TOWNGREEN2025
Middle School Climate-Change Curriculum

Lesson 7

Carbon Cycles through Ecosystems

Unit Title: **Carbon Cycles through Ecosystems**	
Theme: **Ecosystems & Cycles**	Grade Level: **7**
# of sessions for the unit: **3**	Session #11: **How are photosynthesis and respiration related to each other?**
Date created: **Summer 2017**	Author: **B. Allia, C. McWilliams**

CC Climate Change Curriculum

Unit Description

Focusing on systems and cycles, students use their understanding of climate-change and how carbon and thermal energy interact with Earth's land and atmosphere. Students practice skills such as argumentation and collecting and analyzing data. Students gain experience with the interactions of humans and Earth processes with ecosystem dynamics, and with developing solutions to complex climate-change issues. The lessons generally follow this order:

- Introduce unit and culminating event: climate-change's effect upon fauna
- analyze global temperature and carbon dioxide trends
- understand personal climate-change experiences, such as weather, matter and energy uses
- collect wetland and upland forest soil carbon-stores
- sample atmospheric carbon-store
- analyze land and atmospheric carbon-stores
- understand the carbon cycle, pre-human and human era
- describe personal experiences with solid forms of carbon changing into atmospheric carbon
- develop and present solutions to save a fauna from climate-change issues

Standard(s)

Based upon the 2016 MA Science & Technology/Engineering Curriculum Framework

MA LS2 Ecosystems: Interactions, Energy, and Dynamics

MA 7.MS-LS2-3 Develop a model to demonstrate how matter and energy are transferred among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes

Unit Goals

1. Create an action plan to decrease carbon in the atmosphere, increase carbon stored by the land, and preserve natural carbon-stores in the ground
2. Build background knowledge of how carbon cycles within a local ecosystem
3. Understand relevant climate-change issues in order to make informed decisions
4. Identify authentic scientific processes, such as sampling, gathering, and analyzing land and atmospheric carbon-content data, in order to validate evidence regarding climate-change

Unit Objectives

Students will be able to

understand that:

1. Carbon cycles through the atmosphere and land
2. Human activities increases atmospheric carbon by burning fossil fuel
3. Atmospheric carbon is a "greenhouse gas"
4. Greenhouse gases increase global temperatures
5. Wetlands and uplands store different amounts of carbon above and below ground

and to:

1. Sample, collect, and analyze primary-source data
2. Collect and analyze secondary data as a means to validate causes of climate-change

Lesson Objectives

1. Students will identify what processes remove carbon from the atmosphere and which processes add carbon to the atmosphere
2. Students will construct a model of carbon cycling through photosynthesis and respiration
3. Illustrate through flowcharts how photosynthesis and consumer respiration affect the flow of carbon through an ecosystem
4. Identify the processes in which consumers emit carbon to the atmosphere

Note any potential barriers to the lesson — consider variability

Student challenges

- Through 7th grade, students begin a process of moving from a more concrete to an abstract perspective. For some students, this presents a developmental challenge since the carbon cycle is not directly observable or experienced.

Student Mitigating Factors

- Students draw concept drawings to make the invisible carbon cycle more concrete
- Students use tactile strategies to make the abstract carbon cycle more concrete

Teacher challenges

- Student access to websites

Evaluation/Assessment

(directly linked to the goals, i.e., Formative/Ongoing Assessment or Summative/End of Lesson Assessment)

Formative Assessment

- Homework questions
- Photosynthesis activity questions

Vocabulary

- respiration
- photosynthesis
- emissions
- sink
- carbon atom
- atmospheric carbon
- particle
- reactant
- product
- inverse relationship

Differentiated Vocabulary Ideas

1. word wall
2. word splash
3. common prefixes and suffixes
4. content vocabulary roundtable
5. flashcards

NOTE: Consider the UDL Guidelines in selecting methods and materials to ensure that you provide options for engagement, representation, and action and expression.

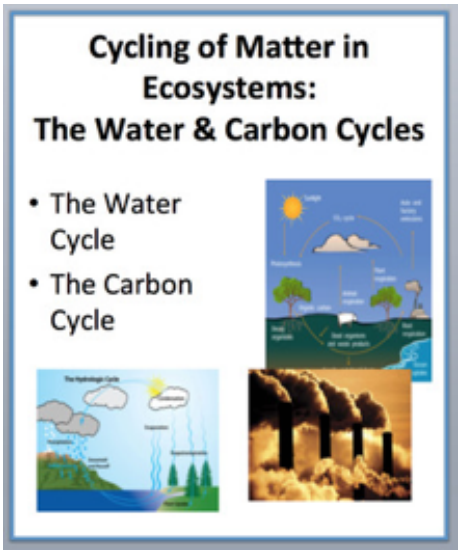
Methods

(e.g., Anticipatory Set, Introduce and Model New Knowledge, Provide Guided Practice, Provide Independent Practice)

Day 1: Introducing the Carbon Cycle

Hook Show students this picture and pose the question: How can putting this much carbon into our atmosphere be a good idea? Then show this short Video Clip: *https://youtu.be/0Vwa6qtEih8*

1. Review the term "Cycle" using the familiar water cycle
   - **A.** Cycles on Earth need to be introduced if they have not yet been discussed One of the easiest and one that may be known to students is the water cycle.
   - **B.** Solicit from students what the 4 steps of the water cycle are
   - **C.** Draw it on the board as the students review how it works
   - **D.** Ask if we get new water on Earth. Reinforce that we do not get new water, that all the water on Earth is constantly recycled through the water cycle. And yes, tell them the water we have now on Earth contains the same water that was here when the dinosaurs were on Earth. Point out that every time they hear it is raining, that water has gone through the water cycle.
   - **E.** Reinforce or introduce the term, "closed system" to represent the atmosphere holding H_2O.
2. Introduce Carbon Cycle
   - **A.** Introduce carbon, or carbon dioxide and ask students if they think carbon is cycled through the Earth's systems in a similar manner as water.
   - **B.** Yes, it is, same as many other elements on the Earth.



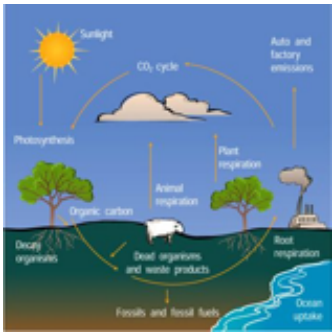
C. Carbon can be in more than one form (molecule) but for this exercise, focus on carbon dioxide.

D. Remind students that the cycles began long before humans evolved on Earth

E. Students brainstorm in small groups-roles what processes would remove carbon dioxide from the atmosphere and which processes would add carbon dioxide to the atmosphere.

F. Groups report what they have decided on. Write the 2 lists on the board. When all correct student answers are on the board, ask leading questions to get any missing ones and add them to the board.

- Be sure to add how past processes have sequestered much carbon deep underground as coal and oil
- Point out that the ocean (all all other bodies of water) absorbs carbon dioxide (it is the biggest carbon sink).
- Ocean acidification is a result of excess carbon dioxide in the oceans.



3. Students record a simple carbon cycle, based on this example projected on the board.

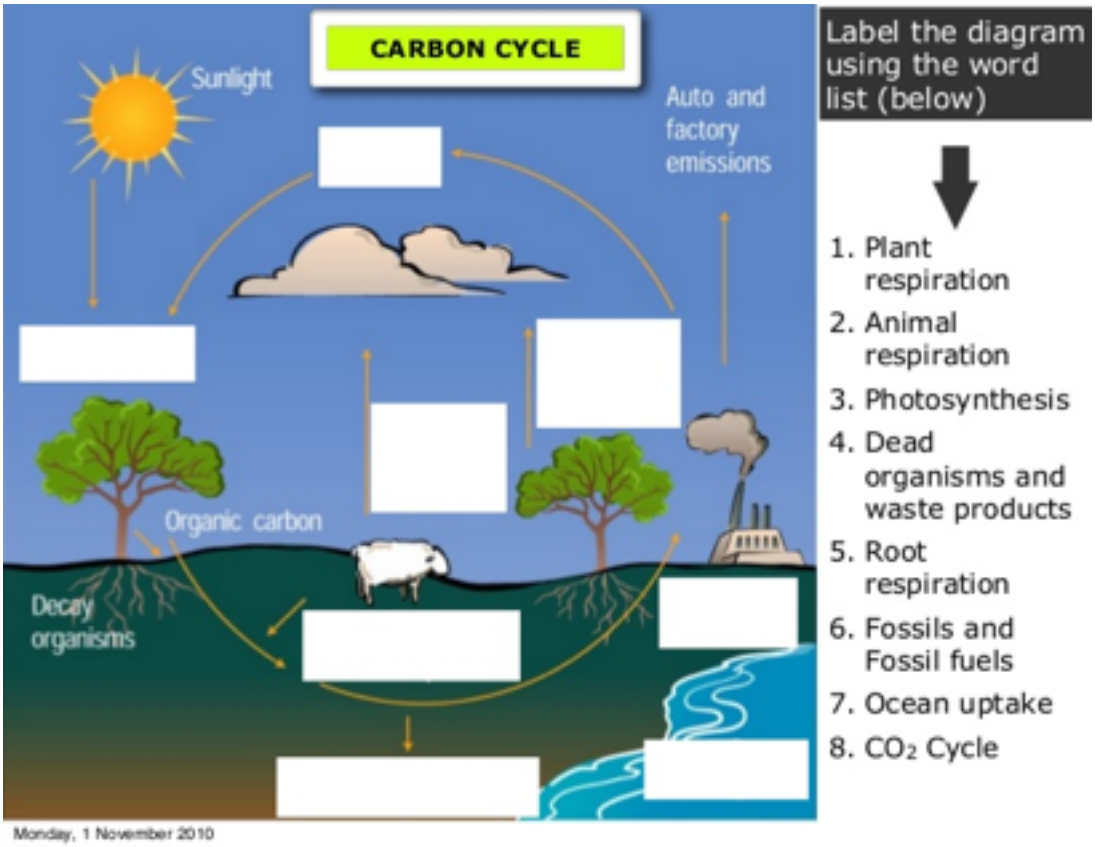
A. Direct students to individually draw the carbon dioxide cycle as shown on the board in their science journals.

B. Ask if they think it will be a simple cycle, like the water cycle. It is not, so encourage them to draw it the best they can.

C. Circulate and ensure that students are on track with their drawings.

D. Explain to students that if the factory is removed, and this becomes a pre-human carbon dioxide cycle.

E. Here is an alternate version for students who need assistance:



4. Vocabulary Strategies

A. Students apply one of the vocabulary strategies, as recommended in the above Vocabulary Section

B. Students write vocabulary notes in their science notebook/journal where they can easily refer to, during the unit

5. Homework: Brain Pop photosynthesis video & quiz

A. To preview next day's photosynthesis lesson

- *https://www.brainpop.com/science/cellularlifeandgenetics/photosynthesis/*
- The elementary school frameworks introduced students to photosynthesis, so this homework is a review, but it also includes middle school frameworks
- See 15 Brain Pop photosynthesis video questions below in the homework resource section

B. To review carbon cycle after lesson

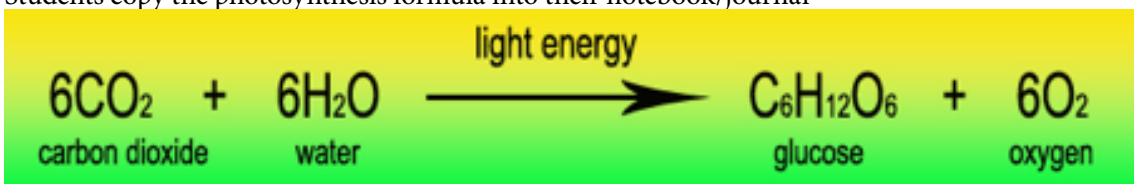
- Brain Pop "The Carbon Cycle" video and quiz *https://www.brainpop.com/science/ecologyandbehavior/carboncycle/*

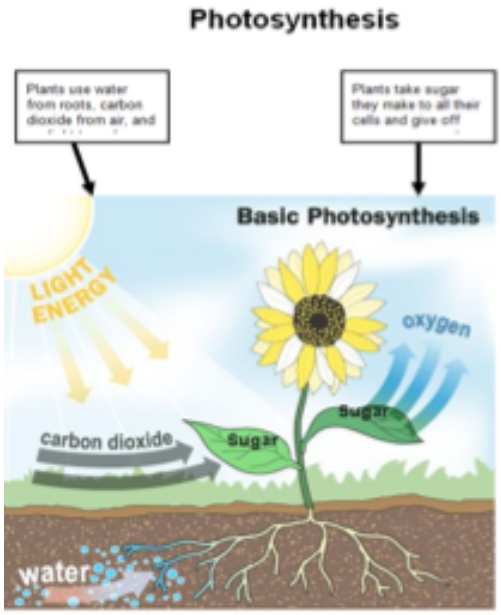
Day 2: Students practice the model and manipulate photosynthesis

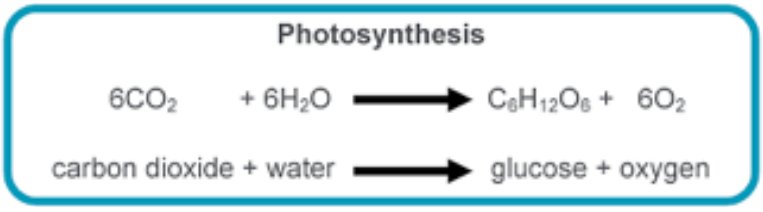
Hook Show students the BBC's Climbing a Tree short video clip *https://youtu.be/3mIIuBS-CdA*

1. Most of Earth's carbon is stored in rocks and sediments, while the rest is located in the ocean, atmosphere, and in living organisms. Today we will focus on carbon cycling through living organisms in a process called photosynthesis.

2. Students copy the photosynthesis formula into their notebook/journal







3. Vocabulary Strategies
   - **A.** Students apply one of the vocabulary strategies, as recommended in the above Vocabulary Section
   - **B.** Students write vocabulary notes in their science notebook/journal where they can easily refer to, during the unit.
4. Students develop a model of the chemical reaction as photosynthesis occurs.
   - **A.** Students make a hands-on photosynthesis model made of gumdrops and toothpicks, allowing the disassembly and reassembly of the various atoms.
   - **B.** Alternate option: the model could be a drawing that would be frames of a comic strip showing the steps as photosynthesis makes sugar and, subsequently, cellular respiration breaks the sugar down.
   - **C.** By using physical models of photosynthesis teachers should check for student engagement and make sure that all of the "atoms" in their models are being used for the "before" and "after" so that they and consistent with the conservation of matter.
   - **D.** Matter is conserved because atoms are conserved in physical and chemical processes: cross-cutting concept.
   - **E.** By considering the atoms that are linked before and the atoms that are linked afterward, the teacher should make sure the students understand that none have been created or destroyed.
   - **F.** The teacher should also link this lesson to one on chemical energy and address the idea that energy is stored in the bonds of the molecules and how the energy can be used or 'banked' when molecules form.
     - Thermal energy transfers from the sun's energy into the glucose bonds as chemical energy.
     - Remind students that photosynthesis is a "chemical change" because it "produces" a new substance, glucose.
   - **G.** Students work in small groups, manipulating their gumdrops as directed in this activity.
     - Formative assessment Question #7 = check-in for understanding before students continue.
     - Differentiation = some students will move beyond questions 7, some will not. Need to know content is up to #7.
     - Take pictures during activity, to post to website and to discuss with class.
     - This lesson focuses on photosynthesis, giving students an opportunity to master it before reversing to respiration. The next lesson focuses on the relationship between photosynthesis and respiration.

Name _____ Per ___

Sweet Photosynthesis

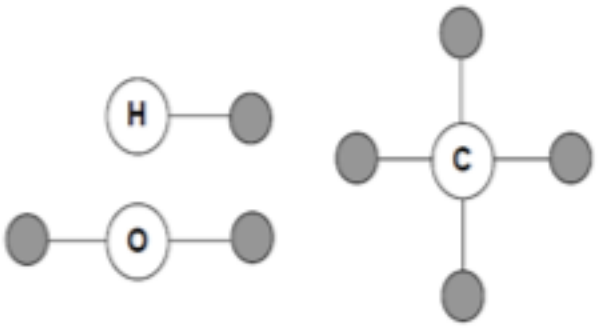
In this activity, you will be working with a partner to see how atoms rearrange themselves to form glucose and oxygen out of carbon dioxide and water. Gumdrops will be the atoms, and toothpicks will be the bonds between them.

And now for a little chemistry…

1. You will need 18 oxygen atoms, 12 hydrogen atoms, and 6 carbon atoms. Choose one color for each type of atom and count them out.

Hydrogen color: _____
Oxygen color: _____
Carbon color: _____

Hydrogen (H) likes to have **1** bond.
Oxygen (O) likes to have **2** bonds.
Carbon (C) likes to have **4** bonds.



2. A water molecule (H_2O) is made of two atoms of hydrogen (H) and one atom of oxygen (O).
Using the gumdrops and toothpicks, build **6** water molecules so that each hydrogen has one bond and each oxygen has two bonds.

3. A carbon dioxide molecule (CO_2) is made of one carbon (C) atom and two oxygen (O) atoms.
Using the gumdrops and toothpicks, build **6** CO_2 molecules so that each carbon has 4 bonds and each oxygen has 2 bonds. You will need to be creative for this one!

Before going any further, raise your and so I can check your molecules and give you a stamp.

4. In photosynthesis, plants use water (H_2O) and carbon dioxide (CO_2) to make glucose ($C_6H_{12}O_6$). Try to write the equation below (you might not be able to fill in all the blanks yet):

_____ + _____ → _____ + _____

5. Rearrange your carbon dioxide and water molecules to make a molecule of glucose ($C_6H_{12}O_6$). REMEMBER: H likes one bond, O likes 2 bonds, and C likes 4 bonds. HINT: The carbons form a ring.

6. What do you have left over? See if you can put those left over atoms together to make them "happy" (have the right number of bonds each).

7. Go back to your equation in question 4 and revise it as needed.

Raise your hand again so I can stamp you. When you have been stamped, answer the questions below:

1. What are the **inputs** of photosynthesis?

2. What are the **outputs** of photosynthesis?

3. Did any atoms disappear when you were creating glucose and oxygen?

4. Did you have to get any extra gumdrops when creating glucose and oxygen?

5. Glucose is a molecule with lots of stored energy, while water and carbon dioxide have practically no stored energy. Where does the energy come from to make glucose?

6. Why do plants make glucose? (Your notes from yesterday will help with this.)

7. Write the formula for photosynthesis. Try not to peek at the other side!

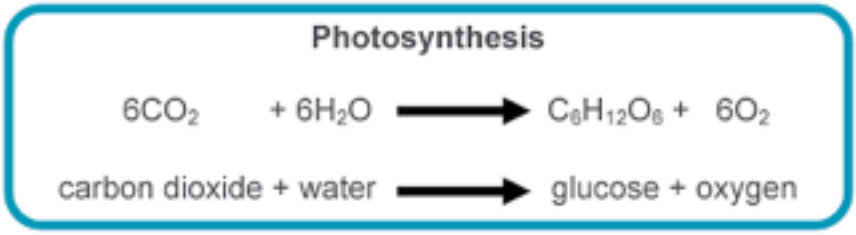
Day 2 Homework: Practice Photosynthesis

Video link — see 6 companion questions below in the Homework Section
http://ed.ted.com/lessons/the-simple-but-fascinating-story-of-photosynthesis-and-food-amanda-ooten#watch

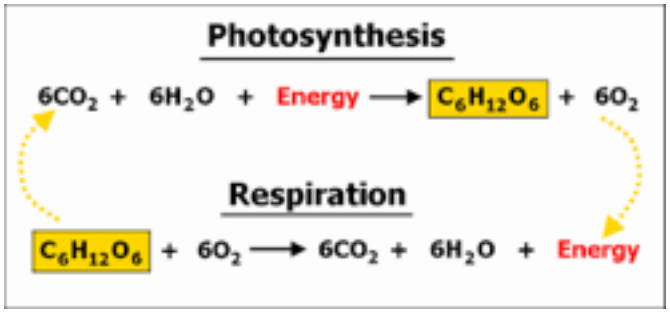
Day 3: Students discover the relationship between Photosynthesis and Respiration

Hook: Photosynthesis viewed from space — after about 1 minute the video shows monthly carbon absorption
https://youtu.be/Nsmdzd2NSjQ

1. After showing Hook, briefly review photosynthesis gumdrop photos and photosynthesis chemical equation, to review that plants remove carbon from the atmosphere



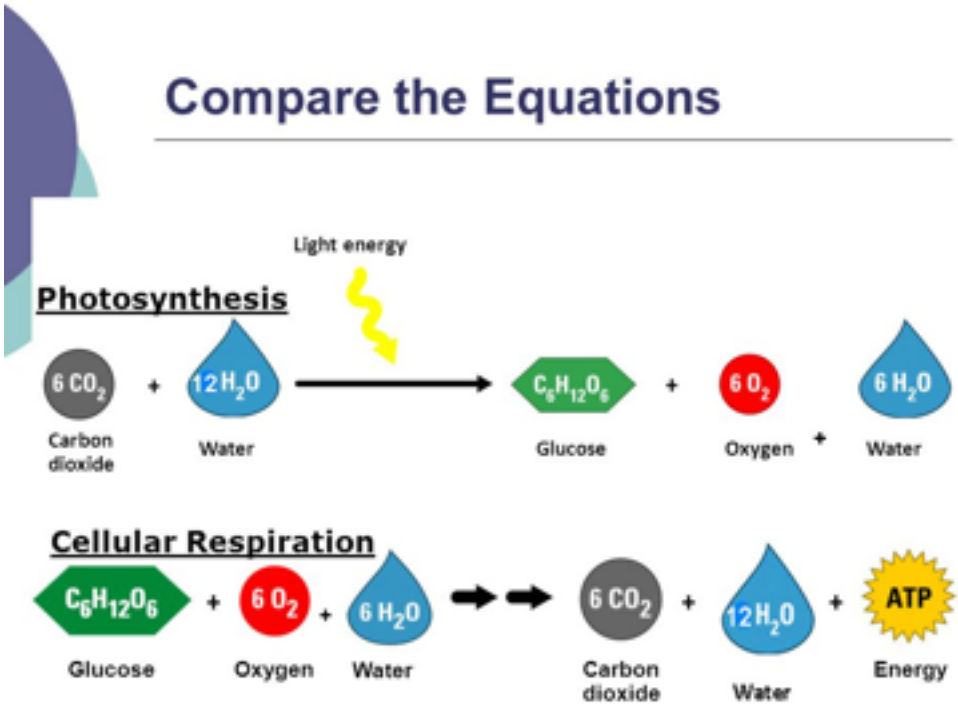
2. Show both the Respiration and Photosynthesis chemical equations and ask students what they notice?



- Law of conservation of matter
- Law of conservation of energy
- reverse chemical equations
- either remove or emit carbon into environment

3. Students copy the respiration and photosynthesis formula into their notebook/journal
   - Label Reactant and Product
4. Vocabulary Strategies
   - Students apply one of the vocabulary strategies, as recommended in the above Vocabulary Section
   - Students write vocabulary notes in their science notebook/journal where they can easily refer to them during the unit

5. Teacher gives this handout to each student, in a black & white copy



- Students color-code the handout, using this key.
- Students identifies what processes remove carbon from the atmosphere and which processes add carbon to the atmosphere, by labeling with an arrow: "Remove CO_2" or "Add CO_2."
- Student tapes it into their science notebook/journal.
- Teacher provides colored pencils.
- carbon dioxide = grey
- water = blue
- glucose = green
- oxygen = red
- energy = yellow

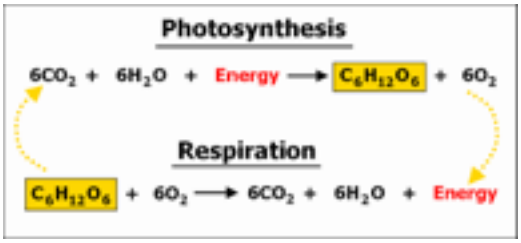
6. Students will construct a model of carbon cycling through photosynthesis and respiration

A. Photosynthesis v. Respiration Bead Activity

B. Distribute supplies to each small-group: green felt-leaf, beads, toothpicks

C. Each student individually writes the photosynthesis and respiration formula, without looking at notes

- Students use notes when necessary.
- Students compare chemical equations with group members to check for accuracy.



- Teacher instructs students to construct the steps below, in the pictures.

a. 1st Photosynthesis model

b. 6 Carbon dioxide molecules + 6 Water molecules

c. Students identify which reactant they made, by pointing to their chemical equations they wrote (teacher checks for understanding).

d. Teacher asks students which organelle uses CO_2 and H_2O as a raw material (plant's chloroplast).

e. Connecting with toothpicks, students make 1 glucose molecule.

f. With left-over atoms, students make diatomic Oygen O_2.

g. For effect, students place the glucose molecule on the green leaf.

h. Students practice / repeat building while teacher asks how law of conservation of energy applies? and If this is a chemical or physical change? (chemical change / new substances formed).

i. 2nd Respiration model

j. 1 Glucose molecule + 6 Oxygen molecules on the green leaf.

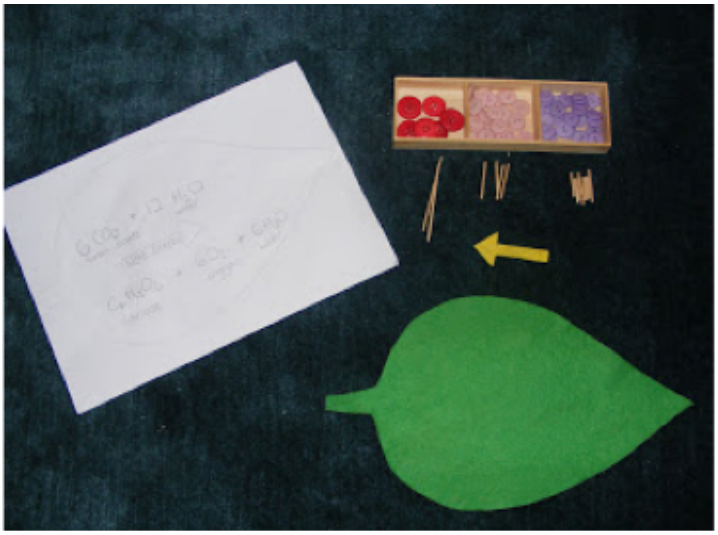
k. students identify which reactant they made, by pointing to their chemical equations they wrote (teacher checks for understanding).

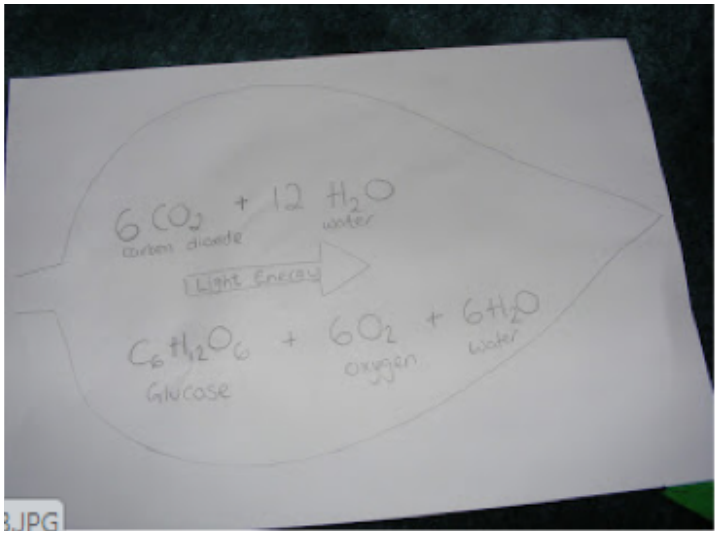
l. teacher asks students which organelle uses glucose as a raw material (consumer's mitochondria).

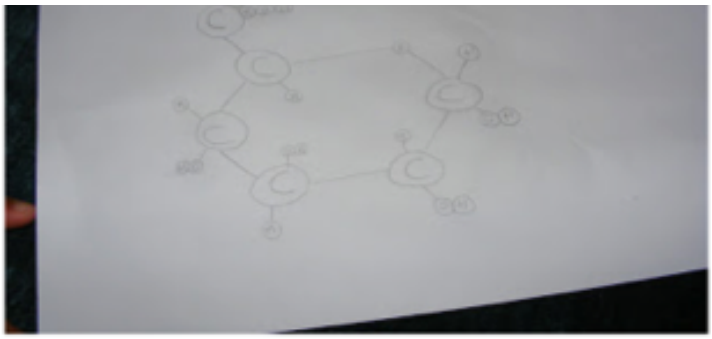
m. Connecting with toothpicks, students make 1 carbon dioxide molecule.

n. With left-over atoms, students make water H_2O molecules.

o. Students practice/repeat building while teacher asks how law of conservation of energy applies?

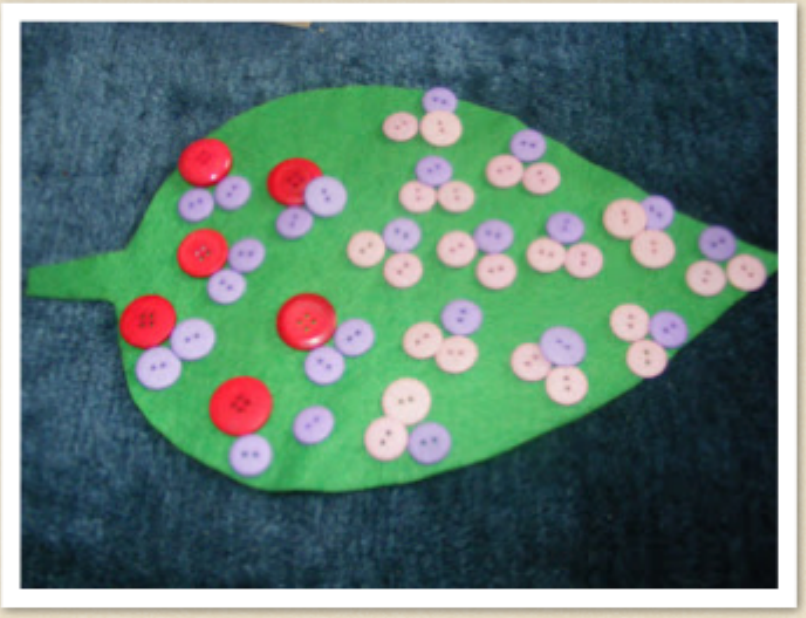






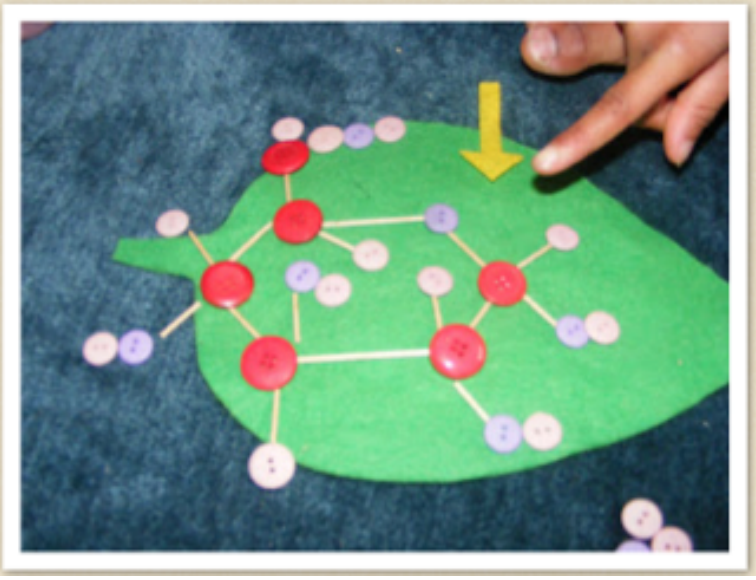
showed the process of photosynthesis (using buttons to create the different
nolecules)
Ve started by making Carbon Dioxide and discussing how the plants absorb it,

then discussing how plants absorb water and made the water molecules.



Plants use these raw ingredients combined with the light energy and chlorophyll to create glucose

at this point I mixed them all up and remade in the form of glucose



with the remaining Oxygen and Water produced during the process released from the leaf

7. Students summarize using this table. Teacher blanks selected cells (notice parts of reactants/products parsed for students to complete) and photocopies so about most columns 2 and 3 are blank (differentiate as needed).

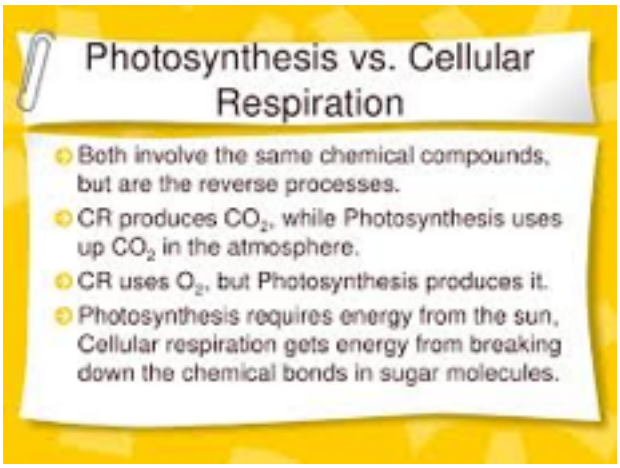
Comparing Photosynthesis and Cellular Respiration

	Photosynthesis	Cellular Respiration
Function	Energy capture	Energy release
Location	C loroplasts	Mitoc ondria
Reactants	C $_2$ and H_2	C_6H_{12} $_6$ and $_2$
Products	C_6H_{12} $_6$ and $_2$	C $_2$ and H_2
Equation	6C $_2$ 6H_2 $\xrightarrow{\text{Energy}}$ C_6H_{12} $_6$ 6 $_2$	6 $_2$ C $_6H_{12}$ $_6$ $\xrightarrow{\text{Energy}}$ 6C $_2$ 6H_2

A. Teacher distributes chart and students it

B. When teacher reviews students' work for accuracy, teacher asks students to:

- determine if there is a direct or inverse relationship between photosynthesis and respiration
- identify what process removes carbon from the atmosphere
- identify what process adds carbon to the atmosphere
- Student writes "adds carbon" or "removes carbon" next to respiration/photosynthesis.
- Students tape chart into their science notebooks/journals .
- Here are some points to discuss with the class.



8. Homework — students complete a compare/contrast graphic organizer to emphasize the inverse relationship between photosynthesis and respiration .
   - See day 3's homework details in the Homework Section below.

Day 3 Differentiated option for higher-level students

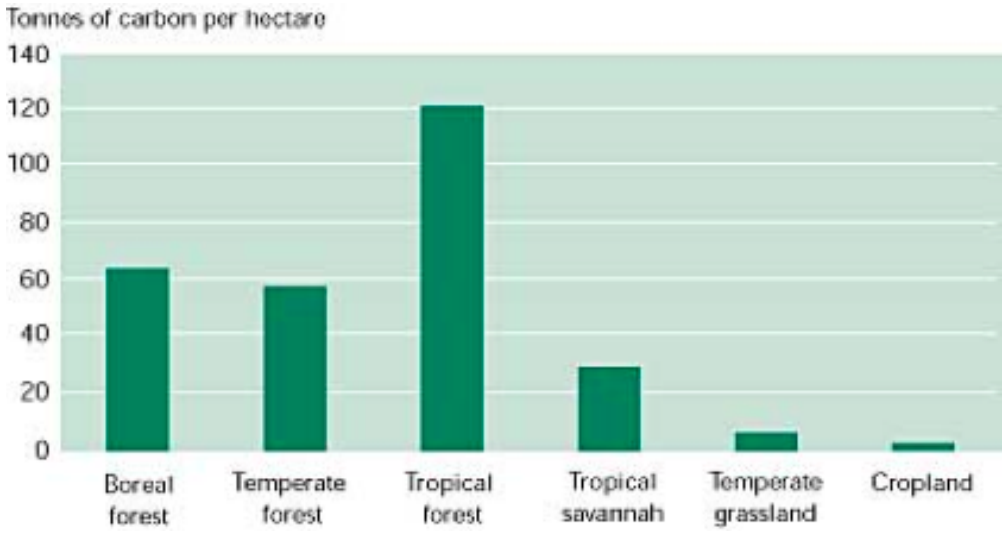
1. This lesson achieves the same objectives, but it covers issues concerning deforestation and plant-type carbon-capacity.
2. additional vocabulary words:
   - perennial plant
   - annual plant

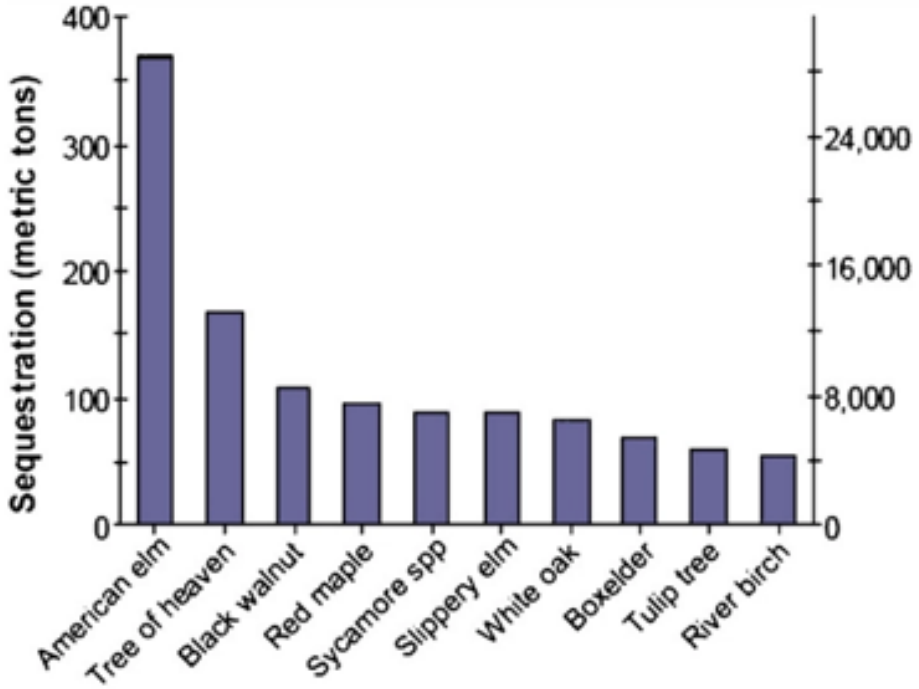
- herbaceous
- terrestrial
- carbon sequestration

Purpose

This lesson allows students to think more carefully about the important role plants play in global carbon cycling through the processes of photosynthesis and growth. We begin by reviewing the fixation of gaseous CO_2 into plant compounds (initially, glucose), which is one of the primary ways CO_2 is removed from the atmosphere. Then, in small groups, students consider how this general trend plays out in a variety of plant types (annual vs. perennial, woody vs. herbaceous, aquatic vs. terrestrial). Finally, the students come back together as an entire class and report on their findings to the rest of the class, helping to inform a discussion on human land use decisions and carbon sequestration.

3.





Whole Class Discussion: Human Land-Use Decisions ~25 minutes

1. Bring the groups back together and have them share their answers to the questions below. After the groups have reported, move into a discussion of how human land use decisions can affect global carbon cycling by promoting or discouraging different types of trees and plants. Of particular importance is deforestation, since it replaces long-lived reservoir species with shorter-lived species that will respire most of their CO_2 on a much faster basis. On the other hand, allowing annual cropland to slowly grow back into forests will lead to a high level of carbon storage while that forest is growing. You can also discuss the difference between annual and perennial plants in terms of storage of CO_2 in root tissues. There is a growing movement to increase the proportion of perennial species used as food crops, not least because below-ground carbon storage is much more significant with these species.

Name: Block: Date:

Lab Report

Carbon Cycles through Ecosystems

Molecule Models

THE FORMULA

WHAT IS THE FORMULA THAT REPRESENTS PHOTOSYNTHESIS?

_____ (LABEL REACTANTS AND PRODUCTS)

1. Create 6 Water (H_2O) and 6 Carbon Dioxide (CO_2 Molecules)
   - **A.** Draw the molecules in the table below
2. Create a Glucose ($C_6H_{12}O_6$) molecule
   - **A.** This is a ring structure
   - **B.** The carbons make the ring
   - **C.** Draw the molecules in the table below
3. What do you have left over?
   - **A.** Draw the molecules in the table below

Molecule	Carbon Dioxide	Water	Oxygen	Glucose
Formula				
Drawing				

Name: Block: Date:

Lab Report

Carbon Cycles through Ecosystems

Analysis Questions:

Photosynthesis Questions

1. Write the formula for photosynthesis.

2. After you made glucose from carbon dioxide and water, did you have atoms left over?

3. Which atoms were they? How many were there? (see question #2)

4. When a plant goes through photosynthesis, what is released as a waste product?

5. Where does that molecule go?

6. Where does the energy come from in photosynthesis?

7. What is the purpose of the glucose that the plants make?

8. Why don't the glucose molecules get built during the light reactions?

9. Do plants use the glucose they make?

   A. What do they use it for?

10. We know plants need carbon dioxide and water. What else do plants need and how do they get it?

11. What is the connection between plants and global climate-change?

Cellular Respiration Questions

12. Write the formula for cellular respiration

13. Using the equations for photosynthesis and cellular respiration, explain how the two cycles are related.

14. What are the waste products of cell respiration?

A. What are the above waste products used for?

B. How is the energy released from the product above?

15. Why do you think that we use the term "burning energy" when we talk about food?

Homework Resources

Day 1: Introduce Photosynthesis

Brain Pop Photosynthesis video link: *https://www.brainpop.com/science/cellularlifeandgenetics/photosynthesis/*

Brain Pop Photosynthesis video questions

1 **What are the chemical products of cellular respiration?**

A Water and amino acids
B Carbon dioxide, nitrogen, and urea
C Oxygen, lactic acid, and ammonia
✓ D Carbon dioxide, water, and ATP

Flag this question for moderator review

2 **How do animals add carbon dioxide to the atmosphere?**

✓ A Through breathing
B Through evaporation
C Through cellular respiration
D Through transpiration

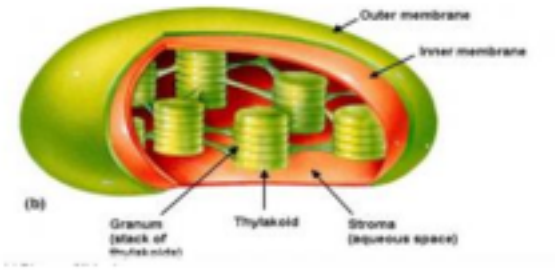
Flag this question for moderator review

3 **What organelle is this?**

A chloroplast
✓ B mitochondria
C golgi body
D lysosome

Flag this question for moderator review

4 **What organelle is this?**



A mitochondria
✓ B chloroplast
C nucleus
D lysosome

Flag this question for moderator review

5 **What is the sugar that is made by a plant during photosynthesis?**

A lactose
B sucrose
C fructose
✓ D glucose

Flag this question for moderator review

6 **How do we get the glucose we need to power our cells?**

A Breathing
B Exercising
✓ C Eating
D Drinking water

Flag this question for moderator review

7 **In what way does plant nutrition differ from human nutrition? Choose the best answer.**

✓ A Plants make their own nutrients; humans must consume theirs
B Plant nutrition consists mainly of protein; human nutrition consists mainly of carbohydrates
C Plants absorb their nutrients from the soil; humans get theirs from food
D Plants cannot make their own food; humans can

Flag this question for moderator review

8 **The correct chemical equation for a molecule of glucose is:**

A H12 CO6
B C4 He4 O6
✓ C C6 H12 O6
D C6 H8 O8

Flag this question for moderator review

9 **ATP is to your cells as _____ is to a car.**

A The engine
✓ B Gasoline
C The tires
D The steering wheel

Flag this question for moderator review

10 **What is the cellular process that a plant uses to make glucose for its food?**

✓ A photosynthesis
B cellular respiration
C sugar creation
D carbon fixing

Flag this question for moderator review

11 **What is the cellular process that breaks apart glucose to release energy in order to make ATP?**

A photosynthesis
✓ B cellular respiration
C carbon cycle
D oxygen fixation

Flag this question for moderator review

12 **In which organelles does cellular respiration take place?**

A chloroplast
✓ B Mitochondria
C Ribosomes
D chromosome

Flag this question for moderator review

13 **Which of the following is NOT a source of carbon dioxide for our atmosphere?**

A driving cars
B animal cellular respiration
C the use of factories
✓ D plant photosynthesis

Flag this question for moderator review

14 **Chlorophyll is green because**

A it absorbs green wavelengths of light
✓ B it reflects green wavelengths of light
C it absorbs blue and yellow wavelengths, which makes green
D of an optical illusion caused by transmitted light

Flag this question for moderator review

15 **What is ATP?**

A an energy source for plants
B a compound created by the smooth endoplasmic reticulum
C an energy source for animals
✓ D an energy source for both plants and animals

Homework Day 2: Practice Photosynthesis

Video link: *http://ed.ted.com/lessons/the-simple-but-fascinating-story-of-photosynthesis-and-food-amanda-ooten#watch*

Video Questions

On average, what percentage of the food we eat on a daily basis comes from carbohydrates?

A 20%

B 40%

C 60%

D 80%

What are the pores in a plant's skin called?

A Stigmata

B Stomata

C Stamen

D Strivia

The sun helps plants transform carbon dioxide into a simple carbohydrate called:

A Cellulose

B Glucose

C Fructose

D Maltose

What's another name for cellulose?

A Sodium Chloride

B Corn syrup

C Table sugar

D Fiber

Which organelle is ultimately responsible for breaking down carbohydrates into usable energy at the molecular level?

A ATP

B Mitochondria

C Ribosomes

D Golgi Apparatus

In five sentences or less, list the major steps involved in photosynthesis.

Homework Day 3: Cellular Respiration

Video link: *https://www.brainpop.com/science/cellularlifeandgenetics/cellularrespiration/*

Video Questions

1 What do the respiratory system and cellular respiration have in common?

A Oxygen plays a key role in both

B They both rely on the heart

C They both expel oxygen as a waste product

D They have nothing in common

2 What are the chemical products of cellular respiration?

A Water and amino acids

B Carbon dioxide, nitrogen, and urea

C Oxygen, lactic acid, and ammonia

D Carbon dioxide, water, and ATP

3 ATP is to your cells as _____ is to a car.

- **A** The engine
- **B** Gasoline
- **C** The tires
- **D** The steering wheel

4 Which cells in your body undergo cellular respiration?

- **A** Your heart cells
- **B** Your skin cells
- **C** Your brain cell
- **D** Every cell in your body

5 How does your body get rid of the carbon dioxide produced by cellular respiration?

A Through your lungs

B Through your urine

C Through your sweat

D Through your intestines

6 In which organelles does cellular respiration take place?

A Nuclei

B Mitochondria

C Ribosomes

D Golgi bodies

7 Which produces more energy, aerobic respiration or fermentation?

- **A** Fermentation
- **B** Respiration
- **C** They produce the same amount of energy
- **D** It depends on the type of cell

8 How do we get the glucose we need to power our cells?

- **A** Breathing
- **B** Exercising
- **C** Eating
- **D** Drinking water

9 In fermentation, what do cells use instead of oxygen to break down glucose?

A Carbon dioxide

B Water

C Lactic acid

D Nitrogen

10 What's one major reason human cells have evolved to depend on aerobic, and not anaerobic, respiration?

A There's more oxygen in the atmosphere than any other gas

B Aerobic respiration is simpler than anaerobic respiration

C Aerobic respiration is faster than anaerobic respiration

D Aerobic respiration produces more energy than anaerobic respiration

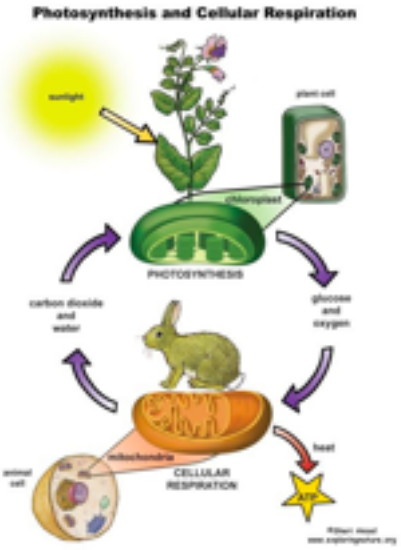
Day 2 Homework Option

- Option = additional Brain Pop Photosynthesis/Respiration Games: https://www.brainpop.com/games/whatplantsneed/

Day 3 Homework

As a final lesson-review, teacher summarizes for whole class the inverse relationship between photosynthesis and respiration

- Teacher distributes a compare/contrast graphic organizer for students to complete (scaffold for those students who need it)
- Include this visual on the back of the handout and ask students to refer to it



Materials

Day 2 Gumdrop Activity

1. Each group receives gumdrops of 3 different colors (36 gumdrops for each group)
   - A. 1st color large gumdrop = 6 (carbon)
   - B. 2nd color large gumdrop = 18 (oxygen)
   - C. 3rd color small gumdrop = 12 (hydrogen) (may substitute small gummy-bears)
2. 20 toothpicks per group

Day 3 Button Activity

1. Each group receives buttons of 3 different colors (36 buttons for each group)
   - A. 1st color large button = 6 (carbon)
   - B. 2nd color large button = 18 (oxygen)
   - C. 3rd color small button = 12 (hydrogen)
2. 20 toothpicks per group

Alternative activity ideas

1. beads/yarn or string
2. clay
3. drawing