region 4
Educated Solutions

Gateways to Science

STAAR Edition

Grade 7

Teacher Edition

Safety Alert Icon
reminds teacher and students of safe lab practices.

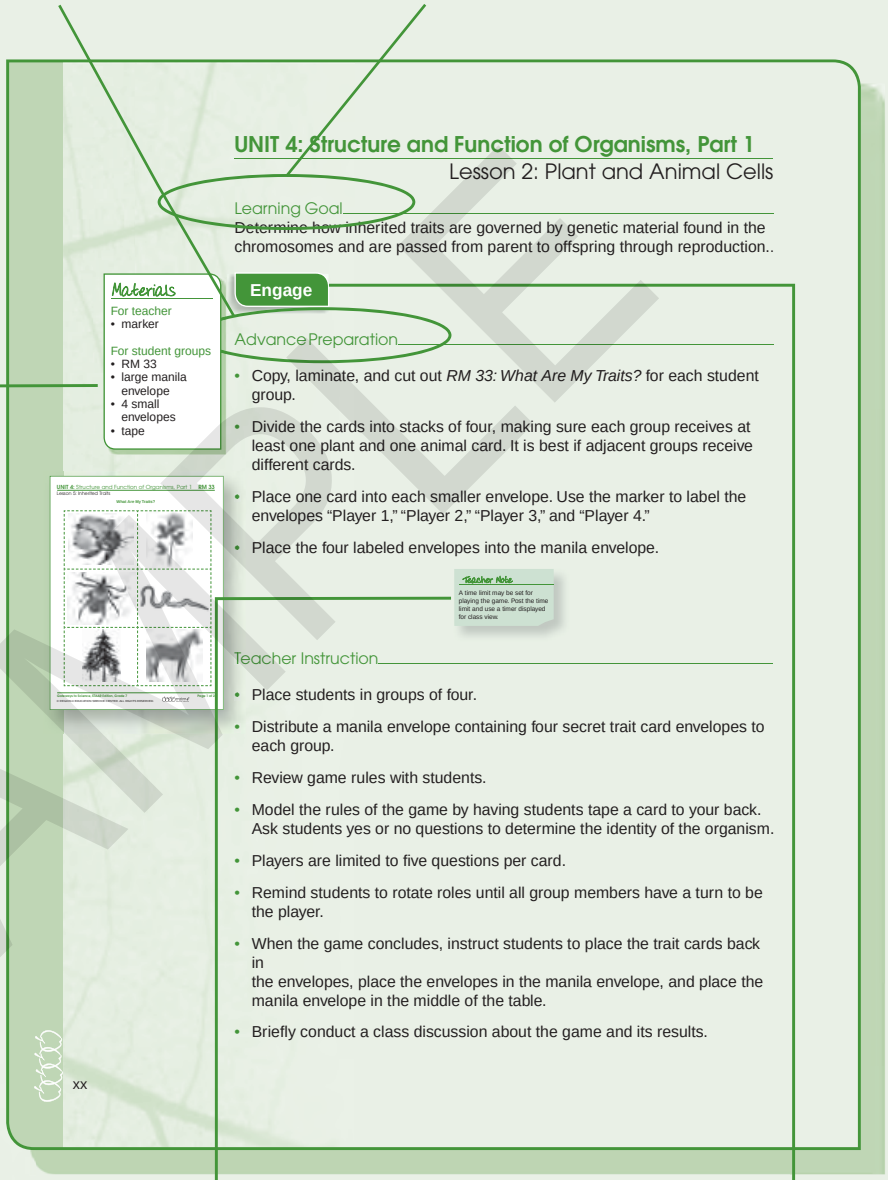
Lab Rotation Icon
signals students to prepare for lab station activities.

Stations

Station Descriptors
summarize for students lab activities by station.

Advance Preparation
allows for preplanning to ensure lesson goes smoothly.

Learning Goal
provides a brief outlook of lesson purpose.



UNIT 4: Structure and Function of Organisms, Part 1
Lesson 2: Plant and Animal Cells

Learning Goal
Determine how inherited traits are governed by genetic material found in the chromosomes and are passed from parent to offspring through reproduction..

Materials
For teacher
- marker

For student groups
- RM 33
- large manila envelope
- 4 small envelopes
- tape

Engage

Advance Preparation
- Copy, laminate, and cut out *RM 33: What Are My Traits?* for each student group.
- Divide the cards into stacks of four, making sure each group receives at least one plant and one animal card. It is best if adjacent groups receive different cards.
- Place one card into each smaller envelope. Use the marker to label the envelopes "Player 1," "Player 2," "Player 3," and "Player 4."
- Place the four labeled envelopes into the manila envelope.

Teacher Note
A time limit may be set for playing the game. Post the time limit and use a timer displayed for class view.

Teacher Instruction
- Place students in groups of four.
- Distribute a manila envelope containing four secret trait card envelopes to each group.
- Review game rules with students.
- Model the rules of the game by having students tape a card to your back. Ask students yes or no questions to determine the identity of the organism.
- Players are limited to five questions per card.
- Remind students to rotate roles until all group members have a turn to be the player.
- When the game concludes, instruct students to place the trait cards back in the envelopes, place the envelopes in the manila envelope, and place the manila envelope in the middle of the table.
- Briefly conduct a class discussion about the game and its results.

xx

Materials List
aids in lesson preparation.

5 Es
are clearly labeled to help keep track of lesson progress.

Teacher Note
provides helpful tips and information.

UNIT 4: Structure and Function of Organisms, Part 1

Lesson 5: Inherited Traits

In your science notebook, create a vocabulary table similar to the one below. Make your table with seven rows.

Use Table 4.1 to predict the meaning of each of the following words. Record your prediction in the middle column.

Vocabulary Term	Prediction	Actual Definition
genetics		
chromosome		
gene		

Facilitation Questions

- Did any of the children inherit a trait from a grandparent? *Yes, all traits inherited by the children were also traits of the grandparents, but no child's traits were identical to all of the traits of one grandparent or parent.*
- Did any of the children lack one of the grandparents' traits? *It is very possible that the offspring lack one of the grandparent's traits. The offspring are diverse because the traits were chosen at random.*
- How does this compare to traits that you have inherited from your parents or grandparents? *This was a simplified study of how traits can be tracked through a family tree, but humans, as well as other organisms, have many more traits. Some of our traits are inherited from our fathers and some of our traits are inherited from our mothers.*

- Preview the questions in "Genetics and Heredity."
- Study the diagram and read the passage.
- With a partner, discuss the main ideas of each paragraph and your answers to the questions in the passage.

Science Notebook Icon
quickly indicates the need for students to use a science notebook.

Student Pages
are embedded in all lessons for ease of use and include answers to student edition.

Facilitation Questions
assist in guiding and scaffolding instruction.

Lesson 5: Inherited Traits

Evaluate

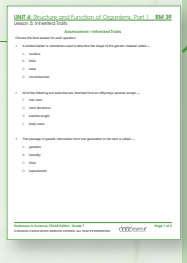
Materials
For each student
- RM 39

Teacher Instruction

- Instruct students to complete *RM 39: Assessment—Inherited Traits.*

RM .39 Answer Key

1. B
2. J
3. B
4. H
5. A



Reproducible Master (RM) Snapshots and Answer Keys
offer an at-a-glance view. RM Answer Keys are placed in lesson to reduce the amount of printed materials.

UNIT 5: Structure and Function of Organisms, Part 2

Lesson 1: Physical and Chemical Changes in Digestion

Learning Goal

Identify physical and chemical changes in matter in the digestive system.

Materials

For each student
- 2 unsalted crackers
- timer or access to clock

Engage

Teacher Instruction

- Instruct students to chew the crackers without swallowing for 2 minutes.
- Students should notice that the crackers become sweeter. This is due to the release of an enzyme in the saliva that breaks down carbohydrates into glucose, a simple sugar.

Engage

Page 194

Eat a Cracker

1. Your teacher will give you two unsalted crackers.
2. Chew the crackers in your mouth for 2 minutes without swallowing.
3. Record your observations, including the initial taste of the crackers and their taste after 2 minutes.
    - Why do we chew our food before swallowing? *We chew food to break it into smaller pieces and increase the surface area of the food so it can break down faster. We also chew food in order to swallow it easier.*

Materials

For teacher
- knife

For student groups
- gelatin
- Petri dish or portion cups with lids
- fresh (not canned) pineapple

Explore

Teacher Note

- Many meat tenderizers use enzymes from plants. Bromelain, the enzyme in pineapple, and papain, the enzyme in papaya, break down proteins. Other fruits such as kiwi and figs also contain enzymes that break down proteins. Gelatin is made from protein. Proteins are broken down into amino acids. This represents a chemical change.
- Canned pineapple slices will not work because the canning process destroys the enzyme in pineapples.

Lesson 1: Physical and Chemical Changes in Digestion

Advance Preparation

- Prepare the gelatin mix according to box directions and pour into Petri dishes or portion cups prior to class. Place in refrigerator to aid in hardening the gelatin.
- Cut the pineapple into small pieces, approximately 3 cm x 3 cm.

Teacher Instruction

- Ask students to hypothesize what will happen prior to placing the pineapple on the gelatin.
- Instruct students to complete the science notebook entry.

Explore Page 194

Procedure

1. Write a hypothesis of what will happen when pineapple is placed on gelatin. Record your hypothesis in your science notebook.
2. Place the small piece of pineapple in the middle of the Petri dish containing gelatin.
3. Over several minutes, record your observations.
4. Dispose of all materials according to your teacher's directions. Leave your area clean and organized.

Conclusion

1. Do your results support your hypothesis? *Student answers will vary. Accept all appropriate answers.*
2. Did a chemical change occur? *A chemical change did occur.* If yes, what evidence do you have? *It appears that a new substance was formed. The gelatin, in contact with the pineapple, was broken down.*

Lesson 1: Physical and Chemical Changes in Digestion

Materials

For teacher
- small marble
- 50 cm of clear, large aquarium tubing
- measuring tape
- large trash bag
- popcorn
- 10 sandwich-size resealable plastic bags

For each student
- RM 1
- RM 2
- colored pencils

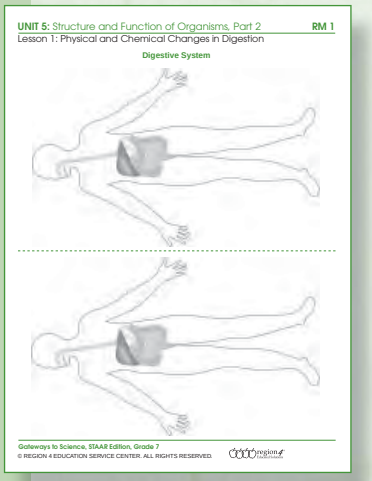
Explain

Teacher Note

Dangerous metabolic by-products, such as hydrogen peroxide, are also chemically changed into harmless substances by enzymes.

Teacher Note

The diagram of the excretory system on *RM 2* includes the heart as a location reference only. Remind students that the heart is not part of the excretory system.


UNIT 5: Structure and Function of Organisms, Part 2 RM 1
Lesson 1: Physical and Chemical Changes in Digestion
Digestive System
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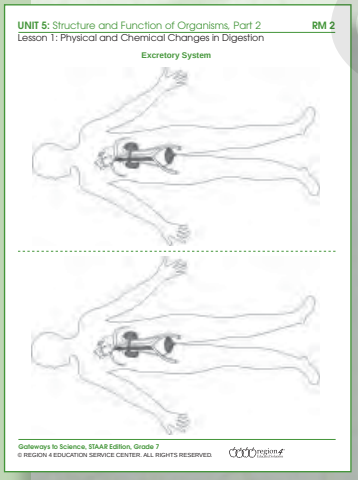
UNIT 5: Structure and Function of Organisms, Part 2 RM 2
Lesson 1: Physical and Chemical Changes in Digestion
Excretory System
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Advance Preparation

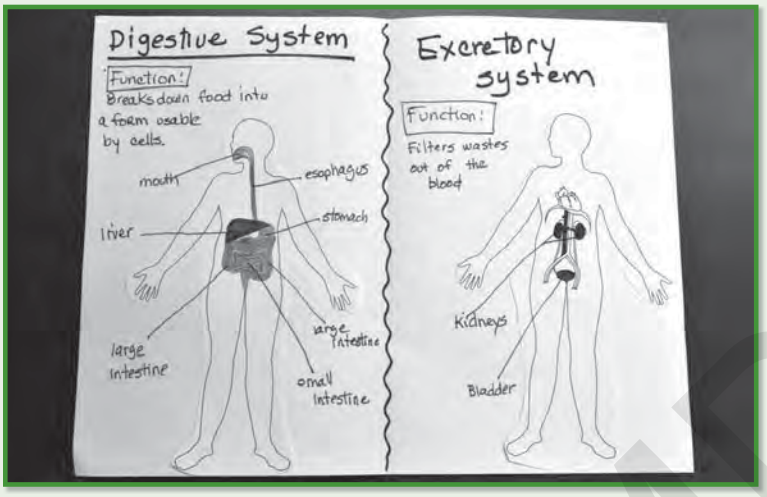
- Prepare a floor-size model of the digestive system: Set up the classroom so the middle of the room has two parallel pieces of masking tape down the length of the room. Depending on available space, the tapeline should be 2–4 feet apart.
- Prepare a large ball of "food" by placing popcorn in 10 plastic sandwich bags. Put the popcorn-filled bags into a large plastic bag to make a "food ball."

Teacher Instruction

- Debrief the Explore activity. Students should observe that the gelatin area liquefies when it comes in contact with the pineapple.
- Read and discuss "Physical and Chemical Changes" using the following activities and facilitation questions.
  - Ask students to predict if swallowing food is impossible while standing on your head. Refer to the digestive system diagram and ask students how food travels around all the curves in the digestive organs.
  - Provide time for students to observe a demonstration of a marble being squeezed down a large piece of aquarium tubing to simulate how peristalsis squeezes food through the narrow tubelike esophagus.
  - Instruct students to model a "food ball" pushed through the digestive tract during peristalsis. Ask students to stand on either side of the floor-size model of the digestive system and move the large plastic bag, keeping it between the tape lines.
- Instruct students to complete the science notebook entry, relating the physical and chemical changes that occur during digestion.
- Review the science notebook entry with students.

Lesson 1: Physical and Chemical Changes in Digestion

- Read and discuss "The Excretory System."
- Guide students to complete the activity for creating a Human Body Book that includes a title for each diagram (*RM 1: Digestive System* and *RM 2: Excretory System*), description of the function of each system, and labeled and colored organs as specified in the student edition. Book entries will continue for the next several lessons.



Explain

Pages 195–198

Physical and Chemical Changes

Physical changes occur when a substance has a change in one of its physical properties, such as density, size, smell, or luster. Physical changes do not alter the chemical makeup of the substance. Examples of a physical change include tearing paper, adding food color to water, or chewing food to break it into smaller pieces.

If a substance has a change in its chemical properties, a chemical change occurs. New substances form during a chemical change. Examples of a chemical change include paper burning, organic material decomposing, and vinegar reacting with baking soda. Photosynthesis is an example of a chemical change that occurs in plants. Physical and chemical changes occur during digestion in humans.

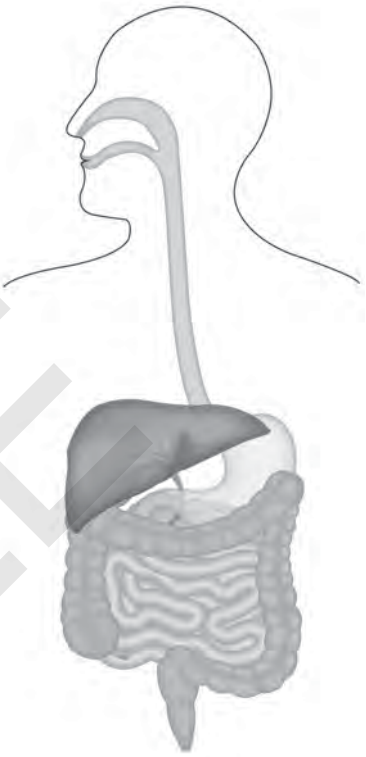
The Digestive System

Our cells need energy and nutrients from food to survive and grow. Food that we eat must be broken down into molecules that can be used by our cells. Large molecules of carbohydrates, proteins, and fat are broken into even smaller molecules during digestion.

Lesson 1: Physical and Chemical Changes in Digestion

Digestion begins in the mouth. Chewing food physically breaks it into smaller pieces. The act of chewing also releases saliva from glands in the mouth. Saliva contains an enzyme that begins breaking down food molecules. Complex carbohydrates like starches are broken down into smaller simple sugars. The cracker tastes sweet because the complex starch is being broken down into glucose, a simple sugar.

Figure 5.1. The Digestive System

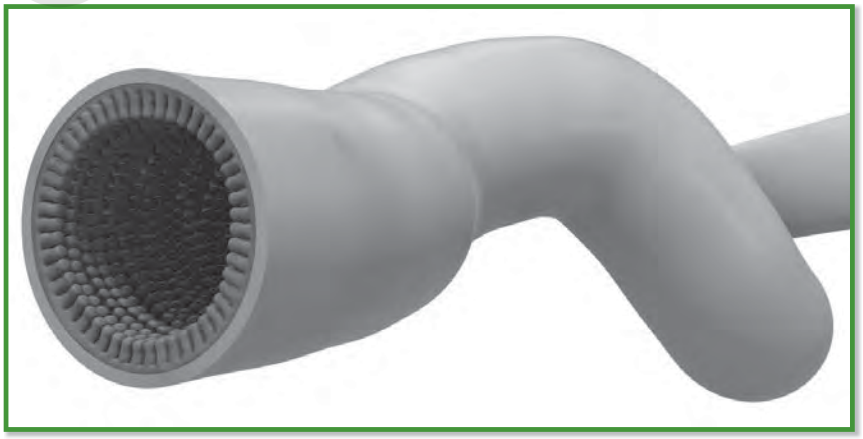


The tongue moves the food particles around to shape it into a ball, called a bolus. The bolus is swallowed, moves down the esophagus by a squeezing action, and enters the stomach. The muscles of the stomach physically mix the bolus and gastric juices, which include hydrochloric acid and enzymes. The acid and enzymes continue to chemically break down the food into even smaller pieces to form a smooth paste called chyme.

DID YOU KNOW?

Hydrochloric acid breaks down food and also kills bacteria and viruses that are ingested with the food.

The chyme moves into the small intestine, and different digestive enzymes from the liver and pancreas continue breaking the molecules down. Approximately 6–8 hours after the food enters the mouth, it has been physically and chemically broken down into simple molecules that are easily absorbed into the blood through the small intestine's villi. The circulatory system then transports the digested food to the cells of the body.



Villi increase the surface area in the intestines for nutrient absorption.

Lesson 1: Physical and Chemical Changes in Digestion

Dangerous metabolic by-products such as hydrogen peroxide are chemically changed into less harmful substances by enzymes. Indigestible parts of chyme are moved along to the large intestine, where usable water and minerals are absorbed. Unusable waste material is expelled from the anus.

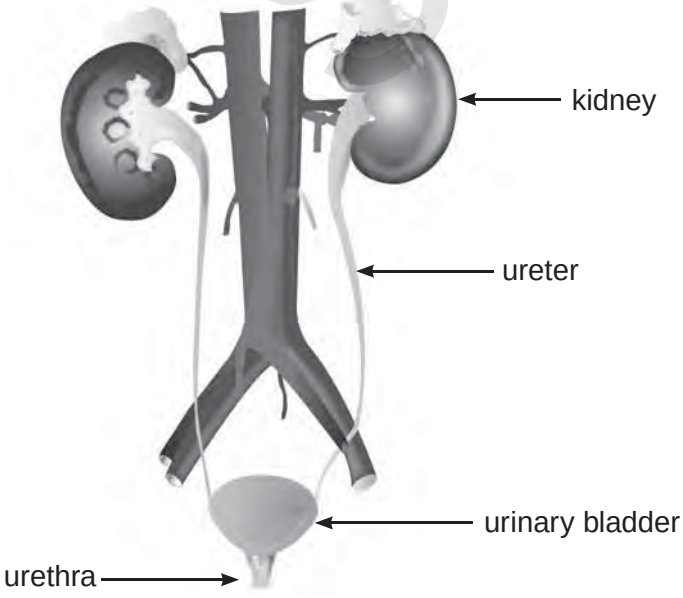
Create a table similar to the one below that describes whether physical changes, chemical changes, or both physical and chemical changes occur in each organ.

Organ	Physical, Chemical, or Physical and Chemical Changes
mouth	*physical (chewing); chemical (enzymes)*
esophagus	*physical (food is squeezed and changes shape)*
stomach	*physical (mixing); chemical (digestion by HCl and enzymes)*
small intestine	*chemical (enzymes break down molecules)*
large intestine	*physical (water is removed)*

The Excretory System

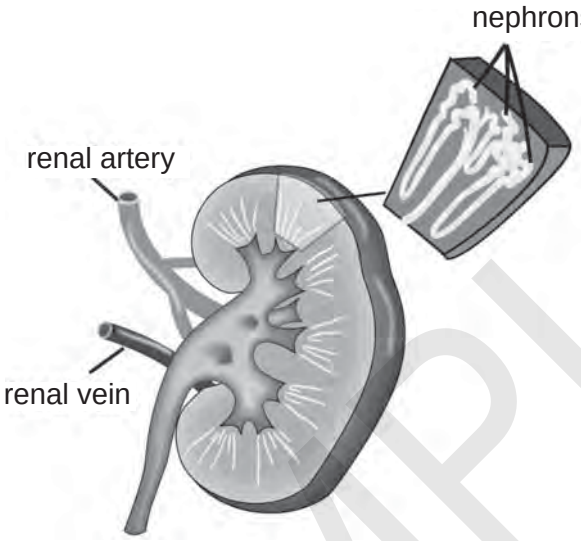
The daily activities of cells include chemical reactions that require energy from food. Chemical waste products are formed as a result of these activities and are moved out of the cells and into the blood. In order to maintain a balance in the body, the blood must be cleaned of these waste products. The kidneys are the main organs of the excretory system.

Figure 5.2. The Excretory System



The kidneys are bean-shaped organs that act as the main blood filters of the body. More than a quart of blood is cleaned every minute as blood passes through the filtering structures of the kidneys. Tiny tubelike structures called nephrons filter out waste materials and extra fluid from the blood. This liquid is sent to the bladder to be stored until it is released as urine.

Figure 5.3. The Kidney



Human Body Book

Following your teacher's instructions, create a book about the functions of the human body.

- Title each diagram.
- Describe in your book the functions of the system.
- On the diagrams provided by your teacher, label and color the following:

  mouth—red
  esophagus—blue
  stomach—orange
  small intestine—brown
  liver—green
  large intestine—yellow
  kidneys—brown
  urinary bladder—yellow

Lesson 1: Physical and Chemical Changes in Digestion

Facilitation Questions

- Describe the physical and chemical changes that occur during digestion. *Physical changes occur when food is broken into smaller pieces, mixed with other substances, or when water is removed from wastes in the large intestine. Chemical changes occur when food material is broken down by a variety of enzymes and acids into smaller molecules usable by cells.*
- Describe how food moves through the digestive system. *The walls of the organs of the tubelike digestive system squeeze the food down, like squeezing a marble through a tube.*
- Where does digestion start? *Digestion begins in the mouth, where teeth tear and grind food into smaller pieces as saliva is added to help form the food into a ball called a bolus.*
- What happens to food in the stomach? *The chemical digestive and gastric juices, along with the physical churning of the stomach, break the food into a smooth paste called chyme.*
- What is the main function of the small intestine? *The small intestine continues to break down food. Absorption of nutrients into the blood also occurs here.*
- How does the body rid itself of indigestible food? *The large intestine removes extra water. The waste then passes to the rectum and is expelled through the anus.*

Elaborate

Materials

For student groups
- spaghetti strainers
- tea strainers
- coffee filters
- muddy water
- dialysis tubing
- additional materials at student request

Teacher Instruction

- Ask: Do you know someone who has had kidney dialysis treatments? Why are these treatments necessary? *To clean the blood of its wastes if the kidneys are not functioning properly*
- Ask: Why does blood need to be filtered, or "cleaned"? *Waste materials from cellular respiration are transferred into the bloodstream; it is the way the cells get rid of their dangerous waste products.*
- Set out the materials for the kidney model design in a central location.
- Instruct students to design and explain a filter system to clean muddy water, which represents blood.
- Allow students to participate in a gallery walk to view the different models.
- Ask each group to describe their kidney model and show a sample of the water filtered by their model.
- Review questions with students and utilize the facilitation questions.

Elaborate

Page 198

Using the materials provided by your teacher, design a filter to model how kidneys filter waste from the blood. The "blood" to be cleaned is muddy water.

In your science notebook, draw and label the filter and describe the efficiency of the filter.

Keep a small amount of muddy water to use as a control for comparisons. Participate in a gallery walk to observe filters created by other groups.

Questions

1. Compare the water before and after filtering through each one of the filters. Which one cleaned the water most efficiently? *Student answers will vary. Accept all appropriate answers.*
2. Which of the filters is most like the kidneys? Why? *Student answers will vary. Accept all appropriate answers*

The function of the kidneys is much more complex than your model. There is a delicate chemical balance that must be maintained in the body. The kidneys are "chemists" in that they measure amounts of chemicals your body needs, such as sodium, phosphorus, and potassium, and they make sure there is the correct amount in the blood for your body to function.

Facilitation Questions

- What was the shape and structure of the most effective filter? *Answers will vary, but a funnel shape that has several layers of filter paper is likely the most effective.*
- The kidney is the main organ of the excretory system. How are the filtering units, called nephrons, like the filtering models made by you? *Both filter the "blood" to remove wastes.*
- How are they different? *The nephrons filter wastes out of the blood, while our models filtered the dirt materials out of the water.*

Lesson 1: Physical and Chemical Changes in Digestion

Evaluate

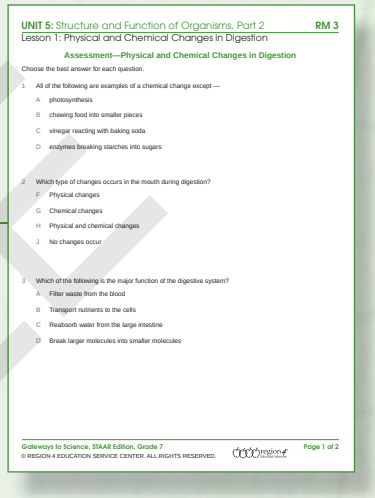
Materials

For each student
- RM 3

For student groups
- chart paper
- markers

Teacher Instruction

- Instruct student groups to use the chart paper and markers to create a concept map showing physical and chemical changes that occur during digestion.
- Provide time for students to present their concept maps to the class using a gallery walk or other strategy.
- Instruct students to complete *RM 3: Assessment—Physical and Chemical Changes in Digestion*.



UNIT 5: Structure and Function of Organisms, Part 2 RM 3
Lesson 1: Physical and Chemical Changes in Digestion

Assessment—Physical and Chemical Changes in Digestion

Choose the best answer for each question.

1 All of the following are examples of a chemical change except —
A photosynthesis
B chewing food into smaller pieces
C vinegar reacting with baking soda
D enzymes breaking starches into sugars

2 Which type of changes occurs in the mouth during digestion?
F Physical changes
G Chemical changes
H Physical and chemical changes
J No changes occur

3 Which of the following is the major function of the digestive system?
A Filter waste from the blood
B Transport nutrients to the cells
C Reabsorb water from the large intestine
D Break larger molecules into smaller molecules

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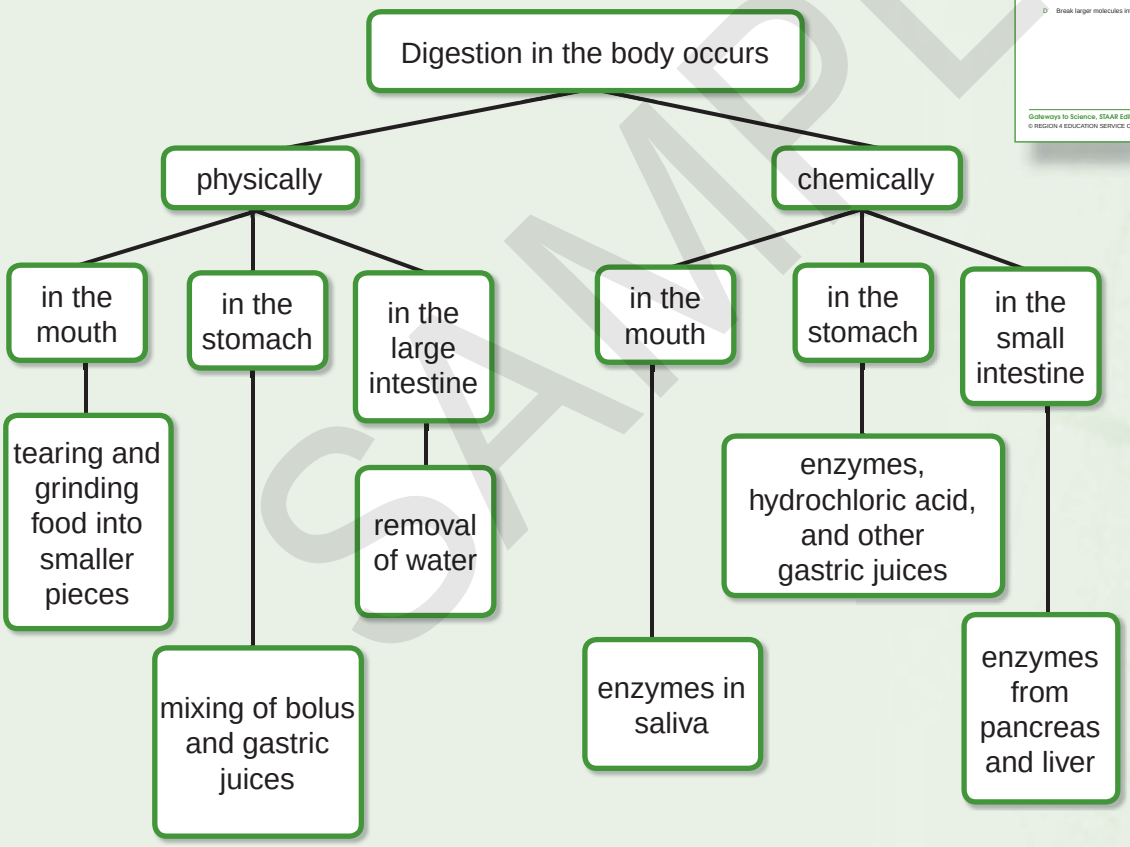
Concept Map Answer Key

Student concept maps will vary. Accept all appropriate maps.



RM 3 Answer Key

1. B
2. H
3. D
4. G
5. A
6. F

region 4
Educated Solutions

Gateways to Science

STAAR Edition

Grade 7

Student Edition

UNIT 5: Structure and Function of Organisms, Part 2

Introduction

Energy, movement, reproduction, and exchange of gases are functions of every living organism. The structure of a cell, tissue, organ, organ system, and/or organism is directly related to its function. In nature, structure complements function at all levels. In this unit, we will model and discover the functions of the body's organs and systems, relate responses of organisms to stimuli, and investigate adaptations.

By the end of this unit, you will—

Know these concepts:

- Functions of human organs and organ systems
- Organic compounds
- Physical and chemical changes that occur during digestion
- Large molecules such as carbohydrates break down into smaller molecules such as sugars
- Energy transformation within an organism
- Work
- Functions at different levels of organization
- How organisms maintain balance in response to stimuli
- How structural adaptations allow for specific functions
- Accommodations that allow for human space travel

Do these things:

- Demonstrate safe practices.
- Make wise choices in use of materials.
- Make connections to prior learning.
- Collect and organize data.
- Design, construct, and analyze models and evaluate their limitations.
- Use problem-solving skills.
- Draw conclusions based on evidence.
- Represent information through visuals.
- Design an investigation using variables and constants.

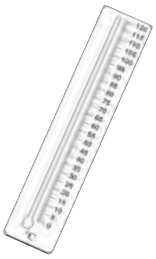
Use these tools:


disposable gloves


apron


safety goggles

timing device


thermometer

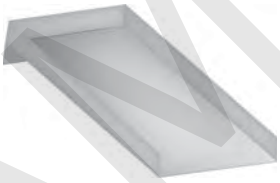

Petri dish

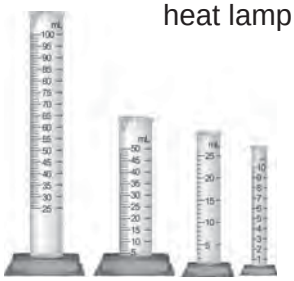

hot plate


spring scale


heat lamp

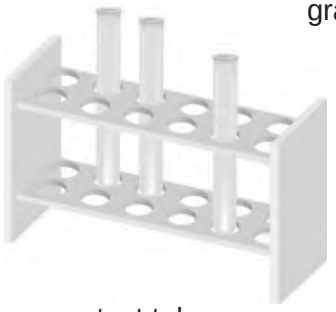

triple beam balance

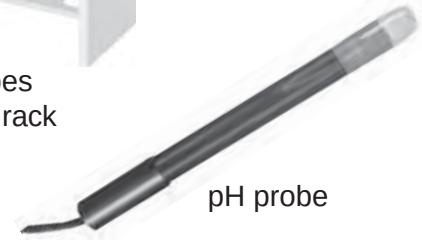

inclined plane

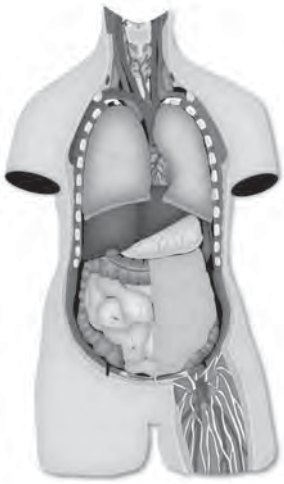

graduated cylinders


beakers


hand lens


test tubes
test tube rack


pH probe


science models


stereoscope

metric ruler

Lesson 1: Physical and Chemical Changes in Digestion

Engage

Eat a Cracker

1. Your teacher will give you two unsalted crackers.
2. Chew the crackers in your mouth for 2 minutes without swallowing.
3. Record your observations, including the initial taste of the crackers and their taste after 2 minutes.
    - Why do we chew our food before swallowing?

Explore

Procedure

1. Write a hypothesis of what will happen when pineapple is placed on gelatin. Record your hypothesis in your science notebook.
2. Place the small piece of pineapple in the middle of the Petri dish containing gelatin.
3. Over several minutes, record your observations.
4. Dispose of all materials according to your teacher's directions. Leave your area clean and organized.

Conclusion

1. Do your results support your hypothesis?
2. Did a chemical change occur? If yes, what evidence do you have?

Lesson 1: Physical and Chemical Changes in Digestion

Explain

Physical and Chemical Changes

Physical changes occur when a substance has a change in one of its physical properties, such as density, size, smell, or luster. Physical changes do not alter the chemical makeup of the substance. Examples of a physical change include tearing paper, adding food color to water, or chewing food to break it into smaller pieces.

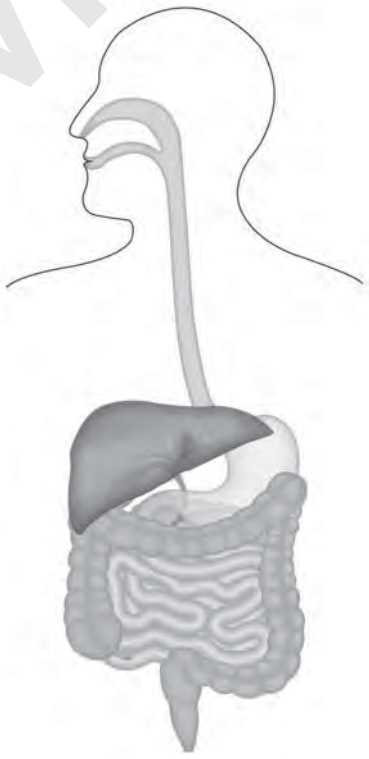
If a substance has a change in its chemical properties, a chemical change occurs. New substances form during a chemical change. Examples of a chemical change include paper burning, organic material decomposing, and vinegar reacting with baking soda. Photosynthesis is an example of a chemical change that occurs in plants. Physical and chemical changes occur during digestion in humans.

The Digestive System

Our cells need energy and nutrients from food to survive and grow. Food that we eat must be broken down into molecules that can be used by our cells. Large molecules of carbohydrates, proteins, and fat are broken down into even smaller molecules during digestion.

Digestion begins in the mouth. Chewing food physically breaks it into smaller pieces. The act of chewing also releases saliva from glands in the mouth. Saliva contains an enzyme that begins breaking down food molecules. Complex carbohydrates like starches are broken down into smaller simple sugars. The cracker tastes sweet because the complex starch is being broken down into glucose, a simple sugar.

Figure 5.1. The Digestive System

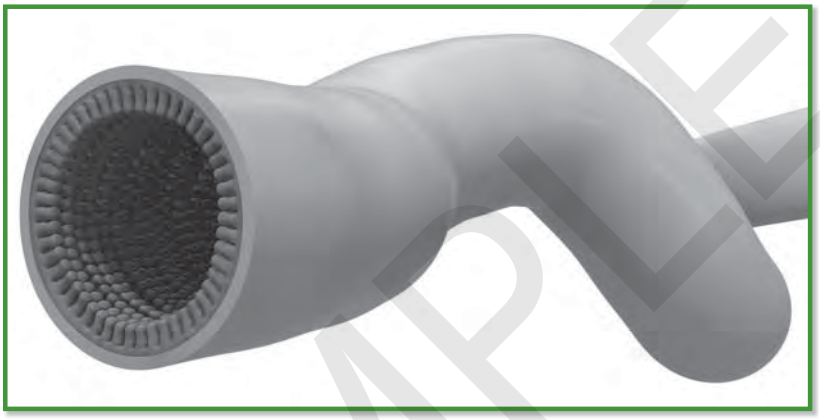


The tongue moves the food particles around to shape it into a ball, called a bolus. The bolus is swallowed, moves down the esophagus by a squeezing action, and enters the stomach. The muscles of the stomach physically mix the bolus and gastric juices, which include hydrochloric acid and enzymes. The acid and enzymes continue to chemically break down the food into even smaller pieces to form a smooth paste called chyme.

Lesson 1: Physical and Chemical Changes in Digestion

DID YOU KNOW?
Hydrochloric acid breaks down food and also kills bacteria and viruses that are ingested with the food.

The chyme moves into the small intestine, and different digestive enzymes from the liver and pancreas continue breaking the molecules down. Approximately 6–8 hours after the food enters the mouth, it has been physically and chemically broken down into simple molecules that are easily absorbed into the blood through the small intestine's villi. The circulatory system then transports the digested food to the cells of the body.



Villi increase the surface area in the intestines for nutrient absorption.

Dangerous metabolic by-products such as hydrogen peroxide are chemically changed into less harmful substances by enzymes. Indigestible parts of chyme are moved along to the large intestine, where usable water and minerals are absorbed. Unusable waste material is expelled from the anus.

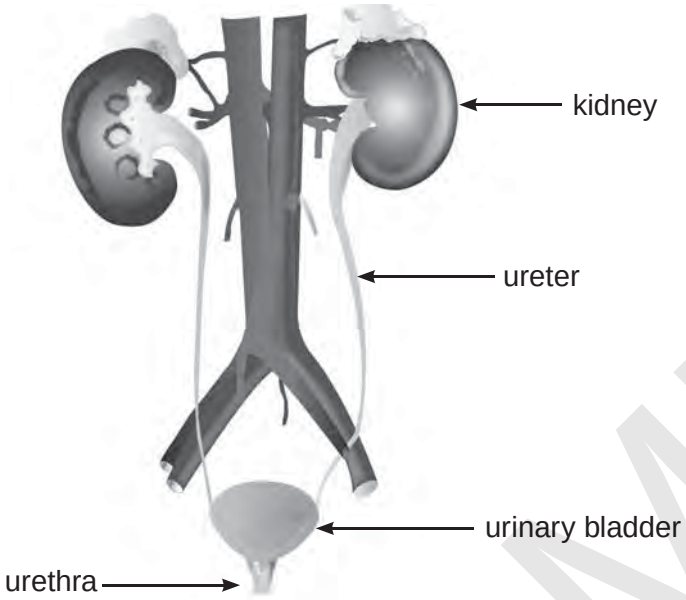
Create a table similar to the one below that describes whether physical changes, chemical changes, or both physical and chemical changes occur in each organ.

Organ	Physical, Chemical, or Physical and Chemical Changes
mouth	
esophagus	
stomach	
small intestine	
large intestine	

The Excretory System

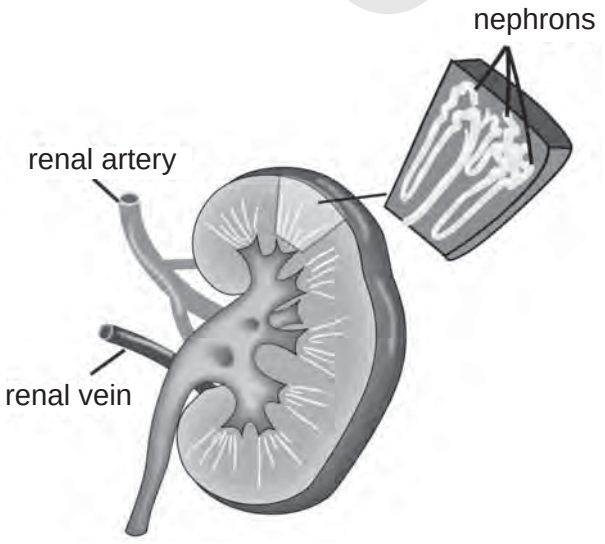
The daily activities of cells include chemical reactions that require energy from food. Chemical waste products are formed as a result of these activities and are moved out of the cells and into the blood. In order to maintain a balance in the body, the blood must be cleaned of these waste products. The kidneys are the main organs of the excretory system.

Figure 5.2. The Excretory System



The kidneys are bean-shaped organs that act as the main blood filters of the body. More than a quart of blood is cleaned every minute as blood passes through the filtering structures of the kidneys. Tiny tubelike structures called nephrons filter out waste materials and extra fluid from the blood. This liquid is sent to the bladder to be stored until it is released as urine.

Figure 5.3. The Kidney



Lesson 1: Physical and Chemical Changes in Digestion

Human Body Book

Following your teacher's instructions, create a book about the functions of the human body.

- Title each diagram.
- Describe in your book the functions of the system.
- On the diagrams provided by your teacher, label and color the following:

  mouth—red
  esophagus—blue
  stomach—orange
  small intestine—brown
  liver—green
  large intestine—yellow
  kidneys—brown
  urinary bladder—yellow

Elaborate

Using the materials provided by your teacher, design a filter to model how kidneys filter waste from the blood. The "blood" to be cleaned is muddy water.

In your science notebook, draw and label the filter and describe the efficiency of the filter.

Keep a small amount of muddy water to use as a control for comparisons. Participate in a gallery walk to observe filters created by other groups.

Questions

1. Compare the water before and after filtering through each one of the filters. Which one cleaned the water most efficiently?

2. Which of the filters is most like the kidneys? Why?

The function of the kidneys is much more complex than your model. There is a delicate chemical balance that must be maintained in the body. The kidneys are "chemists" in that they measure amounts of chemicals your body needs, such as sodium, phosphorus, and potassium, and they make sure there is the correct amount in the blood for your body to function.

Evaluate

Part 1

Create a concept map showing the chemical and physical changes that occur during digestion.

Part 2

Use your knowledge of physical and chemical changes in digestion to complete the assessment.