**UNIT 9 – Solutions - Test May 19, 2016**
Kavanah pp. 117-134 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



# Review

## Pure Substance

### Element

### Compound

## Mixture

### Homogeneous

### Heterogeneous

# What is a solution?

## Important to study because most reactions take place in solution, ex. double replacement lab

## Def: homogeneous mixture of substances in the same physical state

## Solutions may contain atoms, ions or molecules spread uniformly throughout

# Types of solutions

## Solid

### One metal dispersed uniformly throughout another metal is an ALLOY

### Ex. brass is mixture of zinc and copper (Hanukah Gelt lab!)

## Gas

### Ex. air is a mixture of gases that form a solution

## Liquid

### Liquid solutions are the topic of Unit 9

### Solute – the substance being dissolved, the smaller amount of substance

### Solvent – the substance that dissolves the solute, the greater amount of substance

### Ex. Dissolve solid salt (NaCl) into water.

#### NaCl is the solute

#### Water is the solvent

### Aqueous solutions

#### Water is the most common solvent

#### Water solutions are called aqueous

#### Notation for aqueous is (aq)

### Ex. Dissolve solid salt (NaCl) into water. NaCl(s) 🡪 Na+ (aq) + Cl- (aq)

### Liquid solutions are homogenous mixtures

#### Sol’ns are clear, although they may be colored (ex. transition element solutes)

#### Solutions will not settle when left to stand

#### Solutions will pass through a filter

#### Demo of light passing through a solution

# Solubility Factors

## Solubility: How much of a solute will dissolve in a certain amount of solvent at a certain temperature

## Definitions:

### Soluble: materials with high solubility

### Insoluble: materials with low solubility

### Miscible: 2 liquids that are soluble

### Immiscible: 2 liquids that do not dissolve in each other

## Nature of solute and solvent

### Review polarity

#### Polar bond – caused by electronegativity difference-charge asymmetry-occurs whenever 2 atoms are not the same

#### Polar molecule – asymmetrical molecule with polar bonds

###  “Like dissolves like” refers to polarity

#### Polar dissolves polar (and ionic)

#### Nonpolar dissolves nonpolar

### Hybrid molecules

#### Soaps are polar at one end and nonpolar at the other end

#### Butter or grease dissolves in the soap and so does water, so that the non-polar substance washes off

### Ionic substances dissolve well in polar solvents

#### Ion is a charged particle

#### Charge of the ion is stabilized by the adjacent positive or negative ends of the polar molecule

#### Solutions of ions will conduct electricity – that is an electrolyte

#### Draw picture of ions and water

## Temperature

#### Solids are more soluble at higher temp.

#### Gases are less soluble at higher temperature

## Pressure

#### No effect on a solid dissolving in a liquid

#### Gas solubility increases with increasing pressureEx. CO2 comes out of solution when the bottle of soda is opened

# Table G – your new best friend

## Take out your reference tables. Table G.

## Demo of potassium nitrate dissolving in 100 grams of water

### Step 1 – begin with 100 grams of water

### Step 2 – check temperature

### Step 3 – slowly add KNO3 while stirring until saturated

### Step 4 – recheck mass to see how much KNO3 was added

### Step 5 – turn up the heat and return to step 2

## Do now – graph of KNO3 vs temperature

### Describe the graphIncreasing solubility with temperature

### What is solubility of KNO3 at 30 degrees Celsius? Ans: approx. 47 grams

### What is solubility of KNO3 at 35 degrees Celsius? Ans: 55 grams

### How much KNO3 dissolves in 200 grams of water at 65 Celsius? Ans: 240 grams

### A solution contains 100g of water and 35 grams of KNO3 at 20 degrees Celsius. Is it saturated/unsaturated/supersaturated?

### A solution contains 100g of water and 50 grams of KNO3 at 40 degrees Celsius. Is it saturated/unsaturated/supersaturated?

### A solution contains 100g of water and 60 grams of KNO3 at 20 degrees Celsius. Is it saturated/unsaturated/supersaturated?

### Where on the graph are points that are saturated? Unsaturated? Supersaturated?

### A solution contains 100g of water and 30 grams of KNO3 at 20 degrees Celsius. Is it saturated? How much more KNO3 would need to be added to make a saturated solution?

## Definitions:

### Saturated solution: a solution that contains the maximum amount of solute that will dissolve at a specific temperature. If any more solute is added, it will not dissolve. These points are on the line.

### Unsaturated solution: a solution that holds less than the maximum amount of solute that will dissolve. More solute can be added and will dissolve. These points are below the line.

### Supersaturated solution: rarely, when you drop the temperature, the extra solute does not precipitate. All the solute stays in solution and the solution is supersaturated. Adding a slight disturbance, such as a crystal, will cause the solute to precipitate. These points are above the line.

# Table F – renewing an old friendship

## Table F shows the solubility in water of various ionic compounds

## Compounds on the left are soluble.

### They form solutions

### They are electrolytes

## Compounds on the right are insoluble

### They form precipitates

### Represent with (s) symbol

## Look for exceptions to the rule

## Show tutor video

## Quizlet

# Concentrations of Solutions

## Solutions can be concentrated or dilute

### Concentrated means they have a lot of “stuff” (solute)

### Dilute means not a lot of “stuff” (solute)

### Concentrated does not always mean saturated.Ex. How much KClO3 is in a saturated solution at 10 degrees Celsius? Ans. Only 7 grams, so this is saturated but dilute

## Molarity

### Used for concentrations of solutions

### Review the mole wheel

### Formula in Table T: molarity = moles of solute/liters of solutionEx. 1.0 liter of salt water solution is made with 10 moles of NaCl. What is the molarity? Ans. 10 M

### Symbol is M for mols/liters

## Percent solution by mass

### Table T: mass of part/mass of whole X 100

## Parts per million

### Used for very small concentrations, such as pollutants

### Table T: grams of solute/grams of solution X 1,000,000

# Colligative Properties

## Freezing point is lowered when solute is added

### Water freezes or melts at less than 0 degrees CEx. Melt the ice on roads

## Boiling point is raised when solute is added

### Water boils at greater than 100 degrees CEx. Salted water boils at a higher temperature.

## Caused by solute in a solvent

## More solute causes bigger effect

### Number of dissolved particles effects colligative effect.

### Ionic compounds dissolve into 2 or more ions, so they have bigger colligative effect

# Vapor Pressure and Boiling Point

## Definitions:

### Vapor – A gas formed by boiling or evaporating a liquid. A gas that is usually a liquid at room temperature.

### Vapor pressure – the pressure exerted by the molecules of a vapor. The pressure exerted by a vapor when it is in contact with its liquid form in a closed container.

## Fun facts about vapor pressure:

### Higher vapor pressure is an indication of a liquid's higher evaporation rate. Ex. Which evaporates more quickly, acetone (nail polish remover aka propanone) or water

### Adding solute to a substance LOWERS the vapor pressure, just like it lowers the freezing point and raises the boiling point.

### Normal boiling point – the temperature at which the vapor pressure of the substance equals sea level atmospheric pressure (101.3 kPa)

### When IMF’s are stronger, the vapor pressure is lower and the boiling point is higher. Hydrogen bonding is the strongest IMF.