

TITLE OF LESSON

Biology Unit 1 Lesson 4 – Energy Flow

How does energy flow from the inside to the outside of a cell and vice versa?

TIME ESTIMATE FOR THIS LESSON

One class period

ALIGNMENT WITH STANDARDS

California – Biol CB 1

MATERIALS

Teacher’s Notes lesson 4 – Teacher Page

Venn Diagram – Student Page

overhead sheets

markers

paper and colored pens for visual aid

LESSON OBJECTIVES

- To learn what potential and kinetic energies are
 - To learn how energy flows
 - To learn how cells use energy to do work
 - To learn how to take notes
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EXPLANATION OF LESSON

This lesson is focused on the flow of energy. Students will have to answer the following questions: How does a cell use energy and how does it flow from one area to another? How do molecules move from one side of a membrane to another?

Look for images of the topics in the lesson to display. Some images about chemical bonds can be found at <http://gened.emc.maricopa.edu/Bio/BIO181/BIOBK/BioBookCHEM1.html> and <http://gened.emc.maricopa.edu/Bio/BIO181/BIOBK/BioBookCHEM2.html> for information about water molecules. The rest of the images you may want to look for in your class textbook to make them easily accessible to students.

FOCUS AND MOTIVATE STUDENTS – WARM-UP ACTIVITY

- 1) Homework Check – Stamp/initial complete homework assignments. Pass back graded assignments and have students place them in the appropriate section of their binders.
- 2) **Agenda** – Have students copy the agenda you posted.
- 3) **Venn Diagram** – Have the students get out their list of similarities and differences between the components in animal and plant cells that they completed as homework last night. Quickly, draw a **Venn Diagram** (see *teaching strategies* section for a description of this strategy) on the front board. Over the right side, write animal cells. Over the left side, write plant cells. Tell students that you are going to write the differences that make each cell unique under each separate circle. In the intersecting portion of the circles, you are going to write the similarities. Pass out a **Venn Diagram** for each student. Tell them they must write out notes exactly as you do. Go around the room and ask each student for one unique quality of plant cells that is one quality that they believe animal cells do not have. Tell them they may not give the same answer as anyone who has gone before them. Keep going until each student has given at least one response or until you run out of answers. You may need to give some prompting. Do the same for animal cells. Then have them give you the similarities between the two and place those answers in the intersecting circle. When you have finished, collect all **Venn Diagrams**.



ACTIVITIES – INDIVIDUAL AND GROUP

1. **Vocabulary** – Have students copy the list of vocabulary words (see below) on the board in their binders. They will need to use this vocabulary to show their understanding of the lesson. Tell them they will listen for the definition of each vocabulary word in the lecture today and write them down on this sheet next to the word.

energy
potential energy
kinetic energy
ATP
1st law of thermodynamics
2nd law of thermodynamics
electron transfer
substrate
allosteric
entropy
endergonic reaction
exergonic reaction
enzyme
product
intermediate

2. **Notetaking** – Tell students they should be taking notes during the rest of this lesson.
3. **Group Definition** – Define energy using the **Group Definition** strategy found in the strategies portion of our web site. Have students write the definition in their binders. Then show them the following definition. How close were they?

def. Energy is the capacity to do work

Remember that energy is not lost or destroyed; it is merely converted from one form to another (First law of thermodynamics). Contrast potential and kinetic energy.

- Potential energy is the capacity of any stationary object to do work owing to its position in space or to the arrangements of its parts.
- Kinetic energy is the energy of motion.

Give examples. A brick held in the air has potential energy. As it drops it has kinetic energy. When it hits the floor it releases heat known as heat energy.

4. **Brainstorm** – Ask students to list at least 5 other forms of potential and kinetic energy. Have them choose a partner in their group to work with. Allow them 5 minutes to work on their forms.
5. **Present** – At the end of 5 minutes, call time. Ask each pair to give their ideas out loud. You write them on the front board or overhead projector. Be sure their answers are correct. If they are not, ask them why they believed they were examples and help them to see what they may have missed. Ask all students to add examples they do not have to their list. Get all pairs answers.

*Some possible examples: water falling to turn turbines to form electricity, gas fueling an engine, wind to form electric energy, sun to heat water, a battery connected to a fan changes from chemical bond energy to electrical energy to kinetic energy, etc. **Biological examples:** two hydrogen gas molecules and an oxygen gas molecule each have chemical bond energy, they combine to form water molecules, which vibrate and release heat energy. Sunlight is an example of electromagnetic energy that strikes a chlorophyll molecule and then excites the electrons in the chlorophyll. This is a conversion of electromagnetic energy to chemical bond energy.*

6. Have students put a copy of all the ideas in their binders.

7. **Note taking** – Explain the Lesson 4 concepts. Refer to **Teacher’s Notes Lesson 4** in the Teacher Pages section for the key points and questions of this lesson. Tell students to take out a sheet of blank paper, as they will be taking notes today. Tell them these notes are to be kept in the notes section of their binder and should be dated appropriately.
 8. **Model Note taking** – Make sure you have prepared an overhead with an example of good notes. As you go through your lecture, point out how you have taken good notes, tips and advice. This way, they will know what is expected of them as they take notes throughout the quarter and year. In the upcoming classes, a different student each day takes notes on an overhead while the rest take notes on paper. At the end of the class the students and teacher will **Applaud/Critique** the notetaker. Remind students of this. Tell them that today, they will have the opportunity to watch you model what is expected of them and then tell you what they think you did well and what you need to work on. So they should pay close attention.
 9. **Applaud/Critique** – When you have finished your lecture, have students **Applaud/Critique** your note taking skills. Remind them that they are commenting on your skills not you personally. Go around the room and have each student tell one thing you did well. Make sure they are specific. This is where you can help them to hone their skills when critiquing. So take your time. Then ask each student to tell one thing you might do better next time. Help them to keep their comments respectful, as this will set the tone for how they **Applaud/Critique** each other.
 10. **Visual** – After explaining the concepts, have the students work with their partner from the warm up activity to make a visual in which they show, through drawings AND the use of the vocabulary, that they understand the concept of energy flow. They will present their visual to the class and explain their point of view tomorrow. If they don’t complete the drawing in class they must finish it as part of their homework tonight. These visuals will be hung in the classroom tomorrow. Give them an example to help them get started... such as a car. It won’t work without gas. They can draw gas being put into a car, then the car can move to another location. They must put where the gas comes from in their visual. Gas comes from plants that died and were buried and turned into fuel that is gathered by drilling and is stored in tanks. Trucks take the gas to the stations and we drive the car to the station. We can drive our car around as long as it has gas. Eventually our car becomes very old and doesn’t work. It is made out of metals that rust and eventually become part of nature once again. You can think of other better examples if you choose. It is important for them to realize how everything is connected in some fashion. Give them the rest of the period to work on this assignment.
 11. **Homework Review** – Five minutes before the end of the period, remind students of their homework.
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HOMEWORK

- 1) Read the textbook, Starr’s *Biology Concepts and Applications*, Chapter 5, pp. 74-83. If you have another text, make sure the students read about: energy, the 1st and 2nd laws of thermodynamics, doing cellular work such as ATP, electron transport and metabolic pathways; enzyme structure and function, and enzyme control. Write a summary of the key points of the reading.
 - 2) Read chapter 1 to 3 in *The Double Helix*. Predict 5 things you think the author will write about next. Make sure you tell why you have chosen those 5 things based on evidence from previous readings.
 - 3) Complete your visual of energy flow if you have not finished it.
 - 4) Have students think about what they learned about membranes during the student presentations. Ask them to bring a household item that they think would mimic a membrane (colander, sponge, pantyhose, screen, etc) to class tomorrow. Then have them bring two things that will and won’t pass through this barrier.
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GROUP ROLES

None

DOCUMENTATION FOR PORTFOLIO

None

