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Chemical Equilibrium Lesson Plan

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Basic Information

Name of Instructor: Morgan Sanford and Bridget Baxter
Grade Level/Course Name: 7th-8th Grade General Science
Time/Period: 4th Period
Lesson Topic: Diffusion and Osmosis
Unit: Cellular Transport
Materials/Safety/Management:
Physical materials include: Several household compounds (eggs, vinegar, salt, distilled water), beakers, analytical balance.
Classroom materials used: White/Smart/Chalk-board for class discussion/lecture. Textbooks and notebooks for students.
Safety: Students must show care when handling eggs to be sure they do not break. Raw eggs can carry salmonella, students will be required to wear gloves when handling eggs and must wash hands after the demonstration.

Lesson Objectives and Content

Lesson Rationale:
This lesson has been designed to expose student to the Cellular Transport unit. This lesson is planned to have three major components. Prior to the lesson the students were taught about cellular membranes and the phospholipid bilayer. We will begin by introducing the topic of diffusion using a PowerPoint presentation, defining diffusion, and discussion of particle movement and kinetic theory. Within the presentation we will show a demonstration using agent sheets to model passive diffusion across a semipermeable membrane as well as osmosis. The second part is a laboratory component in which the students will complete a prelab handout to make predictions on the outcome of the experiment and then carry out an experiment illustrating osmosis and make excel graphs displaying their results. The third components is for the students to return to the agent sheet models and work in groups manipulating the models while completing an in class assignment. This is intended to reinforce the topics they have learned about.

Content Standard:
S1.1 Formulate questions independently with the aid of references appropriate for guiding the search for explanations of everyday observations.
S1.1a formulate questions about natural phenomena
S1.1b identify appropriate references to investigate a question
S1.1c refine and clarify questions so that they are subject to scientific investigation
S1.2 Construct explanations independently for natural phenomena, especially by proposing preliminary visual models of phenomena.
S1.2a independently formulate a hypothesis
S1.2b propose a model of a natural phenomenon
S1.2c differentiate among observations, inferences, predictions, and explanations
S1.3 Represent, present, and defend their proposed explanations of everyday observations so that they can be understood and assessed by others.

S1.4 Seek to clarify, to assess critically, and to reconcile with their own thinking the ideas presented by others, including peers, teachers, authors, and scientists.
S3.1 Design charts, tables, graphs, and other representations of observations in conventional and creative ways to help them address their research question or hypothesis.
S3.1a organize results, using appropriate graphs, diagrams, data tables, and other models to show relationships
S3.1b generate and use scales, create legends, and appropriately label axes
2.1 Select an appropriate model to begin the search for answers or solutions to a question or problem.
2.2 Use models to study processes that cannot be studied directly (e.g., when the real process is too slow, too fast, or too dangerous for direct observation).
2.3 Demonstrate the effectiveness of different models to represent the same thing and the same model to represent different things.

Next Generation Science Standards
MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
Academic Language Demand:

Passive Transport: The movement of materials across the cell membrane without using cellular energy.
Diffusion: The process by which particles move from an area of high concentration to an area of lower concentration.
Facilitated Diffusion: The process in which molecules pass across the membrane through cell membrane channels.
Aquaporin: Water channel proteins that allow water to pass right through them.
Osmosis: Diffusion of water through a selectively permeable membrane.
Isotonic: When the concentration of two solutions is the same.
Hypertonic: When comparing two solutions, the solution with a greater concentration of solutes.
Hypotonic: When comparing two solutions, the solution with lesser concentration of solutes.
Osmotic Pressure: A force driven by differences in solute concentration leading to the net movement of water into or out of a cell.

Content Objectives:

C1: All students will understand the concept of cellular transport, diffusion, and osmosis.
C2: Students will be able to identify solutions as isotonic, hypertonic and hypotonic.
C3: students will understand osmotic pressure and concentration gradient.
C4: Students will understand and carry out safe laboratory practices

C5: Students will formulate hypotheses and carry out an experiment testing their predictions
C6: Students will create graphs showing experimental results using Excel

Instructional Strategies and Learning Tasks

	Learning Activities (What and How: questions, discussion, group work, inquiry, Formative assessments)	*Purpose (Why)*
C1	Class will begin by introducing the topic of diffusion using a PowerPoint presentation, defining diffusion, and osmosis and discussion on particle movement and kinetic theory.	The purpose of this section of the lesson is to expose the students to the unit topic of cellular transport.
C2, C3	We will then show a demonstration using agent sheets. This will allow students to visualize the movement of particles by showing them models of diffusion and osmosis. And introduce a laboratory experiment they will be doing the following day. We will begin the experiment by putting eggs in 300ml of vinegar remove their shells and expose their membranes.	This section is designed to grab the students attention by showing them visual representation of the topics they are learning about and prepare them for a laboratory experiment.
C5, C4	The students will now complete a pre laboratory worksheet in which they will make predictions on the outcome of the experiment.	The worksheet is used to get students to independently formulate a hypothesis.
C6	The lab experiment will be using shell-less eggs to show osmosis through observations of the effects of various liquids on a shell-less egg. The students will take an initial weight of the eggs on a triple beam balance then the eggs will be placed in 300ml of a hypertonic solution of distilled water, 300 ml of syrup and 300ml of hypotonic solutions of salt water at two different concentrations. The eggs will sit in the solutions for 15 minutes then removed and weighed, again after 30 minutes and a final weight will be taken the following day.	The purpose of the experiment is for students to practice safe laboratory procedures and to have hands on experience to illustrate the lessons learned. It will also be used for students to gain experience using a balance and to test their hypothesis.

	In between weighing the students will be given an in Class worksheet to complete in groups of two using the Agent Sheet models. The following day the eggs will be removed from the solutions and a final weight will be taken. The students will fill out charts documenting the initial and final weights as well as the percent difference. From here they will create excel graphs plotting their results.	This section will be used to get students to work together and practice team work as well as to gain experience with Agent Sheets and Excel.

EGG EXPERIMENT DATA

Liquid	Initial Weight(g)	Weight(g) 15min	Weight(g) 30min	Final Weight(g) 24h	Percent Change (final-initial)/ (initial)*100
Distilled Water					
Syrup					
Salt Water (15%)					
Salt Water (50%)					

Name: _____

Pre-Laboratory Worksheet

1. How do water molecules move in an isotonic solution?
    a. Into the cell
    b. Out of the cell
    c. Both a and b
2. When the egg is placed in the syrup what will be the net direction of water molecules?

3. What do you think will happen to the overall weight of the egg after it has been soaked in a 50% salt solution after 24 hours? Why?

4. Explain what happens to a cell when placed in a hypotonic solution?

5. Osmosis is an example of…
    a. Passive transport
    b. Facilitated diffusion
    c. Active transport
6. What liquid(s) do you think will make the egg….

    Shrink: _____
    Swell: _____
    Remain the same: _____

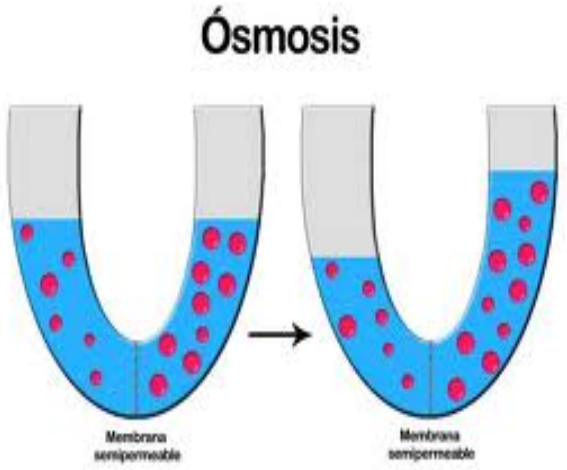
In Class Model Worksheet

1. What process is this model illustrating?

2. What happens to the water level on the right when sucrose molecules are added to the right?

3. Driven by the difference in solute concentration, the movement of water into or out of the cell produces a force known as: _____.

4. Which image depicts equilibrium?



5. Manipulate the model to show equal concentrations of water on both sides and describe how you did this.

6. Which molecule cannot pass through the membrane? Why?