Important Concepts . . .

Preview Review

Science   *Grade 8*   *TEACHER KEY*

W1 - Lesson 2: Solubility and Saturation Points

Important Concepts of Grade 8 Science	Materials Required

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Materials Required

Textbook:
Science in Action 8

The Alberta Distance Learning Centre has an Internet site that you may find useful. The address is as follows: **http://www.adlc.ca**

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

Preview/Review Concepts
for
Grade Eight Science

TEACHER KEY

OBJECTIVES

By the end of this lesson, you should

- define and use common terms dealing with solutions

- identify solvents and solutes in solutions

- list factors that affect solubility

- calculate concentrations in grams per millimetre and percent concentration

GLOSSARY

concentration - the amount of solute dissolved in a solvent

saturated - the state of a solution that will dissolve no more solute

saturation point - the point at which no more solute will dissolve in a given volume and temperature of solvent

solubility - the amount of solute that can dissolve in a given volume and temperature of solvent

unsaturated - the state of a solution that will still dissolve more solute

W1 - Lesson 2: Solubility and Saturation Points

Welcome to W1 - Lesson 2. This lesson teaches you about **solubility** and **saturation points**; it should take about 1.5 hours to complete.

General Terms

A **solvent** is something that something else (a **solute**) will **dissolve** (seem to disappear) in.
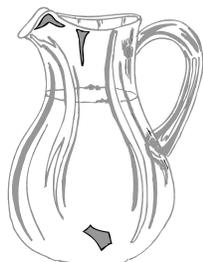
We can communicate how much solute is in a solvent by calculating the **concentration** of the solution that was made.

To calculate the concentration of a solution, divide the mass of the solute (grams) by the volume of solvent (mL).

C = concentration   **m = mass**   **V = volume**
The formula to use is $C = \dfrac{m}{v}$

A common unit for concentration is g/mL. For example, if 3.0 g of sugar is mixed in water to make 30 mL of solution, its concentration is

$$C = \frac{m}{v} \quad = \quad \frac{3.0 \text{ g}}{30 \text{ mL}} \quad = \quad 0.1 \text{ g/mL}$$

Another way of stating concentration is to show **percent concentration**. That is the number of grams of solute per 100 mL of solvent x 100%.

$$\frac{12 \text{ grams of solute}}{100 \text{ mL of solvent}} \text{ x } 100\% = 12\% \text{ concentration}$$

A solution is **unsaturated** if more solute can be dissolved. It is **saturated** if no more solute can be disolved.
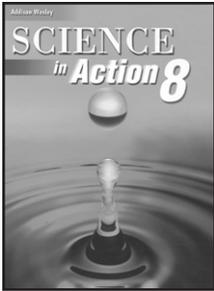
Activity 1

Read and understand pages 24 - 25, and 28 in *Science in Action 8*. Then, answer the following questions.

1. What is the the substance that dissolves called?

   solute

2. What is the substance that does the dissolving called?

   solvent

3. What is the solute in a fruit punch drink?

   drink crystals or concentrate

4. What does aqueous solution mean?

   The solvent is water.

5. Why is water sometimes referred to as the universal solvent?

   It dissolves many different substances.

6. Give three examples on the chart of possible solutes and solvents that would mix together. An example has been done for you. You should try to think of solvents other than water.

   Answers will vary. Some examples are below:

Solvent	Solute
water	sugar
water	*salt*
turpentine	*oil*
oil	*vaseline*

7. If you found the concentration of a certain solute/solvent combination, what metric units would you use to indicate this?

g/mL (perhaps ppm, etc.)

8. On the chart below, a student recorded three different concentrations of juice crystals in water. Show the concentration in appropriate units; then, calculate the percent concentration on the chart below. The first one has been done for you.

Mass of Crystals (g)	Volume of Water (mL)	Concentration (g/mL)	Percent Concentration (%)
10	50	0.2	20%
15	100	*0.15*	*15%*
6	25	*0.24*	*24%*

a. In the above chart, which one has the highest concentration?

6 g/25mL (24% or 0.24 g/mL)

b. What would happen if you kept adding juice crystals to the container of water until no more would dissolve? What kind of solution would you have?

The extra amount added would settle to the botton.

You would have a saturated solution.

Solubility

Solubility is the mass of a solute that can dissolve in a given amount of solvent to form a saturated solution at a given temperature. In other words, "How well can a substance dissolve in something else?" For example, if you took some water and added sugar to it, how much sugar could you add before sugar granules appear at the bottom of the container?

Water is a common solvent, but it cannot dissolve all solutes. For example, if you have ever painted a house or a fence using an oil-based paint, you would have found that water did not wash the paint out of the brush. A different solvent such as paint thinner must to be used.

Temperature also has a role in solubility. You can dissolve more sugar in water if the water has a higher temperature, and less sugar if the water has a lower temperature. Imagine trying to dissolve sugar in water with ice in it.
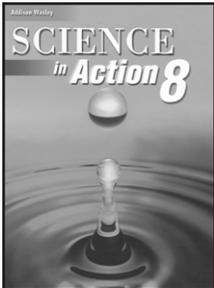
Activity 2

Read and understand pages 29 to 31 in *Science in Action 8*. Then, answer the following questions.

1. In which condition does a solvent have a higher solublity: warm or cold? Explain your answer.

   warm - The solvent molecules are spread further

   apart, and there is more space for the solute to fit.

2. Solubility depends on three factors. What are they?

   type of solute

   type of solvent

   temperature of the solvent

Solubility in 100 mL of Water
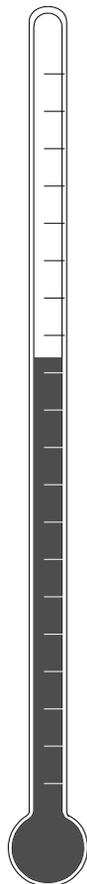
Substance	at 0°Celsius	at 100° Celcius
Glucose	74	182
Potassium Permanganate	21	421
Sodium Chloride	35	39

3. Which substance is most soluble at 100°C?

    potassium permanganate

4. Which substance is the most soluble at 0°C?

    glucose

5. Which substance shows the most change in solubility as the temperature increases?

    potassium permanganate

6. What happens to the solubility of a gas in a liquid as the solvent's temperature

    a. decreases: *the solubility of the gas increases*

    b. increases: *the solubility of the gas decreases*

7. Explain how the effect of temperature on gas solubility in a liquid can affect the health of fish in a shallow prairie lake.

    If a lake is shallow, the water can warm up more easily

    than if it is deep. This can cause oxygen to escape from

    the water. Oxygen levels can drop too low for the fish.

Saturation Points

A **saturation point** is the point at which no more solute can be dissolved in a given volume of solvent at a given temperature. In other words, it is the point at which the solute stops dissolving in the solvent and settles on the container bottom. Each solute has a different saturation point in a given volume and temperature of solvent.
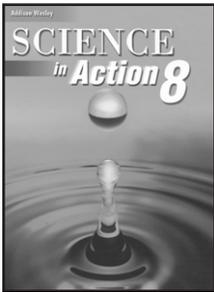
Activity 3

Read and understand page 25 in *Science in Action 8*. Then, answer the following questions.

1. A student performed three experiments. This student slowly stirred in sugar until the saturation point was found.

Experiment Number	Mass of Sugar Crystals (g)	Volume of Water (mL)	Saturation Point
1	50	100	50g/100 mL
2	75	100	75g/100 mL
3	80	100	80g/100 mL

What is the one determining factor that could be responsible for the difference in saturation point?

 the temperature of the solvent

2. Etienne was making a syrup out of sugar and water. He stirred the required amounts of each together but there was still a lot of sugar on the bottom of the container. How could he get the sugar to dissolve?

Heat the mixture.

> You should now be able to meet all of the objectives
> listed at the beginning of the lesson. Go through the
> list to see it there is anything you need to spend more
> time on.

Extended Activity (Homework)

At your home, make some Jello. Be sure you follow the directions
on the box correctly. Answer the following questions.
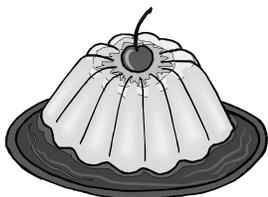
1. When making Jello, why do the directions say that you must boil
    1 cup of hot water and stir in the Jello powder, and then add a
    cup of cold water?

    First to get the large amount of solute dissolved.

    Second to help it set before the solute drops out of solution.

2. When you stirred the powder into the hot water, was there any
    powder that did not dissolve?

    most should have dissolved

3. Use the size of the Jello box (in grams) and the amount of water
    you used (both hot and cold) to determine the concentration of
    your jello mixture. Show your calculations.

    Answers will vary.
    For a 170 g box, 1 000 mL of water should have been used.

    $$c = \frac{m}{v}$$

    $$c = \frac{170 \text{ g}}{1000 \text{ mL}}$$

    $$c = \frac{17 \text{ g}}{100 \text{ mL}} \quad (17\% \text{ or } 0.17 \text{ g/mL})$$

4. Look at the ingredients on the Jello box. What is the key ingredient in Jello that allows it to set or harden?

gelatin

NOTE: **You may want to get started on Lesson 3A because you will have only part of the next class to do it.**