Cell Transport

Grade/ Grade Band: 7th	**Topic: Cell Transport**	**Lesson # __2__ in a series of _3_ lessons**

Brief Lesson Description:

In this lesson students will learn about the function of the cell membrane and cell transport. Students will be able to distinguish between Diffusion and Osmosis and predict whether molecules will move in or out of the cell based on their concentration.

MS-LS1-2.

Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

[Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.]

Specific Learning Outcomes:

- Cell membrane forms a boundary that controls what is going in and out of the cell
- Diffusion is a movement of molecules across the cell membrane from the area of higher concentration to lower concentration
- Osmosis is diffusion of water molecules

Narrative / Background Information

Prior Student Knowledge:
Cell structure
Cell membrane is selectively permeable
Solutions
Solute and Solvent
Familiarity with EV3

Science & Engineering Practices (SEPs)	Disciplinary Core Ideas (DCIs)	Crosscutting Concepts (CC
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and use a model to describe phenomena.	**LS1.A: Structure and Function** • Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.	**Structure and Function** • Complex and n structures and be visualized, r used to describ function depen relationships ar therefore comp structures/syst

		analyzed to det they function.

Possible Preconceptions/Misconceptions:

- **Small molecules can cross the cell membrane at any time**
- **Movement of molecules in and out of the cell is random**
- **Once equilibrium is reached movement of molecules stops.**

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

1. Display a picture of a person being thrown out of the water to the uninhabited island with the caption: I'm dying of thirst. Can I start drinking seawater?

Allow students to volunteer with answers and explanations.

Credit to: http://paradise.docastaway.com/drinking-sea-water/

Aligned with SL.8.5

- **Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.**

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

- Students given a pre-programmed EV3 , a worksheet, and a poster paper with the line representing cell membrane and “inside” and “outside” areas of the labeled cell.
- Use EV3 to represent a molecule at the cell membrane.
- EV3 would move into the proper direction(into the cell or out of the cell) based on data input.
- Students will be instructed to enter random numbers for number of molecules inside and outside and will record displayed information in worksheet #1.
  Please note: Worksheet #1 includes directions and labeled diagram of EV3 brick.

Number of molecules inside (i)	**Number of molecules outside (o)**	**Direction of movement (i → o, <u>or</u> o → i, <u>or</u> both)**

<u>Worksheet 1</u>

Students will be asked to describe the pattern observed. If possible, data can be entered into Google docs and shared with the class.

Aligned with MS-LS-1-2 SEP

<u>Developing and Using Models</u>
<u>Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</u>

- **<u>Develop and use a model to describe phenomena.</u>**

CCC

<u>Structure and Function</u>

- **<u>Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.</u>**

EXPLAIN: Concepts Explained and Vocabulary Defined:

Vocabulary:

- Equilibrium
- Diffusion
- Osmosis
- Intracellular
- Extracellular
- Passive transport

Discussion **:**

Teacher does the following:

- Explain passive transport (Diffusion), homeostasis
- Define osmosis
- Explain the role of osmosis when gargling with a saltwater solution. Swollen throat tissue causes pain. Water from the tissue will move out of the cells when exposed to salt water.

Put the following questions on the board for pair-share:

- Why does eating popcorn in the movie theater make you want to drink more?
- Why is salt sometimes used to preserve foods?

Modifications:

Have students make their own drawings of diffusion and osmosis. Ask to include brief captions that describe what is happening in their own words. (**visual learners**)

Aligned with **LS1.A DCI :Structure and Function**

- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.

ELABORATE: Applications and Extensions:

- Students will complete the worksheet in groups
- Students will use EV3 for self-assessment
- The EV3 program will allow for data input of intracellular and extracellular concentration and the display of the solute and water

movement as inside or outside.

- Students will check their answers.

Diffusion	Osmosis		
Does the <u>SOLUTE</u> move **inside** or **outside** of the cell?	Does <u>WATER</u> move **inside** or **outside** of the cell?	**Intracellular fluid** (Inside the cell)	**Extracellular fluid** (outside of the cell)
1.	2.	5% salt	10% salt
3.	4.	10% salt	10% salt
5.	6.	3% glucose	1% glucose
7.	8.	2% protein	1% protein
9.	10.	9% salt	9% salt
11.	12.	13% water	25% water
13.	14.	59% water	45% water
15.	16.	90% water	92% water
17.	18.	74% glucose	87% glucose

<u>Worksheet 2</u>

Teacher asks students :

1. Return to question from the engage part of the lesson and see if you want to change your answers. Share
2. You have a fresh water aquarium and for your birthday, your parents bought a Nemo and Dory (saltwater fish) to add some color to your aquarium. Using your knowledge of osmosis, **predict** if they will survive in your tank and **provide evidence** to support your prediction.

Aligned with :
MS-LS1-2 <u>CCC</u>
Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.

MS-LS1-2 SEP : Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena.

EVALUATE:

Formative Monitoring (Questioning / Discussion):

Exit Ticket

Teacher will demonstrate a clear container with water, 2 drops of dark food color dispensed along the inside of the cup. Ask students to observe , describe, and explain what they see. Students will record their answers on the card.

2. Why can you smell food being cooked from a different room in the house? Students will record their answers on the card.

Aligned with: **LS1.A DCI: Structure and Function**
Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell and CCC.

CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique the reasoning of others

Elaborate Further / Reflect: Enrichment:

Math Extension:

Students can use equations to model the transport of molecules across the cell membrane in order to reach equilibrium.

The cell membrane can be represented with the equal sign and the EV3 robot will be equal to 2x. Students will be presented with different concentrations of molecules intracellular and extracellular. Students will model the concentrations with constants and place the EV3 robot on the side of the equation where there is a lower concentration of molecules. Students will solve the 2 step algebraic equation to determine how many molecules need to move for the cell to be at equilibrium.

For example: Intracellular concentration: 5 molecules of NaCl, Extracellular concentration: 9 molecules of NaCl

Mathematical Model: $2x + 5 = 9$

$x = 2$

Therefore 2 molecules of NaCl will move into the cell in order for the cell to be at equilibrium at 7 molecules of NaCl both inside and outside the cell membrane.

Mathematics

- **6.EE.C.9 - Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-2)**
- CCSS.MATH.CONTENT.7.EE.B.3 -Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

- CCSS.MATH.CONTENT.7.EE.B.4 **Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.**

Materials Required for This Lesson/Activity			
Quantity	**Description**	**Potential Supplier (item #)**	**Estimated Price**
5	pre-programmed EV3		
5	pre-labeled chart paper		
5	worksheets		
class set	Exit ticket		
