

RET 2011 Module

Course: Resource/Replacement Biology

Grade: 9

Population: Special Education

MODULE TOPIC:

Cell Transport, Solubility, and Permeability

RATIONALE:

The acquisition of biochemicals and life sustaining compounds is a major theme in life science. This lesson provides students with an interactive experience in which they will be able to observe a process similar to that of cell transport. Upon completion of this lesson, students will have an increased understanding of diffusion, selective permeability, and solubility/insolubility of substances.

STANDARD(S) & INDICATOR(S):

5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.

5.2.12.A.5 Describe the process by which solutes dissolve in solvents.

5.3.12.A.3 Predict a cell's response in a given set of environmental conditions.

OBJECTIVE(S): SWBAT:

- **Explain** the relationship between semi permeability and active vs. inactive pharmaceutical ingredients.
- **Distinguish** between diffusion and osmosis in one sentence.
- **Predict** the outcome of an experiment based on scientific knowledge.

MATERIALS:

Iodine

Beakers (1 per Group)

Corn Starch

Salt

Food Coloring

Baking Soda

Baby Powder

Crushed potato chips

Sugar

Dialysis Tubing

Graduated Cylinder

Water

LIST OF HANDOUTS (attach original copies of each handout - teacher & student edition)

BACKGROUND INFORMATION:

In this unit, cellular requirements such as homeostasis, equilibrium, diffusion, and osmosis are covered. Students will learn that all processes of life occur on a cellular level, and should develop an understanding of the process in which cells obtain nutrients, medicines, etc...

The lab associated with this unit is designed as an enrichment opportunity. Through the lab, students will be exposed to science related career opportunities, knowledge of medicine, chemistry, and practices associated with pharmaceutical engineering will be paired with the curriculum standards posted above.

CLASSROOM ACTIVITY DESCRIPTION (LABORATORY/EXERCISES/PROBLEMS) including detailed procedures:

Following this module, students will have gained an understanding of cellular requirements and how they are maintained. Students will demonstrate understanding of these concepts by designing “medicine” based on ingredients that adhere to the concepts of diffusion and permeability in membranes.

1. **Part 1 A:** The module will begin with a lesson on cellular requirements. Themes such as diffusion, osmosis, permeability, solubility, homeostasis, and equilibrium will be taught in a lecture based format (see attachment: Cellular requirements).
2. **Part 1 B:** Diffusion Demonstration: Students will observe diffusion based in an aqueous solution (Food coloring in water) and a gas based mixture (Body spray in air). Students will write a three sentence statement connecting the concept of diffusion to that of equilibrium.
3. **Part 2 A:** Students will be provided with an interactive lecture on the processes in which cells obtain, or reject substances. This lesson will be based on acquired knowledge regarding cell parts, cell structure, and cell function.
4. **Part 2 B:** Permeability Demonstration: Students will observe a demonstration in which semi permeability is simulated through an iodine/starch activity. In this activity, students will see that plastic is semi permeable to starch, but rejects food coloring. Students will create a one page essay comparing this demonstration to the permeability as it exists in cells.
5. **Part 3: Unit Project**
 - As an introduction to the project, students will be asked to discuss what they know about medicines and how they work. The teacher will provide an overview of different types of medication and explain how they affect living systems.
 - Students will be asked to consider what they have learned about the cells ability to acquire, and reject substances, and explain how this process can impact whether or not a type of medicine might work.
 - Students will be given an overview of the project. In this activity, students will play the role of pharmaceutical engineers. They will be given the profile of an ailment (see attachment) and will be asked to choose from a specific set of ingredients in order to remedy that ailment.
 - Students will create “Pills” with the ingredients they choose. The “pills” will be tested on “cells” made of dialysis tubing filled with indicators. Students will have to make five of the same pill.
 - Students will experiment with their pills. They will determine whether or not the ingredients of their pills were effective in changing the conditions of the “cell”. Students will collect data on their pills based on five trials. The data will revolve around the time it took for the cell to change, and the amount of change that occurred.

- Upon completion, each group will compare their results. After compiling all data, students will be asked to indicate which set of ingredients was the most effective, and create a one page lab writeup relating the effectiveness with what they have learned regarding cellular requirements.

SAMPLE QUESTIONS TO ELICIT CLASS DISCUSSION:

Which ingredients did you choose and why?

Why is cell transport important?

What is the goal of this activity?

Which class concepts support your predictions?

How does this activity relate to selective permeability?

How does particle size relate to permeability?

Would it be better to administer active ingredients (such as medicines and antibiotics) in small particulates or large particles? Why do you think that?

HOMEWORK ACTIVITY/EXERCISES/PROBLEMS:

Explain transport in your own words

Vocabulary Review

Section Reviews

Post lab Questions

Post Lab Writeup

Resources:

- <http://bio.winona.edu/berg/Free.htm>

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