Environmental Systems
Assignment for April 13 – April 17, 2020

1. Read the paragraph on the Active Reading Worksheet, Chapter 10.
2. Answer questions 1-12. All answers can be found by reading the paragraph.
3. Please take a picture of your work and send to your teacher.

Please contact your assigned teacher with questions regarding your assignment(s):

Coach Nance	cnance@mpisd.net
Coach Zaldivar	dzaldivar@mpisd.net
Coach Henderson	rskelton@mpisd.net

Name________________________ Class ______________ Date ______________

Skills Worksheet

Active Reading

Section 3: The Future of Biodiversity

Read the passage below and answer the questions that follow.

In 1973, the U.S. Congress passed the Endangered Species Act and has amended it several times since. This law is designed to protect plant and animal species in danger of extinction. Under the first provision, the U.S. Fish and Wildlife Service (USFWS) must compile a list of all endangered and threatened species in the United States. As of 2012, 1383 species of plants and animals were listed as endangered or threatened. Dozens more are considered for the list each year. The second main provision of the act protects listed species from human harm. Anyone who harms, buys, or sells any part of these species is subject to a fine. The third provision prevents the federal government from carrying out any project that jeopardizes a listed species.

IDENTIFYING MAIN IDEAS

One reading skill is the ability to identify the main idea of a passage. The main supporting information that offers detailed facts about main ideas.

In the space provided, write the letter of the term or phrase that best answers each question.

______ 1. What law protects plant and animal species in danger of extinction?
a. the U.S. Fish and Wildlife Service
b. the Endangered Species Act
c. the species recovery plan
d. the captive breeding plan

______ 2. Who was responsible for passing this law?
a. the state of California
b. Greenpeace
c. the U.S. Fish and Wildlife Service
d. the U.S. Congress

______ 3. Who is responsible for compiling a list of all endangered and threatened species in the U.S.?
a. the U.S. Fish and Wildlife Service
b. the U.S. Congress
c. individual states
d. forest rangers

Read each question and write the answer in the space provided.

4. How many species were listed as endangered or threatened in 2012?

____

5. Who or what is restricted by the third provision of the Endangered Species Act?

____

6. How does the third provision protect plant and animal species that are in danger of extinction?

____

____

7. Who or what is restricted by the second provision of the Endangered Species Act?

____

VOCABULARY DEVELOPMENT

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

______ 8. The second sentence in the passage begins, "This law." To what do those words refer?
a. U.S. Fish and Wildlife Service
b. the second provision
c. the third provision
d. the Endangered Species Act

______ 9. What words does the author use to organize the information in the passage?
a. first, second, third
b. U.S. Congress, Fish and Wildlife Service, federal government
c. endangered, extinct
d. threatened, endangered, extinct

RECOGNIZING CAUSE AND EFFECT

One reading skill is the ability to recognize cause and effect.

Read each question and write the answer in the space provided.

10. Because of the first provision of the Endangered Species Act, what is the U.S. Fish and Wildlife Service required to do?

____

____

11. What consequence must any violator of the second provision of the Endangered Species Act face?

____

____

12. What actions are considered violations of the second provision?

____

____

Biology Week of 4/13

Name: ______________________ Date: ________ Period: ________

So, What's an Enzyme?

Content Objective: identify and investigate the role of enzymes using models and by conducting a lab experiment showing how the body breaks down hydrogen peroxide.

Language Objective: write to complete statements about the characteristics of enzymes

TEKS: B9.A, B9.C, B1.A, B1.B, B2.E, B2.F, B2.G, B2.H

Essential Question: ____

____

Word Bank		
Lipid	Decrease	Carbohydrate
Change	Shape	Energy
Substrate	Protein	Used up
Nucleic acid	Increase	

From this activity I can infer the following information about enzymes.

1. Enzymes, like your partner, ______________ the rate of a chemical reaction.
2. They do this by lowering the amount of ______________ needed to get the reaction started.
3. Enzymes can be used over and over because they do not ______________ and they are not ________ ______.
4. Each enzyme can only combine with a specific ______________ because of their ______________.
5. Enzymes are made of a biomolecule called ______________.
6. Draw and label the enzyme/substrate complex and label the parts. As always, add color. Label the enzyme, the substrate, the active site, and the products.

INSTRUCTIONS FOR AP BIOLOGY LESSON FOR WEEK OF APRIL 13-17, 2020

For the Antibiotic Resistant Bacteria Lab you can use three coins such as pennies, nickels, and dimes for the plastic chips needed. Each coin will represent red, blue, and yellow. Further instructions are on the handout. This assignment will show how bacteria exponentially grow if no antibiotics are taken or are stopped too early. Use three map colors for the graph (red, blue, and yellow).

To connect to Schoology where my assignments are attached here is the code:

6FNXS-3NJCZ Choose AP Biology 5-7

You may also email me jyoung@mpisd.net

Take as Directed

Antibiotic Resistance Simulation

FLINN SCIENTIFIC BIO FAX!

Introduction

A scratchy throat, an earache or a cut that won't heal—all could be signs of a bacterial infection. Antibiotics are prescribed to reduce the length and severity of infections. Antibiotics taken on time and finished completely are very effective. Study the effects of antibiotics on bacterial populations.

Concepts

- Antibiotic treatment
- Bacteria
- Antibiotic resistance

Materials

Bingo chips, red, 20
Bingo chips, blue, 15
Bingo chips, yellow, 15
Colored pencils
Die

Safety Precautions

The materials used in this activity are considered nonhazardous. Please follow all laboratory safety guidelines.

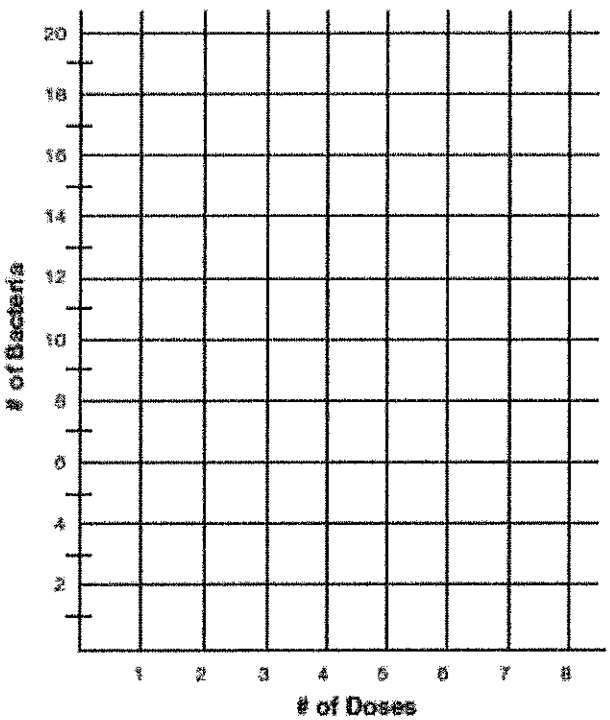
Procedure

1. Obtain 20 red bingo chips, 15 blue bingo chips, 15 yellow bingo chips, and one die. Place 13 red, 6 blue, and 1 yellow bingo chip on the work surface in front of you and your partner. These chips represent harmful bacteria found in a patient's body before beginning antibiotic treatment. Set aside the remaining bingo chips.
2. It is time to take the first dose of antibiotics. Roll the die and follow the key below.

Number Tossed	Event	Results
2, 3, 4 or 5	Antibiotic was taken at appropriate time—bacteria killed	Remove 5 disks in the following order: remove red bingo chips first, followed by blue and then yellow as needed.
1 or 6	Antibiotic was not taken at the appropriate time.	Do not remove any bingo chips.

3. Record the number of each remaining type of bacteria in the table on the next page.
4. Bacteria are constantly reproducing in the host; in this case the host is the patient's body. If one or more bacteria of a particular type (color) are still present in the patient's body after the first dose (step 2), add one chip of that color to the population. *Example:* If the patient still has blue and red bacteria present, add one blue and one red chip to the population.
5. Repeat steps 2–4 at least eight times (or until all bacteria have been eliminated) to complete the table.
6. Using the data from the table, construct a graph displaying the number of each type of bacteria versus the number of doses. Use different color pencils to plot the following data: total number of bacteria, least resistant bacteria, medium resistant bacteria, and most resistant bacteria. Connect each set of data points by drawing a colored line.

		Bacterial Population			
Dose No.	No. Rolled	Low Resistance (Red)	Medium Resistance (Blue)	High Resistance (Yellow)	TOTAL
INITIAL	N/A	13	6	1	20
1					
2					
3					
4					
5					
6					
7					
8					



Tips

- Enough materials are provided in this kit for 30 students working in pairs or for 15 groups of students. This laboratory activity may reasonably be completed in one 50-minute class period. The *Pre-Lab Questions* may be completed before coming to class, and the data compilation and *Post-Lab Questions* may be completed the day after the lab.
- Stress to students the importance of recording the number of each bacterial type on Table 1 before adding one more bingo chip of each type present as instructed in step 4. If the population grows before the data is recorded students may be confused by the results.

NGSS Alignment

This laboratory activity relates to the following Next Generation Science Standards (2013):

Disciplinary Core Ideas: Middle School
MS-LS1 From Molecules to Organisms: Structures and Processes
LS1.A: Structure and Function
MS-LS2 Ecosystems: Interactions, Energy, and Dynamics
LS2.A: Interdependent Relationships in Ecosystems

Disciplinary Core Ideas: High School
HS-LS1 From Molecules to Organisms: Structures and Processes
LS1.A: Structure and Function
HS-LS2 Ecosystems: Interactions, Energy, and Dynamics
LS2.A: Interdependent Relationships in Ecosystems

Science and Engineering Practices
Developing and using models
Analyzing and interpreting data
Constructing explanations and designing solutions

Crosscutting Concepts
Cause and effect
Scale, proportion, and quantity
Structure and function

Discussion

Antibiotics are powerful drugs that are used to treat many serious and life-threatening diseases. Antibiotics are only effective against bacterial infections, some fungal infections, and some parasites. The principles of antibiotic treatment were actually dis-covered by accident in 1928 by Alexander Fleming (1881–1955). Fleming was culturing bacteria in glass dishes in his laboratory. However, mold (fungus) had contaminated some of his bacterial cultures. He planned on throwing them away but instead noticed that no bacteria grew in the vicinity of the mold. The bread mold named *Penicillium* produces an antibacterial chemical named penicillin.

Since the discovery of penicillin, scientists have developed numerous antibiotics to help stop the spread of infectious disease. Although antibiotics have been proven very useful, misuse of antibiotics has become a serious problem. Frequent unnecessary use has resulted in the evolution of bacteria which are resistant to many common antibiotics. These extremely antibiotic-resistant bacteria develop because the original antibiotic failed to kill all of the targeted bacteria. As a result, the remaining bacteria survive and become resistant to the original antibiotic. Doctors then prescribe a different antibiotic, but resistant forms of the bacteria quickly develop the ability to withstand the new antibiotic as well, bringing about a continual cycle requiring different, more powerful drugs to treat infection.

As more bacteria become resistant to the original antibiotic, the consequences become more severe. Consequences include longer lasting illnesses, increased risk of serious complications, and death. The inability of antibiotics to treat infection also leads to longer periods in which a person is contagious and able to spread resistant strains to other people.

References

"Antibiotics: Misuse Puts You and Others at Risk." Mayo Clinic. http://www.mayoclinic.org/antibiotics/ART-20045720 (Accessed January 2014)

Materials for *Antibiotic Resistance Simulation* are available from Flinn Scientific, Inc.

Catalog No.	Description
FB1928	Antibiotic Resistance Simulation—Super Value Kit

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

Chemistry / Pre-AP Chemistry Mrs. Pena, Mrs. Tigert, Mrs. Trimm
Assignment #3 Mr. Trickey.
Ch 13 Solutions

SECTION 13-1

Types of Mixtures

OBJECTIVES

- Distinguish between heterogeneous and homogeneous mixtures.
- List three different solute-solvent combinations.
- Compare the properties of suspensions, colloids, and solutions.
- Distinguish between electrolytes and nonelectrolytes.

CHEMISTRY INTERACTIVE TUTOR
Module 1: States of Matter/Classes of Matter

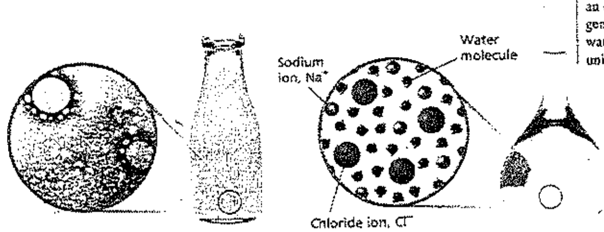
It is easy to determine that some materials are mixtures because you can see their component parts. For example, soil is a mixture of various substances, including small rocks and decomposed animal and plant matter. You can see this by picking up some soil in your hand and looking at it closely. Milk, on the other hand, does not appear to be a mixture, but in fact it is. Milk is composed principally of fats, proteins, milk sugar, and water. If you look at milk under a microscope, it will look something like Figure 13-1(a). You can see round lipid droplets that measure from 1 to 10 μm in diameter. Irregularly shaped protein (casein) particles that are about 0.2 μm wide can also be seen. Both milk and soil are examples of heterogeneous mixtures because their composition is not uniform.

Salt (sodium chloride) and water form a homogeneous mixture. The sodium and chloride ions are interspersed among the water molecules, and the mixture appears uniform throughout. A model for a homogeneous mixture like salt water is shown in Figure 13-1(b).

Solutions

Suppose a sugar cube is dropped into a glass of water. You know from experience that the sugar will dissolve. Sugar is described as "soluble in water." *By* **soluble** *we mean capable of being dissolved.*

What happens as sugar dissolves? The lump gradually disappears as sugar molecules leave the surface of their crystals and mix with water molecules. Eventually all the sugar molecules become uniformly distributed among the water molecules, as indicated by the equally sweet taste of any part of the mixture. All visible traces of the solid sugar are gone. Such a mixture is called a solution. *A* **solution** *is a homogeneous mixture of two or more substances in a single phase.* In a solution, atoms, molecules, or ions are thoroughly mixed, resulting in a mixture that has the same composition and properties throughout.



(a) Heterogeneous mixture—milk (b) Homogeneous mixture—saltwater solution

FIGURE 13-1 (a) Milk consists of visible particles in a nonuniform arrangement. (b) Salt water is an example of a homogeneous mixture. Ions and water molecules are in a uniform arrangement.

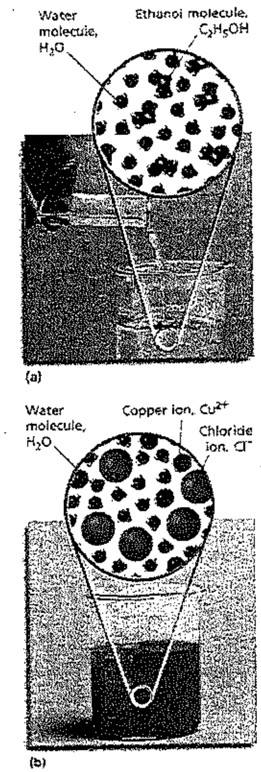


FIGURE 13-2 The solute in a solution can be a solid, liquid, or gas. (a) The ethanol-water solution is made from a liquid solute in a liquid solvent. (b) The copper(II) chloride-water solution is made from a solid solute in a liquid solvent. Note that the composition of each solution is uniform.

Components of Solutions

In the simplest type of solution, such as a sugar-water solution, the particles of one substance are randomly mixed with the particles of another substance. *The dissolving medium in a solution is called the* **solvent,** *and the substance dissolved in a solution is called the* **solute.** The solute is generally designated as that component of a solution that is of lesser quantity. In the ethanol-water solution shown in Figure 13-2, ethanol is the solute and water is the solvent. Occasionally, these terms have little meaning. For example, in a 50%-50% solution of ethanol and water, it would be difficult, and in fact unnecessary, to say which is the solvent and which is the solute.

In a solution, the dissolved solute particles are so small that they cannot be seen. They remain mixed with the solvent indefinitely, so long as the existing conditions remain unchanged. If the solutions in Figure 13-2 are poured through filter paper, both the solute and the solvent will pass through the paper. The solute-particle dimensions are those of atoms, molecules, and ions—which range from about 0.01 to 1 nm in diameter.

Types of Solutions

Solutions may exist as gases, liquids, or solids. Some possible solute-solvent combinations of gases, liquids, and solids in solutions are summarized in Table 13-1. In each example, one component is designated as the solvent and one as the solute.

Many alloys, such as brass (made from zinc and copper) and sterling silver (made from silver and copper), are solid solutions in which the atoms of two or more metals are uniformly mixed. By properly choosing the proportions of each metal in the alloy, many desirable properties

TABLE 13-1 Some Solute-Solvent Combinations for Solutions

Solute state	Solvent state	Example
Gas	gas	oxygen in nitrogen
Gas	liquid	carbon dioxide in water
Liquid	gas	water in air
Liquid	liquid	alcohol in water
Liquid	solid	mercury in silver and tin (dental amalgam)
Solid	liquid	sugar in water
Solid	solid	copper in nickel (Monel™ alloy)

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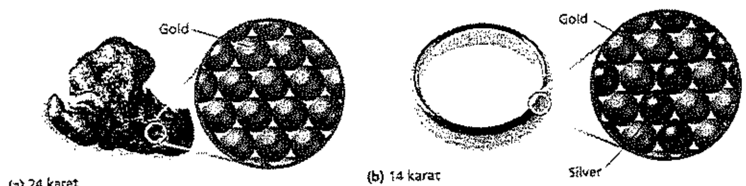

FIGURE 13-3 (a) 24-karat gold is pure gold. (b) 14-karat gold is an alloy of gold and silver. 14-karat gold is 14/24, or 58.3%, gold.

can be obtained. For example, alloys can have higher strength and greater resistance to corrosion than the pure metals. Pure gold (24K), for instance, is too soft to use in jewelry. Alloying it with silver greatly increases its strength and hardness while retaining its appearance and corrosion resistance. Figure 13-3 shows a model for comparing pure gold with a gold alloy.

Suspensions

If the particles in a solvent are so large that they settle out unless the mixture is constantly stirred or agitated, the mixture is called a **suspension.** Think of a jar of muddy water. If left undisturbed, particles of soil collect on the bottom of the jar. The soil particles are much larger and denser than water molecules. Gravity pulls them to the bottom of the container. Particles over 1000 nm in diameter—1000 times as large as atoms, molecules, or ions—form suspensions. The particles in suspension can be separated from the heterogeneous mixtures by passing the mixture through a filter.

Colloids

Particles that are intermediate in size between those in solutions and suspensions form mixtures known as colloidal dispersions, or simply **colloids.** Particles between 1 nm and 1000 nm in diameter may form colloids. After large soil particles settle out of muddy water, the water is often still cloudy because colloidal particles remain dispersed in the water. If the cloudy mixture is poured through a filter, the colloidal particles will pass through, and the mixture will remain cloudy. The particles in a colloid are small enough to be suspended throughout the solvent by the constant movement of the surrounding molecules. The colloidal particles make up the *dispersed phase,* and water is the *dispersing medium.* Examples of the various types of colloids are given in Table 13-2. Note that some familiar terms, such as *emulsion* and *foam,* refer to specific types of colloids. For example, mayonnaise is an emulsion

TABLE 13-2 Classes of Colloids

Class of colloid	Phases	Example
Sol	solid dispersed in liquid	paints, mud
Gel	solid network extending throughout liquid	gelatin
Liquid emulsion	liquid dispersed in a liquid	milk, mayonnaise
Foam	gas dispersed in liquid	shaving cream, whipped cream
Solid aerosol	solid dispersed in gas	smoke, airborne particulate matter, auto exhaust
Liquid aerosol	liquid dispersed in gas	fog, mist, clouds, aerosol spray
Solid emulsion	liquid dispersed in solid	cheese, butter

of oil droplets in water; the egg yolk in it acts as an emulsifying agent, which helps to keep the oil droplets dispersed.

FIGURE 13-4 A beam of light distinguishes a colloid from a solution. The particles in a colloid will scatter light, making the beam visible. The mixture of gelatin and water in the jar on the right is a colloid. The mixture of water and sodium chloride in the jar on the left is a true solution.

Tyndall Effect

Many colloids appear homogeneous because the individual particles cannot be seen. The particles are, however, large enough to scatter light. You have probably noticed that a headlight beam is visible on a foggy night. This effect, known as the Tyndall effect, occurs when light is scattered by colloidal particles dispersed in a transparent medium. The Tyndall effect is a property that can be used to distinguish between a solution and a colloid, as demonstrated in Figure 13-4.

The distinctive properties of solutions, colloids, and suspensions are summarized in Table 13-3. The individual particles of a colloid can be detected under a microscope if a bright light is cast on the specimen at a right angle. The particles, which appear as tiny specks of light, are seen to move rapidly in a random motion. This motion is due to collisions of rapidly moving molecules and is called Brownian motion, after its discoverer, Robert Brown.

TABLE 13-3 Properties of Solutions, Colloids, and Suspensions

Solutions	Colloids	Suspensions
Homogeneous	Heterogeneous	Heterogeneous
Particle size: 0.01–1 nm; can be atoms, ions, molecules	Particle size: 1–1000 nm, dispersed; can be aggregates or large molecules	Particle size: over 1000 nm, suspended; can be large particles or aggregates
Do not separate on standing	Do not separate on standing	Particles settle out
Cannot be separated by filtration	Cannot be separated by filtration	Can be separated by filtration
Do not scatter light	Scatter light (Tyndall effect)	May scatter light, but are not transparent

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Solutes: Electrolytes vs. Nonelectrolytes

CHEMISTRY INTERACTIVE TUTOR

Module 8: Strong and Weakly Ionized Species, pH, and Titrations

internetconnect

SCI LINKS. NSTA

TOPIC: Electrolytes/nonelectrolytes
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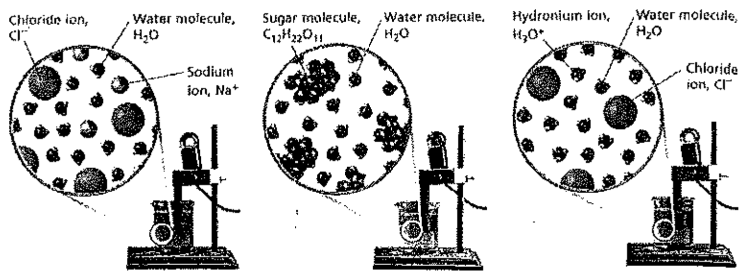
Substances that dissolve in water are classified according to whether they yield molecules or ions in solution. When an ionic compound dissolves, the positive and negative ions separate from each other and are surrounded by water molecules. These solute ions are free to move, making it possible for an electric current to pass through the solution. *A substance that dissolves in water to give a solution that conducts electric current is called an* **electrolyte.** Sodium chloride, NaCl, is an electrolyte, as is any soluble ionic compound. Certain highly polar molecular compounds, such as hydrogen chloride, HCl, are also electrolytes because HCl molecules form the ions H_3O^+ and Cl^- when dissolved in water.

By contrast, a solution containing neutral solute molecules does not conduct electric current because it does not contain mobile charged



(a) Salt solution—electrolyte solute

(b) Sugar solution—nonelectrolyte solute

(c) Hydrochloric acid solution—electrolyte solute

FIGURE 13-5 (a) Sodium chloride dissolves in water to produce a salt solution that conducts electric current. NaCl is an electrolyte. (b) Sucrose dissolves in water to produce a sugar solution that does not conduct electricity. Sucrose is a nonelectrolyte. (c) Hydrogen chloride dissolves in water to produce a solution that conducts current. HCl is an electrolyte.

particles. *A substance that dissolves in water to give a solution that does not conduct an electric current is called a* **nonelectrolyte.** Sugar is a nonelectrolyte. Figure 13-5 shows an apparatus for testing the conductivity of solutions. The electrodes are conductors that are attached to a power supply and that make electric contact with the test solution. For a current to pass through the light-bulb filament, the test solution must provide a conducting path between the two electrodes. A nonconducting solution is like an open switch between the electrodes, and there is no current in the circuit.

The light bulb glows brightly if a solution that is a good conductor is tested. Such solutions contain solutes that are electrolytes. For a moderately conductive solution, however, the light bulb is dim. If a solution is a poor conductor, the light bulb does not glow at all. Such solutions contain solutes that are nonelectrolytes. You will learn more about the strengths and behavior of electrolytes in Chapter 14.

Answer Each → in complete Sentences (and on back.)

SECTION REVIEW

1. Classify the following as either a heterogeneous or homogeneous mixture, and explain your answers.
   a. orange juice b. tap water
2. a. What are substances called whose water solutions conduct electricity? b. Why does a saltwater solution conduct electricity? c. Why does a sugar-water solution not conduct electricity?
3. Make a drawing of the particles in an NaCl solution to show why this solution conducts electricity. Make a drawing of the particles in an NaCl crystal to show why pure salt does not conduct.
4. Describe one way to prove that a mixture of sugar and water is a solution and that a mixture of sand and water is not a solution.
5. Label the solute and solvent in each of the following:
   a. 14-karat gold
   b. water vapor in air
   c. carbonated, or sparkling, water
   d. hot tea

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6. a) What is the Tyndall effect?

b) Identify one example of this effect

7. Given an unknown mixture consisting of two or more substances, explain one technique that could be used to determine whether that mixture is a true solution, a colloid, or a suspension.

8. a) how does pressure affect the solubility of a gas in a liquid?

b) what law is a statement of this relationship?

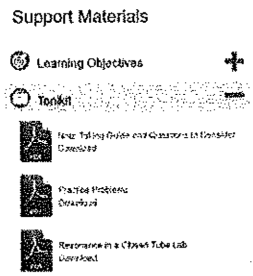
c) If the pressure of a gas above a liquid is increased, what happens to the amount of the gas that will dissolved in the liquid, if all other conditions remain constant?

d) Two bottles of soda are opened. One is a cold bottle and the other is partially frozen. Which system will show more effervescence and why?

Pre-AP Physics (L. Russell)
Assignment for Weeks April 13 – April 24

These materials are on the Georgia Public Broadcasting website. Watch the internet video about waves using this link https://www.gpb.org/physics-in-motion/unit-6/sound-standing-waves-and-resonance

These files are found on the same web page as the video above. Click on the "+" beside the word Toolkit in order to access them. Complete the Note Taking Guide as you watch the video, complete the Practice Problems, then perform the Resonance in a Closed Tube Lab.



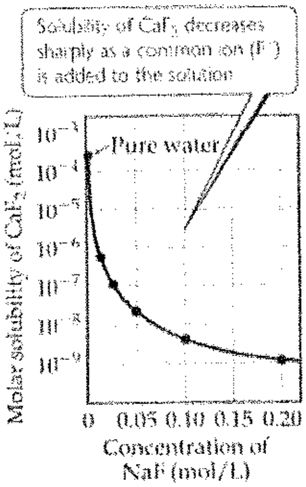
Dual Credit Physics (L. Russell)
Assignment for Week April 13 – April 24

The course is now being administered through Blackboard and Webassign. We will complete assignments over Chapter 21 during the week April 6 – April 10. There will be an exam in Webassign over chapters 19-21 on Tuesday April 14. Assignments for Chapters 22-24 will become available during the April 13-17 week, and we will continue working on these chapters through April 24.

APChemistry

17.5 FACTORS THAT AFFECT SOLUBILITY

Solubility is affected by temperature and by the presence of other solutes. The presence of an acid, for example, can have a major influence on the solubility of a substance. In Section 17.4 we considered the dissolving of ionic compounds in pure water. In this section we examine three factors that affect the solubility of ionic compounds: (1) presence of common ions, (2) solution pH, and (3) presence of complexing agents. We will also examine the phenomenon of *amphoterism*, which is related to the effects of both pH and complexing agents.



▲ **FIGURE 17.17 Common-ion effect.** Notice that the CaF_2 solubility is on a logarithmic scale.

Common-Ion Effect

The presence of either $Ca^{2+}(aq)$ or $F^-(aq)$ in a solution reduces the solubility of CaF_2, shifting the solubility equilibrium to the left:

$$CaF_2(s) \rightleftharpoons Ca^{2+}(aq) + 2\,F^-(aq)$$

This reduction in solubility is another manifestation of the common-ion effect we looked at in Section 17.1. In general, *the solubility of a slightly soluble salt is decreased by the presence of a second solute that furnishes a common ion*, as ◀ **FIGURE 17.17** shows for CaF_2.

SAMPLE EXERCISE 17.12 Calculating the Effect of a Common Ion on Solubility

Calculate the molar solubility of CaF_2 at 25 °C in a solution that is **(a)** 0.010 *M* in $Ca(NO_3)_2$, **(b)** 0.010 *M* in NaF.

SOLUTION

Analyze We are asked to determine the solubility of CaF_2 in the presence of two strong electrolytes, each containing an ion common to CaF_2. In (a) the common ion is Ca^{2+}, and NO_3^- is a spectator ion. In (b) the common ion is F^-, and Na^+ is a spectator ion.

Plan Because the slightly soluble compound is CaF_2, we need to use K_{sp} for this compound, which Appendix D gives as 3.9×10^{-11}. *The value of K_{sp} is unchanged by the presence of additional solutes.* Because of the common-ion effect, however, the solubility of the salt decreases in the presence of common ions. We use our standard equilibrium techniques of starting with the equation for CaF_2 dissolution, setting up a table of initial and equilibrium concentrations, and using the K_{sp} expression to determine the concentration of the ion that comes only from CaF_2.

Solve

(a) The initial concentration of Ca^{2+} is 0.010 *M* because of the dissolved $Ca(NO_3)_2$:

	$CaF_2(s)$ $\rightleftharpoons$	$Ca^{2+}(aq)$ +	$2\,F^-(aq)$
Initial	—	0.010 *M*	0
Change	—	$+x$ *M*	$+2x$ *M*
Equilibrium	—	$(0.010 + x)$ *M*	$2x$ *M*

Substituting into the solubility-product expression gives

$$K_{sp} = 3.9 \times 10^{-11} = [Ca^{2+}][F^-]^2 = (0.010 + x)(2x)^2$$

This would be a messy problem to solve exactly, but fortunately it is possible to simplify matters. Even without the common-ion effect, the solubility of CaF_2 is very small (2.1×10^{-4} *M*). Thus, we assume that the 0.010 *M* concentration of Ca^{2+} from $Ca(NO_3)_2$ is very much greater than the small additional concentration resulting from the solubility of CaF_2; that is, x is much smaller than 0.010 *M*, and $0.010 + x \approx 0.010$. We then have

$$3.9 \times 10^{-11} = (0.010)(2x)^2$$

$$x^2 = \frac{3.9 \times 10^{-11}}{4(0.010)} = 9.8 \times 10^{-10}$$

$$x = \sqrt{9.8 \times 10^{-10}} = 3.1 \times 10^{-5}\ M$$

This very small value for x validates the simplifying assumption we made. Our calculation indicates that 3.1×10^{-5} mol of solid CaF_2 dissolves per liter of 0.010 *M* $Ca(NO_3)_2$ solution.

(b) The common ion is F^-, and at equilibrium we have

$$[Ca^{2+}] = x \quad \text{and} \quad [F^-] = 0.010 + 2x$$

Assuming that $2x$ is much smaller than 0.010 *M* (that is, $0.010 + 2x \approx 0.010$), we have

$$3.9 \times 10^{-11} = (x)(0.010 + 2x)^2 \approx x(0.010)^2$$

$$x = \frac{3.9 \times 10^{-11}}{(0.010)^2} = 3.9 \times 10^{-7}\ M$$

Thus, 3.9×10^{-7} mol of solid CaF_2 should dissolve per liter of 0.010 *M* NaF solution.

Comment The molar solubility of CaF_2 in water is 2.1×10^{-4} *M* (Sample Exercise 17.11). By comparison, our calculations here give a CaF_2 solubility of 3.1×10^{-5} *M* in the presence of 0.010 *M* Ca^{2+} and 3.9×10^{-7} *M* in the presence of 0.010 *M* F^- ion. Thus, the addition of either Ca^{2+} or F^- to a solution of CaF_2 decreases the solubility. However, the effect of F^- on the solubility is more pronounced than that of Ca^{2+} because $[F^-]$ appears to the second power in the K_{sp} expression for CaF_2, whereas $[Ca^{2+}]$ appears to the first power.

PRACTICE EXERCISE

For manganese(II) hydroxide, $Mn(OH)_2$, $K_{sp} = 1.6 \times 10^{-13}$. Calculate the molar solubility of $Mn(OH)_2$ in a solution that contains 0.020 *M* NaOH.

Answer: 4.0×10^{-10} *M*

AP/Dual Credit Chemistry Questions: Determining Ksp and Common-Ion effects
Assignment #4. Assigned 4/13.

#1) Estimate the solubility (in g/L) of silver cyanide (AgCN) if the Ksp for this substance is 1.6×10^{-14}.

#2) The Ksp for calcium phosphate ($Ca_3(PO_4)_2$) is 1.0×10^{-25}.

a) What is the molar solubility?

b) What is the solubility?

#3) The Ksp for silver bromide (AgBr) and silver thiocyanate (AgSCN) are 7.7×10^{-13} and 1.0×10^{-12} respectively. Which has a greater molar solubility? What is that molar solubility?

#4) The Ksp for magnesium phosphate, $Mg_3(PO_4)_2$, and magnesium hydroxide, $Mg(OH)_2$ is 1.0×10^{-25} and 1.8×10^{-11} respectively. Which is more soluble and what is the solubility of the more soluble substance?

#5) Consider a beaker containing a saturated solution of CaF_2 in equilibrium with undissolved CaF_2(s).

a) If solid CaCl2 is added to this solution will the amount of solid CaF_2 at the bottom of the beaker increase, decrease, or remain the same?

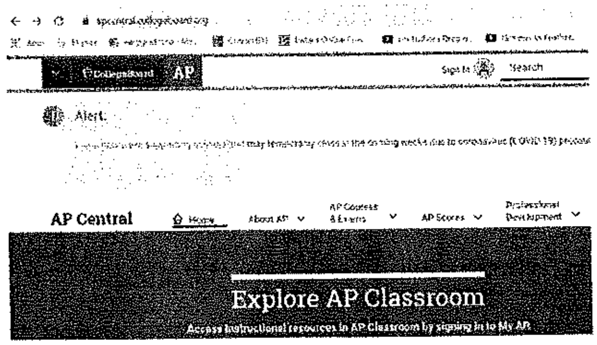
b) Will the concentration of Ca^{2+} ions in solution increase of decrease?

c) Will the concentration of F^- ions in solution increase or decrease?

#6) Calculate the solubility of Ag_2CO_3 in 225 mL of water to which 0.15 g of Na_2CO_3 has been added.

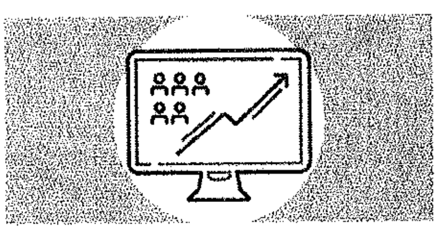
AP Physics C (L. Russell)
Assignment for Week April 13 – April 24

Go to apcentral.collegeboard.org and click on the "Learn how we're supporting schools" tab that you see in the screenshot below. Then click on the "AP Online Course Schedule" tab on the next screen. This gives you access to a list of video lessons that the College Board is providing now for AP students. The AP exam will not cover oscillations or gravitation this year due to the shortened schedule. I posted an old AP exam on Schoology in the folder "AP Review Materials". Here is the access code for our Schoology course if you need it. J4ZN-CXRF-7RFF9 You can take a picture of your answers with your phone and submit using Schoology and I'll check it for you.



Resources for Remote Teaching

To support communities that experience substantial disruption or school closures, we're providing several ways for teachers to help students prepare for exam day.



AP Classroom Resources and Tools

Continue to provide remote instruction with AP Classroom. You can assign Topic Questions and use Personal Progress Checks to evaluate where students may want to focus their reviews for exam prep.

Get Tips

AP Online Course Schedule

Get more details, including the schedule, for AP online classes and review sessions. These mobile-friendly classes, designed to be used alongside your work, are recorded and available on demand.

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