Fuel for the Ride

Model how food molecules change as cells use oxygen.

L.7.3.3 "Use models to describe how food molecules (carbohydrates, lipids, proteins) are processed through chemical reactions using oxygen (aerobic) to form new molecules."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the food molecules and the smaller molecules made during digestion. Circle oxygen and the new molecules made during aerobic reactions, then number any steps that must happen before those reactions.

What Powers Your Legs?

1. At the end of a long bike ride, your leg cells need a steady supply of usable energy. A sandwich can supply carbohydrates, lipids, and proteins, but cells cannot simply burn whole bites of food. During digestion, carbohydrates are broken into simple sugars such as glucose. Blood carries glucose and oxygen to cells. In aerobic cellular respiration, reactions rearrange atoms from glucose and oxygen into carbon dioxide and water. Some released energy is captured in ATP, a molecule cells use to power work. A model can show the inputs and outputs with labeled arrows.

2. Fat in the sandwich follows a different route before it joins the energy-making reactions. Digestion splits lipids into fatty acids and glycerol. Cells can break down fatty acids in several steps; their carbon atoms eventually leave as carbon dioxide when oxygen is available. Oxygen helps cells finish these reactions, and water and ATP are formed. A useful model shows lipids becoming smaller parts before showing oxygen used in aerobic reactions. Its arrows represent chemical changes, not a single jump from a bite of fat to ATP.

3. Protein has another pathway. Digestion breaks it into amino acids, which cells usually use to build new proteins. If amino acids are used for energy, the nitrogen-containing part is removed first. The remaining carbon parts can enter aerobic reactions that use oxygen and produce carbon dioxide, water, and ATP. The removed nitrogen is made into urea in the liver and leaves the body in urine. In a model, a separate arrow to urea matters: it shows why protein cannot be represented as taking exactly the same route as glucose.

2 ANSWER WITH EVIDENCE

Use the passage

1. Write a word-arrow model tracing carbohydrate from the sandwich through digestion and aerobic respiration. Show where oxygen enters and name the new molecules formed.

2. Write a word-arrow model for the lipid route. Include the smaller parts made during digestion, oxygen, and the products of aerobic reactions.

3. When amino acids are used for energy, a model needs two branches. What does each branch show?

4. A model shows glucose, fatty acids, and amino acids all going straight to ATP. Name two changes that would make this model more accurate.

3 YOUR TURN

Your own words

Invent a snack with a carbohydrate, a lipid, and a protein. In five or six sentences, use word arrows to model how each is digested and used in aerobic reactions, including oxygen, the new molecules formed, and the separate route for nitrogen.

ANSWER KEY

Fuel for the Ride

GRADE 7 · L.7.3.3

PART 1 · READ AND MARK

Underline the food molecules and the smaller molecules made during digestion. Circle oxygen and the new molecules made during aerobic reactions, then number any steps that must happen before those reactions. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Write a word-arrow model tracing carbohydrate from the sandwich through digestion and aerobic respiration. Show where oxygen enters and name the new molecules formed.	**Carbohydrate → glucose; glucose + oxygen → carbon dioxide + water, with released energy captured in ATP.**
2	Write a word-arrow model for the lipid route. Include the smaller parts made during digestion, oxygen, and the products of aerobic reactions.	**Lipids → fatty acids + glycerol; fatty acids + oxygen → carbon dioxide + water, with energy captured in ATP.**
3	When amino acids are used for energy, a model needs two branches. What does each branch show?	**Amino acids → removed nitrogen → urea in the liver. The remaining carbon parts + oxygen → carbon dioxide + water, with energy captured in ATP.**
4	A model shows glucose, fatty acids, and amino acids all going straight to ATP. Name two changes that would make this model more accurate.	**Show oxygen entering the aerobic reactions and show carbon dioxide and water forming. Also accept a separate nitrogen-to-urea branch for amino acids.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

My snack is oatmeal with peanut butter and milk. The oatmeal's starch → glucose during digestion, and glucose + oxygen → carbon dioxide + water, with energy captured in ATP. The peanut butter's lipids → fatty acids and glycerol, and fatty acids + oxygen → carbon dioxide + water, with energy captured in ATP. The milk's proteins → amino acids during digestion. If those amino acids are used for energy, their remaining carbon parts + oxygen → carbon dioxide + water, with energy captured in ATP. Their removed nitrogen → urea in the liver by a separate route.

Accept word-arrow models that show the correct sequence, even if students arrange the arrows differently. ATP should be identified as a molecule that captures released energy, not as the only product.