Osmosis

Course Description:

Name: Pre-AP Biology

Grade Level: 10th Grade

Honors or Regular: Honors

Lesson Source:

Miller K., & Levine J. (2004). Cell boundaries. *Biology*. Upper Saddle River, NJ: Prentice Hall

Campbell, N., Reece, J., Urry, L., Cain, M., Wasserman, S., Minorsky, P., & Jackson, R. (2008). Passive transport. *Biology.* (8th ed.). San Francisco, CA: Pearson Benjamin Cummings.

Vodopich, D., & Moore, R. (2008). Diffusion and osmosis. *Biology.* (8th ed.). Denton, TX: McGraw-Hill.

Accommodations for Learners with Special Needs (ELL, Special Ed, 504, GT, learning styles, etc.):

The Osmosis/Diffusion lesson contains a hands-on lab for kinesthetic learners and illustrations with the vocabulary posted for visual learners.

Concepts

Students will become familiar with components of the cell membrane and processes of osmosis and diffusion by using scientific thinking and performing experiments that relate to real world experiences and bodily homeokinesis.

Objectives

- SWBAT differentiate between hypotonic, hypertonic and isotonic solutions and the effects on cell turgor.
- SWBAT create an appropriate hypothesis and use scientific reasoning to determine what happens to a cell during the different states of osmosis.
- SWBAT demonstrate where osmosis occurs in their own body and in other plants and animals.

Texas Essential Knowledge and Skills (TEKS)

§112.34. Biology

(3) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(E) Evaluate models according to their limitations in representing biological objects or events

(4) Science concepts. The student knows that cells are the basic structures of all living things with specialized parts that perform specific functions and that viruses are different from cells. The student is expected to

(B) Investigate and explain cellular processes, including homeostasis, energy conversions, transport of molecules, and synthesis of new molecules

(9) Science concepts. The student knows the significance of various molecules involved in metabolic processes and energy conversions that occur in living organisms. The student is expected to:

(A) Compare the structures and functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids

Materials List and Advanced Preparations

- Glucose Mixtures - teacher will mix prior to class meeting (1%, 10%, & 25%)
- Dialysis tubing and clips - 3 tubes and 6 clips per group of 4 students (extras available)
- Triple Beam balance - 1 per group
- Beakers - 3 per group
- Microscope – 1 per group of 2 or 4
- Slide and slip cover – 1 per person
- Elodea leaf – 1 per person
- Dropper – 1 per group of 2 or 4
- Saltwater mixture at 30% concentration.

Safety

- Do NOT ingest sucrose and saltwater mixtures or elodea.
- If any glass breaks, notify teacher IMMEDIATELY.
- Clean up spills so nobody slips on wet surface.
- Slides and slipcovers have sharp corners, be cautious.
- Wear safety goggles.

ENGAGEMENT		Time: 10 Minutes
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Display snails and swimming pool analogy slide on PowerPoint.	What makes your fingers wrinkle? What happens to a snail or slug when you put salt on them? Why? Can anyone tell me the difference between a solution, solvent and a solute?	Water leaving the cells in your body. The snail will shrivel up and eventually die. (Water is being removed from their bodies) The snail doesn't like salt and spits it out. Solute is what you are adding to a solvent. Solution is a mixture of solvent and solute.
Evaluation/Decision Point Assessment		**Student Outcomes**
Do the students understand the movement of water across a semi-permeable membrane?		Students will be able to compare and contrast osmosis and diffusion.

EXPLORATION		Time: 30 Minutes
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Dialysis tube experiment Explain and demonstrate technique for filling and clipping dialysis tubes. Have each student write a hypothesis of what will happen in each different sucrose solution. Explain the students need to collect data by recording changes in mass at 10 minute time intervals**.**	Ask students what the best method for measuring their results would be.	A graduated cylinder. A triple beam balance. The sugar will move into the tube. The tube will fill up with too much water and burst. Water will move in and/or out of the tube depending on solution concentrations.
Evaluation/Decision Point Assessment		**Student Outcomes**
Students will have completed timed weight checks for all 3 concentrations of sucrose and recorded appropriate data.		Students should calculate the percent change in mass of the 3 dialysis tubes.

Comment [K1]: This is very appropriate for completing the experiment portion of a lab.

Comment [K2]: This is very appropriate for the beginning of analysis/applying learning in lab.

EXPLANATION		Time: 20 Minutes
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Discuss outcome of dialysis tube fluid changes. Students will record result on class whiteboard. Discuss vocabulary and concepts: Osmosis, diffusion, cell membrane, hypertonic, hypotonic, and isotonic.	Ask students to describe what happened in each concentration of sucrose based on the class results. Why did this happen? What is the solvent and solute in our experiment? What stops the solvent from entering the dialysis tubes? What is the difference between diffusion and osmosis?	The tube that was in hypotonic solution will gain mass from extra water molecules entering. The tube that was in hypertonic solution will lose mass from water molecules exiting tubing. The tube that was in isotonic solution should remain at same mass since water was exiting AND entering the tubing. Solvent=sucrose. Solute=water. Solvent=water, Solute=sucrose. Small holes in dialysis tubing only large enough to allow water and very small molecules to pass through. Stickiness of sucrose. Osmosis is the movement of WATER across a membrane only. Diffusion is the passive transport of any liquid or gas through any other liquid or gas.
Evaluation/Decision Point Assessment		**Student Outcomes**
Students should be able to give proficient descriptions of vocabulary words and use them properly while explaining what happen in the experiment.		Students called on are capable of explaining the experiment using vocabulary words properly. If large number of students struggle teacher is to review the vocabulary words and use visuals.

Comment [K3]: This is a great check for understanding. The students' usage of vocabulary does begin to indicate understanding of the concepts.

ELABORATION		Time: 20 Minutes
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Discuss transfer of nutrients across cell membranes that contribute to cellular function. Explain Elodea experiment.	What is the difference between active and passive transport? What type of transport is osmosis? What is going to happen to the Elodea leaf when a drop of saltwater is placed? Make a hypothesis. Why does the plant cell not shrink?	Active transport requires energy to pass through the cell membrane; passive transport requires no energy. Passive Active The vacuole is going to shrink (fast!) Will look like the chloroplasts "ball up". The cell will shrink. Plants have a rigid cell wall.
Evaluation/Decision Point Assessment		**Student Outcomes**
Students will understand what the effect a hypotonic, isotonic, and hypertonic solution will have on both animal and plant cells.		Students will explain what happens to a animal and plant cell in hypotonic, isotonic, and hypertonic solutions.

Comment [K4]: This is a fast and easy application of what the students did in lab. ☺ I hope you can show this to the whole class, or have students look through several microscope set-ups.

EVALUATION		Time: 10 Minutes
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Post-assessment		