Supplemental Document 1

Grade Level: 10 (Biology)

Photosynthesis/Respiration Student Learning Map

Key Learning: **Photosynthesis and respiration are the mechanisms by which living things obtain the energy necessary for life processes.**

Unit Essential Question(s): How is energy transformed in living systems?

Concept: #1 ATP	**Concept: #2 Photosynthesis**	**Concept: #3 Cellular Respiration**
Lesson Essential Question: How is ATP used as energy molecule?	**Lesson Essential Question:** How do producers change light energy into chemical energy?	**Lesson Essential Question:** How do consumers convert chemical energy into ATP?
Vocabulary: Adenosine Triphosphate (ATP) Adenosine Diphosphate (ADP) Phosphate Group Cellular Activities (Processes) Potential Energy Chemical Energy ATP-ADP Cycle Endergonic Reaction Exergonic Reaction	**Vocabulary:** Carbon Dioxide Glucose Chlorophyll Electron Transport Chain (Photo) Calvin Cycle Light Dependent Reactions Chloroplast Producers Visible light Products Reactants	**Vocabulary:** Cellular respiration Aerobic Anaerobic (fermentation) Glycolysis Pyruvic acid Citric Acid Cycle Electron Transport Chain (resp.) Lactic Acid Fermentation Alcoholic Fermentation Mitochondria Consumers

Summarize the lesson essential for concept #1 using the following vocabulary words: **adenosine triphosphate (ATP), adenosine diphosphate (ADP), phosphate group, cellular activities, potential energy, chemical energy, ATP-ADP Cycle, endergonic reaction, and exergonic reaction**.

How is ATP used as energy molecule?

Supplemental Document 1

Summarize the lesson essential for concept #2 using the following vocabulary words: **carbon dioxide, glucose, chlorophyll, electron transport chain, calvin cycle, light dependent reactions, chloroplast, and producers**.

How do producers change light energy into chemical energy?

Summarize the lesson essential for concept #3 using the following vocabulary words: **cellular respiration, aerobic, anaerobic (fermentation), glycolysis, pyruvic acid, citric acid cycle, electron transport chain, lactic acid fermentation, alcoholic fermentation, mitochondria, and consumers**.

How do consumers and producers convert chemical energy into ATP?

Supplemental Document 2

Statue of Liberty Investigation

Introduction

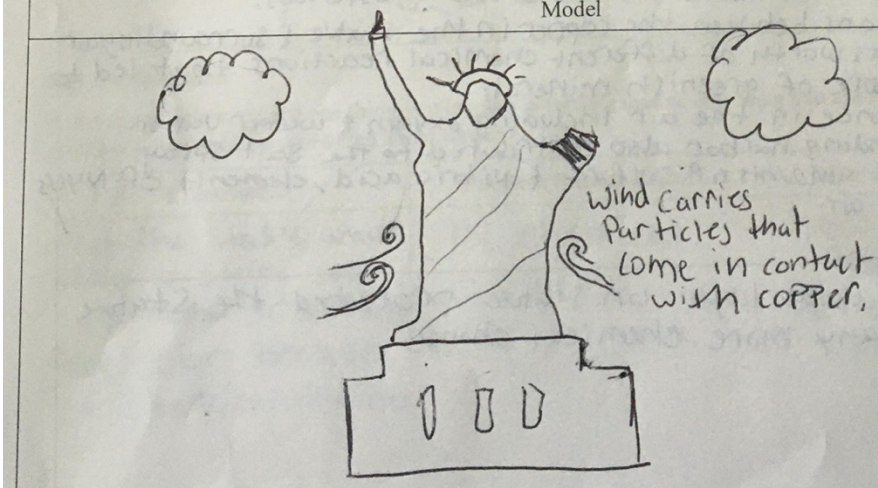
When the Statue of Liberty was first placed in New York Harbor, it was a bright copper color. This is in stark contrast with the green statue we know today. What happened to the statue that turned it from brown to green? View the before and after images of the statue and record some questions you have, along with some possible explanations of what may have caused the color change.

Initial Observations and Questions

Questions	Possible Explanations
• How long did it take for the statue of Liberty to be fully green & why?	• 15 year b/c of the weather.
• what is the full explanation as to why the statue turned green?	• copper came into contact with oxygen

Initial Model

Based on your initial understanding, draw and label a simple model on the large poster paper that shows how the statue turned from brown to green. You may use colored pencils/markers to make your model as realistic as possible. Include some explanatory text along with your drawing. Be prepared to share your model with the class. Transfer your model to the space below as well.

Model


Guided Reading

With your group, read your assigned text excerpt and answer the guiding questions. Be prepared to share your responses with the whole class.

Supplemental document 3

<u>Phenomenon</u>: A peppermint candy dissolves more quickly in hot water than cold water.

1. Answer the following based on your observations watching the video of the peppermint candy in different water:

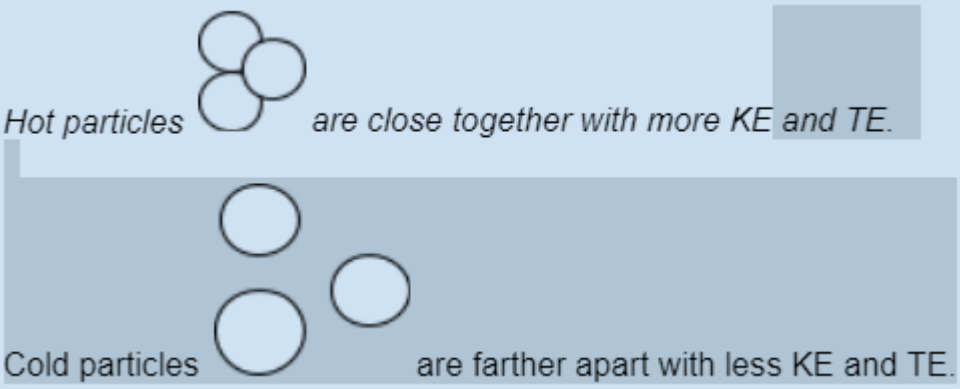
How is hot water different from cold water? (think about the particles too!)

Hot Water	Cold Water
-particles have more KE -particles are far apart -particles have more TE -we know that hot air is less dense	-particles have less KE -particles are close together -particles have less TE -we know that cold air is more dense

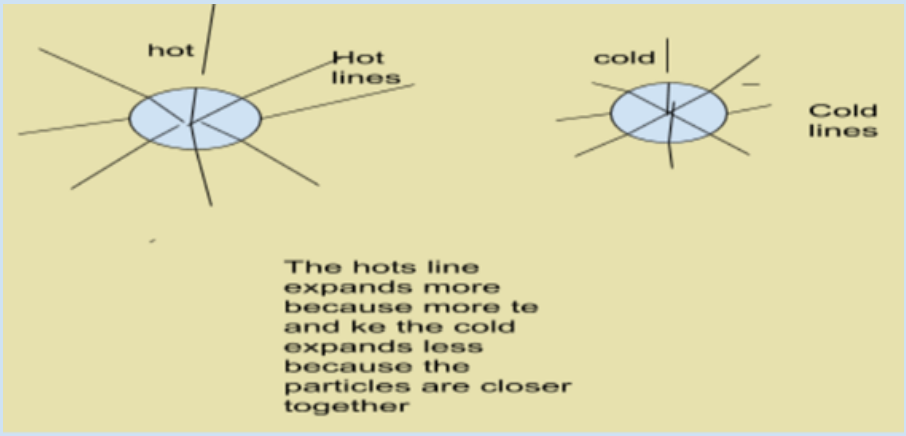
Initial Model and Explanation

2. Create an initial model and explanation to show how hot and cold water particles are different. Remember to include pictures and words in your model and use your answers from questions 1 and 2 to help you. Don't worry about being "correct", just add as much detail to your drawing and label as much as possible.

Initial model from student #1



Initial model from student #2



Supplemental document 3

Initial model from student #3

Hot and cold water particles are really different from each other. Like if i was to talk about how they act in hot water the particles are more so far apart from

each other, but in cold water they are close together.

But there dense,TE,KE, and moment is way different from each other.

Initial Model from student #4

3. **Investigation #1: Follow this link to the simulation.** Investigate how the particles in hot and cold water behave. How are hot water and cold water particles different?

Particles in Hotter Water	Particles in Colder Water
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Supplemental document 3

Investigation #2: "James Joule's Experiment" and "What is Thermal Energy?"

Directions: Using what you have read in the two articles, your discussion board post and your multiple-choice questions, answer the following summary questions.

4. How are the characteristics (energy, spacing, movement, etc.) of particles in hot soup different from the particles in an iceberg?

5. The article discusses an iceberg and a hot bowl of soup. Justify why the iceberg has more thermal energy than the hot soup.

Final Model and CER

6. Let's create a FINAL model to show how hot and cold water particles are different. Remember to include pictures and words in your model.

7. Write a scientific argument using the graphic organizer below.

Prompt/Question: Use what we have learned about the phenomenon to answer the following: *Chris and Sara are learning about particles in an 8th grade science class.* ● *Sara says, "The particles in a hot object behave the same as particles in a colder object. The particles all have the same characteristics"* ● *Chris replies, "I disagree. Particles in a hotter object behave differently than particles in a colder object. The particles do not have the same characteristics."* **Which student, Sara or Chris, is correct about particles? Support your claim with evidence and reasoning from the videos, reading, simulation, and class notes.**
CLAIM: (Write in a complete sentence stating which student is correct.)
EVIDENCE: (What did you observe happen in the candy video, food coloring video, and the simulation? Remember you have notes that you can look at to help you, as well as our discussions.)
REASONING: (Connect your evidence to the particle model. Be sure to explain how particles in a hot object are different from particles in a colder object.)

Supplemental document 4

	1. What did we do?	2. What did we see?	3. What have we figured out? What do your observations mean?	4. How does what we learned help explain the lesson phenomenon?	5. What questions have we answered? What new questions do you have?
Investigation 1: Touching	Particle model, observed ice melting on different surfaces, spoke about why different materials/surfaces feel different temperatures, investigated difference between temperature, touch and TE	all of the objects in the room are not the same temp. because they are different, when objects are cold the particles are close together the particles are aranged differently in sgl	the ice melted fastest on metal because science, ke/te changes with temp. in the particle model,	ice melts quicker on metal than wood we learned that metal changes to room temp. because of thermal equlilbirum	
Investigation 2: Mixing	Watched ice melt in hot water, mixed different amounts of hot and cold water, practiced TE transfer, defined temperature and thermal equilibrum	ice melted in hot water and hot water took over	that hot water has more te than the ice and ice can be beat	the ice needs different temps. to melt and different temps. to freeze	Answered: the ice how long it takes to melt and what it looks like, new Q: what temp. does it take to just completeley discinagrate?
Investigation 3: Conductors and Insulators	Watched wax melt off of different solid metal rods, defined thermal conductor and thermal insulator, watched wax melt off of different hollow metal rods, defined conduction, convection, and radiation	whatched wax melt and see witch was the fastest	that aluminum was the fastes coonductor and steel was the best insulator	the metals need diferent or more cold metals just like aluminum.	Answered: the ice how long it takes to melt on certain metals and whitch one is fastest.
	LESSON PHENOMENON: Ice melts at different rates on different surfaces.				
	PHENOMENON QUESTION: How can we design a device that minimizes the transfer of thermal energy?				

Innovations Supplemental Document 5

Lesson 1	**Earth's Rotation and Revolution** Phenomenon: The sun appears to move across the sky during the day, and stars appear to move across the sky during the night. Phenomenon Question: What causes the patterns of movement of the Sun and the stars across the sky?		
	What students do	**What students learn**	**How it relates to the phenomenon**
Investigation 1	Developing a model using their bodies of Earth's rotation to show cause and effect relations between Earth's rotation and cycles of day and night.	Counterclockwise rotation of Earth, which explains: • Why Sun rises in the East and sets in the West • What hours of the day and one week looks like • Which part of the Earth is experiencing day and which part is experiencing night	Rotation and patterns of day and night helps explain day-night cycles on Earth. Earth and Moon are the object in the solar system that is moving, not the Sun, in reference to one another.
Investigation 2	Develop a model using their bodies to model day and night, observing which constellations would be visible at certain time Then, model one revolution (Earth year), note different constellations at different times of the year	As Earth revolves around the Sun, different constellations are visible in the night sky Seasonal patterns of constellations visible in the night sky as a result of the revolution of Earth around the Sun Day-night patterns of constellations and Sun visible in the sky as a result of rotation of Earth on its axis	The rotation on its axis explains why constellations are seen only at night and revolution around the Sun helps explain why different constellations are visible in certain seasons.
Investigation 3	Use a model of Earth to show how as Earth revolves it is always pointed towards Polaris (due to tilt)	Earth's axis is always pointed towards Polaris as Earth revolves around the Sun; as a result, Polaris is always visible in the night sky Polaris is only visible in the Northern Hemisphere, not the Southern Hemisphere	Polaris is always visible in the night sky from any point in the northern hemisphere regardless of season because of the Earth's tilt on its axis is always tilted towards Polaris