

# Animals Unit – Packet 2

Name: \_\_\_\_\_ Hour \_\_\_\_\_ Date: \_\_\_\_\_

Date Packet is due: after Part 5 Why late? \_\_\_\_\_

If your work was late, describe why

Score

- Above & Beyond
- Fully Complete
- Mostly Complete
- Incomplete – fix the following pages:

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

**Anchoring Phenomenon:** Last week we investigated how Olympic athletes' diets vary depending on different sports. This week we're looking at how animals acquire the atoms their cells are made from, and how this relates to the food they eat. We will explore how our food provides the matter and energy our cells need to function.

### Deeper Questions

1. How do our cells acquire the matter they need?
2. How do our cells acquire the energy they need?
3. How much of the mass of consumed food gets added to an animal's body?
4. What happens to the matter in food that isn't added to the body?

### Schedule

#### **Part 1: Introduction**

- Initial Ideas – How do babies gain mass?
- Data Dive – Tracing Atoms in Cattle
- Discussion & Developing Explanations

#### **Part 2: Core Ideas**

- Core Ideas
- Revisions of Part 1 Explanations

#### **Part 3: Investigation**

- Mealworm Mass

#### **Part 4: Review & Assessment**

- Ranking Your Readiness
- Assessments (Formative Assessment & Mastery Check)

#### **Part 5: Life Connections**

- Life Connections - Interview an Expert



### 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 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: How do plant cells differ from animal cells?

Week 2: How do plants get their food and gain mass?

Week 3: How do plants get other needed molecules?

Week 4: Unit Assessment

#### **Ecosystems**

Week 1: Why do some places have more species than others?

Week 2: How does human activity affect living species?

Week 3: Unit Assessment

#### **NGSS Standards:**

HS-LS1-2. How bodily systems interact to provide specific functions in multicellular organisms.

HS-LS1-6. 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. In cellular respiration, bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

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# Part 1: Introduction – Tracing Atoms in Cattle

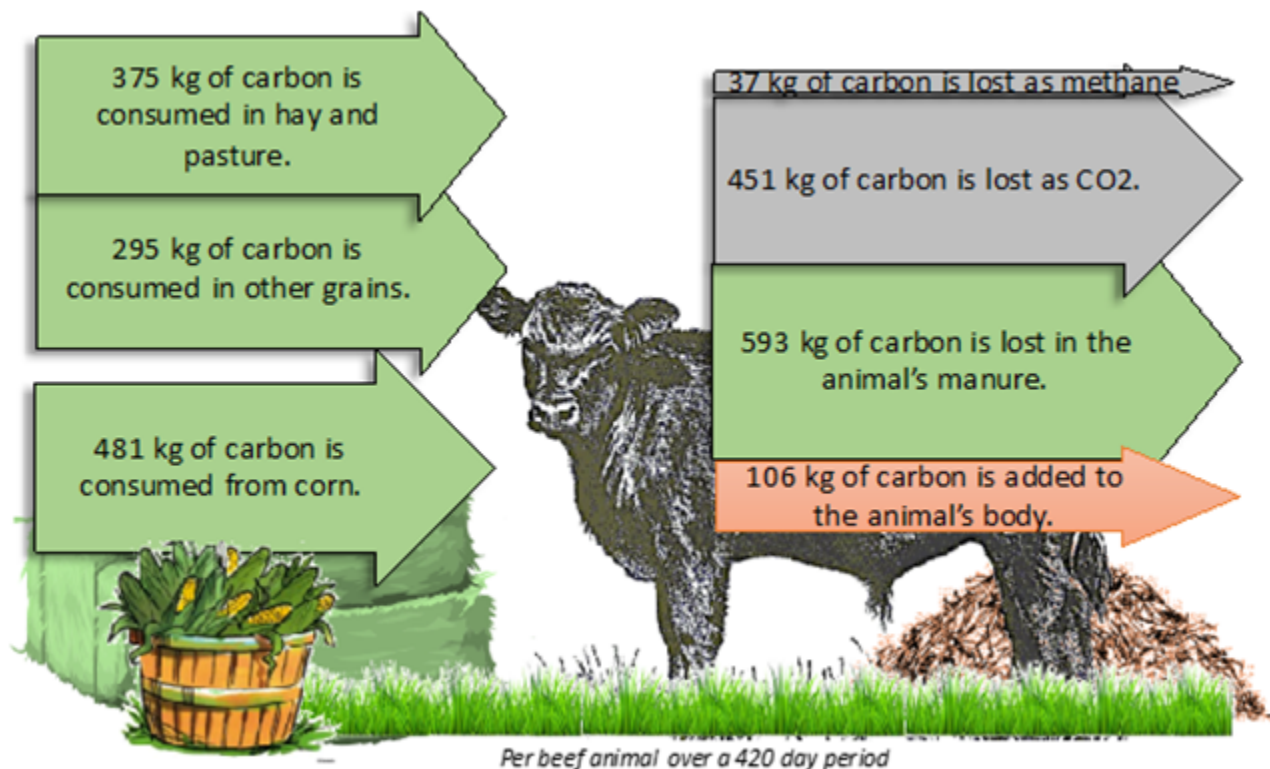
**Overview:** In this activity, you will begin by discussing your initial ideas about what happens when we consume food. You will then analyze data and work in teams to develop your initial explanations.

## Initial Ideas:

- Students are visiting a farm and see a calf (baby cow). The farmer explains the calf will grow from 100 lbs. to over 1000 lbs. in under two years! These students debate how the baby calf gains so much mass. Read the following responses from students. **Do you agree or disagree with each student's claim?**
  - Avery thinks that the cells of the calf divide, creating more matter to allow it to grow larger.
  - Bristol thinks that the food the calf consumes gets turned into more and more cells, causing the calf to grow larger and heavier.
  - Chandra thinks that the calf gets most of its mass from the water it drinks.
- Work in your small groups to discuss your ideas.** How are your ideas similar or different? Decide as a group whether each statement is correct (and why). Be prepared to present your ideas to the class.

**Video:** Next, watch this [video](https://www.youtube-nocookie.com/embed/2uK3VVCQq-A?playlist=2uK3VVCQq-A&autoplay=1&iv_load_policy=3&loop=1&modestbranding=1&start=) individually or as a class (based on your teacher's instructions). [Click here](#) (or visit [https://www.youtube-nocookie.com/embed/2uK3VVCQq-A?playlist=2uK3VVCQq-A&autoplay=1&iv\\_load\\_policy=3&loop=1&modestbranding=1&start=](https://www.youtube-nocookie.com/embed/2uK3VVCQq-A?playlist=2uK3VVCQq-A&autoplay=1&iv_load_policy=3&loop=1&modestbranding=1&start=))

**Data Dive:** In the image below, you can see data showing the mass of carbon atoms (*in kilograms, or kg*) that a calf will consume as it grows into a full-grown animal on the left. On the right, you can see where these carbon atoms end up after the calf digests its food. *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.*



**Questions:** record your group's ideas using materials provided by your instructor (such as a dry erase board).

1. **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?
2. **Next, work in your teams to discuss your ideas.** Where do you agree? Where do you disagree? Can you use this data to reach an agreement? Do others have prior knowledge or experience that could help?
3. **Based on this data, what is one conclusion that would be supported by this data?** How is this conclusion supported by this data? What specifically suggests that your claim is accurate?
4. **Based on this data, what is a second conclusion that would be supported by this data?** How is this conclusion supported by this data? What specifically suggests that your claim is accurate?
5. **Does this data support or refute any of the claims from Avery, Bristol, and/or Chandra on the previous page?** If so, explain.

**Discussion & Developing Ideas**

6. As a class, discuss your ideas about this data. What are ideas that most agreed on? Where did your ideas differ as a class? Record your ideas in the spaces below.

We all agree that...

We disagreed or are unsure about...

7. **How do animal cells acquire matter and energy from food?** 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.

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*Throughout this packet, you will be updating this explanation as you gain more information and more experience. When you complete this packet, compare your early versions to your final version. You should see distinct improvement with each revision.*

## Part 2: Core Ideas

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**Overview:** In this activity, you will begin with 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-AnimalsW2>

### Driving Questions:

1. What are the two primary purposes of consumed food?
2. What do each of the following macromolecules provide to cells? *Fat, Protein, Carbohydrates.*
3. What is digestion? How does digestion change macromolecules?
4. What are enzymes? What is the primary function of enzymes during digestion?
5. What happens to food molecules after enzymes break apart macromolecules?
6. What are examples of molecules that the blood transports to *and* from cells?
7. What happens to most glucose molecules after being absorbed by cells?
8. How are the carbon dioxide (CO<sub>2</sub>) and water vapor (H<sub>2</sub>O) that an organism breathes out related to the food molecules and oxygen that it consumes?
9. What is ATP? What does ATP do for the cell?
10. Summarize what occurs during cellular respiration. What happens to the matter and energy in glucose?
11. Why do animals only gain 10% of the mass of the food they consume? What happens to the other 90%?
12. What is biosynthesis? How does biosynthesis relate to the fat and protein that cells are made from?
13. **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?

### **How do animal cells acquire matter and energy from food?**

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*Throughout this packet, you will be updating this explanation as you gain more information and more experience. When you complete this packet, compare your early versions to your final version. You should see distinct improvement with each revision.*

# Part 3 Investigation: Mealworm Mass

Adapted from materials by Carbon TIME

**Overview:** You will collect evidence to determine what happens to the mass of food when it is consumed by animals. Do animals gain the same amount of mass as the food they consume?

**Pre-Investigation Questions:** Work as a group to determine the best response to each question. Be prepared to provide verbal responses for these questions for your instructor before you complete the investigation.

1. Summarize how digestive enzymes change macromolecules in consumed food.
2. How are the carbon dioxide ( $CO_2$ ) and water ( $H_2O$ ) that an organism breathes out related to the food molecules and oxygen that it consumes?
3. Summarize what occurs during cellular respiration. What happens to the matter and energy in glucose?
4. Why do animals only gain 10% of the mass of the food they consume? What happens to the other 90%?

When you think you are ready, **raise your hand**. Your instructor will listen to your verbal responses.

This activity was completed \_\_\_\_\_ (instructor signature)

**Intro Video** - This [video](#) will provide you with an overview of this investigation. [Click here](#).

**Setting Up the Investigation:** In this investigation, you will compare how the mass of a potato changes as it is consumed by worms. You will compare this data to the change in the mass of mealworms to acquire evidence about what is happening to food when it is consumed.

**Materials Need Per Group:** [mealworms](#) (at least a dozen per group); gallon-sized sealable bags (e.g., [Ziplock](#) freezer bags); 25 ml of BTB per group (which can be pre-measured in 50 ml [centrifuge tubes](#)); 2-3 shallow disposable plastic cups; a chunk of potato; paper towel; digital balance; tweezers; marker and tape for labeling.

**Instructor Note:** prepare sealable bags with these materials in advance to save time.

**Safety Note:** Students must wash their hands after any situations in which they handle animals.

**Methods:** Check each box as you complete each step.

1.  In this experiment, you will measure changes in mass of a potato and in the worms that eat it. First, predict how the mass of the potato and the mass of the worms will change.

I think that the mass of the potato will \_\_\_\_\_ and the mass of the worms will \_\_\_\_\_.

2. Next, predict how the change in mass of the potato will compare to the change in mass of the worms. Will the potato lose the same amount of mass as the worms gain? For example, if the potato loses 2 grams of mass, will the worms gain 2 grams of mass? Make your prediction in the space below:

I predict that the change of mass of the potato will be **equal to** / **different from** (circle one) the change of the mass of the worms because... \_\_\_\_\_





3.  In this investigation, you will determine how food consumption among animals affects a chemical called BTB. When you start, the BTB will be green. If the air in the sealed bag loses CO<sub>2</sub>, BTB turns blue. If the air gains CO<sub>2</sub>, BTB turns yellow. If the CO<sub>2</sub> levels don't change, the BTB will stay green.

What do you think will happen to the color of the BTB as mealworms consume the potato? I think that the BTB will **turn blue / turn yellow / stay green** (*circle one*) because... \_\_\_\_\_

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4.  Acquire the needed materials from your instructor as directed.
5.  Your mealworms may still be in bedding (such as shredded paper or sawdust shavings). If so, you will need to separate the worms from their bedding using a pencil or tweezers. If your worms come already separated from bedding, skip this step.
6.  Place a disposable cup onto the digital balance. "Zero" out the scale (by pressing T or "tare"). Then gently pour about 15 g of mealworms into this container. Record this data in the data table below.
7.  Place another disposable cup onto the digital balance. "Zero" out the scale (by pressing T or "tare"). Then place your chunk of potato in the cup and record its mass in the data table below.
8.  Gently place the cup of worms into the sealable plastic bag. Then remove the chunk of potato from the cup and gently lower it into the cup with the worms.
9.  Rinse and/or use paper towel to wipe out the cup that contained the potato. Pour the BTB into the cup.
10.  Place a piece of tape on the sealable plastic bag. Add a) your the last names of your group members, b) your class period & teacher; and c) the date.
11.  Gently lower the cup of BTB into the sealable plastic bag (be careful not to spill). Tightly seal the bag; make sure some air remains inside (*your worms need air to breathe!*).
12.  "Zero" out the scale. Carefully place the sealable plastic bag containing the worms, potato, and BTB onto the scale. Record this mass in the data table below (Total Bag Mass).
13.  Place your sealed plastic bag and all other materials in the location determined by your instructor.

Item	Initial Mass (g)	Final Mass (g)	Change in Mass (g)
Worms			
Potato			
Total Bag Mass (worms, potato, & BTB)			

14.  After 24+ hours, acquire your sealed bag. Before opening the bag, zero your balance, and carefully place the sealable plastic bag containing the worms, potato, and BTB onto the scale. Record the final mass in the data table on the previous page.

15.  The inside of the sealed bag should now have visible water vapor. Where did this vapor come from?

*I think that the water vapor comes from...* \_\_\_\_\_

16.  Remove the cup of BTB. Did it change color? Record this data in the space below.

Initial Color of BTB: \_\_\_\_\_ Final Color of BTB: \_\_\_\_\_

What do your changes to your BTB indicate about changes to the amount of CO<sub>2</sub> in the air in the bag?

17.  Dispose of your BTB in the manner determined by your instructor. Rinse and wipe out the cup.

18.  Place this disposable cup onto the digital balance. “Zero” out the scale (by pressing T or “tare”). Remove what remains of your chunk of potato from the cup of worms and place in the cup on the balance. Record the final mass of the potato in the data table on the previous page.

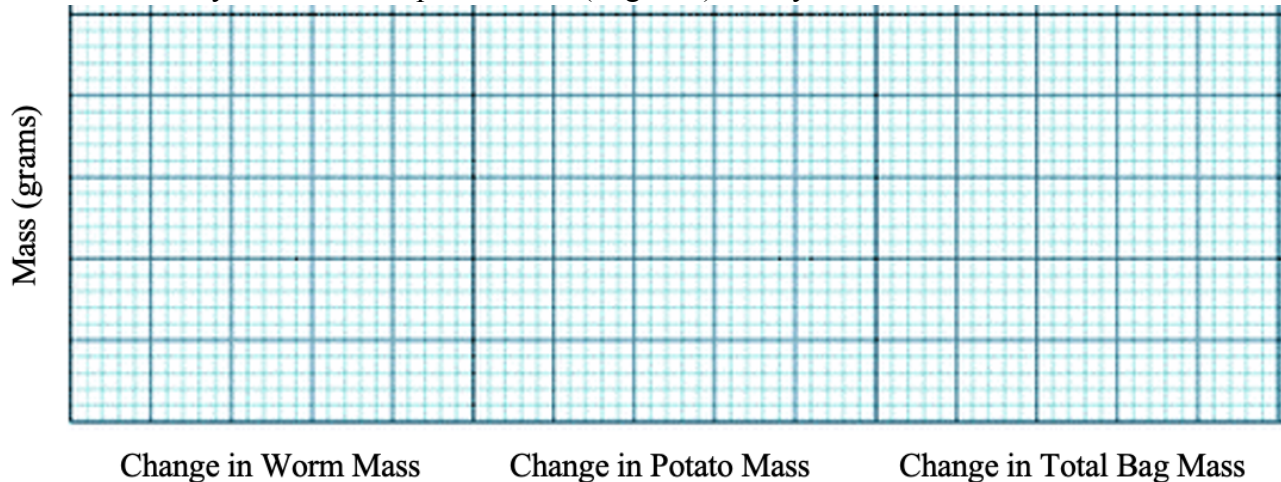
19.  Dispose of the chunk of potato in the manner determined by your instructor. Rinse/wipe out the cup.

20.  Place this disposable cup onto the digital balance. “Zero” out the scale (by pressing T or “tare”). Pour your cup of mealworms into this cup. Record the final mass of the worms on the previous page.

21.  Clean up all remaining items in the manner determined by your instructor.

**Post-Investigation Questions:**

1. Use your data in the table on the previous page to create a bar graph below based on the change in mass. Be sure to label your data with specific units (in grams) from your data table.





2. Did the potato lose the same amount of mass as the worms gained? The change in mass of the potato was **equal to / different from** (*circle one*) the change in mass of the worms.

3. What does the change in the color of BTB indicate about changes to the amount of CO<sub>2</sub> in the air?

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4. If the mass lost by the potato did not equal the mass gained by the worms, where did these atoms go? What do you think happened to the atoms in the potato that were not added to the body of the worms?

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5. Based on your data, the amount of atoms in the potato (*circle one*): increased / decreased / didn't change.

6. Based on your data, the amount of atoms in the air (*circle one*): increased / decreased / didn't change.

7. If something loses mass, it loses atoms. If something gains mass, it gains atoms. Based on this information, what happened to the atoms in the potato as it was consumed? Explain using data.

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8. You likely observed that animals moved as they consumed the potato. The temperature in your sealed bag was also likely higher than the surrounding air. Where did this energy come from? Explain.

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9. Animal cells are primarily made from water, fat, and protein. Where do you think the worms acquired these materials to make their cells and gain more mass? Defend your ideas with evidence and reasoning.

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**Revising Explanations:** Return to your original explanation from Parts 1 & 2. Based on this new information, how would you now respond to this question?

10. **How do animal cells acquire matter and energy from food?** \_\_\_\_\_

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*Be prepared to discuss and defend your ideas in small groups and as a class.*



## Part 4: Review & Assessment

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**Overview:** Rank each Driving Question in Part 2 as a 1 (*completely unsure*), 2 (*somewhat unsure*), or 3 (*completely sure*) based on your comprehension. Then work in teams to review each item and prepare a response. Next, write a final explanation below. You will conclude by completing a formative assessment.

**How do animal cells acquire matter and energy from food?**

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*Go back and compare your early versions of your explanation to your final version above. You should see distinct improvement compared to your first attempts.*

## Part 5: Life Connections – Interview An Expert

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In this activity, you will have an opportunity to interview an individual with professional expertise in this week’s content topics, or watch a pre-recorded [video](#). 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.

### Part 1 - Planning

1. Briefly summarize the topics that were covered in class this week in one sentence:

This week in class, we studied \_\_\_\_\_

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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*
- 
- 
- 

*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:

*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. Explain 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.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Part 3 – Analysis & Debrief** (*your instructor may choose to use verbal discussion instead of written responses*)

7. 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: \_\_\_\_\_  
\_\_\_\_\_



# Animals Unit, Packet 2 Formative Assessment

Name: \_\_\_\_\_ Hour \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_

**Directions:** A 3x5 notecard with *handwritten* notes can be used to guide your answers. Your instructor may allow you to work in assigned groups. If so, have a different person write each response while others assist.

1. The farmer explains a calf will grow from 100 lbs. to over 1000 lbs. in under two years. Three students debate how the baby calf gains so much mass. **Do you agree or disagree with each student's claim?**
  - A. Avery thinks that the cells of the calf divide, creating more matter. AGREE/DISAGREE
  - B. Bristol thinks the food the calf consumes gets turned into more and more cells. AGREE/DISAGREE
  - C. Chandra thinks that the calf gets most of its mass from the water it drinks. AGREE/DISAGREE

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

a) \_\_\_\_\_

b) \_\_\_\_\_

c) \_\_\_\_\_

Writer: \_\_\_\_\_

3. **What happens to fats, proteins, and carbohydrates in food after being consumed. Include and underline the following: *molecules, enzymes, bloodstream, cells.***

\_\_\_\_\_

\_\_\_\_\_

Writer: \_\_\_\_\_

4. A steer consumes 15 lbs of food per day, but gains 1.5 lbs per day. The steer produces about 7 lbs. of feces (dry weight). **What is happening to the 5.5 lbs. of atoms that weren't added to the animal's body or feces?**

\_\_\_\_\_

\_\_\_\_\_

Writer: \_\_\_\_\_

5. **Summarize what occurs during cellular respiration. Include and underline the following: *glucose, oxygen, CO<sub>2</sub>, H<sub>2</sub>O, high energy bonds, ATP.***

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Writer: \_\_\_\_\_