Animals Unit – Week 2

Name: _____ Hour_____Date: _____

Date Packet is due:_____ Why late? _____Score: _____
Day of Week Date If your project was late, describe why

Driving Question: What happens to food when it is consumed?

Anchoring Phenomenon: Last week we wondered why Olympic athletes must consume so much more food than usual. This week, we will address a similar question – what happens to the food that cattle consume as they grow from a small calf to a full-grown animal?

Deeper Questions

1. What happens to the atoms in molecules of food when it is consumed?
2. How is what an animal consumes or breathes in related to what an animal breathes out?
3. Is it possible for the atoms found in food to become a part of the atoms found in the organism that consumed that food?

Weekly Schedule

Part 1: Introduction
- Initial Ideas
- Data Dive – Cattle Diets
- Discussion & Developing Explanations

Part 2: Core Ideas
- Nutshell Video
- Core Ideas
- Revisions of Part 1 Explanations

Part 3: Investigation
- Mealworm Mass
- Revisions of Part 1 Explanations

Part 4: Review & Assessment
- Critiquing Ideas
- Assessment

Part 5: Life Connections
- Weekly Recap
- Life Connections
  - Option A: Interview an Expert
  - Option B: Life Connections

NGSS Standards:
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, & geosphere.

Semester Schedule

Matter & Energy
Week 1: What happens when something burns?
Week 2: What happens to molecules during burning?
Week 3: Unit Assessment

Animals
Week 1: What are animal cells and food made from?
Week 2: What happens to food when it is consumed?
Week 3: What happens inside animal cells?
Week 4: Unit Assessment

Plants
Week 1: What are plant cells made from?
Week 2: How do plants get their food?
Week 3: What happens inside plant cells?
Week 4: Unit Assessment

Ecosystems
Week 1: How do living organisms affect each other?
Week 2: Tracing Matter
Week 3: Global Biodiversity
Week 4: Humans & Biodiversity

Part 1: Introduction

Overview: In this activity, you will begin by recording your ideas about how animals grow and move. You will then work in teams to review data to identify patterns and trends. This will enable you to develop an initial explanation that you will revise over the course of this week. You will then conclude by comparing your observations and explanations to those of other groups to check your accuracy and make revisions.

Initial Ideas: When a calf is growing into a full-grown animal, it must consume large amounts of hay, grain, and other items. What happens to most of the food that a calf consumes?

1. **Decide whether you agree or disagree with each of the following.**
   A) "The calf's body will turn the mass of the food into energy in order to grow. AGREE/DISAGREE
   B) "The calf will turn most of the solid food it eats into gases that it breathes out." AGREE/DISAGREE
   C) "The calf's body will get rid of most of the mass of the food as waste (feces)." AGREE/DISAGREE

2. **Work in your small groups to discuss your ideas.** Try to identify how your ideas are similar or different. Then work as a team to decide as a group whether each statement is correct or incorrect (and why). Be prepared to present your ideas to the class.

Data Dive: In the image on the next page, you can see data showing the mass of carbon atoms that a calf will consume over 420 days as it grows into a full-grown animal. *Note: this image only shows the mass of carbon atoms; it does not include hydrogen, oxygen, and nitrogen atoms that are also found in the food*.

3. **Begin by individually attempting to make sense of this image**. What trends or patterns do you notice? How does this relate to any prior knowledge or experience that you have?

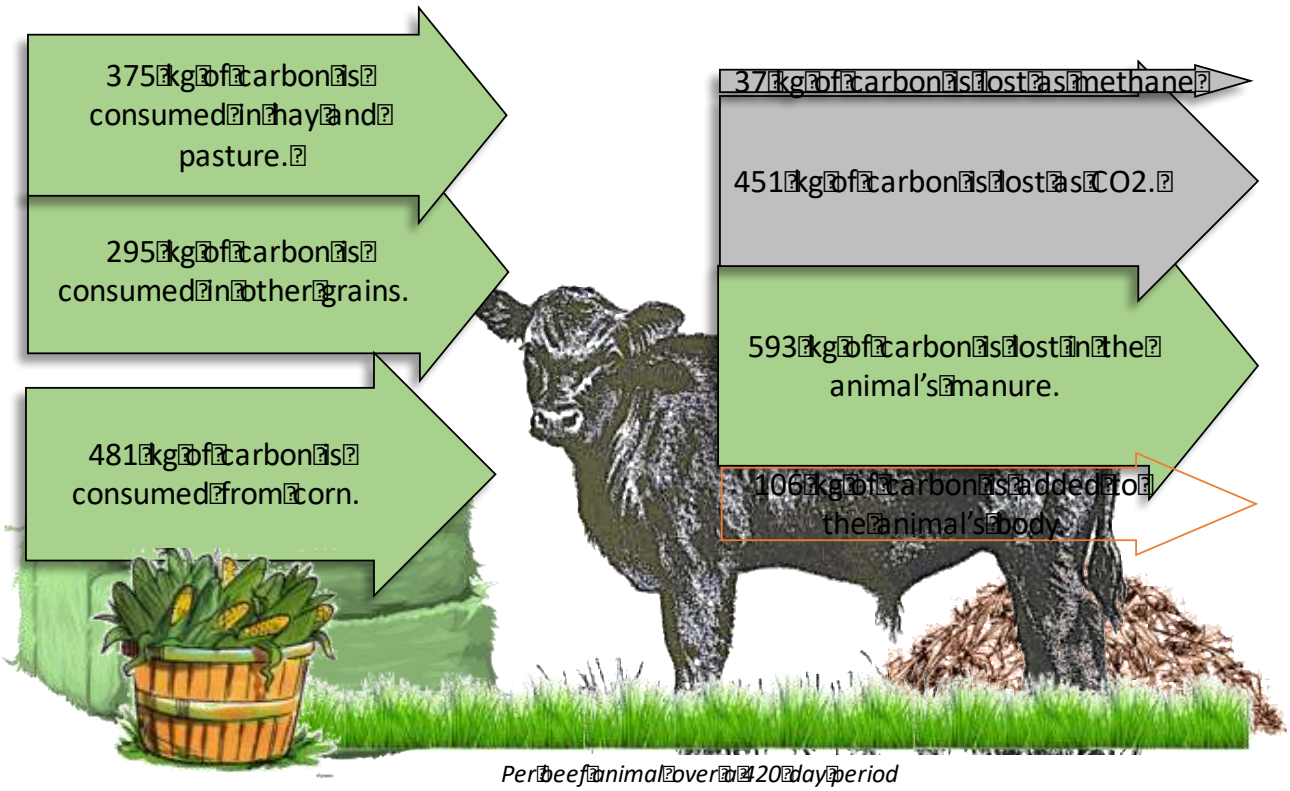
4. **Next, work in your teams to discuss your ideas**. Where do you agree? Where do you disagree? Can you use this data to reach agreement? Do others have prior knowledge/experience that could help?

5. **Based on this data, what is one conclusion that would be supported by this data?**
   a. How is this conclusion supported by this data?
   b. What specifically suggests that your claim is accurate?

6. **Based on this data, what is a second conclusion that would be supported by this data?**
   a. How is this conclusion supported by this data?
   b. What specifically suggests that your claim is accurate?

7. **Would you change any of your responses to the first question above?** (See Question #1 under *Initial Ideas*). Discuss as a team.

Be prepared to discuss your ideas with other groups and/or as a class.



Per beef animal over the 420 day period

Discussion & Developing Ideas

8. As a class, discuss your ideas about what happens to the food that a calf consumes. What are ideas that most agreed on? Where did your ideas differ as a class? Based on your instructor's directions, use the space below or another option (e.g., whiteboard, online document, etc.) to record your ideas.

We all agree that…	We disagreed about…

9. **What happens to the food that a calf consumes in order to grow and move**? Write down your initial explanation in the space below. Don't worry if you aren't completely sure about your answer! You will come back and revise this explanation as you gain more information during this unit.

I think that when a calf consumes food… _____

_____

_____

Part 2: Core Ideas

Overview: In this activity, you will begin by watching a short video. This will help to clarify some of the questions you may have had yesterday.

Next, you will look at a short slideshow presentation. This will provide you with core ideas that will help you clarify your initial ideas. Your instructor will decide on how to implement this portion depending on your previous experience and capabilities with this content.

You will then work in small teams to answer the questions listed below. You should take notes in a notebook, on a dry erase board, or on scratch paper so that you are prepared to deliver your responses during the class discussion that will follow. *Note: your instructor may assign specific questions to your group if time is limited.*

Core Ideas Presentation: https://bit.ly/WUHS-Bio-Animals-W2

Driving Questions:

1. What first happens to food in the digestive tract after it is consumed? How does this occur?
2. What are the two primary purposes that food serves when it is consumed?
3. Most of the time, consumed food is used for what?
4. What happens to the energy found in the high energy bonds (C-C, C-H) in food when digested?
5. Corn is mostly comprised of carbohydrate macromolecules. What does this mean?
6. A cell can rearrange the atoms in glucose and oxygen to form what molecules?
7. How are the carbon dioxide (CO_2) and water (H_2O) molecules that an organism breathes out related to the molecules in the food and oxygen that it consumes?
8. About 90% of consumed food is utilized for its energy. How do cells use the remaining 10%?
9. What happens to the energy in the high energy bonds in food when it is used to create and maintain the animal's cells?

Revising Explanations: Return to your original explanation that you created at the end of Part 1. Based on this new information, how would you now respond to this question?

I think that when a calf consumes food… _____

_____

_____

Remember the following "rules" for energy and matter:

- **All solids, liquids, and gases are made of tiny particles called atoms**. Multiple atoms can bond together to form molecules (*e.g., water molecules consist of 1 oxygen atom & 2 hydrogen atoms*).
- In biology, **atoms last forever**. Atoms cannot be created or destroyed (*e.g., a carbon atom is always a carbon atom*). Atoms found on molecules can be rearranged to form new molecules.
- In biology, **energy lasts forever**. Energy cannot be created or destroyed. Energy can exist as light, heat, motion, or as chemical energy stored in the bonds of molecules. Energy in one form can be transferred into a different form (*e.g., light energy can be transformed into heat energy*).

Part 3: Investigation: Mealworm Mass

Overview: In this activity, you will be recording data about how mass changes and how BTB changes when mealworms move, eat, and grow. While we are focusing on how cattle use the food they consume to grow and move, it is not feasible to study cattle in our classroom. As such, we will use mealworms as a substitute. In science, we refer to this as a "model organism", or an organism that is widely studied because it is easy to maintain in a laboratory setting but can still provide valuable insights.

Overview Video: https://www.youtube.com/watch?v=vL_9cs7nTRI

Directions: Begin by answering the pre-investigation questions below. Then use the instructions on the following page to complete the investigation. Conclude by answering the post-investigation questions on this page. (*Note: your instructor may ask you to record your answers to questions using a different format, such as a whiteboard or online document*).

Pre-Investigation Questions: Answer these questions individually and in small groups before completing the investigation using the space provided.

1. What do you think will happen to the mass of the potato as it is consumed by mealworms? Why?

2. What do you think will happen to the mass of the mealworms as they consume the potato? Why?

3. Do you think that overall change in mass of the potato will be a) greater than, b) less than, or c) the same as the change in mass to the mealworms? Why?

4. How do you think energy will be transformed as the mealworms consume the potato?

5. What do you think will happen to the BTB in your container as the mealworms consume the potato?

Remember the following "rules" for energy and matter:

- **All solids, liquids, and gases are made of tiny particles called atoms**. Multiple atoms can bond together to form molecules (*e.g., water molecules consist of 1 oxygen atom & 2 hydrogen atoms*).
- In biology, **atoms last forever**. Atoms cannot be created or destroyed (*e.g., a carbon atom is always a carbon atom*). Atoms found on molecules can be rearranged to form new molecules.
- In biology, **energy lasts forever**. Energy cannot be created or destroyed. Energy can exist as light, heat, motion, or as chemical energy stored in the bonds of molecules. Energy in one form can be transferred into a different form (*e.g., light energy can be transformed into heat energy*).

Investigation Directions:

1. Get a small container for your mealworms during the investigation.
    a. Make sure the container is deep enough for mealworms to not crawl out, or has holes in the lid for ventilation so your mealworms have air.

2. If your mealworms are already in their meal bedding and container, you will need to separate the mealworms from the bedding. Using the end of a pencil, separate all the worms from the meal. If your worms come already separated from bedding, skip this step.

3. Place an empty small container onto the digital balance and "zero" out the scale. Then gently pour about 15 g of mealworms into this container. Record this data below:

    Initial Mass of the Mealworms: _____g

4. Cut a small piece off of the potato (about 10g) and place on the scale. Record this data below:

    Initial Mass of the Potato: _____g

5. Place the piece of potato that you massed into the container with worms.

6. Place the small container with the worms and food into a large disposable plastic container.

7. Measure the mass of the entire container with all of its contents. Record this data below:

    Initial Mass of Whole Container: _____g

8. Place a petri dish with about 25 ml of blue BTB into the large disposable plastic container near the container with the mealworms. Record the color of the BTB in the space below

    Initial Color of BTB: _____

9. Seal the large disposable plastic container. Move the container to the space that your instructor has provided.

Post- Investigation Questions: Answer these questions after completing your investigation.

1. What was the final mass of the potato after it was consumed by mealworms? _____g

   How much mass did the potato lose? _____g Does this agree with your predictions?_____

2. What was the final mass of the mealworms? _____g

   How much mass did the worms gain? _____g Does this agree with your predictions?_____

3. Was the change in mass of the mealworms greater, less, or the same as the potatoes? _____
   In other words, did the potato lose the same amount of mass as the worms gained?

   Why do you think this happened?_____

   _____

4. How do you think energy was transformed as the mealworms consumed the potato?

   _____

5. How did the BTB change during the investigation? _____

   What does this indicate?_____

   _____

6. Create a bar graph based on the changes in mass of the potato and worms using the space below.

Be prepared to discuss the following questions in your groups and as a class:

1) How did the results vary from group to group? Did everyone obtain similar results?

2) What patterns do you notice in the data? What do these patterns indicate?

3) How do our findings relate to our Core Ideas for this week?

4) What questions do we still have?

Part 4: Review & Assessment

Overview: you will begin by reviewing the driving questions below in your small groups. For each objective, rank it as a 1 (*completely unsure*), 2 (*somewhat unsure*), or 3 (*completely sure*) based on your comfort with that objective. Then work in teams to create responses to the questions (your instructor will determine if you will answer all the questions or only a portion).

After you have had time to create your responses, you will critique the responses of another group before coming together as a whole class. Be sure to use the "rules" for matter and energy as you do so. You will conclude by completing an assessment for this week's ideas.

Driving Questions

1. What first happens to food in the digestive tract after it is consumed? How does this occur?
2. What are the two primary purposes that food serves when it is consumed?
3. Most of the time, consumed food is used for what?
4. What happens to the energy found in the high energy bonds (C-C, C-H) in food when digested?
5. Corn is mostly comprised of carbohydrate macromolecules. What does this mean?
6. A cell can rearrange the atoms in glucose and oxygen to form what molecules?
7. How are the carbon dioxide (CO_2) and water (H_2O) molecules that an organism breathes out related to the molecules in the food and oxygen that it consumes?
8. About 90% of consumed food is utilized for its energy. How do cells use the remaining 10%?
9. What happens to the energy in the high energy bonds in food when it is used to create and maintain the animal's cells?
10. **What happens to the food that a calf consumes in order to grow and move**? Write down your revised explanation in the space below. After doing so, see how it compares to your original response in Part 1.

    I think that when a calf consumes food… _____

    _____

    _____

Remember the following "rules" for energy and matter:

- **All solids, liquids, and gases are made of tiny particles called atoms**. Multiple atoms can bond together to form molecules (*e.g., water molecules consist of 1 oxygen atom & 2 hydrogen atoms*).
- In biology, **atoms last forever**. Atoms cannot be created or destroyed (*e.g., a carbon atom is always a carbon atom*). Atoms found on molecules can be rearranged to form new molecules.
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Part 5: Life Connections

Overview: For this activity, you will begin with a recap of the things that you learned in this packet. You will then take part in one of two activities. If possible, you will interview a local professional whose work involves the ideas we discussed this week. If this is not possible you will take part in a separate activity. If time is limited, your instructor may decide to postpone some of these options.

Weekly Recap (use a whiteboard, scratch paper, online document, etc.)

1. Summarize everything that you have learned through this packet within your group. Try to identify the common themes, major ideas, and most important concepts from the content you have learned.
2. Is there anything that anyone still doesn't completely understand? Is there anything that anyone maybe disputes or disagrees with? Did anything seem particularly surprising or noteworthy?
3. What you think are the most important ideas and concepts that you have learned so far. Aim to have at least 5 or 6 ideas written down. It is ok to have more than this.

Option A: Interview an Expert: In this activity, you will have an opportunity to interview an individual with professional expertise in this week's content topics. This activity will be reflective of *social science* research, or gathering, analyzing and interpreting information about human interactions. Often this work is conducted using *qualitative interviews*, which are interviews designed for research and data collection.

This activity will be divided into three parts:

1. **Part 1 – Planning**: After your instructor describes today's guest speaker, your group will identify your research question, which should pertain to the topics covered in class this week. Your instructor may ask your group to share your research question and interview questions prior to the interview and make sure that a variety of questions are ready.
2. **Part 2 – Interview**: Your instructor will facilitate the interview. Your group should record fields notes during this time that you will use at the end of the hour to address your research question.
3. **Part 3 – Analysis & Debrief**: You will be provided with some time to consider the responses that they receive and reach a tentative conclusion about their research question based on this data.

Part 1 - Planning:

1. Briefly summarize the topics that were covered in class this week in one sentence: *This week in class, we studied* _____

2. As a group, discuss what questions you still have about this week's topics. Ideally, use some of the following to start your questions: *Who, What, When, Where, Why, How*

   1. _____

   2. _____

   3. _____

   Once you have developed three questions, ask for your instructor to provide you with some feedback.

3. From this list, choose a research question for your group and complete the prompt below:

   Research Question: *We are unsure* _____

   _____

4. Turn your research question into a hypothesis. What do you think is the answer to your research question given what you currently know?

   We hypothesize that _____

   _____

5. Create three interview questions that you could ask this individual that may provide information related to your research question. Try to focus on their particular area of expertise as you craft your questions.

   1. _____

   2. _____

   3. _____

6. Be prepared to briefly describe your research question and hypothesis, and how your interview questions will provide you with information that will help to address your research question.

Part 2 – Interview Field Notes

Use the space below to record some field notes as the guest speaker presents to the class. Record anything that you hear or observe that might be relevant to your research question. Note: you should also consider recording the guest speaker's responses to other group's questions if they are relevant to your own research question.

_____

_____

_____

_____

_____

_____

_____

Part 3 – Analysis & Debrief *(your instructor may choose to use oral responses as well as or instead of written)*

What are your conclusions based on the guest speaker's responses? Answer the questions below.

1. Does your data (your observations and field notes from this interview) support or refute your hypothesis? Circle one: *Supports it* / *Refutes it* / *Not sure*

   Explain: _____

   _____

   _____

2. If you were to continue this work, what kinds of investigations would you do next? Describe a potential research experiment that would be a suitable follow-up for today.

   _____

   _____

   _____

Option B: Life Connections: In this activity, students will break into teams based on their personal interests and/or career aspirations. They will then work in their assigned teams to address the questions below. After a sufficient amount of time, students will summarize their discussions for the class.

1. As a group, try to determine how these ideas relate decisions you will make in your future life. Specifically…
   a. How do these concepts relate to prior knowledge experiences from your life?
   b. How could your prior knowledge and experience help you to better understand these concepts?
   c. How might your daily activities in your life be affected by these concepts?
   d. How might the decisions you make as part of your career be influenced by these ideas?

2. As you listen to the ideas presented by other groups, listen for any ideas you might have missed that might be relevant to your life.

Animals Unit, Week 2 Assessment

Name: _____ Hour_____ Date:_____ Score:_____ /___

Directions: A 3x5 notecard with *handwritten* notes can be used to guide your answers.

Background: A class was interested in how animals grow. The teacher started the lesson by telling his students that a cricket eats a lot of food each week but only gains a little bit of weight. The teacher asked, "What happened to the mass of the rest of the food?" Three students shared their ideas about what happened.

1. **Do you agree or disagree with what each student claims? Circle "Agree" or "Disagree" for each of the three claims below.**

a) Daryll: "The cricket's body turned the mass of the food into energy in order to grow." Agree / Disagree

b) Marisol: "The cricket breathed out most of the extra mass of the food as gases, like CO2." Agree / Disagree

c) Bai: "The cricket got rid of most of the extra mass of the food as solid waste (feces)." Agree / Disagree

2. **Provide an explanation. Why did you agree or disagree with each student's claim?**

a) _____

b) _____

c) _____

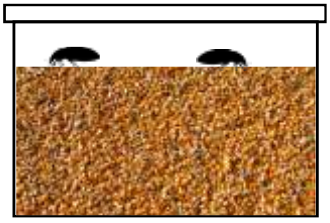
The class generated some data. They measured the starting mass of 5 crickets and put each cricket in its own container. Then they gave each cricket 3 grams of food and made sure the crickets always had the same amount of water. After one week, the students measured the mass of the cricket, leftover food and cricket feces. Below are the data they generated.

Sample	Increase in cricket mass (g)	Decrease in mass of food (g)	Mass of solid waste (g)
1	+0.2	-2.0	+0.4
2	+0.2	-2.1	+0.5
3	+0.3	-2.3	+0.5
4	+0.1	-1.9	+0.4
5	+0.4	-2.3	+0.7
Average	**+0.3**	**-2.1**	**+0.5**

3. **Which claim is best supported by this data?**
   a. Daryll's claim b. Marisol's claim c. Bai's claim

4. **Explain how the patterns in the data support the claim that you chose for the previous question.**

5. **A pheasant farmer stores corn in a sealed container. Some bugs get into this container and eat the corn. The farmer decides that this is not problem because the matter and energy in the corn the bugs eat will stay inside the bugs. When the pheasants eat the bugs, they will obtain whatever matter and energy the bugs consumed. Is this accurate? Explain.**



6. **Briefly explain what is <u>inaccurate</u> about each of the following claims**:
   a. "When an animal consumes food, their bodies convert matter into energy."

   b. "When an animal consumes food, the matter in the food is destroyed within their bodies."

   c. "When an animal consumes food, most of the mass of that food is lost in their feces."

   d. "When an animal consumes food, they change the atoms in the food into the atoms that their bodies need."

7. **A calf must consume large amounts of food to acquire the matter and energy needed to become a full-grown animal. What happens to the food that a calf consumes in order to grow and move?**

When a calf consumes food…

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