BIOLOGY

INTERACTIVE NOTEBOOK

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DAILY SCHEDULE

NAME: _____

Period	Class / Title	Room #	Teacher

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NAME:

Period:

PAGES

THE CHALLENGE

This year, you are not just stepping into a classroom.

You're stepping into a story—a story about life, systems, survival, and discovery.
Biology is more than just memorizing facts about cells, genetics, or ecosystems. It's about learning to ask big questions, make connections, and think like a scientist. It's about seeing the invisible patterns that hold life together—and understanding how you fit into that story.

This class will push you. You will be challenged to think deeply, to work through frustration, and to grow in ways that matter far beyond a test. Success here doesn't mean getting every answer right—it means showing up, staying curious, and refusing to give up when things get tough.

You don't have to be the smartest in the room.

You just have to be committed to becoming a better learner than you were yesterday.

Because biology is not about perfection. It's about progress.
And your progress starts with one choice: to lean in, to engage, and to try.

"Education is not the learning of facts, but the training of the mind to think."
—Albert Einstein

So here's your challenge:

- This year, choose growth over comfort.
- Ask the hard questions.
- Hold yourself to a higher standard.
- And when you fall behind or feel lost—reach out, reset, and rise up.
- You're capable of more than you know.

Let's prove it.

Carbohydrate

Nucleic Acids

MACROMOLECULES
&
THE CHEMISTRY OF LIFE

Protein

LIPIDS

THE INTRODUCTION

Macromolecules are large, important molecules that your body uses to stay alive and do all its work. They are made up of smaller parts called **monomers**, which link together to form **polymers**. These macromolecules come in four major types: **carbohydrates**, **proteins**, **lipids**, and **nucleic acids**. Let's break each of them down!

First, **carbohydrates** are like the **energy** snacks your body needs to stay active. They are made up of **monomers** called **monosaccharides** (simple sugars like **glucose**). When these monosaccharides join together, they form **polymers** like **starch** (energy storage) and **cellulose** (a part of plant cell walls). The process of joining the monosaccharides to make polymers is called **dehydration synthesis**—your body takes away a water molecule to make the bond. To break them apart and release energy, your body uses **hydrolysis**, which adds water back in. So, carbs are your body's **quick energy fix**, like eating a snack during a long school day.

Next, let's talk about **proteins**, the workers of your body. They help with everything, like **building muscles, helping digestion, and fighting off infections**. Proteins are made up of **monomers** called **amino acids**. When amino acids link together, they form **polymers** called **polypeptides** (a long chain of amino acids). Just like with carbs, proteins are built through **dehydration synthesis** (removing water to form a special type of bond - **peptide bond**), and they break down through **hydrolysis** (adding water to break the bonds). So, proteins are like the all-star helpers that do tons of jobs in your body!

Now, let's look at **lipids** (fats). These are the body's **long-term energy storage** and also help protect your organs. Lipids aren't made of repeating monomers like carbs and proteins, but they are still important. They are mostly made up of **fatty acids** and **glycerol**. When these molecules combine, they form polymers called **triglycerides** (fat molecules). These fat molecules are also formed by **dehydration synthesis**, and when your body needs to break them down, it uses **hydrolysis** to add water and break the bonds. Lipids are great for energy storage and keeping you warm. Also make up all of your cell membranes -**PHOSPHOLIPIDS**!

Finally, **nucleic acids** (like **DNA** and **RNA**) are the **instruction books** for your body. They **carry the genetic information** that tells your body how to grow, work, and stay healthy. **Nucleic acids** are made up of **monomers** called **nucleotides**. When many nucleotides link together, they form **polymers** called **polynucleotides** (which make up DNA and RNA). **DNA** holds the **instructions** long-term, while **RNA** helps read and carry out those instructions to eventually **make proteins**. Just like the other macromolecules, nucleic acids are built using dehydration synthesis and broken down using hydrolysis.

So, to sum it up: monomers are the small building blocks, and polymers are the long chains formed by these blocks. Carbs, proteins, lipids, and nucleic acids are all made of these monomers and polymers, and they do different jobs in your body. Your body builds them using dehydration synthesis (removing water to make bonds) and breaks them down using hydrolysis (adding water to break bonds). It's like a fun building game, but with important parts for keeping you alive!

VOCABULARY

Vocabulary Word	Definition
activation energy	
amino acids	
carbohydrates	
catalyst	
dehydration synthesis	
enzymes	
hydrolysis	
lipids	

VOCABULARY CONTINUED

macromolecules	
monomers	
Nucleotides	
nucleic acids	
polymers	
polysaccharides	
proteins	
saturated	
substrates	
unsaturated	

p THE PHENOMENA

Color the following image and identify: Carbohydrates, Lipids, and proteins.

1. Why does your body need carbohydrates?
2. How do proteins help your body?
3. Why are fats (lipids) important for your body, even though too much can be unhealthy?
4. Why is it important to eat a mix of carbohydrates, proteins, and fats?

NUTRITION LABELS

Nutrition Facts

8 servings per container

Serving size **2/3 cup (55g)**

Amount per serving

Calories **230**

	% Daily Value*
Total Fat 8g	**10%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 4g	**14%**
Total Sugars 12g	
Includes 10g Added Sugars	**20%**
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 240mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

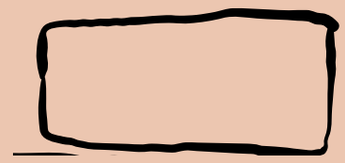
1. The serving size appears in large, bold font and some serving sizes were updated.
2. Calories are displayed in large, bold font.
3. Daily Values were updated.
4. Added sugars, vitamin D, and potassium are required on the label. Manufacturers must declare the amount in addition to percent Daily Value for vitamins and minerals.

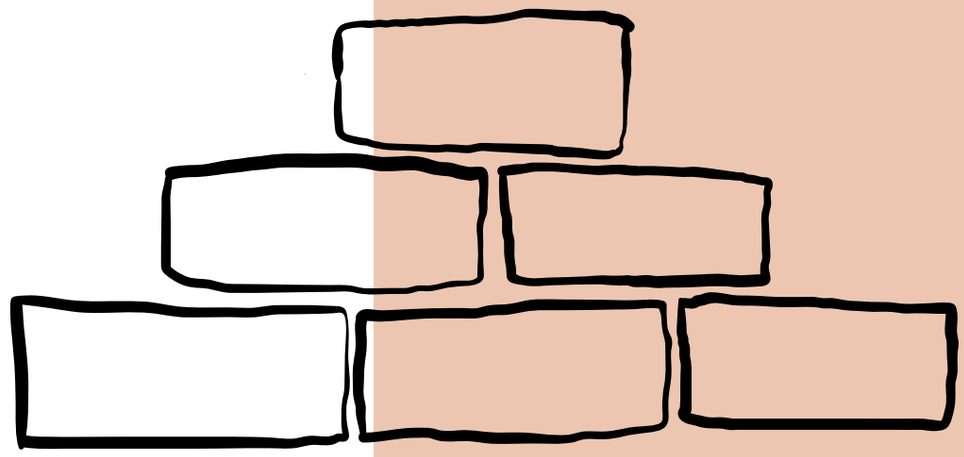
1. What information does the serving size tell you, and why is it important to look at first?
2. Look at the Total Sugars and Added Sugars. Why do you think it's important to know how much added sugar is in your food?
3. Which nutrients on the label should we try to get more of, and why?
4. Based on the label, do you think this food is a healthy choice? Explain your answer using at least two facts from the label.

CARBOHYDRATES

Macromolecules

- **Characteristics -**
  - Large molecules.
  - Also called
  - Made up of smaller “building blocks” called

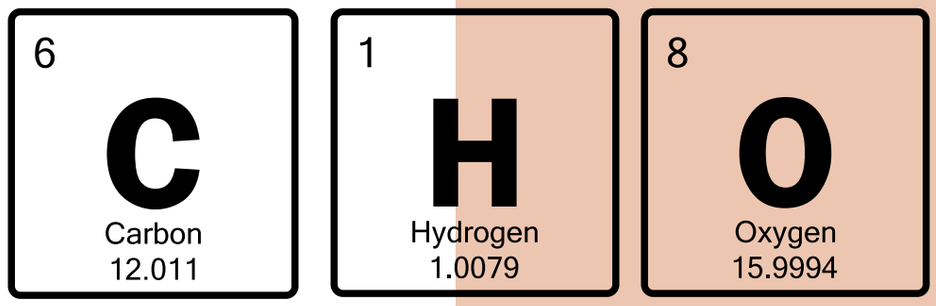




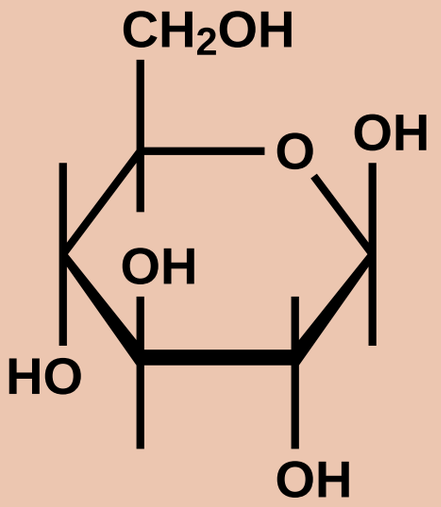
- **Biological Macromolecules are** -
  -
  -
  -
  -

Carbohydrates

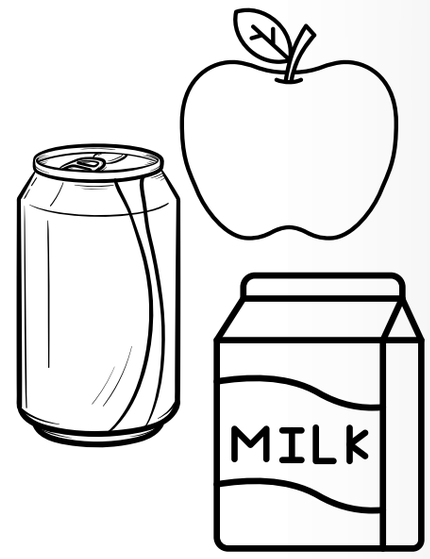
- Carbohydrates can range in size from small sugar molecules to large strands of sugar molecules bonded together.
- Elements Used to Form:
  -
  -
  -



- **Examples:**
  - a.
    - **Called** Simple Sugars **(**monomer**).**
    - **Include:** Glucose, Fructose & Galactose.



- They have the same chemical formula, C6H12O6, but have different structures.
- These three sugars are structural forms:
  - [ ] found in sports drinks.
  - [ ] is called “milk sugar”
  - [ ] found in fruits.



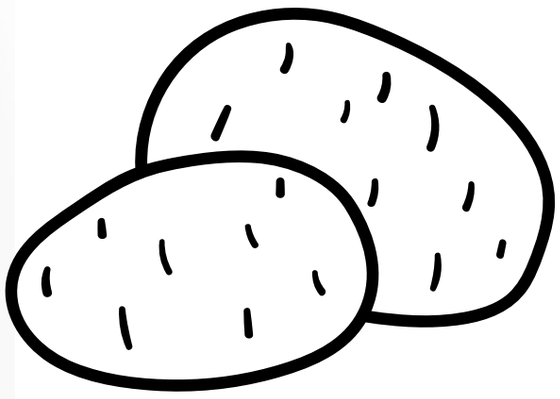
- If the compound name ends in – ose means it is a sugar.
  - In aqueous (watery) solutions, Monosaccharides form ring structures.
  - They are the main fuel that cells use for work.

b. [ ]

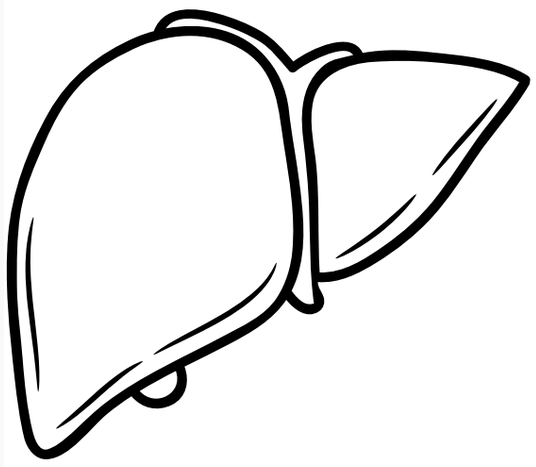
- A disaccharide is made of [ ] sugar molecules joined together.
- They are joined in the [ ] process.
- There is a [ ] bond between the two sugars.

c. [ ]

- **Complex** carbohydrates
- Composed of many sugar **monomers** linked together.
- [ ] of monosaccharide chains.
- Three types of **polysaccharides** are: [ ], [ ], and [ ]
- **Starch** – in **iodine** (indicator) turns dark blue or black
  - **Starch**: This is a type of complex sugar found in plants.



- **Storing starch**: Plants use starch to store energy.
- Starch in our diet: Foods like potatoes and grains have a lot of starch, which gives us energy when we eat them
  -



- **Glycogen**: Animals store extra sugar as glycogen in the liver.
- Structure: Glycogen and starch are similar because they're both made of glucose units.
  -

- **Cellulose**: It's a common material in plants.
- Plant structure: It helps plants keep their shape - cell wall
- Tough walls: Cellulose makes strong.
- Digestion: Some animals can't digest cellulose, but it's good for our diet as fiber.

1. What are some foods that have simple sugars, and where can we find them?
2. How are double sugars (disaccharides) different from many sugars (polysaccharides), and can you give some examples of each?
3. Why do plants store energy as starch, and how is this different from how animals store energy as glycogen?
4. How does cellulose help plants stay strong, and why can't some animals digest it?
5. Why do living things need carbohydrates for energy and to keep their bodies strong?

SUMMARIZE

1. What elements make up carbohydrates?
    - Sentence Starter: Carbohydrates are made of...
2. What are monosaccharides, and where can they be found?
    - Sentence Starter: Monosaccharides are...
    - You can find them in...
3. What are polysaccharides, and what are some examples?
    - Sentence Starter: Polysaccharides are...
    - Some examples are...
4. How do plants and animals use carbohydrates like starch and glycogen?
    - Sentence Starter: Plants use starch to...
    - Animals use glycogen to...
5. What is cellulose, and why is it important in our diet?
    - Sentence Starter: Cellulose is...
    - It helps our body by...

RESOURCES

Osmosis from Elsevier. (2018, April 4). Carbohydrates & sugars – biochemistry [Video]. YouTube. https://www.youtube.com/watch?v=jQi84Tnst14

Dr Matt & Dr Mike. (2019, August 28). Carbohydrates | Biochemistry [Video]. YouTube. https://www.youtube.com/watch?v=AC5yGU7EfBI

2 Minute Classroom. (2018, September 3). Carbohydrates | Biological Molecules Simplified #1 [Video]. YouTube. https://www.youtube.com/watch?v=PADu-fA7vfA

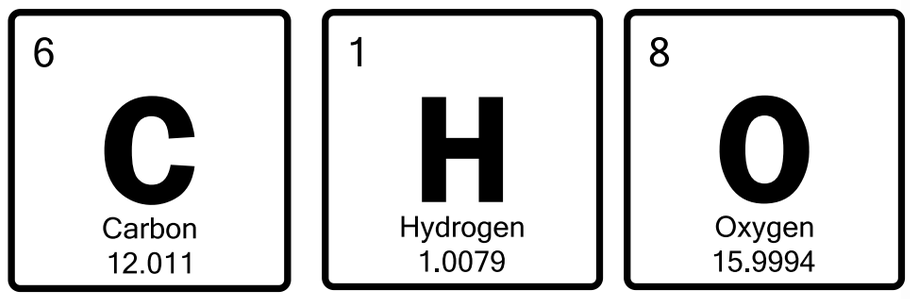
RicochetScience. (2015, November 3). Carbohydrates [Video]. YouTube. https://www.youtube.com/watch?v=LeOUIXbFyqk

Khan Academy. (2018, March 1). Introduction to carbohydrates | High school biology | Khan Academy [Video]. YouTube. https://www.youtube.com/watch?v=6o4WL5jlpn0

LIPIDS

Characteristics

- **Lipids** are [ ]-" water fearing".
- Do **not mix** with water.
- Includes [ ]
- **Stores** the most [ ]
- Composed of: **C, H, & O**



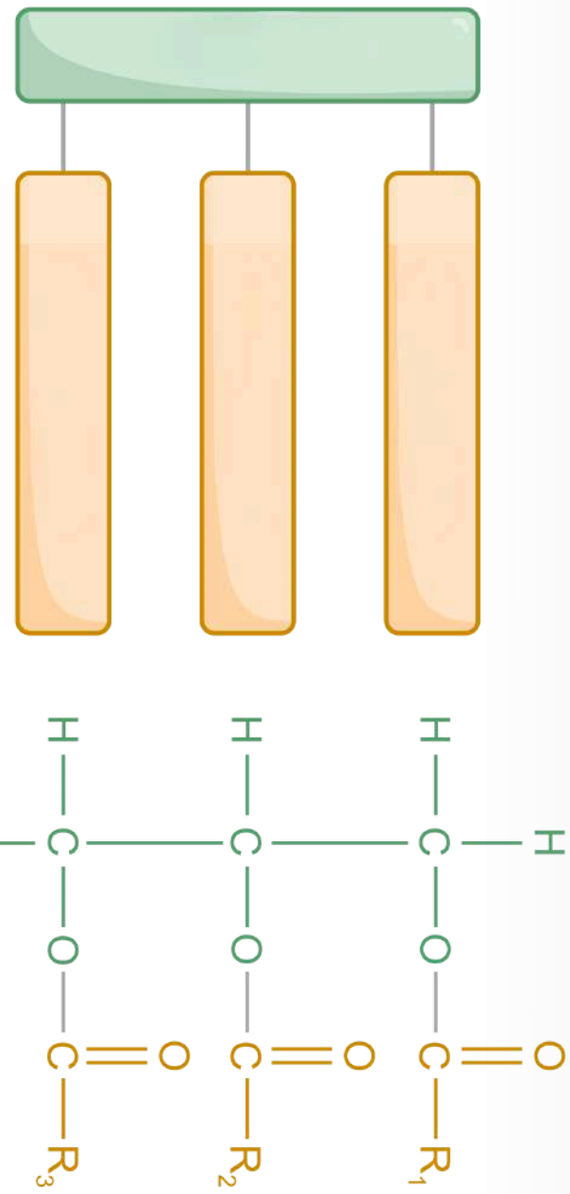
Six functions of lipids:

- [ ]
- **Protection** against heat loss ([ ])
- **Protection** against water [ ]
- **Protection** against physical [ ]
- Chemical messengers ([ ])

Major component of [ ] (phospholipids)

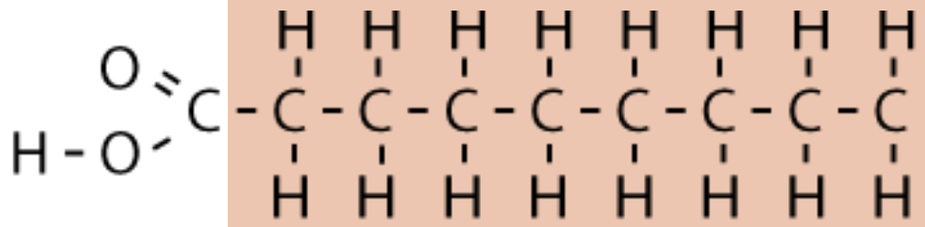
[ ] –

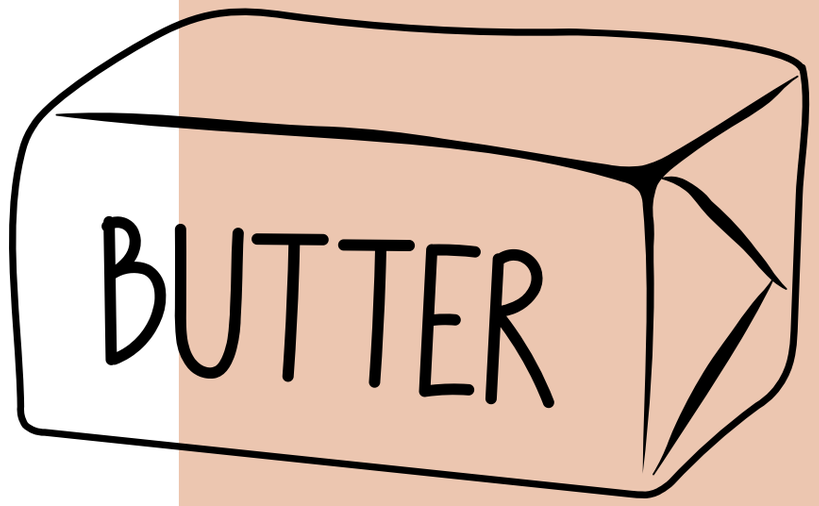
- Fatty Acids: These are long chains of hydrogen and carbon in lipids.
- [ ]: They're different because their basic units aren't considered monomers.
- Fat composition: Fats are made of fatty acids and glycerol in a 3:1 ratio.
- [ ]: When three fatty acids bond to one glycerol, they form a triglyceride.

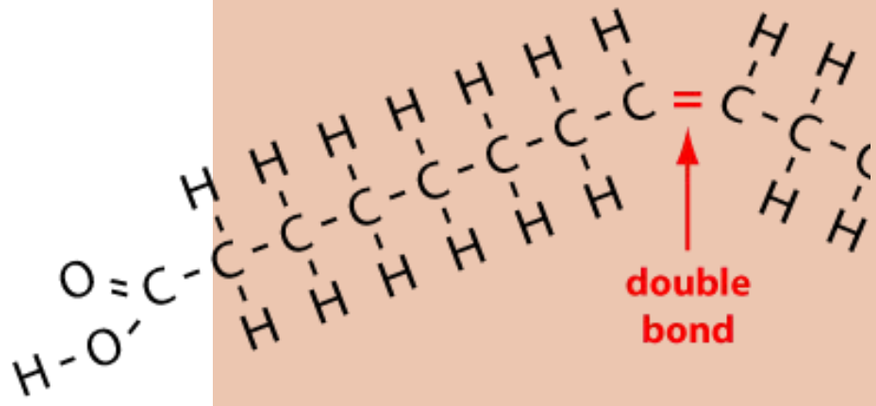


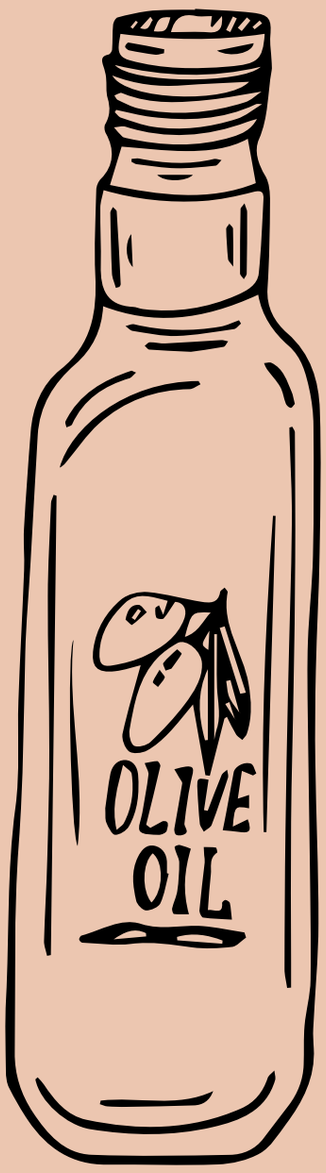
Types of Fatty Acids

- [ ] **Fatty Acid**: if each Carbon is bonded by single bonds to other Carbons inside the fatty acid, the fatty acid is said to be saturated.
    - Most animal fats are solids at room temperature (butter, margarine, shortening).
- **Mono** or [ ] **Fatty Acid:** If a double bond is present, then it is said to be mono-saturated or unsaturated.
- [ ] **Fatty Acid** - More than one double bond
- **Sudan** (indicator) can turn a variety of colors in the presence of lipids.
    - Most plant oils tend to exist as liquids at room temperature (oils).





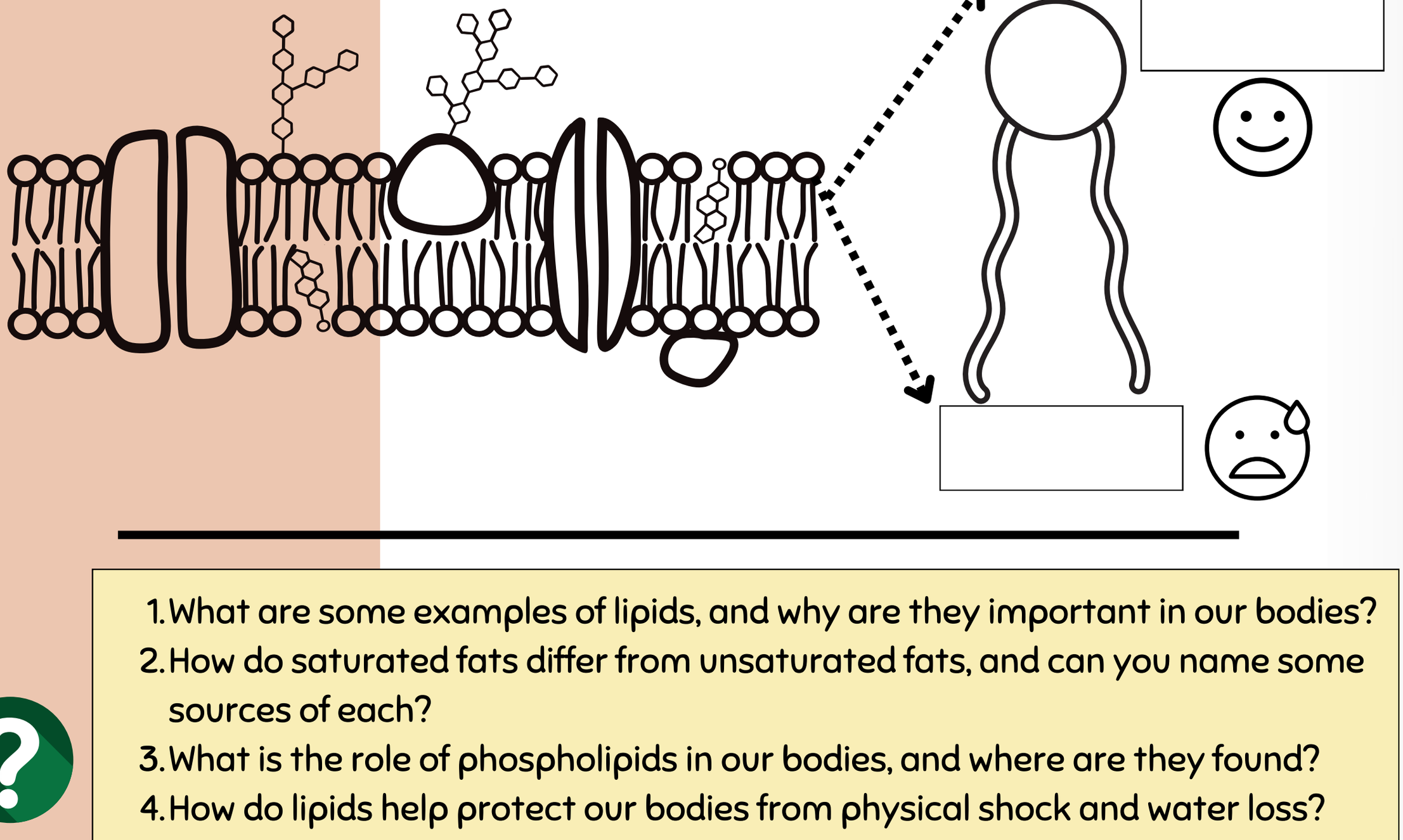




LIPIDS

[ ] - Cell membranes are made of lipids called phospholipids.

- Phospholipids have a head that is [ ] water ([ ]).
- Phospholipids also have 2 tails that are [ ] attracted to water ([ ])



1. What are some examples of lipids, and why are they important in our bodies?
2. How do saturated fats differ from unsaturated fats, and can you name some sources of each?
3. What is the role of phospholipids in our bodies, and where are they found?
4. How do lipids help protect our bodies from physical shock and water loss?
5. Why are lipids considered a major source of energy, and how are they different from carbohydrates in this regard?

Summary

1. What are lipids, and how do they interact with water?
    - Sentence Starter: Lipids are…
    - They do not mix with…
2. What elements are lipids made of, and what types of molecules are lipids?
    - Sentence Starter: Lipids are made of…
    - Some types of lipids are…
3. What are some important jobs lipids do for the body?
    - Sentence Starter: Lipids help the body by…
4. What are fatty acids, and what do they build?
    - Sentence Starter: Fatty acids are…
    - They help make…
5. What is the difference between saturated and unsaturated fatty acids?
    - Sentence Starter: Saturated fats are…
    - Unsaturated fats are…
6. What is a phospholipid, and why is it important to cells?
    - Sentence Starter: A phospholipid is…
    - It helps cells by…

RESOURCES

Bozeman Science. (2012, November 12). Lipids [Video]. YouTube. https://www.youtube.com/watch?v=VGHD9e3yRIU

RicochetScience. (2016, April 12). Lipids [Video]. YouTube. https://www.youtube.com/watch?v=5BBYBRWzsLA

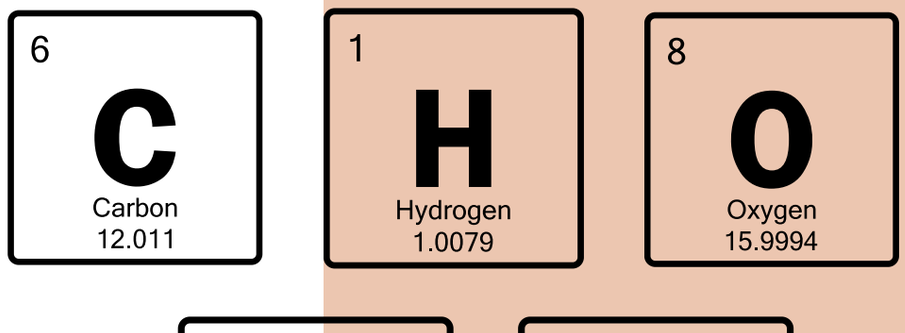
2 Minute Classroom. (2018b, September 24). Lipids | fats, steroids, and phospholipids | Biological molecules simplified #4 [Video]. YouTube. https://www.youtube.com/watch?v=69-eG07XDfU

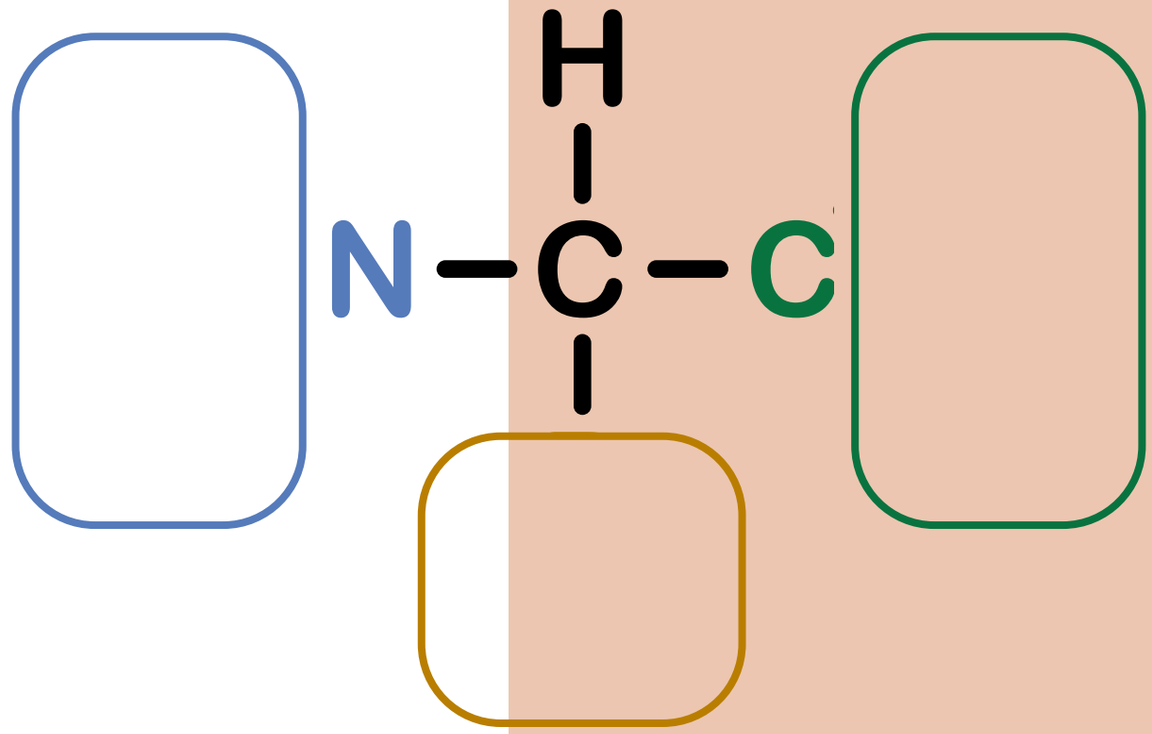
The Organic Chemistry Tutor. (2019, October 14). Lipids – fatty acids, triglycerides, phospholipids, terpenes, waxes, eicosanoids [Video]. YouTube. https://www.youtube.com/watch?v=7dmoH5dAvpY

Chegg. (2024, October 28). Introduction to Lipids ft. Professor Dave [Video]. YouTube. https://www.youtube.com/watch?v=w5zG3s0_dcg

PROTEINS

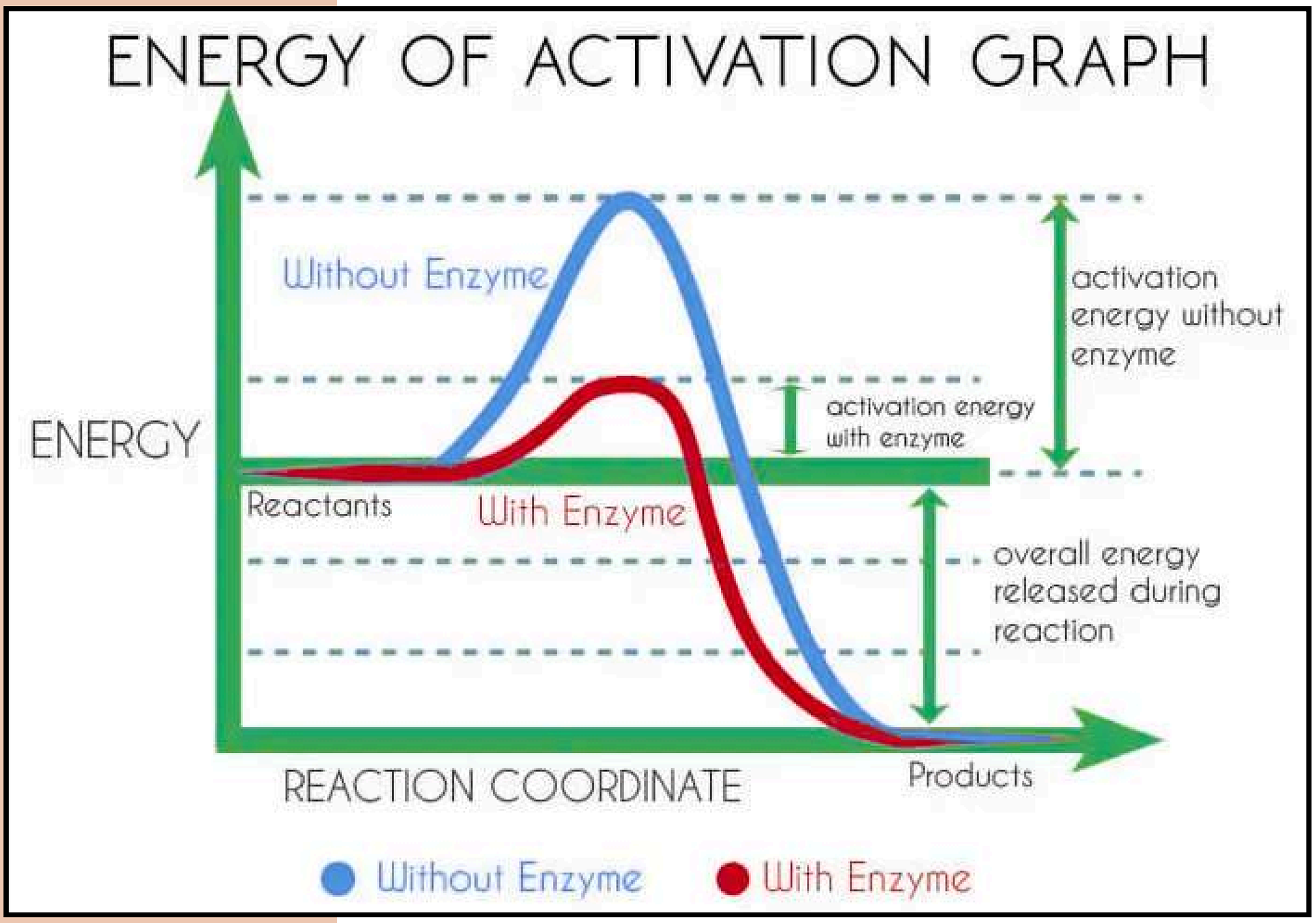
- [ ]
  - Characteristics
    - Composed of
    - [ ]
  - Monomer
    - [ ]
    - 20 different (1 mod)
    - Most different shapes
  - Functions
    - Essential to Life
      - [ ]
      - [ ]
        - Makes up muscle tissue
  - [ ]
    - Carries oxygen in an organism (**hemoglobin**).
  - [ ]
    - Helps fight off foreign invaders
    - [ ]
  - [ ] (more below)
    - [ ] chemical reactions, [ ] activation energy
    - **EX**: amylase and pepsin
  - [ ]
    - 1 gram = 4 kcal of energy



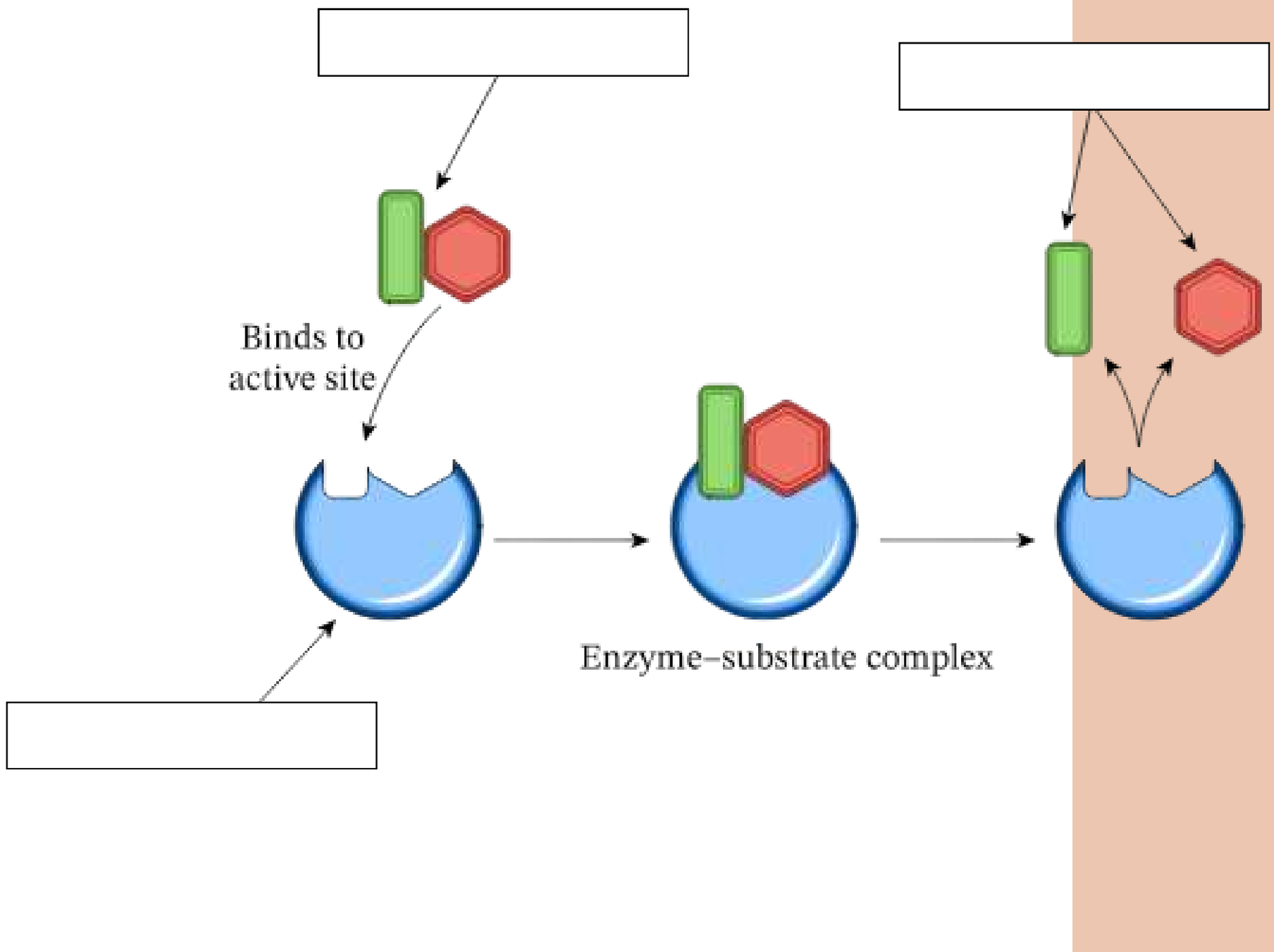


- Polymer: [ ]
- Bonding links
  - [ ]

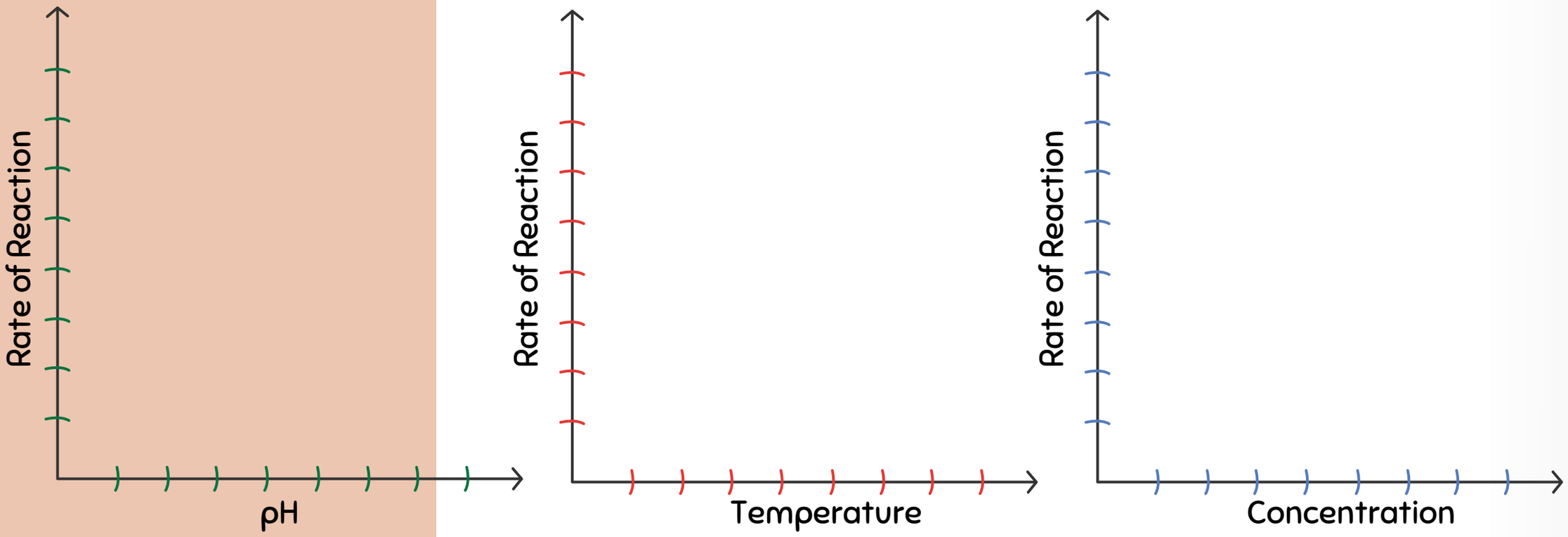
- **Enzymatic Activity**
  - Many proteins act as biological [ ] or enzymes.
  - Enzymes in the body: There are many different [ ] - biological catalysts: that break things down
  - How enzymes work: They [ ] reactions by weakening bonds, which lowers the [ ] needed to start the reaction.
  - Enzyme action: They attach to the things that need to react, then change their shape to make the reaction easier.



- The enzyme contains an opening called its _____ (active) site.
- This site is _____ for the object it will hold, called the _____.
- There are just as many enzymes as there are substrates.
- The enzyme system is the enzyme and substrate combined.
- Most are proteins.
  - They _____ the activation energy of a reaction.
  - They _____ the reaction…
  - They are _____ to the substrate.
- They allow the substrate to fit into the active site like a ball into a glove, holding it tight. (_____ Model/Induced Fit)



- They can be reused – NEVER [ ]
  - They can change shape and make them ineffective: [ ]
- Factors affecting enzyme effectiveness: [ ] (how acidic or basic a substance is) and [ ]



Label each of the graphs with: "Increased energy", "Optimal", and "Dentured". What do you notice about the last one?

---

1. What are enzymes, and how do they help speed up chemical reactions in our bodies?
2. How do enzymes lower the energy needed to start a reaction?
3. What is an enzyme's active site, and why is it important?
4. How are enzymes able to be reused in reactions?
5. What are some factors that can affect how well enzymes work?

SUMMARY

1. What elements are proteins made of, and what is their basic building block?
    - Sentence Starter: Proteins are made of…
    - The building blocks of proteins are called…
2. What are some important jobs that proteins do in the body?
    - Sentence Starter: Proteins help the body by…
3. What is a polypeptide, and how are amino acids linked together?
    - Sentence Starter: A polypeptide is…
    - Amino acids are joined by…
4. What is an enzyme, and what is its job?
    - Sentence Starter: An enzyme is a protein that…
    - It helps by…
5. How do enzymes work with substrates?
    - Sentence Starter: Enzymes have a special spot called the…
    - The thing that fits in is called the…
6. What can make an enzyme stop working (denature)?
    - Sentence Starter: Enzymes can stop working if the…
    - Things like _____ and _____ can affect them.

RESOURCES

FuseSchool – Global Education. (2019, November 5). What are proteins | cells | Biology | FuseSchool [Video]. YouTube. https://www.youtube.com/watch?v=JGZj6DsUZhE

Osmosis from Elsevier. (2019, February 27). Proteins [Video]. YouTube. https://www.youtube.com/watch?v=HSCUAjZQhXI

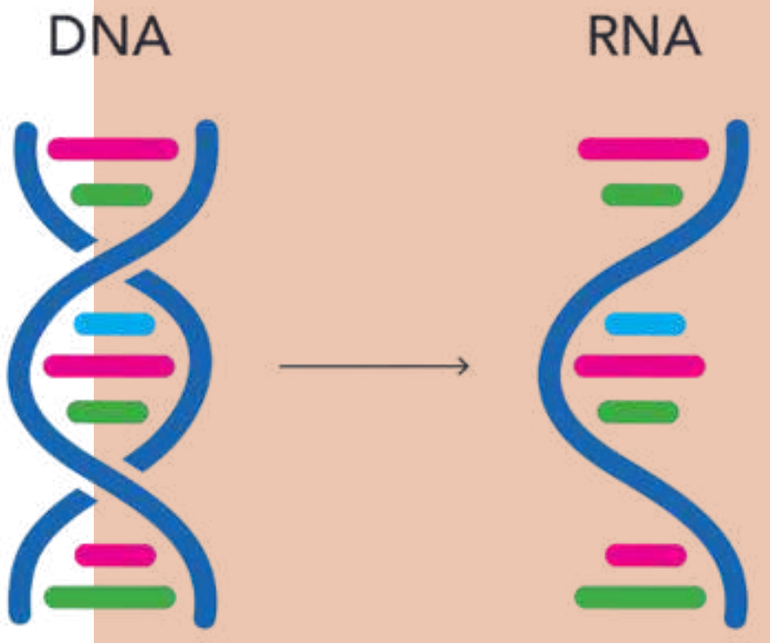
Dr Matt & Dr Mike. (2019b, August 28). Proteins & amino Acids | Biochemistry [Video]. YouTube. https://www.youtube.com/watch?v=9ssCKw-7OvQ

RicochetScience. (2015b, November 13). Proteins [Video]. YouTube. https://www.youtube.com/watch?v=AUMJwjLXh1M

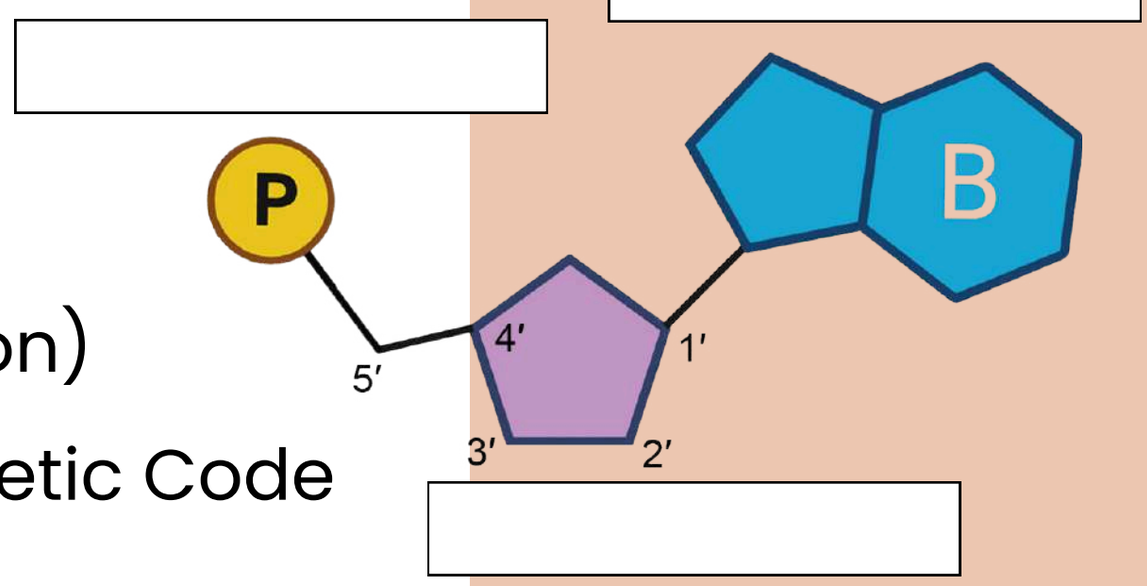
Bozeman Science. (2012, November 13). Proteins [Video]. YouTube. https://www.youtube.com/watch?v=2Jgb_DpaQhM

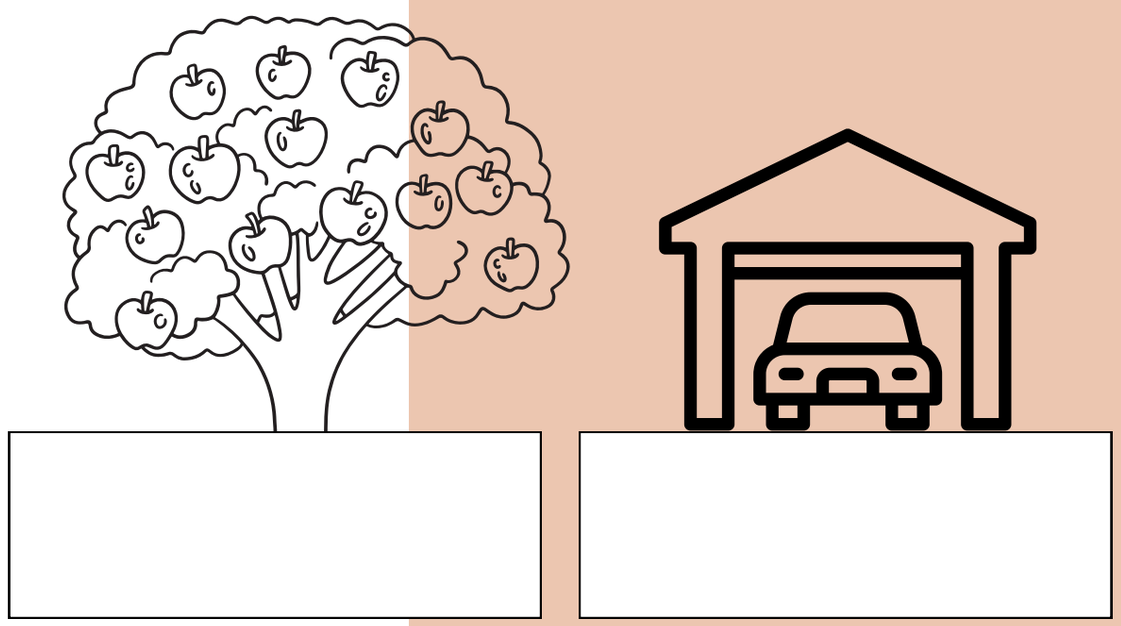
NUCLEIC ACIDS

- Two types: **Polymers**
  - ____ (DNA-double helix)
  - ____ RNA-single strand)
- Nucleic acids are composed of long chains of ____ (**monomer**) linked by dehydration synthesis.
  - Composed of the Elements: ____



- **Nucleotides** include:
  - A ____
  - A ____ (5-carbon)
  - A ____: Genetic Code
    - ____
    - ____ - DNA only
    - ____ - RNA only
    - ____
    - ____





- **Functions**
  - ____: Transmit hereditary or genetic information
  - ____: codes for proteins

1. What are nucleic acids, and why are they important for living things?
2. How are DNA and RNA different in structure, and what are their main functions?
3. What are nucleotides, and what are the three main parts that make them up?
4. Why are the nitrogenous bases in nucleotides important for genetic code?
5. How do DNA and RNA store and pass on genetic information in cells?

SUMMARY

1. What are the two types of nucleic acids, and how are they different?
    - Sentence Starter: The two types of nucleic acids are...
    - DNA has a _____ shape, and RNA has a _____ shape.
2. What are nucleic acids made of?
    - Sentence Starter: Nucleic acids are made of the elements...
3. What is the monomer (building block) of nucleic acids?
    - Sentence Starter: The building blocks of nucleic acids are called...
4. What are the three parts of a nucleotide?
    - Sentence Starter: Each nucleotide has a _____, a _____, and a _____.
5. Which nitrogen bases are found in DNA, and which are found in RNA?
    - Sentence Starter: DNA has _____, _____, _____, and _____.
    - RNA has _____, _____, _____, and _____.
6. What is the job of nucleic acids in living things?
    - Sentence Starter: Nucleic acids store...

RESOURCES

RicochetScience. (2015, October 1). Nucleic acids [Video]. YouTube. https://www.youtube.com/watch?v=MA-ouz1LtpM

Amoeba Sisters. (2019, August 30). DNA vs RNA (Updated) [Video]. YouTube. https://www.youtube.com/watch?v=JQByjprj_mA

Bozeman Science. (2012a, November 13). Nucleic acids [Video]. YouTube. https://www.youtube.com/watch?v=NNASRkIU5Fw

Macromolecules

Test with: _____
Add Heat: Monosaccharides
- Test: Blue
+ Test: Green, Red, Orange, Yellow

CARBS

CHO

saccharides

poly (>2) | di (2) | mono (1)

Test with: _____
Polysaccharides
- Test: Brown
+ Test: Purple or Black

Types

Large

Organic molecules

CHONPS

Essential elements

Monomer ⇄ Polymer

"+ H_2O to break"

"- H_2O to make"

Test with: _____
Lipids
- Test: Red
+ Test: Orange, Pink

LIPIDS

CHO

Not a true monomer/ polymer system

Fat

SUGAR

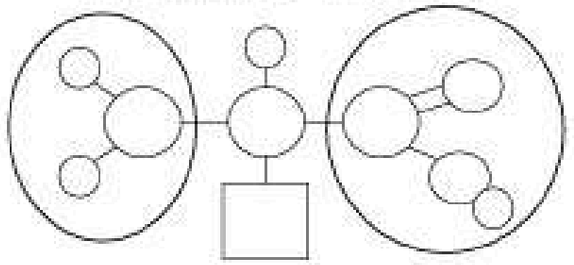
C H O N S

Test with: _____
Proteins
- Test: Blue
+ Test: Lavender

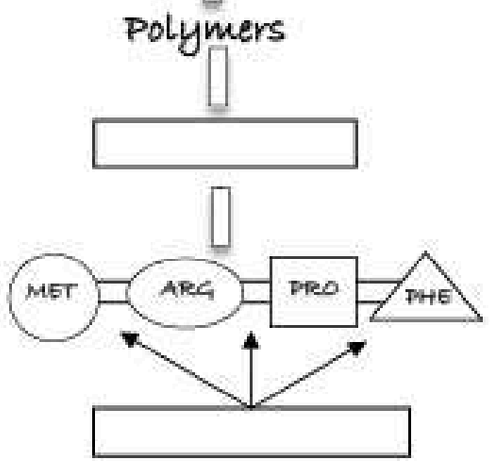
Proteins

Monomer

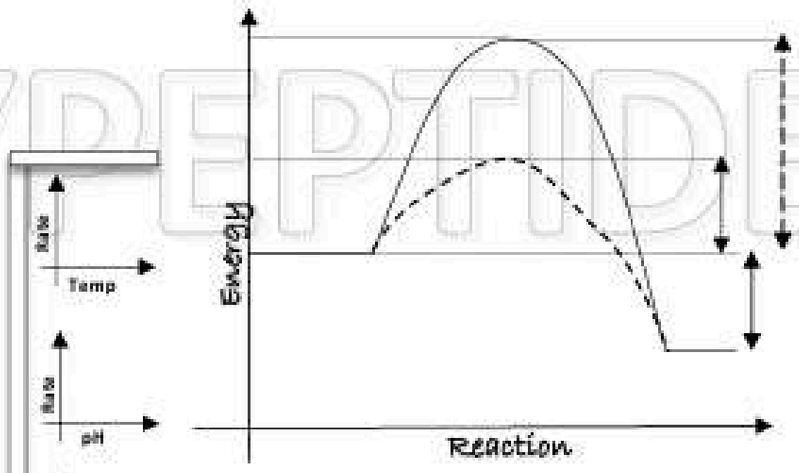
Amino Acid



Polymers



POLYPEPTIDE



Nucleic Acids

CHONP

GENETIC

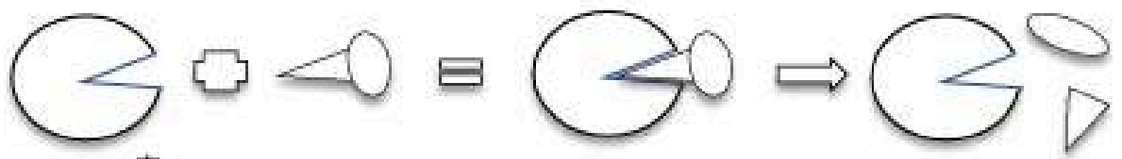
RNA

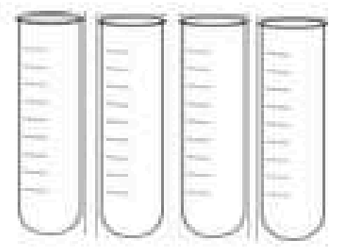
DNA

CODE

A=T
C=G
Apples in Trees
Cars in Garages

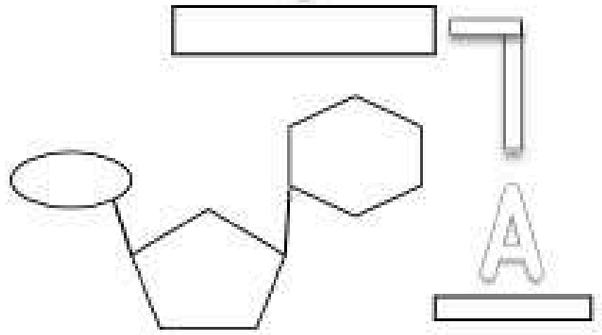
A=U
C=G
Apples Under trees
Cars in Garages



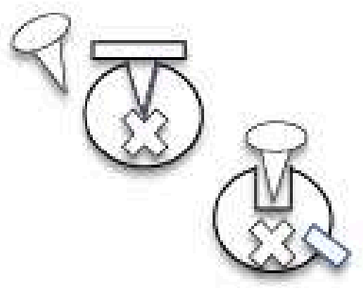


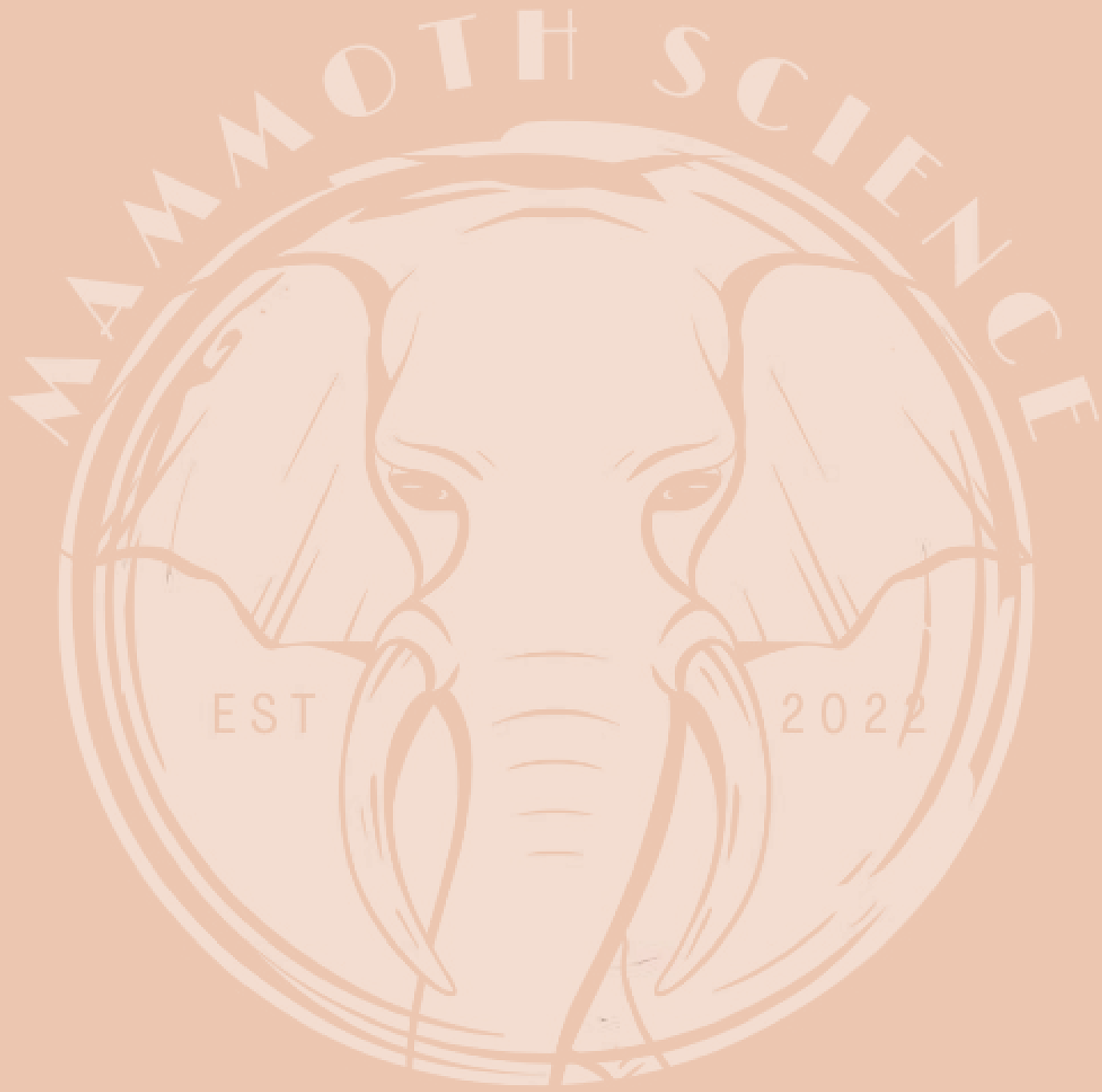
Tube 1: Glucose
Tube 2: Potato Juice
Tube 3: Cream
Tube 4: Albumin

Monomer



T
C
G
U

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2022