

What's Included?

Unit Planning

- State & NGSS Standards document
- Unit Pacing Guide for 50 min classes
- Vocabulary terms for prefix/suffix work
- Differentiation ideas for honors students and virtual students ***Digital links for virtual learning found here**
- Honors assignment list

Notes

- Editable PowerPoints
 - Alimentary Canal PPT (35 slides)
 - Accessory Organs & Nutrition PPT (14 slides)
- Cornell Notes Pages
 - Alimentary Canal (5 pgs)
 - Accessory Organs (2 pgs)
 - Editable Cornell Notes
 - Cornell Notes Keys
- Doodle Notes (9 pgs)
 - Guide to Using Doodle Notes
 - Doodle Note Keys & Examples

Student Pages

- This folder contains duplicate copies of every student page. They are in order according to the pacing guide for QUICK PHOTOCOPYING if you are using the pacing guide as is.

Activities

- Digestive System Station Lab (5 pgs)
- Liver Enzyme Lab (5 pgs)
- Microscopy Labs
 - Alimentary Canal (1 pg)
 - Liver (1 pg)
- Diseases Web-quest (2 pgs)
- Answer Keys for all activities

Extensions

- Digging Deeper: Bariatric Surgery*
- Digestive Homeostasis
- Data Analysis: Enzymes*

*Honors Options

Review and Assessment

- Editable Task Card Review (32 cards) with answer sheet
- 4 diagrams of digestive system and associated structures
- Alimentary Canal Quiz through Google Forms
- Accessory Organs Quiz through Google Forms
- Digestive System Test (paper)- both Honors and Regular versions with answer sheets

Unit Planning:

NGSS and State Standards Document

If your state isn't listed, contact me by email (support@suburbanscience.com) and I'll help you figure out which ones are covered!

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Included Resources by Folder:

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- State & NGSS Standards document
- Unit Pacing Guide for 50 min classes
- Vocabulary terms for prefix/suffix work
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Extensions

- Digging Deeper: Artificial Blood*
- Digestive Homeostasis
- Data Analysis: Enzymes*

*Honors Options

Review and Assessment

- Editable Task Card Review (32 cards) with answer sheet
- 4 diagrams of digestive system and associated structures
- [Alimentary Canal Quiz](#) (Make a copy of this file to your Drive. Do NOT assign to students using this link.)
- [Accessory Organs Quiz](#) (Make a copy of this file to your Drive. Do NOT assign to students using this link.)
- Digestive System Test (paper) - both Honors and Regular versions with answer sheets

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Supplementary Resources

- Experiment: [test the effects of salivary amylase](#)
- Students can compare human digestive anatomy to that of a ruminant (cow, sheep, goats, deer, etc.)
- Have students research the effects of fad dieting on the digestive system
- Identify the causes of peptic ulcers on the alimentary canal
- [Case Study on Meckels' Diverticulum](#)

Materials Needed

- General classroom use: colored pencils, markers, and crayons, index cards for prefixes and suffixes
- Digestive System Station Lab: Printed station cards, loaf of white bread, water, plastic sandwich bags with zippers, pair of nylon pantyhose, tennis ball
- Liver Enzyme Lab: raw chicken liver (from grocery store), water, hydrogen peroxide, vinegar, spoons, blender, microwave or hot water bath, small cups or test tubes
- Alimentary Canal Microscopy Lab: slides of stomach, esophagus, or intestine, microscopes
- Accessory Organs Microscopy Lab: slide of liver, microscopes

Not included:

General classroom use: colored pencils, markers, and crayons, index cards for prefixes and suffixes

Digestive System Station Lab: Printed station cards, loaf of white bread, water, plastic sandwich bags with zippers, pair of nylon pantyhose, tennis ball

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Alimentary Canal Microscopy Lab: slides of stomach, esophagus, or intestine, microscopes

Accessory Organs Microscopy Lab: slide of liver, microscopes

Standards:

Topic:	State:	Standards:
Accessory Organs	OH	AP.AE.2 The metabolic functions of the accessory organs play strategic roles in the breakdown of food products, the maintenance of glucose levels within the blood and the regulation of homeostasis in the body.
	CO	-Examine the organs of the alimentary canal, accessory structures, and the general functions of the digestive system. -Compare and contrast chemical and mechanical digestion and give examples of where each occurs. -Define common medical terms used in digestive processes.
	IN	AP.12.3 Identify and locate physiological functions.
	UT	Strand 12, Standard 12.3 Identify the location and function of the digestive system.
Digestive Disease	FL	SC.012.14.46 Describe the physiology of the digestive system, including mechanical digestion, chemical digestion, absorption, and the neural and hormonal mechanisms of control.
	OH	AP.AE.1 Homeostatic imbalance involves the digestive system.
	CO	-Describe the digestive imbalance involved in the digestive system.
	IN	AP.12.3 Explain the difference between the digestive system and the digestive tract.
Alimentary Canal	UT	Strand 13, Standard 13.1 Identify the following parts of the digestive tract: mouth, pharynx, esophagus, stomach, small intestine, large intestine, rectum, anus.
	FL	SC.012.14.46 Describe the physiology of the digestive system, including mechanical digestion, chemical digestion, absorption, and the neural and hormonal mechanisms of control.
	OH	AP.AE.1 The digestive system consists of the gastrointestinal tract (alimentary canal) as well as various accessory organs including the teeth, tongue, salivary glands, liver, gallbladder and pancreas. The digestive system processes and supplies the molecules needed to sustain the living tissues within the body through the absorption of nutrients. Six major functions of the digestive system include secretion, ingestion, mechanical processing, enzymatic digestion, absorption and excretion. The lining of the digestive system protects surrounding tissues from the mechanical and enzymatic stresses of the digestive process. -Processes of the digestive system include the mechanical and chemical breakdown of food into small molecules which are then absorbed by the digestive tract. Specific actions within the digestive system include mastication, peristalsis, segmentation, and the release of hormones and enzymes necessary for digestion.
	CO	-Examine the organs of the alimentary canal, accessory structures, and the general functions of the digestive system. -Compare and contrast chemical and mechanical digestion and give examples of where each occurs. -Define common medical terms used in digestive processes.
Alimentary Canal	IN	AP.12.2 Investigate the enzymes of the gastrointestinal tract and accessory organs in relation to the processing, digesting, and absorbing of the three major biomolecules.
	UT	Strand 13, Standards 13.8, 13.12 Identify the general functions of the digestive system. -Contrast chemical and mechanical digestion. -Differentiate between the following: mouth, pharynx, esophagus, stomach, small intestine, large intestine, rectum, anus. -Describe the functions of saliva and salivary amylase in digestion. -Identify the following parts of a typical tooth: crown, neck, root, gingiva, periodontal ligament, enamel, dentin, pulp, root canal. -Identify the anatomical features of the stomach: fundus, body, pylorus, rugae, cardiac sphincter, pyloric sphincter. -Identify the basic components and functions of gastric juice: chief cells, pepsinogen, parietal cells, hydrochloric acid, gastric cells, mucus. -Identify the three sections of the small intestine and describe the functions: duodenum, jejunum, ileum. -Identify the structures and sections of the large intestine and describe the functions: cecum, colon, rectum, and anal.
	FL	SC.012.14.46 Describe the physiology of the digestive system, including mechanical digestion, chemical digestion, absorption, and the neural and hormonal mechanisms of control.
	OH	AP.AE.1 The digestive system consists of the gastrointestinal tract (alimentary canal) as well as various accessory organs including the teeth, tongue, salivary glands, liver, gallbladder and pancreas. The digestive system processes and supplies the molecules needed to sustain the living tissues within the body through the absorption of nutrients. Six major functions of the digestive system include secretion, ingestion, mechanical processing, enzymatic digestion, absorption and excretion. The lining of the digestive system protects surrounding tissues from the mechanical and enzymatic stresses of the digestive process. -Processes of the digestive system include the mechanical and chemical breakdown of food into small molecules which are then absorbed by the digestive tract. Specific actions within the digestive system include mastication, peristalsis, segmentation, and the release of hormones and enzymes necessary for digestion.

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Unit Overview Page

plus

Supplementary Resource Ideas and Materials Lists

Editable Pacing Guides

	Day	Intro	Instruct	Assess	Homework
Accessory Organs	6	Prefix/suffix flashcards: • hepato-, -pyloris, procto-	• Accessory Organs PPT- Section 2 • Cornell Notes (Nutrition) • Digestive Homeostasis	• Cornell Notes summaries • Informal discussion and questions • Class discussion of homeostasis answers	*Teacher prep notes: If students aren't preparing or cooking the liver during lab tomorrow, you will need to do it ahead. This will make the lab go faster.
	7	Review prefix/suffix flashcards	• Enzyme Lab Materials: raw chicken liver, water, hydrogen peroxide, distilled white vinegar, measuring spoons, blender, microwave or hot water bath, small plastic or paper cups or test tubes, plastic spoons	• Informal questioning during lab activity • For honors, you may want to grade the lab. For regular classes, they may struggle enough that you'll want to go over it	<u>All:</u> • Finish Enzyme Lab questions • Study for Accessory Organs Quiz <u>Honors:</u> Data Analysis: Enzymes
Diseases of the Digestive System	8	Review prefix/suffix flashcards or study for quiz	• Accessory Organs Online Quiz (need computers) • Diseases of the Digestive System Web-quest research (need computers)	• Formal assessment: quiz • Informal observation of student progress during web-quest	Finish Disease Web-quest if not finished
Review	9	Review prefix/suffix flashcards	• Collect Disease Web-quest • Task Card Review	• Observe student progress during task cards • Informal questioning, if necessary	Study for test
	10	Study for test and/or check over task card answers	• Go over Task Card Review making sure students have correct answers to study for test. • Work on all Digestive System Diagrams	• Assess understanding of task cards • Informal questioning	
Assessment	11	Review notes for test	Digestive System Test	• Formal assessment	

Using this Pacing Guide as is? You can print all the student



The daily topic coincide with the previous standards document.
Lesson planning is now quick and easy!

Digestive System Unit Pacing Guide					
	Day	Intro	Instruct	Assess	Homework
Alimentary Canal	1	Students add to prefix/suffix flashcards: • digest-, aliment-, glosso-, lingua-, -odonto	• Alimentary Canal PPT- Section 1 & Section 2 • Cornell Notes (Intro & Teeth, Mouth & Esophagus)	• Cornell Notes summaries • Informal discussion and questions	
	2	Prefix/suffix flashcards: • -phage, metabol-, peri-, -stalsis, enter/o-, ruga-	• Alimentary Canal PPT- Section 3 & Section 4 • Cornell Notes (Stomach & Small Intestine)	• Cornell Notes summaries • Informal discussion and questions	<u>Honors:</u> Digging Deeper: Bariatric Surgery
	3	Honors: Discuss/review homework Regular: Review prefix/suffix flashcards	• Alimentary Canal PPT- Section 5 • Cornell Notes (Large Intestine & Anus) • Digestive System Lab Materials: Station cards , loaf of white bread, water, plastic sandwich bags with zippers, 1 pair of nylon pantyhose with top & bottom cut off, tennis ball	• Cornell Notes summaries • Informal discussion and questions • Informal questioning during lab activity	<u>All:</u> • Study for Alimentary Canal Quiz
	4	Review prefix/suffix flashcards or study for quiz	• Alimentary Canal Online Quiz (need computers) • Alimentary Canal Microscopy Lab Materials: cross-section slide of esophagus, stomach, or intestines and microscopes (or virtual slide)	• Formal assessment: quiz • Informal questioning during lab activity	
Accessory Organs	5	Review quiz answers and/or answer student questions about quiz	• Accessory Organs PPT- Section 1 • Cornell Notes (Accessory Organs) • Accessory Organs Microscopy Lab Materials: liver histology slide and microscopes (or virtual slide)	• Cornell Notes summaries • Informal discussion and questions • Informal questioning during lab activity	

Coincide with State Standards document in Unit Planning Folder

*Bold items must be photocopied.



This icon is found on the top right corner of Honors pages for easy identification.

Differentiation Ideas for:

- Student Interest
- Student Ability
- Teaching Pace
- Teaching Environment (Virtual, in-class, or hybrid)

Differentiation

Differentiation is a key component to any unit. Here are some tips for differentiating based on student interest, ability and teaching environment.

Student Interest/Choice

- Both Cornell notes and Doodle Notes™ are included in this unit. Although most of my students preferred the Doodle Notes™, they may not resonate with everyone. Some students may prefer the structure of the Cornell notes.

Differentiation

Teaching Environment

- Virtual or Hybrid students
 - Digital Options:
 - Links for PowerPoints
 - Digital Students pages using Google Slides™ for students to type on
 - Digital Doodle Notes™
- All histology labs can be completed using virtual slides on [Histology Guide](#).
- For the **Digestive System Lab**, students can use **kitchen materials** found at home and skip the panty hose/tennis ball station.
- **Digital drag-and-drop diagrams** can be provided for students to self-check and turn in electronically. I have these available for everybody.

All found on the following page.


Honors Assignment List

Although there are no official education standards for what makes an "honors" class, **honors assignments generally provide one of three options:**

- Greater depth of knowledge
- Additional critical thinking
- More independent work

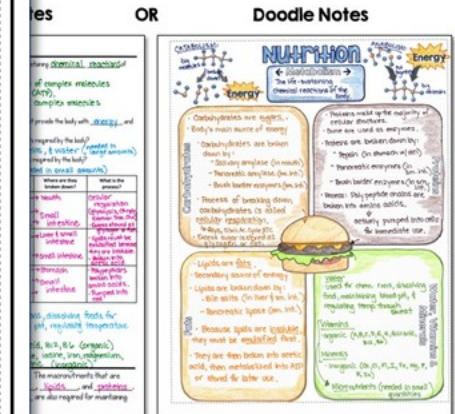
In this unit, you can find some additional assignments used to increase knowledge for honors students. **These can certainly be used for all students also be helpful for extra credit, homework, or sub days if you need it.** Because answers to these assignments are often less straightforward, grading for completion and then **discussing the answers** to make sure

Assignment	Type of work	Skills addressed
Digging Deeper: Bariatric Surgery	Reading assignment	Critical thinking
Data Analysis: Enzymes	Math extension	Interpretation of graphs

All honors assignments are designated by a  in the top right corner for identification.

For additional skill-work in pathology or for students thinking of going into the medical field, I also use my Anatomy case studies. There is one for each body system to allow students to integrate the body system to another.

[Click here to see the Case Studies](#)



Differentiation

Student Ability

- **Advanced students**
 - **Honors options** are included in the student pages. These can be given to a whole advanced class or individual students, as needed.
 - **Editable Cornell notes** (found in the Notes folder)
 - **Delete the fill-in-the-blank notes on the right side** leaving only questions for a more independent note-taking experience.
 - **Delete the summary** and allow students to come up with their own.
 - When using **diagram quizzes**, use the option without the word bank and/or grade on spelling of the structures.
 - **Tests:**
 - **Don't allow students to use prefix/suffix flashcards** on the test.
 - Use the "Honors" tests that **don't have word banks** for the diagrams and include **additional short answer questions**.
- **Struggling students**
 - **Eliminating homework altogether** may work well for students that have trouble thinking independently or have home situations that don't allow for work outside of class. Make sure to account for the extra class time needed to complete all assignments in class.
 - Although I always help students during labs and answer questions as they complete lab worksheets, these students **may need to have each lab answer discussed** and checked the following day rather than grading the labs for accuracy.
 - **Microscopy labs can be eliminated** for these students in order to simplify material.
 - **Editable Cornell notes** (found in the Unit Planning folder)
 - **Use the fill-in-the-blank style** of notes for these students so they can focus on material and less on summarizing.
 - **Using the fill-in-the-blank summary**, see if students can come up with the words that go in the blanks before providing the summary to them.
 - **Diagram Quizzes:** use the option with the word bank or use the option without the word bank but don't grade spelling.
 - **Tests:**
 - **Allow students to use prefix/suffix flashcards** on the test rather than memorizing them.
 - Use the "Regular" tests that eliminate some of the **short answer questions** and include **word banks** for the diagrams.
- **For any ability**
 - Both the PowerPoints and the Cornell notes have **editable options** so whole topics or vocabulary words can be added or deleted.

Every student page also comes in a **digital** version on Google Slides

Virtual, hybrid, or absent students can stay right on track!

Stomach

What is the anatomy of the stomach?

Stomach: muscular sac with thick walls
The stomach continues the processes of mechanical and chemical digestion.
What are sphincters and what is their function in the digestive system?
Thick rings of muscle that act as gatekeepers to regulate food movement
What two sphincters are located in the stomach?
• Cardiac sphincter = separates esophagus from stomach
• Pyloric sphincter = separates stomach from small intestine.


How does mechanical digestion occur in the stomach?

The stomach has a slippery outer layer of Serosa, followed by 3 layers of muscle:
• Longitudinal muscularis
• Circular muscularis
• Oblique muscularis
These muscles help to churn food and propel it towards the small intestine. The churning process is known as maceration.
What are rugae? "wrinkles" in the mucosa that can stretch when full

How does chemical digestion occur in the stomach?

The mucosa layer of the stomach contains several specialized gastric gland cells:
• Mucous cells - secrete mucus to protect stomach lining
• Chief cells - secrete pepsinogen (inactive enzyme)
• Parietal cells - secrete HCl to kill microbes in food & convert pepsinogen into pepsin, which breaks down food proteins.
The soupy mixture formed from the squeezing of the stomach and the addition of these gastric juices is known as chyme.

Summary: The stomach is made of 3 muscular layers and an outer layer of Serosa. During maceration, the stomach churns the food and gastric gland cells add chemicals and enzymes leading to the formation of chyme.



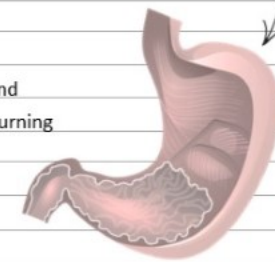
How does mechanical digestion occur in the stomach?

How does chemical digestion occur in the stomach?

The stomach has a slippery outer layer of Serosa, followed by 3 layers of muscle:
• Longitudinal muscularis
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• Oblique muscularis
These muscles help to churn food and propel it towards the small intestine. The churning process is known as maceration.
What are rugae?

The mucosa layer of the stomach contains several specialized gastric gland cells:
• Mucous cells-
• Chief cells-
• Parietal cells-

The soupy mixture formed from the squeezing of the stomach and the



Can be used in Google Classroom, Microsoft OneDrive or many other platforms!

Greek and Latin Roots for Medical Terminology Practice

Anatomical Prefixes/Roots/Suffixes:

	Term	Definition
Digestive System	digest-	dissolve
	aliment-	nourish
	glosso-, lingua-	tongue
	-odonto	teeth
	-orexia	appetite
	phage-	eat
	metabol-	change
	peri-	around, surrounding
	-stalsis	constriction
	enter/o-	gut
	ruga-	wrinkle, fold
	hepato-	liver
	-pyloris	gatekeeper
	procto-	rectum, anus

Using Prefixes/Suffixes in your Classroom:

Why study prefixes and suffixes at all?

The basis of scientific terminology comes from Latin & Greek. By teaching science students Latin & Greek prefixes, suffixes and root words, they can learn to dissect new scientific terms when they come across them in news articles or textbooks. This is a great way to train our students to be scientifically literate adults. Even if they don't remember all the facts they've memorized in this class, they can interpret scientific information from the media and from their own doctors.

How can you use them in class?

• How I do it:

- **Beginning of the year:** I ask students to bring in a stack of 300 3"x5" index cards. I always have a few extra on hand for students that forget or can't afford them, although they're fairly inexpensive.
- **Beginning of (almost) every class:** I write any prefixes and suffixes that are relevant to that day's topic on the board along with the definition. Students record the prefix/suffix on one side of an index card and the definition on the other. If there aren't any terms for that day, students can review the terms they already have written down.
- **On test day:** I add approximately two scientific words to the end of every unit test. These are words that relate to the unit but are not ones we have discussed in class. Students must use the prefixes/suffixes we've studied to interpret the meaning of the new term. For on-level or advanced classes, I recommend not letting students use their index cards on the test, but for low-level students, it may be beneficial to allow it.

Hepato-

Uses in your Classroom:

Helpful tips for using cards:

- Always have a master list of the terms you've given out or keep your own set of notecards. It may be helpful to have students write the date in the top corner of the card. This allows absent students to copy the terms they missed when they return.
- Starting class with these terms is a great way to give yourself a few more minutes to get organized. Students can always review their index cards or quiz each other if you need a few more minutes.
- Students will need some way to keep the cards organized- put them on a ring, rubber band them together, or keep them in a bag.
- Students add to these index card stacks throughout the year without removing terms. The course builds on itself, so it's always beneficial to review terms from previous units as well as the current unit. You may find that some terms are duplicated from one unit to another. No need to have students write the same term twice.
- For advanced students, you may want to have them look up the definition in a textbook rather than providing it to them.

Be sure to mention these prefixes and suffixes again as they come up in class. Using the terms in context is the best way for students to recognize and remember them.

Prep sub plans:

Students can type the terms into Quizlet or a similar site and quiz themselves.

Students can make up scientific terms (real or not) and have other students interpret the meaning of the term.

Use a blank bingo board (provided on the next page) and have students fill in the definitions for the current or past unit in any blank. The sub can call out a prefix or suffix and students mark off the definition until someone wins bingo.

*This is another important reason to have a master list or set of cards for all the terms students have already learned.

A great way to encourage scientific literacy and prepare students for higher level science courses.

2 Highly Visual PowerPoint Presentations

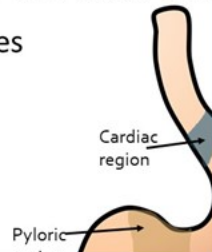
49 editable, fully-animated slides

What is the anatomy of the stomach?

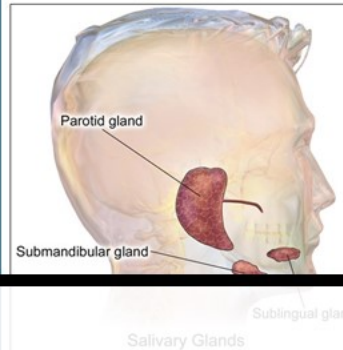
Stomach= muscular sac with thick muscular walls

- Continues the processes of **mechanical** and **chemical** digestion
- 4 main regions of stomach:

1. Cardiac region
2. Fundus
3. Body
4. Pyloric region



What other digestive structures are found in the mouth?

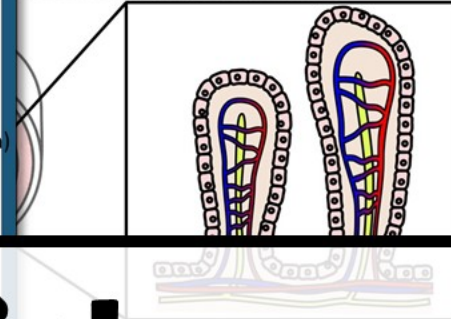


• **Salivary glands** produce saliva:

- 99% water
- Mucus (lubricates food for swallowing)
- Amylase (breaks down starch)
- Lysozymes (kills bacteria)
- Antibodies (mark foreign invaders)

to absorb nutrients efficiently, the intestine is lined with villi and

finger-like projections in the lining of the small intestine filled with blood vessels



Sample Slides

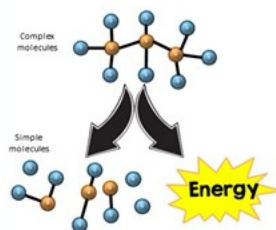
What is the function of the liver?

- The liver is the largest internal organ. It has 2 major lobes: **left and right**.
- It contains **hepatic sinusoids**, which are full of blood.
- Functions of liver cells:** removing bacteria and old red blood cells, detoxifying blood from drugs and poisons, storing glycogen and producing fats, manufacturing proteins, storing iron and copper
- Liver also secretes **bile**, the greenish fluid responsible for breaking down fats

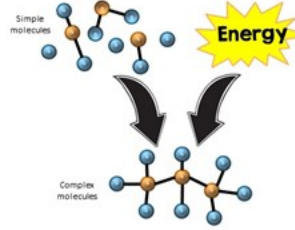


What processes are involved in metabolism?

• **Metabolism** refers to the life-sustaining **chemical reactions** of the body. It is categorized into 2 types:



• **Catabolism:** breaking down of complex molecules while releasing energy (ATP).



• **Anabolism:** formation of complex molecules while using energy.

How are macromolecules digested?

What are they?	Broken down by:	Where?	Process:
Proteins make up the majority of cellular structures. Some are used as enzymes for chemical reactions.	-Pepsin -Pancreatic enzymes -Epithelial enzymes of the small intestine (brush border enzymes)	-Stomach in the presence of HCl -Small intestine -Small intestine	Polypeptide chains are broken into individual amino acids. These amino acids are actively pumped into the cell for immediate use.

Two note-taking styles are included:

Cornell Notes

Nutrition

What processes are involved in metabolism?
Metabolism refers to the life-sustaining chemical reactions of the body. It is categorized into 2 types:
 1. **Catabolism**: breaking down of complex molecules while releasing energy (ATP).
 2. **Anabolism**: formation of complex molecules while using energy.

What types of nutrients are required by the body?
Nutrients are substances that provide the body with energy and can be used for growth.
 What are the 4 types of macronutrients required by the body?
carbohydrates, lipids, proteins, & water (needed in large amounts)
 What are the 2 types of micronutrients required by the body?
vitamins & minerals (needed in small amounts)

What are they?	How are they broken down?	Where are they broken down?	What is the process?
Carbohydrates: • sugars • main source of energy	• Salivary amylase • Pancreatic amylase • Brush border enz.	→ Mouth → Small intestine	Cellular respiration (Glycolysis, Citric Acid Cycle, Electron Trans. Chain) • Excess stored as glycogen or fat.
Lipids: • fats • secondary source of energy	• Bile salts • Pancreatic lipase	→ Liver & small intestine → small intestine	• Lipids must be emulsified because they are insoluble. • Broken into acetic acid
Proteins: • Majority of cellular structures • Enzymes	• Pepsin • Pancreatic enz. • Brush border enzymes	→ Stomach → Small intestine	• Polypeptides broken into amino acids. • Pumped into cell

How are macromolecules digested?

How is water used in the body?
 Water is used for chemical reactions, dissolving foods for digestion, maintaining blood pH, regulating temperature through sweat

What micronutrients are needed by the body?
 Vitamins: A, B, C, D, E, K, folic acid, B12, B6 (organic)
 Minerals: Calcium, chlorine, fluorine, iodine, iron, magnesium, phosphorus, potassium, zinc (inorganic)

Summary: **Metabolic** processes are required for life. The macronutrients that are metabolized in the digestive system are carbs, lipids, and proteins. water, vitamins, and minerals are also required for maintaining homeostasis.

Doodle Notes

Nutrition

CATABOLISM: big molecules broken down → Energy

ANABOLISM: Put together → Energy

Metabolism
 The life-sustaining chemical reactions of the body.

Carbohydrates

- Carbohydrates are sugars.
- Body's main source of energy
- Carbohydrates are broken down by:
 - Salivary amylase (in mouth)
 - Pancreatic amylase (sm. int.)
 - Brush border enzymes (sm. int.)
- Process of breaking down carbohydrates is called cellular respiration.
 - ↳ Glyc, Citric Ac. Cycle, ETC
 - Excess sugar is stored as glycogen or fat.

Proteins

- Proteins make up the majority of cellular structures.
- Some are used as enzymes.
- Proteins are broken down by:
 - Pepsin (in stomach w/ HCl)
 - Pancreatic enzymes (in sm. int.)
 - Brush border enzymes (in sm. int.)
- Process: Poly peptide chains are broken into amino acids.
 - actively pumped into cells for immediate use.

Fats

- Lipids are fats.
- Secondary source of energy
- Lipids are broken down by:
 - Bile salts (in liver & sm. int.)
 - Pancreatic lipase (sm. int.)
- Because lipids are insoluble, they must be emulsified first.
- They are then broken into acetic acid, then metabolized into ATP or stored for later use.

Water, Vitamins & Minerals

Water

- used for chem. rxns, dissolving food, maintaining blood pH, & regulating temp through sweat

Vitamins

- organic (A, B, C, D, E, K, folic acid, B12, B6)

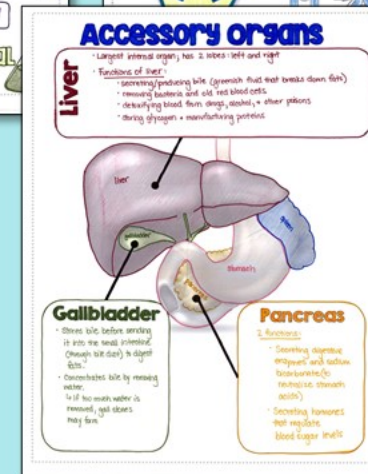
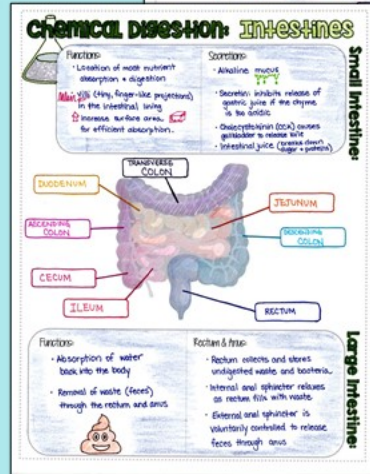
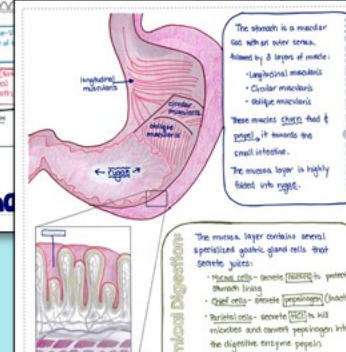
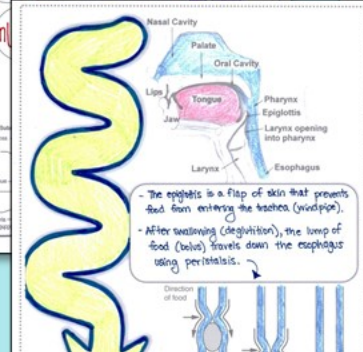
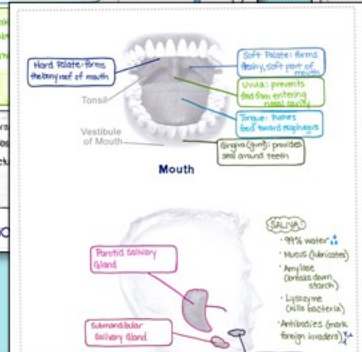
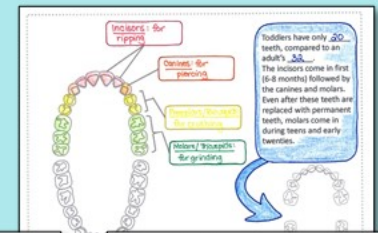
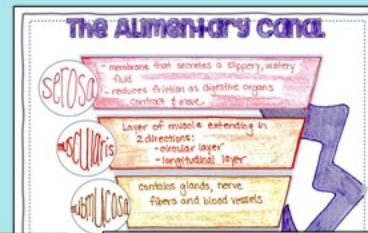
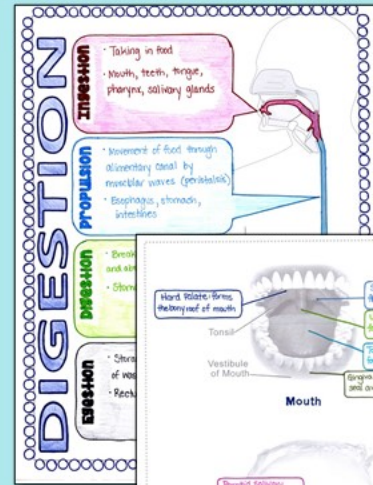
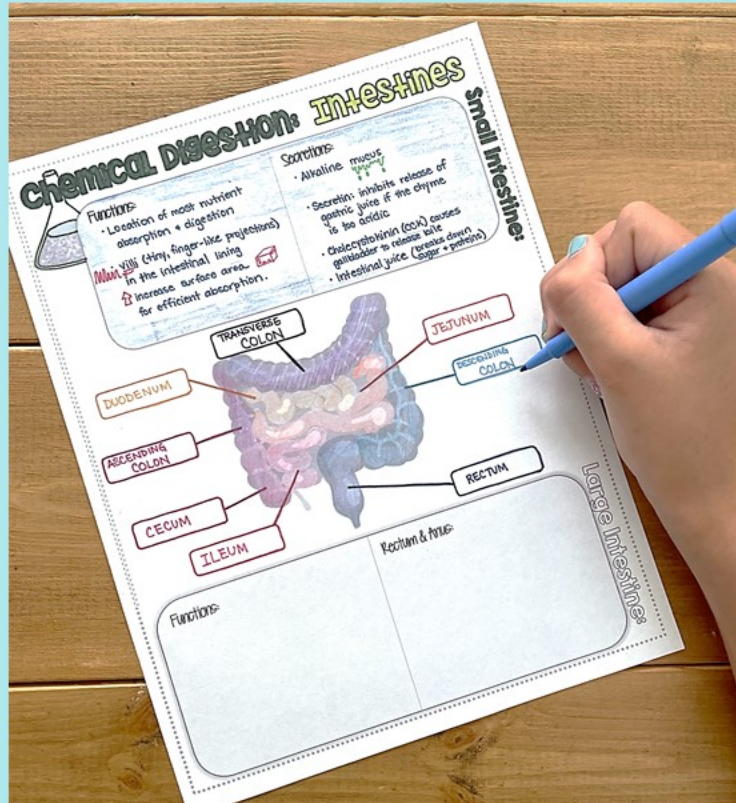
Minerals

- Inorganic (Ca, Cl, F, I, Fe, Mg, P, K, Zn)

Micro nutrients (needed in small quantities)

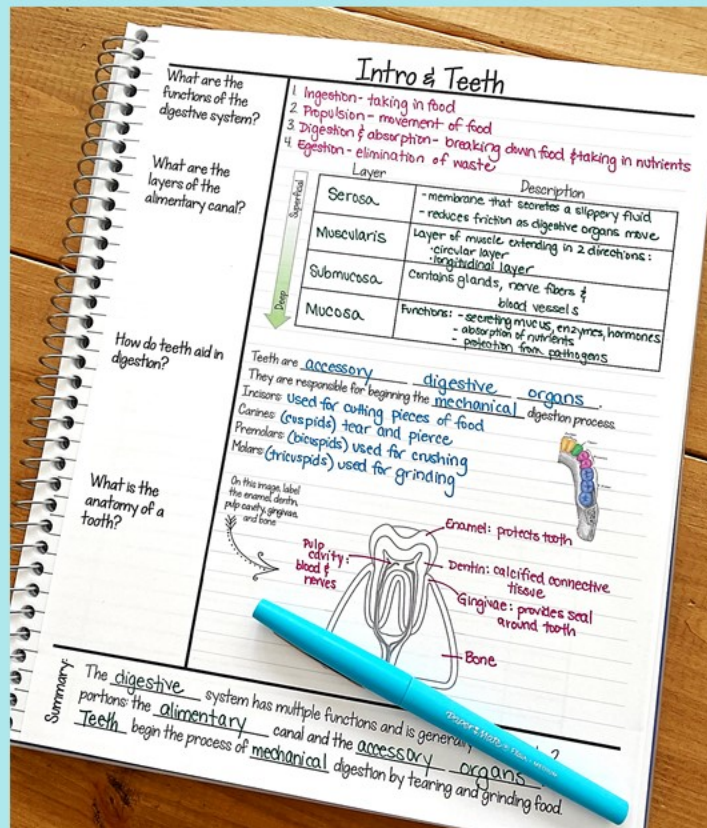
Both coincide perfectly with the presentation for error-proof notes!

9 pages of Doodle Notes



Doodle Notes™ increase student focus and memory-
and they're great fun!
A guide for using them in your classroom is included.

7 pages of Cornell Notes



Big
concept
questions

Content
summary for
each page

Small Intestine

What is the anatomy of the small intestine?

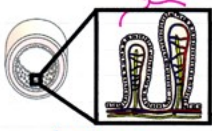
The small intestine is the location of most digestion and nutrient absorption. It is about 10 ft long in an adult. The small intestine has 3 sections:

- Duodenum
- Jejunum
- Ileum

After the ileum, it joins the large intestine at the ileocecal sphincter.

What are villi and where are they found?

Tiny, finger-like projections in the lining of the intestine filled with blood vessels.



Many glands line the small intestine and secrete digestive hormones.

Secretion	Purpose/Function
Mucus	Protects from pathogens
Secretin	Inhibits the release of gastric juices when chyme is very acidic
Cholecystikinin (CCK)	causes gall bladder to release bile
Maltase, Sucrase, Lactase	Break down sugars
Peptidase, Enterokinase	Break down proteins

Because the small intestine needs time to absorb nutrients, the chyme must be slowed down.

Circular muscles in the intestinal wall cause segmentation of the chyme. This is in contrast to peristaltic contractions which involve longitudinal muscles.

Summary: The small intestine is very long and divided into 3 sections. It contains villi, which absorb nutrients and glands that secrete hormones. To give the small intestine time to absorb properly, segmentation slows down the movement of chyme.

Each page is **editable**.
Add and delete text, questions, and summaries
to meet the needs of your students.

Includes 5 Activities

- Digestive System Station Lab
- Liver Enzyme Lab
- Microscopy Labs (2)
- Diseases Web-quest

Station 1

- Get 1 piece of bread.
- Tear it up into small pieces and zippered sandwich bag.
- Add water to the bread pieces and gently squeeze and smash the bread.
- Unzip a small corner of the bag and drain out the water, but leave the bread pieces in the bag.
- Put the bag into the trash for storage.

Station 3

Work with a partner for this activity. Each of you should hold one end of the nylon panty hose. One partner should put the tennis ball into their end of the panty hose and gradually push it down until it is able to be expelled from the other end.

Digestion

Part 1:

Explain how each step you completed represents a section of the digestive process.

Process	Represents	Mechanical or Chemical?
Tearing bread into pieces		
Squeezing bread		
Draining out water		
Storing bag in garbage		

Part 2:

1. Did you notice a difference after keeping the bread in your mouth for several minutes?
2. What was happening during that time that caused the change?

Part 3:

3. Explain how this activity relates to the process of peristalsis in your digestive tract. Use ALL the following words in your explanation: *peristalsis*, *bolus*, *esophagus*, and *waves*.

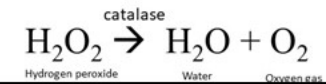
Digestive System Station Lab Sample Page

Enzymes Lab

Background Information:

Your liver is an important organ for breaking down chemicals that are otherwise dangerous to the tissues of the body. As you are performing cellular respiration to make energy, they form **hydrogen peroxide**. Hydrogen peroxide is a beneficial molecule because it is able to kill invading bacterial cells. If the amount of hydrogen peroxide in the cells gets too high, however, the cell's DNA can be damaged. Your liver is able to break down this hydrogen peroxide using an enzyme called **catalase**. In this lab, you'll be able to see the catalase enzyme at work. Catalase is a specialized protein that speeds up a chemical reaction. It breaks down hydrogen peroxide into other molecules without being used up. There are many types of reactions that can be caused by enzymes, including decomposition reactions.

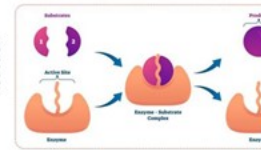
Enzymes require a specific set of environmental conditions to work optimally. Catalase works best at a pH of 6.8 to 7.0 and at body temperature. The chemical reaction caused by catalase is as follows:



Decomposition Reaction



Synthesis Reaction



Liver Enzyme Lab Sample Pages

Procedure:

1. Put about 1 teaspoon of the raw liver mixture into the first 3 cups.
2. Put 1 teaspoon of the cooked liver mixture into the last cup.
3. Next, add 1 teaspoon of water to cup 1.
4. Add 1 teaspoon of vinegar to cup 3.

Here's what your cups should have in them so far:

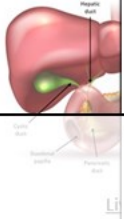
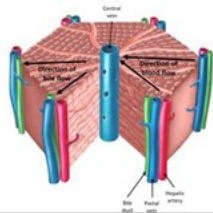
1 tsp water + 1 tsp raw liver	1 tsp raw liver	1 tsp vinegar + 1 tsp raw liver	1 tsp cooked liver
----------------------------------	-----------------	------------------------------------	--------------------



last 3 cups.
each cup when

Accessory Organs Microscopy

The liver is made of structural and functional units called **lobules**. Each lobule is composed of **hepatocytes** (liver cells) and looks roughly like a hexagon. On each corner of the lobules is a **portal triad** consisting of a hepatic artery, a portal vein and a bile duct. The **hepatic artery** brings oxygen-rich blood from the heart while the **portal vein** brings blood from the digestive tract to be processed. Both of these ducts carry blood through the lobule and empty it into the **central vein** in the middle of the hexagonal lobule, which eventually leads to the inferior vena cava. The **bile duct** in the portal triad, however, leads in the opposite direction. As bile is produced in tiny canals called bile canaliculi within the lobule, it passes into the bile duct.



Alimentary Canal Microscopy

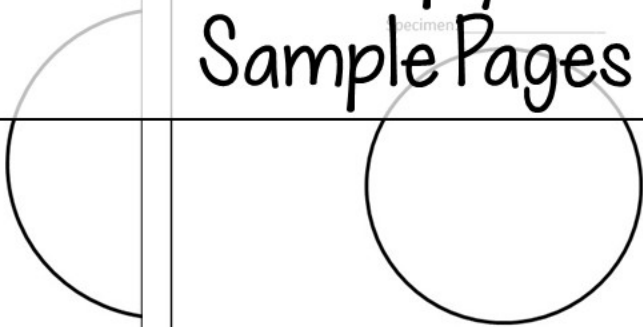
Structures to identify and label:

Serosa
Mucosa
Submucosa
Muscularis
Villi
Crypts

Possible structures to identify and label (depending on your specimen):

Goblet cells
Villi
Crypts
Gastric glands

Microscopy Labs Sample Pages



Magnification: _____

Magnification: _____

- How do the structural differences seen on these layers indicate their function?
- If you have another slide of a different portion of the alimentary canal, compare it with this one. If you don't, predict the differences you'd find for the following:
 - muscular layers:
 - presence of gland cells:
 - villi:

Diseases of the Digestive System

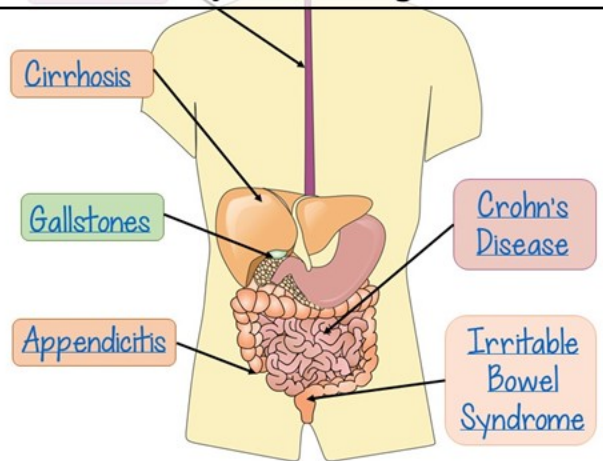
For each of the diseases you learned about on the previous page, complete the appropriate boxes below.

	Cause of the disease	Symptoms	Treatment and/or Prevention
Heartburn			
Gallstones			
Cirrhosis			
Appendicitis			
Crohn's disease			
Irritable Bowel Syndrome			

Diseases of the Digestive System

Each term is linked to a website with information about that particular disease. Use these links to answer the questions on the following page.

Diseases Web-quest Sample Pages



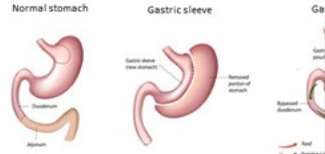
Extension Pages

Digging Deeper: Bariatric Surgery

Background:

Bariatric surgical procedures involve changing the digestive system to allow for weight loss. They are usually only recommended for individuals with a body mass index (BMI) of more than 40. These individuals have often been previously unsuccessful at losing weight using traditional methods of diet and exercise.

The two most common forms of bariatric surgery are gastric bypass and gastric sleeve.



In gastric sleeve surgery, the stomach is vertically sectioned, and a large portion of the stomach is removed. Individuals eat less because they feel full faster. In gastric bypass surgery, the stomach is divided into a small pouch, and the remaining stomach portion is detached from the small intestine and the remaining stomach portion is bypassed, bypassing the duodenum.

Discussion Questions:

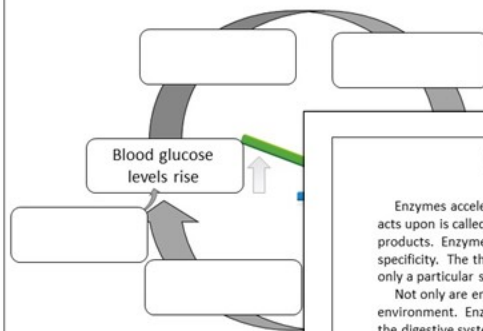
1. In gastric sleeve surgery, what portions of the stomach are removed?
2. In gastric bypass surgery, what portion of the stomach is the only one that remains?
3. In gastric bypass surgery, the duodenum is completely bypassed. What is then connected to the stomach?
4. Individuals with gastric sleeve surgery need to eat smaller meals more often. Individuals with gastric bypass surgery need to eat smaller meals and eat more often. Why is there a difference between these recommendations?
5. Another common bariatric surgery is known as gastric banding. In this procedure, a band is positioned just inferior to the cardiac portion of the stomach. The band is inflated with a saline solution to restrict the amount of food able to enter the stomach. What adjustments would you recommend for these individuals (eating, sleeping, etc.)?

Digestive Homeostasis



Glucose Balance

Glucose, found in carbohydrates, is your body's preferred molecule for producing energy. When glucose levels in your blood rise, the pancreas is stimulated to produce insulin. Insulin is responsible for increasing the ability of body cells to import glucose. This uptake of glucose returns blood glucose levels to normal.



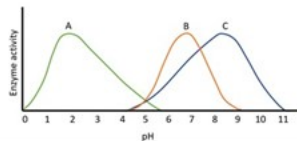
Discussion Questions:

1. Fill in the following statements on the cycle above:
a. When blood glucose levels rise, *insulin* is secreted, *carbohydrates* are ingested, *blood glucose levels* rise, *insulin* stimulates cells to take up glucose, *blood glucose levels* return to normal.
b. Why would individuals with Type 1 diabetes have difficulty maintaining blood glucose levels?
c. Common symptoms of this disease include elevated blood glucose levels, increased thirst, increased hunger, and increased urination.
d. Why would individuals with Type 1 diabetes have difficulty maintaining blood glucose levels?
e. Why would individuals with Type 1 diabetes have difficulty maintaining blood glucose levels?

Data Analysis: Enzymes

Enzymes accelerate chemical reactions within the body. The molecules that the enzymes act upon are called substrates and the molecules that result from the reaction are called products. Enzymes act only on a particular substrate—a property known as enzyme specificity. The three-dimensional structure of an enzyme allows it to cause a reaction only with a particular substrate or bond.

Not only are enzymes specific to certain substrates; they are also picky about their environment. Enzymes often work well only in certain temperatures or at a specific pH. In the digestive system, the pH varies widely as food passes through the alimentary canal. In the stomach, HCl (hydrochloric acid) reduces the pH to 2. After passing the stomach, pancreatic juice containing bicarbonate ions is secreted from the pancreas. This bicarbonate secretion raises the pH to 8, thereby neutralizing the acidic chyme.



This graph shows the amount of activity for each of 3 enzymes in the digestive system.

Discussion Questions:

1. At which pH does enzyme A work optimally? _____
2. At which pH levels are enzymes B and C most active? _____
3. At which pH are enzymes B and C equally active? _____
4. If these enzymes were graphed based on their optimal temperature, would you expect to see the same type of graph distribution? Why or why not? _____
5. Pepsin (works in stomach) _____
6. Trypsin (works in small intestine) _____
7. If these enzymes were graphed based on their optimal temperature, would you expect to see the same type of graph distribution? Why or why not? _____
8. Pepsin and trypsin are both enzymes that digest proteins. These enzymes break apart proteins by breaking the _____ bonds between individual _____.

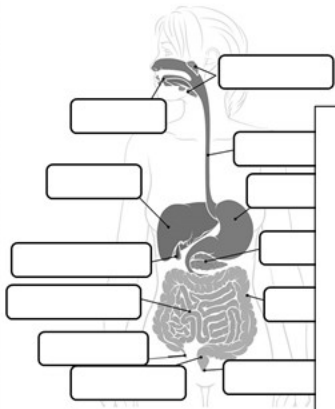
Skills check!

Interpretation of graphs
(great for standardized test prep)

Greater depth of knowledge, scientific literacy, & critical thinking

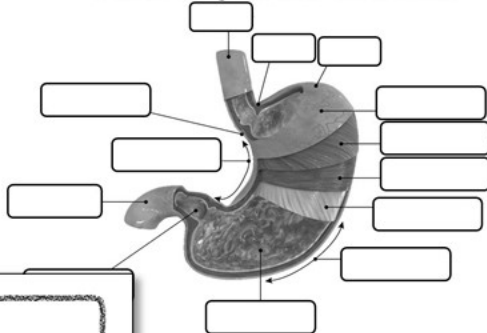
Anatomical Diagrams

Digestive System



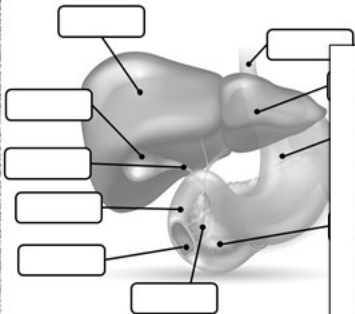
Word bank: esophagus, anus, stomach, pancreas,

Anatomy of the Stomach



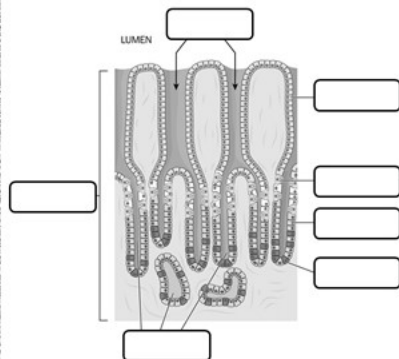
rugae, esophagus, cardia, lower esophageal sphincter, body of stomach, oblique layer, longitudinal layer, circular layer, lesser curvature, duodenal bulb, fundus

Bile Pathway & Digestive Organs



Word bank: cystic duct, esophagus, right lobe of liver, stomach, gallbladder, head of pancreas, major duodenal papilla, duodenum, common bile duct

Microscopic Anatomy of the Stomach

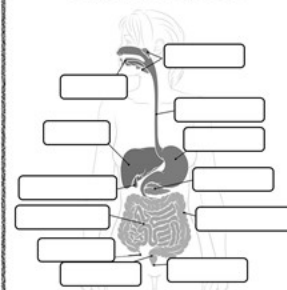


Word bank: chief cells, gastric pits, gastric glands, parietal cells, enteroendocrine cells, mucous cells, mucous membrane

Each diagram comes in 4 versions:

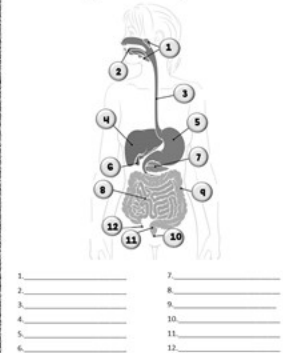
1. Fill-in the blank
2. Numbered quiz
3. Labeled black & white
4. Labeled color

Digestive System

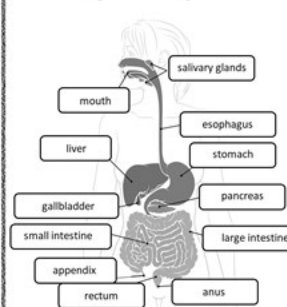


Word bank: esophagus, anus, stomach, pancreas, small intestine, gallbladder, rectum, appendix, salivary glands, large intestine, liver, mouth

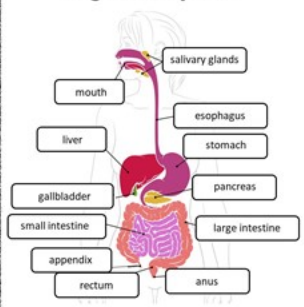
Digestive System



Digestive System



Digestive System



32 Editable Task Cards for Review

Sample Task Cards

1 What are the 4 layers of the alimentary canal?

2 Name 2 structures in the digestive system responsible for mechanical digestion.

3 Which are the incisors and what is their function?

4 Which layer is dentin?

21 What portions of the colon are identified below?

22 Which is voluntarily controlled-the internal or external?

23 How do the liver and gallbladder work together?

24 Name 2 functions of the liver.

Using Editable Task Cards

How to set-up:

1. Print the cards on cardstock or paper.
2. Cut the pages so that each card is separate. If you'd like to use them in future years, it may be worth laminating them to protect them from student writing and other damage.
3. Place each task card at a seat around the room.
4. Students will rotate to each seat until all cards are finished. Answers are recorded on their "Task Card Answer Sheet" or notebook paper.

*TIP: It is important to set a timer. Usually 1-2 minutes is appropriate. Without a timer, students will get backed up while rotating and chaos will ensue. ☺

Teacher Tips

Modifications:

- These task cards are editable so you can change the text on any card.
- There are additional cards at the end of the document for adding questions. Be sure to add the correct number, as well!
- Each card has an icon in the bottom right corner.



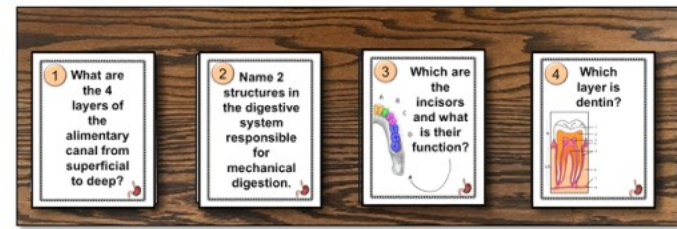
Questions about the alimentary canal



Questions about the accessory organs and metabolism

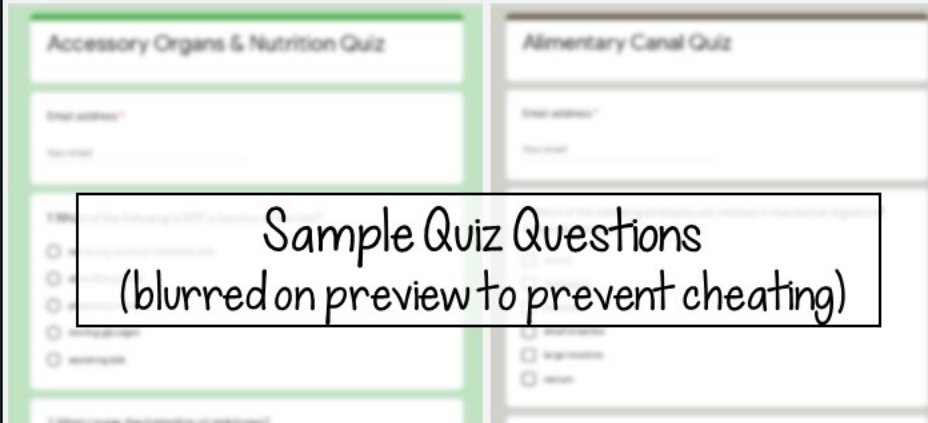
If you'd prefer to divide the unit, you can use the alimentary canal task cards only, then use the accessory organ questions later.

- If moving around your room isn't possible, you can have students pass the cards in one direction.
- Other options:
 - Students can use notes or not depending on the level of memorization you expect prior to reviewing.
 - Students can work in pairs, which adds confidence.



Assessments

Editable Online Quiz through Google Forms



Accessory Organs & Nutrition Quiz

Alimentary Canal Quiz

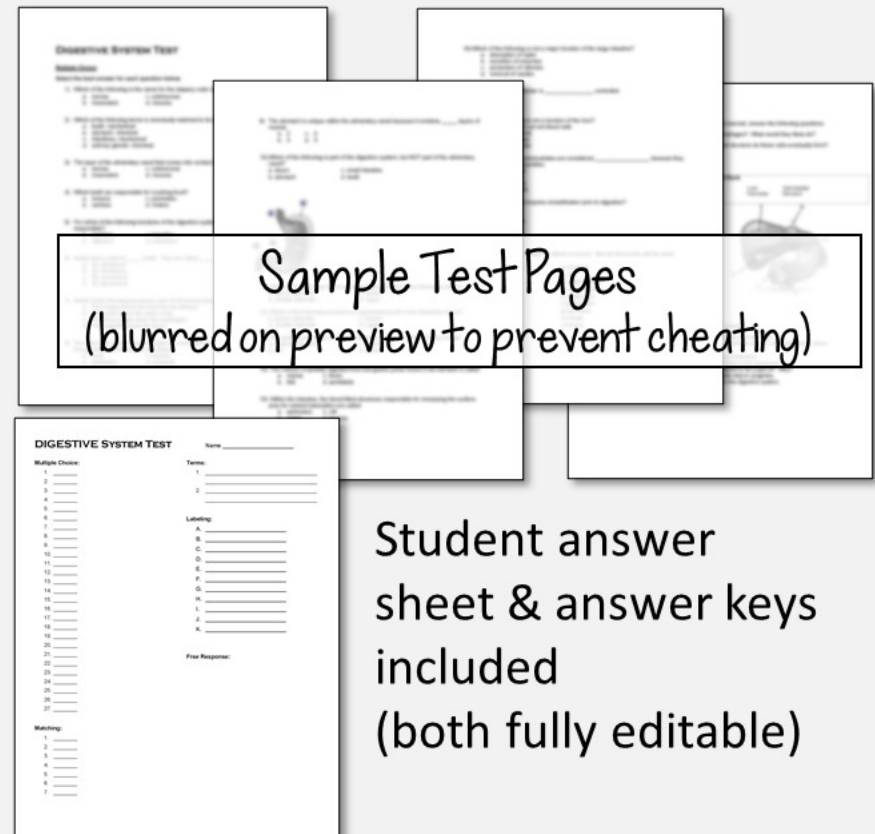
Sample Quiz Questions
(blurred on preview to prevent cheating)

- 25 multi-part questions
- Fully editable
- Answer key included for automatic grading

Editable Unit Test

- 20 multiple choice questions
- 9 matching questions
- 2 Greek/Latin term questions
- 2 labeled diagrams
- 7 free response questions

Two Versions: Honors & Regular



Sample Test Pages
(blurred on preview to prevent cheating)

DIGESTIVE SYSTEM TEST

Multiple Choice

1. _____

2. _____

3. _____

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Matching

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Free Response

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99. _____

100. _____

Student answer
sheet & answer keys
included
(both fully editable)

I'd love to hear from you!

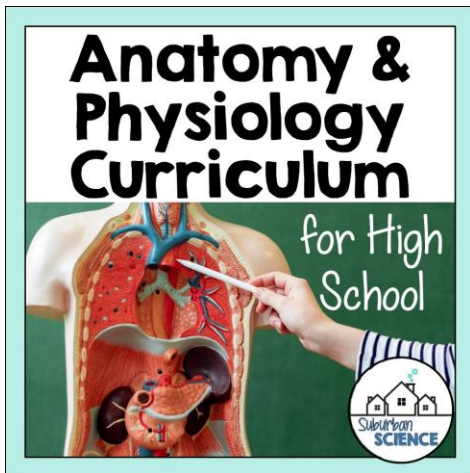
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Sincerely,
Anne from Suburban Science

