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# Planning Commentary-Secondary Life Sciences

## Content Focus

Summarize the central focus of the content you will teach in this learning segment.

“Molecules move into and out of cells via *cell transport*.”

The content I will be teaching in this segment deals with how things get into and out of a cell. This is known as cell transport. This is one of the primary ways that a cell maintains homeostasis. Homeostasis is how a living organisms (or part of it) maintains stable internal conditions. This is one of our yearlong themes that we have been discussing since the first unit. Prior to this learning segment, students learned about the structure and functions of the plasma membrane. The plasma membrane is what separates a cspec from its surroundings and regulates cell transport. Next, students will learn about how different molecules pass through the plasma membrane. Students have already read about and took guided notes on different types of cell transport in their textbooks. During this learning segment, students will deepen their very limited understanding of cell transport.

The first two days of this learning segment focus on two types of transport: osmosis and diffusion. Students will begin this learning segment by doing one of four laboratory experiments to observe the effects of osmosis and diffusion. During the following class period, student groups will present their results and conclusions to their classmates. Students will learn about the remaining three types of cell transport via direct instruction in the form of a PPT and video clip.

## Knowledge of Students to Inform Teaching

For each of the categories listed below (a–d), describe what you know about your students’ prior learning and experience with respect to the central focus of the learning segment. **What do they know, what can they do, and what are they learning to do?** Consider the variety of learners in your class who may require different strategies/support.

1. Academic development (e.g., preconceptions, prerequisite skills, understanding of the nature of science, developmental levels, special educational needs)

The concept of homeostasis was introduced at the beginning of the year. I have continued to provide opportunities for students to identify this concept throughout the rest of the semester. Many students seem proud to finally understand this big word. They are often the ones to remind me that what we are discussing is an example of homeostasis. Now students will now learn some specific processes that enable a cell to maintain homeostasis. We have also been practicing the scientific method since the beginning of the year. From the nutrition segment of our biochemistry unit, students should know that food molecules need to get inside of cells in order for the cell to survive. From the first part of our cell unit (and 7th grade science), students should know what organelles a cell contains as well as the structure and functions of these organelles. Most students will have learned that molecules are always moving, but will need to be reminded of this. Most recently, students have studied the properties of the plasma membrane. There have been several activates were students were able to go through the steps of the scientific method, including laboratory experiments and a self-directed research project. Most students will be unfamiliar with two of the four laboratory experiments (dialysis tubing and egg procedures). However, the procedures are simple enough that students should be able to complete them after watching me model and reading the detailed instructions. The food coloring experiment is something that many students have likely seen before (though modeling and detailed written instructions will still be provided. The plant cell experiment is very similar to a laboratory activity we have done recently, with one minor difference. During the previous laboratory activity, modeling was provided and students were able to practice. For the experiment, little modeling will be provided as students have gotten very good at this procedure. Written directions will still be provided.

Although students have read about diffusion and osmosis, I expect that most of them have a very limited understanding of the concepts. The reading was very brief and most of my students do not learn well from simply reading independently. The laboratory experiments should help students visualize the processes. Having to explain the concepts to each other, should also help students deepen their understanding.

1. Academic language development (e.g., students’ abilities to understand and produce the oral, written, and symbolic language associated with the central focus and standards/objectives within the learning segment)

Biology is a very vocab filled discipline. This unit (cell bio-part two) has a total of nineteen vocabulary words. Two of these words are not based on MN state standards or the textbook, but were added to facilitate the discussion of cell transport. These words will also be commonly used next year in chemistry.

This year most students have been successful in answering definition type questions. However, I have been struggling with getting students to write definitions in their own words. This shows me that they are not understanding the vocabulary enough to be able to verbalize it and/or students struggle with writing in general. Based on several writing assignments, it is clear that writing skills (as well as spelling, grammar, and proofreading skills) in this class are poor overall. However, I think that their difficulties in writing definitions is a combination of both a superficial level of understanding and writing deficiencies.

In this learning segment, students will be exposed to the vocabulary words in a variety of ways. They will first encounter it in a brief textbook reading. They will then hear it in a short video clip. After doing their experiments students will discuss the concept within their group and write out definitions and examples. Then students will have to verbally explain the concepts of osmosis and diffusion to the class using supporting vocabulary such as “solute” and “solvent.” I hope that having students do verbal presentations (after creating written definitions) will help to deepen their understanding of the vocabulary. Students will also have the option of presenting non-linguistic representations of the concepts. Not only will students have to know and be able to explain the definitions of the vocabulary words, but they will have to be able to recognize the difference between each type of cell type and understand the *result* of the processes.

1. Family/community/cultural assets (e.g., relevant lived experiences, cultural expectations, and student interests)

Because this class is an honors course, parental involvement is generally good. I have corresponded with several parents via email and they have all been supportive of both their child and me. However, student interest and motivation can vary considerably. Most of these students are grade-oriented rather than learning-oriented. This means that I always have to strive to make learning activities extra interesting, engaging, and hands on.

Twenty of the 32 students in this class are active in sports, the most popular being cross-country running. Most appear to be upper/middle class. This class includes one Asian student, one Indian student, and two Somalian girls who wear head scarves. .

The students in this class enjoy activities that are hands on and involve movement. They also respond really well to real life examples, especially those that involve animals. This is why I included an example of a freshwater fish in saltwater. I also plan to use an analogy of a strainer (for pasta) to the property of being semipermeable. I am assuming that most students will have seen one of these used, if not used one themselves. Because many of these student’s parents work at the Mayo Clinic, I often tie it in to our learning. For example, when learning about microscopes we talked about what type of microscopes researches at Mayo might use and why.

1. Social and emotional development (e.g., ability to interact and express themselves in constructive ways, ability to engage in collaborative learning, nature of contributions to a productive learning environment)

All of the students in this class are 14 or 15 years old. Like most adolescents, these students have a strong need to be very social and active. Although this can sometimes lead to behavior problems, these needs can also be used to aid in their learning. I try to incorporate activities where students get to move around and talk to each other. Most of the students in this class are outgoing and definitely enjoy working in groups. This class generally has good participation, though I do have some problems with blurting and off-topic comments. However, three students are very shy. It can be difficult to design activities that make these students also feel comfortable and included.

Addressing these needs also helps students with different learning styles. Group activities encourage socializing and help those who are auditory learners. Hands-on activities allow movement and help students who are kinesthetic or tactile learners.

Most students struggle to organize their thoughts and explain their thinking in words. Because I believe explaining your own thinking is a valuable learning tool, I chose to have students teach some of the concepts to each other in this learning segment. I will scaffold this experience by asking key questions both before and during presentations.

3. Supporting Student Learning in Science

Respond to prompts a–e below to explain how your plans support your students’ learning of scientific concepts and processes related to the central focus of the learning segment. As needed, refer to the instructional materials you have included to support your explanations. Cite *research* *and theory* to support your explanations.

1. Explain how your understanding of your students’ varied preconceptions, prior knowledge, experiences, and development guided your choice or adaptation of learning tasks and materials to develop students’ abilities to use science concepts and inquiry skills to explain a real-world phenomenon.

Many of these students are used to always being told exactly what to do in class. One of my goals as a teacher is to teach students how to problem solve and take responsibility for their own learning. This is why I have chosen to have students do experiments related to osmosis and diffusion even though they have had little experience with these concepts. An important component of student driven learning is getting students to question things. Students will most likely be forced to ask their classmates questions, as they will be the ones teaching them the information.

b. How are the plans for instruction sequenced in the learning segment to build connections between students’ preconceptions (based on prior learning and experiences) and new knowledge?

Students had a brief introduction to the structure and function of the plasma membrane during previous units. In our most recent unit, we have been studying the plasma membrane in more detail. I began a discussion of the properties of the plasma membrane by showing a video that helps to clarify the common misconception that the plasma membrane is a rigid structure. The video makes it clear that the plasma membrane is fluid and dynamic. It is very important that students understand the structure of the plasma membrane as it has a significant impact on ways that molecules pass through it (cell transport.) When we started learning properties of the plasma membrane, the students built paper models of it. These models (which are still in the classroom) are something that I will be able to refer to when talking about cell transport. Another misconception

Students were first introduced to the concepts of cell transport via a textbook reading assignment. The first day of this segment begins with some laboratory activities where students will observe osmosis and diffusion and learn about these concepts via inquiry. I chose to focus on those two types of cell transport first because they are the most basic. On the third day of this learning segment, students are introduced to three more types of cell transport: facilitated diffusion, endocytosis, and endocytosis. Before introducing these topics

c. Explain how you will help students use inquiry skills to explore and explain relationships between scientific concepts and phenomena in the learning segment.

Each student will perform one of four experiments that illustrate the concept of diffusion or osmosis. Each of the experiments asks students to predict and explain their predictions. After obtaining the results and observations from their experiments, students will need to search for the explanation themselves via the textbook or internet research. Carrying out the experiments requires students to practice basic, yet important, skills in the sciences such as using a microscope, preparing a wet-mount slide, using an electric balance, and calculating percent change.

Non-linguistic representations (which are supported by research, Marzano) of osmosis and diffusion will be encouraged. The laboratory experiments give students a visual representation of osmosis and diffusion. Students will be required to display some sort of diagram when presenting to each other.

Cooperative learning is a research-supported strategy that has many benefits (Marzano). It fosters teamwork, promotes positive interactions, improves interpersonal skills (which a couple students definitely need to work on), builds trust and leadership skills. It will also help with my goal of students taking responsibility for their own learning because it requires problem solving and decision-making.

1. Explain how, throughout the learning segment, you will help students understand the relationship of the central focus of the learning segment to crosscutting concepts in science and to better understand the nature of science and the difference between scientific and nonscientific evidence and explanations.

In want my students to understand that cell transport is important for the following reasons. 1) It helps a cell maintain homeostasis. 2) It allows a cell to take in food molecules that provide energy and nutrients. 3) It allows a cell to get rid of waste.

Homeostasis is a difficult concept that we introduced at the beginning of the year. It can be difficult for students to understand because it is such a broad concept. Learning the process of cell transport should deepen students understanding of this process because it gives students a concrete example of homeostasis.

In this learning section, student will go through the scientific method (another topic we have been practicing since the beginning of the school year). They will be given a *question*, come up with a *hypothesis*, carry out and *experiment*, make *observations*, and communicate their *conclusions*.

Energy is another big idea that we have discussed in both our ecology unit and our biochemistry unit. The unit following this learning segment (photosynthesis and respiration) goes into more detail on how cells produce energy, so an understanding of cell transport is critical.

1. Describe any instructional strategies planned to support students with specific learning needs. This will vary based on what you know about your students but may include students with IEPs (individualized education programs), English language learners, or gifted students needing greater support or challenge.

Though I do not have any students with specific learning needs, there is a wide range of academic and interest levels in this class. Many of my lower achieving and less motivated students are motivated to do anything that will get the attention of their classmates. This is often disruptive. I hope that having students teach each other about the concepts of diffusion and osmosis (in a relatively unstructured way) will encourage allow these students to the attention they crave without disrupting their own or others learning.

4. Supporting Student Understanding and Use of Academic Language

Respond to the prompts below to explain how your plans support your students’ academic language development.

1. Identify the key academic language demand and explain why it is integral to the central focus for the segment and appropriate to students’ academic language development. Consider language functions and language forms, essential vocabulary, symbols, and/or phrases for the concepts and skills being taught, and instructional language necessary for students to understand or produce oral and/or written language within learning tasks and activities.

Understanding vocabulary is essential for a student to be successful in this unit. A total of nineteen terms will be used in this learning segment. Most of these will be directly assessed in the end of unit “quest.” These vocabulary words are: plasma membrane, fluid mosaic model, phospholipid bilayer, selective permeability, transmembrane proteins, active transport, passive transport, facilitated diffusion, diffusion, osmosis, isotonic, hypotonic, hypertonic, dynamic equilibrium, endocytosis, exocytosis, solute, solvent, and concentration. Unlike previous units, almost all of these words are completely new to students. This can seem overwhelming for many students. I will have to make sure to share mnemonics for many of these words while teaching them, to make them more meaningful to students. For example, I remember the word *hypotonic* because it causes a cell to explOde*.*

I will also ask students to come up with their own ways to remember the vocabulary and share good ideas with the class.

Six of these words come directly from a single Minnesota state benchmark, “compare and contrast *passive transport* (including *osmosis* and *facilitated diffusion*) with *active transport*, such as *endocytosis* and *exocytosis*. The other vocabulary words are directly related to cell transport and make it easier to discuss the causes of and differences between each type of cell transport. There are many other terms that could have been included in this unit, (*concentration gradient*, *ion channel, carrier protein, receptor protein, water potential,* etc.) but it was decided that that depth of coverage was not necessary or feasible in a freshman class. These terms will be introduced to students if they decide to take A.P. biology as a Junior or Senior.

1. Explain how planned instructional supports will assist students to understand academic language related to the key language demand to express and develop their content learning. Describe how planned supports vary for students at different levels of academic language development.

One way that I will support academic language development is by first allowing students to write their explanations of diffusion and osmosis individually, then having students discuss the concepts in groups, and finally explaining the concepts in front of the class. This scaffolds the process so that they begin with a low-risk task and end by presenting their explanations (which they have now revised and practiced) to the class.

Another way I will support students learning of vocabulary is by using the vocabulary as much as possible both in front of the class and when talking with students individually. I will also make sure to use the vocabulary when asking questions, as that is how the test will be structured. However, when *first* discussing new vocabulary it is important to use very student-friendly language so that students have something familiar to build their knowledge on.

5. Monitoring Student Learning

a. Explain how the informal and formal assessments were selected and/or designed to provide evidence for you will use to monitor student progress toward the standards/objectives. Consider how the assessments will provide evidence of science concepts, the phenomenon, the nature of science, and scientific inquiry.

At the end of this learning segment, students will be formally assessed via a “quest” on cell transport and the properties of the plasma membrane (22 points). Students will receive credit for their packet, though the packet will be graded only for completion (3). Students will also receive three points for their effort and listening during presentations.

b. Describe any modifications or accommodations to the planned assessment tools or procedures that allow students with specific needs to demonstrate their learning.

As there are no students with special needs in this class, I do not plan to make any modifications to assignments or assessments. However, it will be up to students as to how involved they would like to be in their group’s presentation. My only requirement is that students fill in their notesheet.