)



4. **Size of solute pieces** (smaller pieces means more surface area to interact with the solvent)

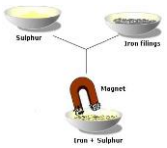
5. **Type of Solvent** (some solutes dissolve better in different sovents)

Separating Mechanical Mixtures:

Physically Sorting: separate mixtures so similar pieces are together

Floating and Settling: separate mixtures by floating lighter components or sinking heavier components

Using a Magnet: separate metal components from non-metal components



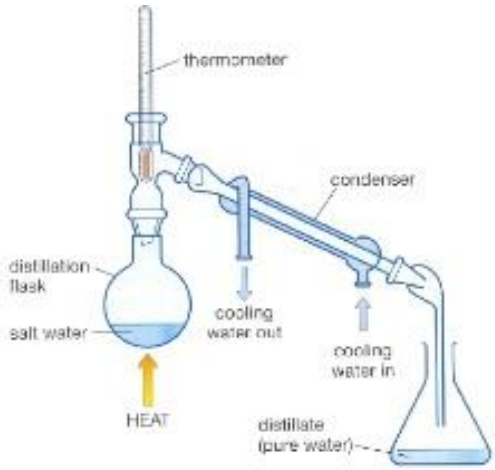
Using Sieves/Filters: passing a mechanical mixture through a screen or filter to remove solid pieces from a liquid or gas

Dissolving: mix a mechanical mixture with water to dissolve a soluble component and leave an insoluble one behind

Separating Solutions:

Evaporation: separate a solution by “boiling away” one of components (used if you don’t mind losing what you boil away)

Distillation the process of separating liquids in a solution by heating the solution, trapping and cooling the gas, and collecting the resulting liquid(s)



Mixtures in Industry: many mixtures have to be separated to yield the materials or products we need

Making Wheat Flour

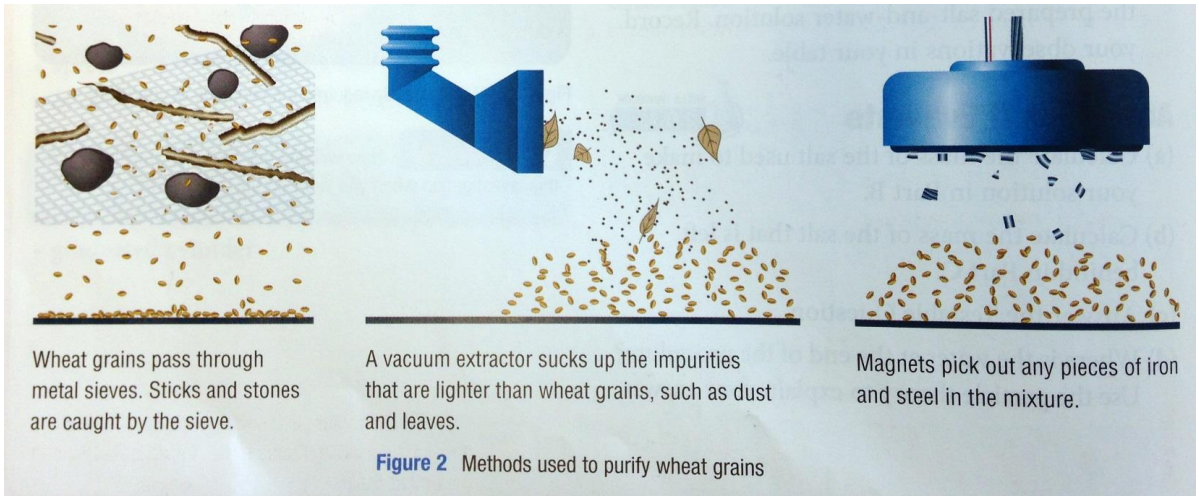


Figure 2 Methods used to purify wheat grains

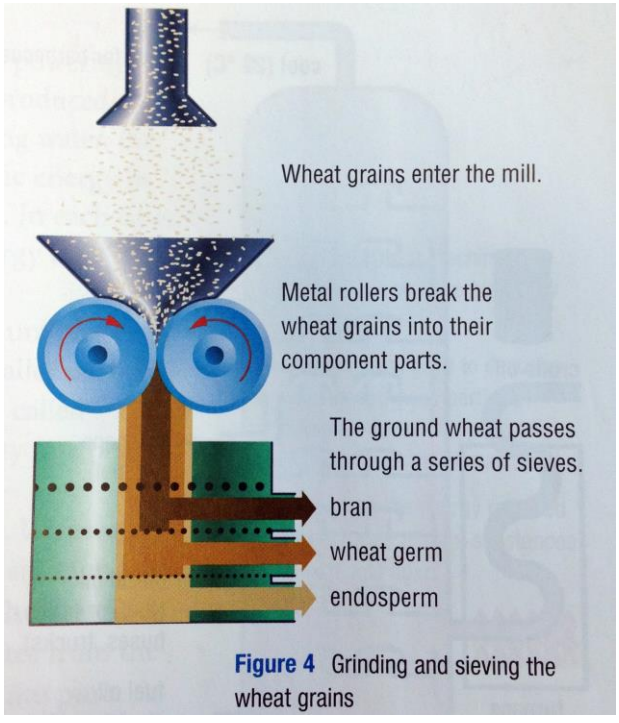


Figure 4 Grinding and sieving the wheat grains

Refining Petroleum

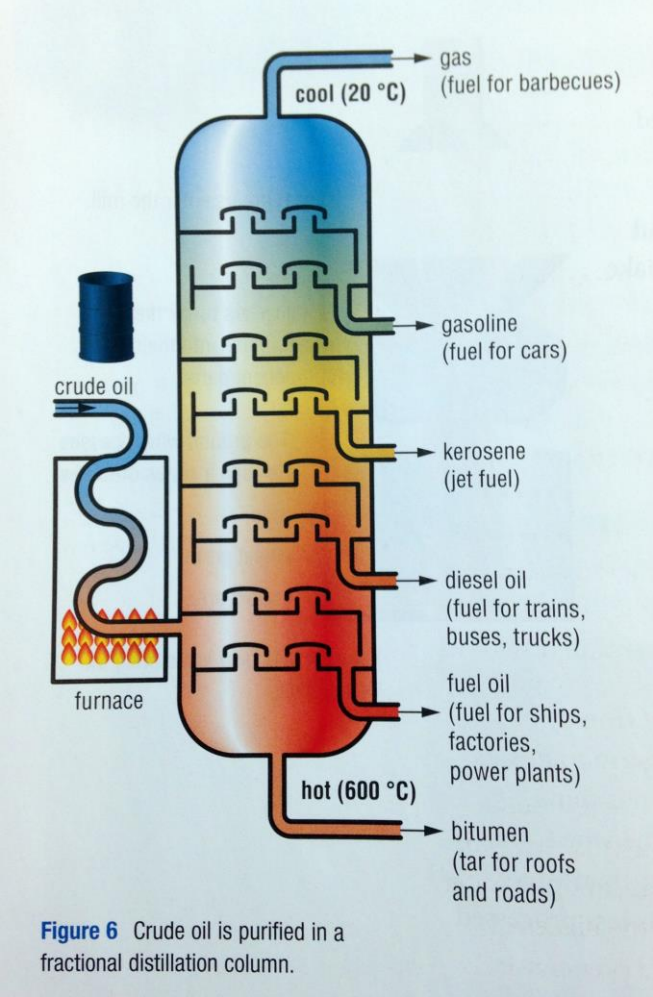


Figure 6 Crude oil is purified in a fractional distillation column.

Uranium and Nuclear Power