Proposing a "Fat Tax": Energy Cycling, Food, and Public Health

This unit is designed to help students construct understanding of the scientific concepts of Photosynthesis and Cellular Respiration. Students will learn about these concepts in the context of a real-life policy issue: a proposed government-enacted tax on foods considered to contribute to obesity and its related health concerns.

Unit Plan & Sequence of Lessons **based upon a block schedule of 85-90 minutes per period.*

Sequence	**(Min)**	**Instructional Focus**	**Activities**	**Plan**	**Student Resources**	**Teacher Resources**
Day 1 Part 0	5	*To prepare for Day 7, Lesson 6, students will need advance notice to be able to complete this assignment*		Lesson one: Obesity and the Fat Tax	Student Handout: Energy Budget Pre-Lab	
Day 1 Part 1	15 +	Analyzing maps to identify changes and trends in obesity	Analysis Discussion		Youtube video: Obesity Trends Among U.S. Adults Between 1985 and 2010	Weblink: Maps of Obesity Trends Among U.S. Adults Between 1985 and 2010
Day 1 Part 2	20 +	Research the effects of Taxes and Bans on behavior	Research Argumentation Discussion Summarization Presentation -- (Informal)		Student Handout: Taxes and Bans:	Teacher Resource: Taxes and Bans
Day 1 Part 3	15 +	Introduction to the concept of a fat tax to affect the obesity epidemic	Reading		Weblink: Would a Fat Tax Save Lives?	
Day 1 Part 4	30+	Explore different resources to research the effectiveness of a fat tax on unhealthy foods	Evaluation Research Collaboration Discussion Summarization Argumentation Presentation		Student Handout: Fat Tax Resources and Questions Student Handout: Knowing Your Sources	
Day 2 Part 1	30+	Finish the Fat Tax research and questions activity from the day before (as well as the know your sources activity)			See Day 1 Part 4	

Day 2 Part 2	60 +	Create a timeline of the USDA guidelines.	Assessment Data Interpretation, Simulation Communication Collaboration	Lesson two: Food Timeline	Student Handout: Food Timeline	Teacher Resource: Food Timeline
Day 3 Part 1	90+	Create timeline of major food events globally. Assess the events from different perspectives.	Argumentation Assessment, Data Analysis Data Interpretation Discussion Communication Collaboration			
Day 4 Part 1 *Ask students to bring a food package with the nutrition label on it for the next class.	90 +	Watch a debate over the role of the government in public health. Discuss the role with examples from program.	Argumentation Evaluation Discussion Communication Communication	Lesson three: Is Obesity the Government's Business?		Video: *Intelligence Squared: Obesity the Government's Business*
Day 5 Part 1	45 +	Students use a website, which explains the four primary macromolecules, to answer questions.	Reading Communication Interpretation Summarization	Lesson four: Macro-molecules	Student Handout: Macromolecule Web Activity Macromolecule website & internet access	
Day 5 Part 2	40 +	Students will formulate a working definition of "healthy food" then analyze a food label to see if it fits the definition.	Reading Data Interpretation Analysis Evaluation Communication		Student Handout: Nutrition Analysis Lab *(& student-provided: food package with nutrition label)*	
Day 6 *Remind students to bring their food logs to the next class.	85 +	Students will apply their understanding of macromolecules to a series of case studies about diets to determine if they are healthy or not.	Communication Reading Data interpretation Analysis Evaluation Summarization	Lesson five: Macro-molecule Case Study	Student Handout: *"Atkins or Fadkins?"*	
Day 7 Part 1	85 + min in	Students will log their food intake	Data Interpretation	Lesson Six:	Students' Personal Food Logs from	PhET Virtual Lab

	class.	and activities for one week, then use data in a virtual lab to assess and predict health. They will then design a plan to promote a healthy lifestyle.	Analysis Evaluation Summarization Communication Planning Computation	Energy Budgets and the Fat Tax	myfitnesspal.com Student Handout: Energy Budget Virtual Lab Student Handout: Energy Budget Assignment	Teacher Resource: Energy Budget Virtual Lab
Day 8 Part 1	20 +	By watching an Amoeba Sisters Edpuzzle and filling in notes with lecture from teacher--students will gain a basic understanding of Cellular Respiration	Listening Communication Questioning Summarization	Lesson Seven: Cellular Respira-tion and the Fat Tax		Weblink: Amoeba Sisters Edpuzzle Video
Day 8 Part 2	65 +	Armed with a basic understanding of Cellular Respiration the students will test the effects of exercise on cellular respiration	Data Interpretation Analysis Communication Computation Application		Student Handout: Respiration and Homeostasis Lab	
Day 9 Part 1	10 +	Students will demonstrate their understanding of the connection between cellular respiration and the fat tax	Application Communication Synthesis			
Day 9 Part 2	20 +	Teacher will use Amoeba Sisters video to lecture about the process of photosynthesis (teachers will need to make their own Edpuzzle).	Listening Communication Questioning Summarization	Lesson Eight: Photosyn-thesis and the Fat Tax		Amoeba Sisters – Photosynthesis Video
Day 9 Part 3	55 +	Students will explore the ingredients for photosynthesis and to see how they can each limit how much glucose is produced	Data collection Data interpretation Analysis Summarization Reading Communication			Teacher Resource: Photosynthesis Lab Stations

Day 10 Part 4	70 +	Students will illustrate their understanding of photosynthesis and limiting factors by creating a model of photosynthesis.	Synthesis Application Summarization Communication			Teacher Resource: Modeling Photosynthesis
Day 10 Part 5	15 +	Students will share their models with another group and get feedback.	Evaluation Analysis Communication			
Day 11 Part 1	10 +	Students view a video summary about how food, photosynthesis and cellular respiration are related.	Listening Synthesis	Lesson Nine: Photosynthesis, Cell Respiration, and Food		Photosynthesis and Food video (4 min)
Day 11 Part 2 & Day 12	70+ 85+	Students will predict how various factors affect the rate of photosynthesis, and design and conduct a virtual experiment to test their predictions.	Synthesis Application Communication Writing Data collection Data Interpretation Analysis Computation		Student Handout: Designing an Experiment – Limiting Factors of PS & CR Student Handout: Limiting Factors of PS & CR Virtual Lab	Virtual lab site Teacher Resource: Lab Report Rubric
Day 13	60+	Students will watch the "Globesity" video and consider the nature of the obesity epidemic as extending globally, beyond the U.S., and to again consider connections between food and health.	Discussion Synthesizing Evaluating	Lesson Ten: Putting it All Together	Globesity Video Globesity Student Handout (one per student; fill out while watching)	Globesity Video, internet access to stream, screen & projector or other means of viewing Globesity discussion questions (teacher facilitates discussion, before and after viewing video)
Day 14	90+	Students will demonstrate an understanding of the obesity epidemic in the United States and to formulate a plan for dealing with the epidemic from the viewpoint of the government, a	Planning Argumentation Discussing Communication		Obesity policy statement assignment	Obesity policy statement assignment

		corporation, or a Non-governmental Organization				
Day 16 Part 1	90 +	Students will create a logo and slogan to support their policy statement--They will present all three in a short informal presentation	Design Application Synthesis Communication		Website to demonstrate how to create an effective logo and slogan	Website to demonstrate how to create an effective logo and slogan

Lesson Plan 1: Obesity and the Fat Tax

Time: 1 class period/90 min

Goals for the lesson:

1. Explore the focal issue for the unit: trends in obesity rates in the U.S., and the proposal of a "fat tax" to address related public health concerns.
2. Identify economic and political dimensions of a proposed fat tax as a response to trends in obesity rates.
3. Articulate an initial position on the issue of a fat tax to address public health.
4. Evaluate the quality of various internet sources.

Lesson assessments:

- Formative assessment throughout
- Fat Tax Resources activity
- Initial Position Statement

Resources:

- Student Handout: Energy Budget Pre-Lab
- Obesity Trends Among U.S. Adults Between 1985 and 2010 http://antranik.org/obesity-trends-among-u-s-adults-between-1985-and-2010/
- (Optional) YouTube Video Explanation of Obesity Trends Among U.S. Adults Between 1985 and 2010 https://www.youtube.com/watch?v=s3hzwZ7WZRA
- Teacher Resource: Taxes and Bans
- Student Handout: Taxes and Bans
- Would a Fat Tax Save Lives? http://money.howstuffworks.com/fat-tax.htm
- Student Handout: Fat Tax Resources (includes multiple weblinks)
- Student Handout: Knowing Your Sources

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
Present Energy Budget Pre-Lab. Distribute handout and demonstrate how to use my fitness pal to record food and drink intake. Students will need to keep a daily log for 7 days, for use in the Energy Budget Lab in Lesson 6.	• Ensure pre-lab directions are clear	Student Handout: Energy Budget Pre-Lab
Facilitate exploration of U.S. obesity data. • Show students maps of the changing obesity rates in the United states since 1990. • Ask students to write (on post it notes) trends	• Students study maps, looking for patterns and trends • Students write observations on post-it notes and send to teacher. • Students write ideas about possible reasons for the	Internet access with projector OR devices for individual or groups of students Link to Obesity Trends site (Optional) Link to

& patterns they notice in the data. Consolidate answers. ● Ask students to write (on post it notes) possible reasons for the trends & patterns they see. Consolidate answers. ● Ask students to share with shoulder partners questions they think of during the discussion, and to write them on post it notes. Consolidate answers.	patterns they see on post-it notes and send to teacher. ● Working in pairs, students write questions that pop into their head on post-it notes and send to teacher.	video of the maps with explanations Post-it notes Whiteboard to consolidate answers.
Lead students in exploring the idea of government-enacted policies, taxes or outright bans to affect a problem like obesity. ● Ask students to research different perspectives of taxes and bans put into effect by different governments. From their research students form a position statement.	● Student groups are assigned a tax or ban to investigate. ● Students consider one *dimension* (social, economic, political, or scientific) and explore this dimension of the tax or ban. Limit this step to 10-15 minutes. ● Students share what they learned and decide as a group whether to support or oppose the tax/ban and why. They should also address whether the tax/ban had the intended effect on the public's behavior.	Taxes and Bans: Teacher Resource Taxes and Bans: Student Handout
Teacher introduces the idea of a fat tax to help curb the obesity epidemic. ● Ask students to read the article *Would a Fat Tax Save Lives?* ● When they finish ask students what questions they have.	● Students read the article ● Share questions they have about the fat tax.	http://money.howstuffworks.com/fat-tax.htm
Teacher asks the students to explore the idea of a Fat Tax further.	● Students will work in small groups to examine various sources to gather	iPads or Chromebooks Fat Tax Resources

• Ask students to work in small groups to read and evaluate a variety of sources. The students will combine their new knowledge to answer the given questions as a group. • Exploring Complexity of a Fat Tax: facilitate students' exploration of the issue, its various dimensions, and the multiple perspectives held by various stakeholders • Ask students to write their initial position statement about a fat tax to address public health **If this portion of the lesson takes more time than you have available, you may choose to assign as homework or continue the next class period.*	information about the issues surrounding a fat tax proposal. Each student will be responsible for reading and evaluating two sources and answering all the questions. Students will collaborate with each other to come to a consensus for each question. • Students will investigate dimensions of the issue (economic, political, scientific, social) to identify perspectives of various stakeholders • Students will gather information and then share with groups at tables to complete the rest of the Fat Tax Resources and Questions Sheet • Students will articulate their first working opinion of the implementation of a fat tax.	and Questions sheet Knowing Your Resources Sheet

Lesson Plan 2: Timeline of Food Recommendations

Time: 2 class periods/150 min

Goals for the lesson:

- Introduce the idea that governments have been involved with food production and distribution for a long time.
- Explore different food movements and government regulations from around the world
- Have students learn more about the history of food regulation
- Explore various perspectives on these regulations

Lesson assessments:

- Brief position paper about fat tax and how the regulations and events presented in this lesson influence their position.

Resources:

- Student Handout: Food Timeline
- Teacher Resource: Food Timeline
- Green, blue, pink, red, orange, yellow and lavender sheets of paper for each group
- Large whiteboard for timeline

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
To guide the students as they create a timeline of major food events (both regulatory and otherwise).		
● Begin by having students research one of the incarnations of the USDA's regulations concerning healthy food.	● Students research one incarnations of the USDA's regulations concerning healthy food. They should summarize the goals of the regulations and evaluate resources.	Student instruction sheet Teacher instruction sheet
● Create a timeline on the whiteboard and guide the students as they look for trends in the regulation of healthy food. ● Discuss if the patterns and trends influence their position on the fat tax	● Students create a timeline of USDA recommendations, looking for patterns and trends in the recommendations ● Students comment on whether the trends and patterns influence their position on the fat tax.	Large whiteboard Green paper Tape Internet access, devices for small groups of students
● Have students	● Students create a timeline of	Same timeline as

research one major event that was influenced by or had an influence on food. They should divide their summaries into different perspectives	events related to or influenced by food and health. They look for patterns, trends, and relationships in the recommendations and events ● Students comment on whether the trends, patterns, and relationships influence their position on the fat tax.	above, various colors of paper, tape, internet access
● Ask students to write a brief position statement about how they feel about the fat tax and how the regulations and events featured in this lesson affected that position.	● Students write a brief position statement about how they feel about the fat tax and how the regulations and events featured in this lesson affected that position.	

Lesson Plan 3: Is Obesity the Government's Business?

Time: 1 class period/90 min

Goals for the lesson: Students will

- articulate pros and cons regarding the government's role in public health.
- express a position about the government's role in public health.
- gather additional evidence to support their position on the fat tax.

Lesson assessments:

- Position Statement on the government's role in public health.

Resources:

- Video: Intelligence Squared: Obesity Is the Government's Business https://www.intelligencesquaredus.org/debates/obesity-governments-business

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
*Ask students to bring a food package with a nutrition label for the next class		
Present the question: *What is the government's role/responsibility in promoting public health?*	Articulate and support a position on the government's role and responsibility in promoting public health	
• Play *Intelligence Squared: Obesity Is the Government's Business* • Ask the students to write arguments expressed for and against government involvement in the video..	• Watch *Intelligence Squared: Obesity the Government's Business* • Write down the arguments expressed for and against government involvement. • Make additional notes for arguments that influence you, including your reasons why.	Video: *Intelligence Squared: Obesity the Government's Business* Internet access, projector
• After the video, lead a whole class discussion about government's responsibility in public health. • Ask for examples of compelling arguments made by the debaters.	• Discuss the responsibility of the government concerning public health. • Share examples of when a debater made a particularly compelling argument and why that swayed your opinion on the topic.	
Ask students to write a brief position statement about how they feel about the role of government's involvement in public health. They should include both pros and cons as well as evidence and reasoning of their position.	Students write a brief position statement about how they feel about the government's involvement in public health, and include both pros and cons as well as evidence and reasoning of their position (claim).	

Lesson Plan 4: Macromolecules

Time: 1 class period/90 min

Goals for the lesson: Students will

- Describe the form and function of the macromolecules required for life
- Formulate a working definition of "healthy food"
- Analyze food labels for alignment with their definition of healthy food

Lesson assessments:

- Exit Pass: Nutrition Analysis Claim/Evidence/Reasoning

Resources:

- Macromolecules Weblink http://faculty.nl.edu/jste/biochem.htm
- Student Handout: Macromolecules of Life Web Activity
- Student Handout: Nutrition Analysis Lab

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
Part 1: Guide students as they learn about form and function of the macromolecules required for life: ● Guide students to log in to the macromolecule webquest website ● Have the students use the information presented in the website to answer the questions.	Part 1: Explore the macromolecule website and answer questions about the form and function of the four essential macromolecules for life.	Macromolecule website Student Handout Macromolecules of Life Web Activity
Part 2: Guide students to develop a working definition of "healthy food." They should be able to not only define, but also defend, this term. ● Guide students in analyzing the food label for pepperoni. ● Ask students to analyze the food label they brought using the same technique. ● Ask student to write an exit slip which makes the claim that the food they analyzed was healthy or not healthy. In addition to the claim they need to provide evidence from the analysis and reasoning which explains how the evidence supports their claim.	Part 2: Articulate a working definition of "healthy food," and use it to analyze various food selections. ● Use the consensus definition to practice analyzing the "healthiness" of pepperoni. ● Use the same procedure to analyze the food package they brought. ● Write an exit slip making a claim about whether the food they analyzed was healthy or not. Provide evidence from their analysis and reasoning which explains how the evidence supports their claim.	Student Handout: Nutrition Analysis Lab

Lesson Plan 5: Atkins or Fadkins? Macromolecule Case Study

Time: 1 class period/90 min

Goals for the lesson: Students will

- Apply their understanding of macromolecules to address real world diet questions in a set of case studies.
- Construct an argument for or against claims presented in the case studies.

Lesson assessments:

- "Atkins or Fadkins" Summary Essay

Resources:

- "Atkins or Fadkins PDF" by Karen E. Bledsoe

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
Assess students' understanding of macromolecules through their responses to case studies about dietary truths and myths. • Guide students in reading Parts I, II, & III of the *Atkins or Fadkins*? activity, and responding to the associated questions • Ask students to construct a summary argument, as outlined in Part IV of the activity.	Demonstrate understanding of macromolecules by applying the concepts to a series of case studies about dietary truths and myths. • Complete the PDF entitled *Adkins or Fadkins?* Write responses to all questions, and write a summary argument.	Student Handout: *Atkins or Fadkins?*

Lesson Plan 6: Energy Budgets and the Fat Tax

Time: 1 + class periods/90 min
*(*Note: This lesson requires students to collect 7 days' worth of food logs in advance. See Lesson 1 for more detail.)*

Goals for the lesson: Students will

- Describe the relationship between food intake and exercise output, in terms of an energy budget
- Calculate how macromolecule composition determines energy content of food, and how variations in macromolecule content of foods account for differences in energy content.
- Explain how a person's choices about what and how much to eat, and how much to exercise can lead to imbalances in the person's energy budget.
- Explain how imbalances between a person's energy intake and energy output can result in changes in the person's body weight.
- Design a lifestyle plan that addresses eating and activity choices to promote a healthy weight, and assess potential affects a fat tax could have on these plans.

Lesson assessments:

- Food consumption and exercise log.
- Using averages from food and exercise log--abbreviated lab write-up using PHeT virtual lab.
- Creation of a diet and exercise plan for one week to achieve a specific goal of weight loss, gain or maintenance.

Resources:

- Students' personal food logs from http://www.myfitnesspal.com/ or alternative app or website of choice; (these are student-created; see Lesson 1)
- Student Handout: Energy Budget Virtual Lab
  http://phet.colorado.edu/en/simulation/legacy/eating-and-exercise
- Teacher Resource: Energy Budget Virtual Lab
- Student Handout: Energy Budget Assignment

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
Part 1 Today's Food Log – direct students to: ● Create 2 lists of the foods they ate that day for breakfast, lunch, and snacks, grouped as "healthy" and "unhealthy." ● Write a short paragraph beneath their lists to explain their choices for the foods on each list. ● Discuss their lists and explanations with a small group. ● Share with the class the responses they found particularly interesting. Today's Activity Log – direct students to: ● Repeat the above steps for physical	Practice making quick assessments of their food and activity choices: ● Record their food intake and exercise output for the previous 12 hours. ● Classify as "healthy" vs. "unhealthy" or "exercise" vs. "not exercise".	

activities they have done in the last 12 hours, grouped into "exercise and "not exercise." ● Write a short explanation about what they believe constitutes exercise. ● Share their lists & explanation with their small group. ● Discuss with the class.	● Justify their classification choices. ● Discuss what they've written with small groups and whole class.	
Part 2: Virtual Lab Using their food log from the previous 7 days, and the Virtual Lab handout, ask students to complete the Energy Budget Lab. Guide them to: ● Open their myfitnesspal accounts and use the history feature to look at daily stats for their food and exercise, and use this information to complete the summary log. ● Open the virtual lab site from handouts: http://phet.colorado.edu/en/simulation/legacy/eating-and-exercise ● Match their calculated food and activities averages with foods and activities on the virtual lab, and run the simulator. ● Answer questions on the summary log. ● Try different scenarios, keeping a record of the variable that they change.	● Complete the Virtual Lab ● Analyze their personal average energy intake and average energy output. ● Determine how different food and activity choices can affect their energy budgets. ● Determine how different food and activity choices can affect their long-term body weight.	Access to Personal Food Log (from Lesson 1) Student Handout: Energy Budget Virtual Lab Device with internet access, PhET weblink Teacher Resource: Energy Budget Virtual Lab
Part 3: Energy Budget and the Fat Tax After completing the lab, ask students create a sustainable eating and activity plan to achieve or maintain a healthy weight. ● Distribute student handout and ensure students understand directions for the assignment.	● Create an eating and activity plan to achieve or maintain healthy weight. ● Assess potential impact of a fat tax on their personal plan	Student Handout: Energy Budget Assignment

Lesson Plan 7: Cellular Respiration and the Fat Tax

Time: 1 class period/85 min

Goals for the lesson: Students will

- Describe how mitochondria turn glucose into ATP in cells.
- Explain how ATP functions as an energy source for cells.
- Describe the relationship between activity and the rate of cellular respiration.
- Describe how our bodies adjust cellular processes to maintain equilibrium.
- Explain the connection between cellular respiration and a fat tax.

Lesson assessments:

- Cellular Respiration and Homeostasis lab

Resources:

- Amoeba Sisters – Cellular Respiration EdPuzzle Video: https://edpuzzle.com/media/5880ec8c76fd5a233d7e144d
- Student Handout: Cellular Respiration and Homeostasis Lab

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
Part 1: Introducing Cell Respiration • Present the Amoeba sisters EdPuzzle video on cellular respiration • Facilitate whole class discussion of responses to the EdPuzzle questions	• View the EdPuzzle cellular respiration video and participate in whole class discussion • Record responses to the questions in the EdPuzzle for reference	EdPuzzle Video: Amoeba Sisters – Cellular Respiration Web access with projector for whole class viewing
Part 2: Cellular Respiration Lab • Guide students as they prepare for, conduct, analyze, and report the cellular respiration lab • Facilitate sense-making and connections to food, energy, and weight.	Perform the respiration lab: • Write a problem statement or testable question, hypothesis • Create a data table, collect data, and record results • Analyze and report results	Student Handout: Cellular Respiration and Homeostasis Lab Supplies for Lab
Part 3: Ask students: How is cellular respiration relevant to the fat tax? Guide them in constructing explanations that include these 3 parts • A **claim** that asserts how the two ideas are related. • **Evidence** that specifically links the two (numeric works best) • **Reasoning** that requires the students to explain how the evidence supports their claim.	Construct a response to the prompt to explain a relationship between cellular respiration and the fat tax. Include **claim, evidence,** and **reasoning** in the explanation.	Students' notes from the Cellular Respiration video *(Student-created)*

*There may be more than one way they are related, so there may be more than one claim, evidence, and reasoning. Students should use their responses to the previous days' video to help them.		

Lesson Plan 8: Photosynthesis and the Fat Tax

Time: 2 class periods/180 min

Goals for the lesson: Students will

- Describe how carbon dioxide and water combine, in the presence of sunlight, to form glucose.
- Relate photosynthesis to cellular respiration a reverse processes of each other.
- Construct physical, pictorial, and chemical equation models of photosynthesis.
- Identify the type of cells and the cell structures in which photosynthesis occurs.

Lesson assessments:

- Brief writing on the connection between cellular respiration and the fat tax.
- Photosynthesis model

Resources:

- Amoeba Sisters – Photosynthesis Video https://www.youtube.com/watch?v=uixA8ZXx0KU
- Teacher Resource: Photosynthesis Lab Stations
- Teacher Resource: Modeling Photosynthesis
  *original activity located at https://www.calacademy.org/educators/lesson-plans/modelling-photosynthesis-and-cellular-respiration

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
Part 1: Intro to Photosynthesis • Explain that cellular respiration has a reverse process. • Help students predict this process (photosynthesis): and explain to them what it is, where it happens, why it is important, and which organisms do it (and how organisms that don't do it, get their glucose). **Create an EdPuzzle for this video in advance. Use the one from Lesson 7 as a guide.* • Present your Amoeba sisters EdPuzzle video on photosynthesis • Facilitate a whole class discussion of responses to the EdPuzzle questions	• Predict the reactants and products of the reverse process of cellular respiration, and identify significant features of this process. • View the EdPuzzle cellular respiration video and participate in whole class discussion • Record responses to the questions in the EdPuzzle for reference	EdPuzzle of Amoeba Sisters – Photosyn-thesis Video (*Teacher-created)* Web access with projector for whole class viewing
Part 2: Exploring Photosynthesis. Ask students to complete the photosynthesis lab stations. Students should explore and construct responses to the prompts at each station.	Explore the concept of photosynthesis by completing each of the stations in the photosynthesis activity and constructing responses to the associated prompts.	Teacher Resource: Photosynthesis Lab Stations

Part 3: Modeling Photosyn-thesis. • Distribute supplies for the modeling activity • Facilitate students' construction of physical models. • Ask them to construct a pictorial model of the same process, and then to represent it in the form of a chemical equation. • If time allows, ask students to use the same procedure to model cell respiration. Emphasize the relationship between the two processes. • To check for understanding, ask students to evaluate each other's models and provide feedback in a different color.	• Construct physical, pictorial, and mathematical models to explain the process of photosynthesis and the relationship between photosynthesis and cellular respiration • Use models to predict the outcome both cellular processes under various circumstances. • Evaluate classmates' models and provide feedback.	Teacher Resource: Modeling Photosyn-thesis Materials for Modeling Activity

Lesson Plan 9: Photosynthesis, Cell Respiration, and Food

Time: 2 class periods/180 min

Goals for the lesson: Students will

- Describe the relationships between the cellular processes of photosynthesis and cellular respiration, and human food consumption.
- Predict limiting factors in the processes of photosynthesis and cellular respiration.
- Design an experiment, collect and analyze data to test predictions about limiting factors in the processes of photosynthesis and cellular respiration.

Lesson assessments:

- Report of Limiting Factors Lab Results

Resources:

- Photosynthesis & Food video https://www.youtube.com/watch?v=eo5XndJaz-Y
- Student Handout: Designing an Experiment – Limiting Factors of Photosynthesis & Cellular Respiration
- Student Handout: Limiting Factors of Photosynthesis & Cell Respiration Virtual Lab
  http://www.classzone.com/cz/books/bio_07/resources/htmls/virtual_labs/virtualLabs.html
  Additional information @ http://ngss.nsta.org/Resource.aspx?ResourceID=480
- Teacher Resource: Lab Report Rubric

Instructional sequence:

Teacher Role	Student Role	Materials/Supplies
Part 1: Relationships among CR, PS, Food, & Energy • Play the video and ask students to discuss ideas about relationships among cell respiration, photo-synthesis, food, & energy	View video and consider: how are photosynthesis, cellular respiration, human food consumption, and energy related?	Photosynthesis and Food video Internet access with projector for whole class viewing
Part 2: Limiting Factors of Photosynthesis & Cell Respiration Lab. • Ask students to predict how various factors might affect these cell processes • Guide students in designing an experiment to test their predictions • Ask students to test predictions w/ virtual lab. • Students may write a report of results.	• Recalling previous lessons about cell respiration and photosynthesis, predict limiting factors (hint: use chemical equations and models to explain the processes and predict outcomes). • Test predictions about limiting factors of PS and CR using a "snails and elodea" virtual lab.	Student Handout: Designing an Experiment – Limiting Factors of Photosynthesis & Cellular Respiration Student Handout: Limiting Factors Virtual Lab Device(s) with internet access Lab Report Rubric (optional)

Lesson Plan 10: Putting It All Together

Time: 4 class periods/340 min

Goals for the lesson: Students will construct a policy statement that demonstrates their understanding of

- cellular energy
- relationships between food and cellular energy
- social issues affecting food availability
- relationships among malnutrition, obesity, and food availability as a public health issue

Lesson assessment:

- Presentation of a policy statement concerning the fat tax, with accompanying logo and slogan

Resources:

- Globesity video: https://topdocumentaryfilms.com/globesity-fats-new-frontier/
- Globesity Discussion Questions
- Globesity Student Handout
- Policy statement, logo, and slogan assignment
- Branding 101 (Logo Design Website): https://www.shoemoney.com/2014/07/30/branding-101-considerations-logo-design-slogan-writing/

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Instructional sequence:

Learning Activity		
Teacher Role	Student Role	Materials/Supplies
Part 1: Students watch Globesity documentary and write responses to handout questions as they watch. Discussion follows.	Watch Globesity video--answer questions and participate in discussion.	• Globesity Video • Globesity Discussion Q.s • Student Handout: Globesity Q.s
Part 2: Teacher assesses students understanding of the relationship between food and health via students' policy statements: • Ask students to write a policy statement expressing support or opposition of the idea a "fat tax" for health promotion. • Optional: Once the policy is written, students design a logo and a slogan to support their policy	Students write a policy statement supporting or opposing the fat tax, to demonstrate their understanding of: 1) the concept of cellular energy and its relationship to food 2) the concept of obesity as a public health issue 3) the social dimensions and considerations of a "fat tax" as a solution to the obesity epidemic Students create a logo and	• Student Handout: Obesity Policy Statement • Branding 101 website, web access for each student

position. They will present all three informally to the class.	slogan to promote their policy position, and then present their logo, slogan, and policy statement to the class.	