Pre-planning information:

The same accommodations discussed in lesson plans 1 and 2 will be used during this lesson to provide the proper learning environment for the two students with learning disabilities in this class. As with any other lab, providing a clear set of directions is imperative to ensure student success in this activity. This is especially important for the two students in this class who require special accommodations. The laboratory packers, demonstrations, visuals, and peer supports used during this laboratory will act as resources for not only the students with special needs but also every other individual. There are a number of considerations taken during the planning of this lab.

The classroom laboratory set up is especially useful in this lesson because students will need to make use of the space and the lab tools that are available. There is a lot of set up to be done prior to this laboratory in order to ensure that the students have all of the materials they need and that the processes that are meant to occur will actually happen. If materials are prepared beforehand then the lesson will run more smoothly and behavior management and safety issues will be less likely. For example, the students will be asked to make a model cell using dialysis tubing, string, a glucose solution, and a starch solution. All of the string will be precut prior to the lab and the dialysis tubing will be soaking in water in order to prepare it to be filled with solutions. The glucose and starch solutions will also be prepared and separated into small bottles for each lab table prior to this lesson. Each of these steps will lead to a better flow during the lesson and in turn increased learning.

At this point, before the completion of this lab students have learned about the many functions of the plasma membrane and its importance in cell function and survival. One of these functions is cell transport, including diffusion. Students understand the basic theory of diffusion and this lesson provides them with the opportunity to observe this process in action.

Content Information

This information is seen in the districts’ curriculum and on the regents exam for this class. The New York State requirements include the completion of this laboratory exercise for all students. In the previous unit students have learned about cell structure and function, in particular the organelles of a cell and the cell theory. During the lesson covered the day before this lesson, the concepts of diffusion and osmosis were discussed along with a video reviewing information on cell transport and the plasma membrane. This is part one of a two-part lab that students will complete during this learning segment. This one will focus specifically on diffusion and will use a model cell and cell membrane to test whether or not starch and glucose can diffuse through a semi permeable membrane.

Objectives

1) Students will apply the concepts of diffusion to develop solutions and support claims about the process of diffusion.
2) Students will create hypotheses regarding the theory of diffusion through a semi permeable membrane.
3) Students will observe the process of diffusion and apply scientific theories to explain what they see.
4) Students will test hypotheses by determining the presence of simple sugars and starch in a solution using chemical indicators.

**Standards:**

*The Living Environment Core Curriculum*

*Standard 1:* Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions. Key Ideas 2 & 3

*Standard 4:* Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science. Key Idea

*WCSD Standards and Outcomes 7-12*

1. Develop abilities in science
2. Be able to apply science knowledge and skills to a variety of purposes
3. Understand the unity and diversity among living things

*Common Core Writing Standards*

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. Explore and inquire into areas of interest to formulate an argument.

**Language Information**

Language is important in this lesson because students are asked to create a hypothesis and draw conclusions based on their inquiry. They have been taught the correct format for creating a hypothesis and will be instructed to use this when writing what they think. Scientists use specific formats when conducting the scientific method and students get to practice this throughout this experiment. They will create a hypothesis based on their knowledge, record their findings as they complete the experiment, and then draw conclusions from this their evidence.

Besides understanding the scientific writing format for lab reports students should also have an understanding for important vocabulary terms such as diffusion and semi permeability. These were discussed in the previous unit when students learned about the plasma membrane and its main functions. They also had a vocabulary test during this unit to practice and assess their knowledge of these terms.

**Orientation/Engagement/Motivation**

This lesson is engaging to students for many reasons. This is collaborative group work where students are actively participating in their learning and observing scientific processes in the classroom. Students will get to construct models of a cell and then watch the process of diffusion occur. Positive results will be indicated by color changes. Sometimes the students have to heat specific substances to get positive results. They are actively involved in the process and get to see it for themselves when changes occur.

Besides students being actively engaged and involved in the procedures they also get to work with their classmates. This provides them with support and opportunities to use their own knowledge to help their classmates succeed. Working in these groups helps students stay on task because they are given responsibilities in their groups. For example, they may be the recorder or the reader. They must stay on task in order to play their role in the group. Students will also be motivated during this lab as well because it is information that will be seen on the state assessment. The majority of the students in
this honors class are invested in their schoolwork and work hard to succeed. Completing this lab will be a great practice for the state exam and also an enjoyable learning experience.

**Presentation/Explicit Instruction**

Explicit instruction will be used at the introduction of this class period. Students will receive explicit instruction regarding the directions and procedures for this lab. During explicit instruction students will be asked to read the introduction to the lab. At this time the instructor will speak after each reader in order to emphasize important concepts and reiterate what students must do to complete the activity correctly. Demonstration will be used to help students hear and then visually see what is expected of them. The explicit instruction also includes the reading of objectives, step-by-step procedures, and safety instructions. Safety is specifically important in this lab because the students must use the hot plates and beaker and test tube holders correctly in order to avoid blisters, burns, and breaking glass. They must also wear goggles because the Benedict’s Solution is corrosive to the eyes.

**Exploration/Expression/Guided Practice/Independent Practice/Feedback/Application:**

Students will complete the laboratory exercise with their lab tables. They will create a model cell that they will fill with glucose and starch. Then they will suspend it in a solution consisting of water and iodine. Once the students do this they will observe the diffusion process and then confirm what will be able to pass through a semi permeable membrane by observing the changes within the cell and the solution outside of the cell. Students will work with Lugol’s Iodine and Benedict’s solution in order to indicate what substances are present inside and outside of the cell at certain times. This will be completed in collaborative groups but the instructor will be available for support and guided practice when necessary.

**Closure:**

This lesson will end with a short video clip that summarizes the information they observed that day. This will present the information to them in a different way and help them draw conclusions from the evidence they collect.

**Assessment**

There are multiple assessments conducted during this lab. First, observation will be used again during collaborative group work as described in lesson plan 1. Also, during this time students will complete a packet that not only takes them through the lab procedures but also asks them to answer questions and organize the information they find from their experiment. Students will hand this in at the completion of the lab to be reviewed by the instructor.

The use of questioning will also be important during this lesson because it helps students find answers from the information they have and also allows the instructor to gauge understanding. For example, when students observe their model cell changing color they may need some probing questions to help them see that the iodine actually diffuses into the “cell.” Also observation will be used before, during, and after the laboratory experiment to ensure safety, progress, and understanding.

**Materials**

| Lab Packet | Dialysis Tubing | Test Tube Holder |
Lesson Script

Students collect lab packet from back table as they walk in.
Students instructed not to touch lab material until instructed to.
Explanation of safety procedures
Students read introduction aloud
Students individually create hypotheses
Variable numbers of students share their hypotheses with the class
Explicit instruction for directions and procedures of lab
Demonstration of procedures
Collaborative group work on lab experiment
Teacher monitors students as they complete tasks
Students answer questions within packet as they complete lab
Short discussion about what they found
Clean up