



## Demos, Labs, & Science Stations Feature:

- Hands-on Investigations
- STEM Challenge
- Scientific Literacy
- Inquiry Process Skills

LIFE SCIENCE - 5ENGSS · TEKS

# CELL PROCESSES & ENERGY

INVESTIGATION STATION

IMAGINATION STATION

**Cell Energy**  
CELL PROCESSES & ENERGY

...cess of photosynthesis, plants convert energy from the sun to convert carbon dioxide into oxygen and sugars. Because photosynthesis usually produces a particular event of photosynthesis can be summed up by the following chemical equation:

$$6 \text{CO}_2 + 6 \text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2$$

carbon dioxide + water  $\xrightarrow{\text{light}}$  glucose + oxygen

...the process by which cells obtain energy from glucose. During respiration, simple food molecules, such as sugar and release the energy they contain. As it occurs in a series of steps, the overall process can be summarized by this chemical equation:

$$\text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2 \longrightarrow 6 \text{CO}_2 + 6 \text{H}_2\text{O} + \text{energy}$$

glucose + oxygen  $\longrightarrow$  carbon dioxide + water + energy

...bromothymol blue is a dye and can stain your skin and clothing.

asks	• bromothymol blue solution	• 2 straws
pers	• 2 Elodea sprigs	• masking tape
ated	• light source	

...cylinder, measure out 100 mL of bromothymol blue solution and pour it into the second flask. Label one flask A and the other B using masking tape.

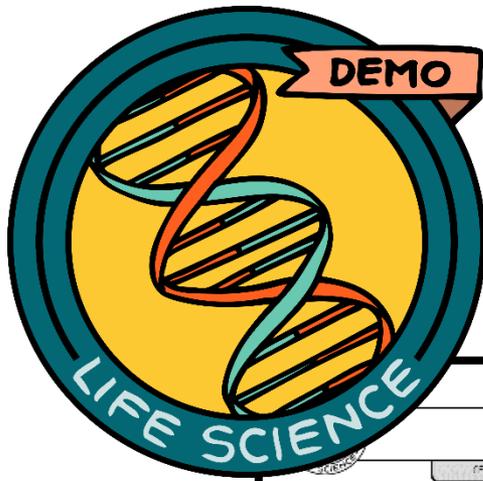
## DEMOS, LABS, & SCIENCE STATIONS

HANDS-ON · STEM · CRITICAL THINKING



**ALL Station Signage Included!!**

Color & Black and White



Teacher guide and answer key offered for every lab!

Easy-to-get materials!



### Respiration

CELL RESPIRATION & ENERGY

**Activity:** Students will observe that yeast needs a sugar (food) that is broken down to release energy.

**Materials:**

- 2 125 mL beakers
- warm water (125°F - 133°F)
- 1 tsp of sugar
- 1 packet of active dry yeast
- stirring rod
- 2 balloons
- empty water bottles

**Procedure:**

**Before Demo:**

- Inflate out balloons by blowing them up repeatedly.

**During Demo:**

- Fill beakers halfway with warm water (NOTE: make sure water is not hot or it will kill yeast).
- Add sugar to one of the beakers.
- Add half of the yeast packet to each beaker, and stir. Make sure to rinse the stirring rod in between the beakers.
- Pour water/yeast mixtures into separate water bottles and attach the balloons to the mouth of the bottle.
- Have students make observations as to what is occurring in each water bottle.

**What's Happening?**

Yeast is living and one gram will make 20 billion cells. As the yeast feeds on the sugar, it produces carbon dioxide. With no place to go, but up, this gas slowly fills the balloon. A very small amount happens for the amount of yeast. Carbon dioxide is produced, forming bubbles in the dough. Once the yeast has been used, this is what gives the bread its airy texture.

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Name \_\_\_\_\_ Date \_\_\_\_\_

### Cell Energy

CELL RESPIRATION & ENERGY

In the process of photosynthesis plants convert energy from the sun to convert carbon dioxide and water into oxygen and sugar. Because photosynthesis usually produces a particular sugar - glucose, the events of photosynthesis can be summed up by the following chemical equation. Glucose, the events of photosynthesis can be summarized by the following chemical equation:

$$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

carbon dioxide + water  $\xrightarrow{\text{light}}$  glucose + oxygen

Respiration is the process by which cells obtain energy from glucose. During respiration cells break down simple food molecules, such as sugar, and release the energy they contain. Although respiration occurs in a series of steps, the overall process can be summarized by the chemical equation:

$$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \longrightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$$

glucose + oxygen  $\longrightarrow$  carbon dioxide + water + energy

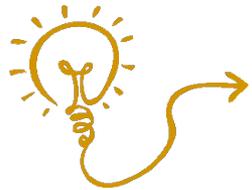
**SAFETY:** Bromothymol blue is a dye that can stain your skin and clothing.

**Materials:**

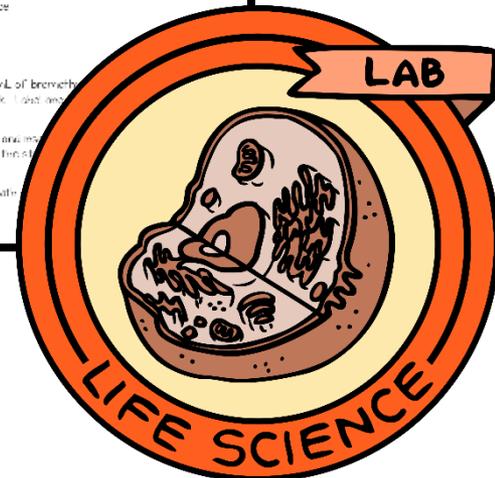
- 2 - 125 mL flasks
- 2 rubber stoppers
- 100 ml graduated cylinder
- bromothymol blue solution
- 2 glass springs
- light source
- 2 straws
- masking tape

**Procedure:**

- Using the graduated cylinder, measure out 100 mL of bromothymol blue solution and pour it into a flask. Repeat with the second flask. Label and use masking tape.
- Have each lab group members each take a straw and place it in the mouth of each flask. Breathe slowly through the straw. Note the color of the bromothymol blue solution.
- Place a spring of glass in each flask and seal with a rubber stopper.



Discussion questions and teacher set-up included!





Group members will read a passage and then complete a task to help increase science literacy and deepen their understanding of the science concept.



**Information Station**

### DNA Fingerprinting

If you turn on your television any day and time of the week, chances are you will find a crime drama or real-life crime on the news. People are fascinated with solving mysteries, and thanks to advances in forensic science and DNA fingerprinting, real-life mysteries are being solved.

DNA fingerprints are similar to regular fingerprints. You have an identical twin, it is unique to you. Any two people who are not twins have a remaining percentage that makes you unique. Although there are about 3 million different base pairs, these differences are what make you unique.

Because DNA structure is unique, it can't be forged. It is the most important tool we have in crime investigations using DNA evidence, and in 1985 DNA fingerprinting proved that it was not just for DNA fingerprints like you can regular fingerprints. You must take the DNA out of the nucleus of a cell. The most common method is using a process called PCR (Polymerase Chain Reaction). The process produces an array of results that can be compared to a suspect's DNA, hair root cells, and cheek cells.

DNA fingerprinting can be used to solve mysteries other than crimes. For example, many families were separated after a tsunami hit Southeast Asia in 2004. One child admitted to the hospital was given the name "Baby B." To ensure the child was given to the correct family, a judge ordered DNA testing to prove who the parents were. DNA can also be used to find information about your ancestors. A sample of DNA can provide a wealth of information, including what part of the world your ancestors come from.

Unlike TV investigators who get their DNA results in minutes, real-life results take longer. As a result, many samples are sitting in labs, waiting to be tested. Unfortunately, labs just don't have the workforce to keep up with the demand. A machine called "lab-on-a-chip" that will help speed up the process. The machine will be able to test samples faster than ever before.

Over the years, advances in forensic science have helped solve many mysteries. DNA fingerprinting is just one of the many ways that science is helping us solve problems.

**Information Station**

**A**

Why is this process called DNA fingerprinting?

**B**

List three reasons for using DNA fingerprinting.

**Information Station**

**D**

What do you think DNA fingerprinting can be used for in the future?

A. \_\_\_\_\_

B. \_\_\_\_\_

C. \_\_\_\_\_

D. \_\_\_\_\_

**Observation Station**

**A**

**Observation Station**

**B**

**Observation Station**

**C**

energy?

from this photo obtain their energy?

Name \_\_\_\_\_ Date \_\_\_\_\_

A1. \_\_\_\_\_

A2. \_\_\_\_\_

B1. \_\_\_\_\_

B2. \_\_\_\_\_

C1. \_\_\_\_\_

C2. \_\_\_\_\_

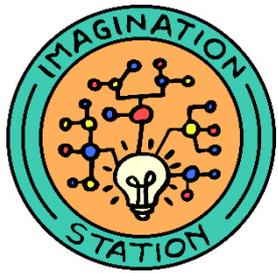
1. Why is breathing necessary for cellular respiration?

2. When the body is doing vigorous exercise, what do you feel your muscles doing? How does the sensation does the muscles feel?

Group members will have images, illustrations, or actual samples at this station that show applications or processes of the science topic.







This station makes science concepts relevant for students by asking them to imagine scenarios that will bring about discussion and critical thinking.

## Job Interview

Directions: Use your imagination to answer the statement below.

IMAGINE you are a maple leaf, and you are applying for a job in an energy factory.

Write a s

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**USER-FRIENDLY PAGES:**  
Students easily recognize which answer sheet to use at each station by matching station icons located on each page!

### Mark and Recapture: Tiger Sharks

Problems from this station require you to mark and recapture to monitor a tiger shark population.

Biologists use the mark and recapture method to monitor the population of the coast of Maui. Data has been collected for the tiger shark population on your answer sheet. For this investigation, for the current year, you are capturing tiger sharks and calculating the population for the current year and the previous four years using the following data.

*Total population = number marked + total number recaptured*

**Materials:**

- Tiger Shark cut-outs
- colored markers
- Fishing pole (with magnet)
- string

**Procedure:**

- Turn lines using the fishing pole to capture tiger sharks. Mark as many tiger sharks as possible. Then set all tiger sharks free. If you catch a tiger shark, you will need to force it to the shore.
- When time is complete, remove all tiger sharks to see if the population from previous studies.
- Count the number of marked or recaptured tiger sharks. Mark the data on your answer sheet for Year 1.
- Use the investigation you did to estimate the estimated population. Do this by completing the data table on your answer sheet.

**Analyze and Conclude:**

- Explain possible reasons why the estimated population size is different from the actual population size.
- Explain when it is most useful for biologists to use the mark and recapture population size.
- Why would a biologist need to monitor a particular population?
- What would a biologist do with the information for a real situation?

Date \_\_\_\_\_

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**Data and Observations**

*Total population = number marked + total number recaptured*

Tiger Shark Data Set				
Year	# marked	Total # captured	# recaptured	Estimated total population
1	20	27	15	
2	26	27	17	
3	22	18	10	
4	16	18	7	
5	15			

**Analyze and Conclude**

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

**TEACHERS SAVE TIME:**  
Laminate station pages and reuse for each class and for years to follow!

# Inquiry and Process Skills

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Demo
  Guided Inquiry Lab
  Science Stations

Inquiry-Based Science Unit:	Classifying	Communicating	Compare & Contrast	Creating Models	Gather/Organize Data	Generalizing	Identifying Variables	Inferring	Interpreting Data/Diagrams	Making Decisions	Manipulating Materials	Measuring	Observing	Predicting
Cell Processes and Energy														
Respiration		X	X			X							X	X
Divide and Conquer		X	X			X		X					X	X
Cell Energy	X	X	X	X	X			X	X		X	X	X	
Information Station: DNA Fingerprinting	X				X	X			X					
Observation Station: Images & Questions	X	X	X			X		X	X	X			X	
Investigation Station: Chromatography	X	X	X		X		X			X	X		X	
Calculation Station: Cycle Time	X		X				X		X			X		
Communication Station: Questions		X	X			X		X		X				
Creation Station: Modeling Mitosis		X		X	X		X			X	X	X	X	X
Imagination Station: Job Interview		X				X				X				

NGS Magnified promotes scientific inquiry throughout the curriculum. Students become more confident and effective learners while developing problem-solving and critical thinking skills. Process skills, such as planning, organizing, and evaluating, help students to complete projects and assignments. These skills allow students to independently gather information, analyze it, and draw their own conclusions.

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