

ACADEMIC ELECTIVE



Learning Activity Sheets for Biology 1

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Table of Contents

The Development of Cell Theory.....	1
Microscope	2
Cell Theory in Action.....	11
Prokaryotic Cell vs. Eukaryotic Cell	14
Cell Cycle Checkpoints.....	17
Differentiating Structural Features of Prokaryotic vs. Eukaryotic Division ...	19
Cell Cycle	22
Cell Cycle	23
Cell Transport Mechanism- Cell Membrane – Selective Permeability	25
Cell Membrane – Structure and Function.....	28
Story Challenge.....	32
Growing Munggo Seeds Experiment.....	34
Photosynthesis in the Locality	37
Cell Requirements: Chlorophylls and Other Pigments	38
Photosynthesis: An Overview	42
Metabolism – Photosynthesis (Light-dependent reactions and light-independent reactions)	47
Metabolism – Photosynthesis (Photosynthesis and carbon dioxide reduction in the atmosphere).....	51
Metabolism – Respiration	54
Metabolism – Respiration	56
Metabolism – Respiration	59
Metabolism – Respiration	63

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	1	Date	
Lesson Title/Topic:	The Development of Cell Theory		
Name		Grade & Section	

Direction: Complete the following table with information needed.

Scientist	Key Work or Investigation	Tools or Methods Used	Important Observations	Year of contribution	Contribution to the Development of Cell Theory
Antonie Van Leeuwenhoek					
Robert Hooke					
Matthias Schleiden					
Theodore Schwann					
Rudolf Virchow					

LEARNING ACTIVITY SHEET (LAS)

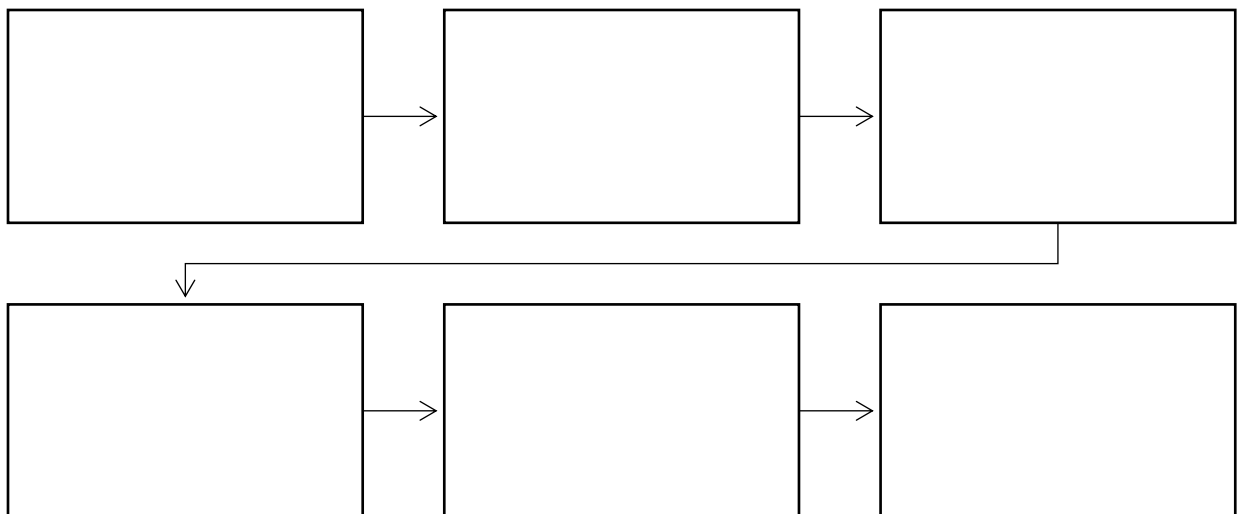
Lesson Exemplar	2	Date	
Lesson Title/Topic:	Microscope		
Name		Grade & Section	

Direction: Read the webpage/reading material provided by your teacher. Identify the data needed and complete the table below for each kind of microscope.

LIGHT MICROSCOPE

Component	Structure / Description	Function
Light Source		
Condenser Lens		
Illumination Filters		
Specimen Stage		
Objective Lenses		
Eyepiece (Ocular Lens)		
Imaging Filters/Apertures		
Focus Knobs (Coarse & Fine)		

Based on your reading, complete the flow chart below on how an image is formed in light microscope.



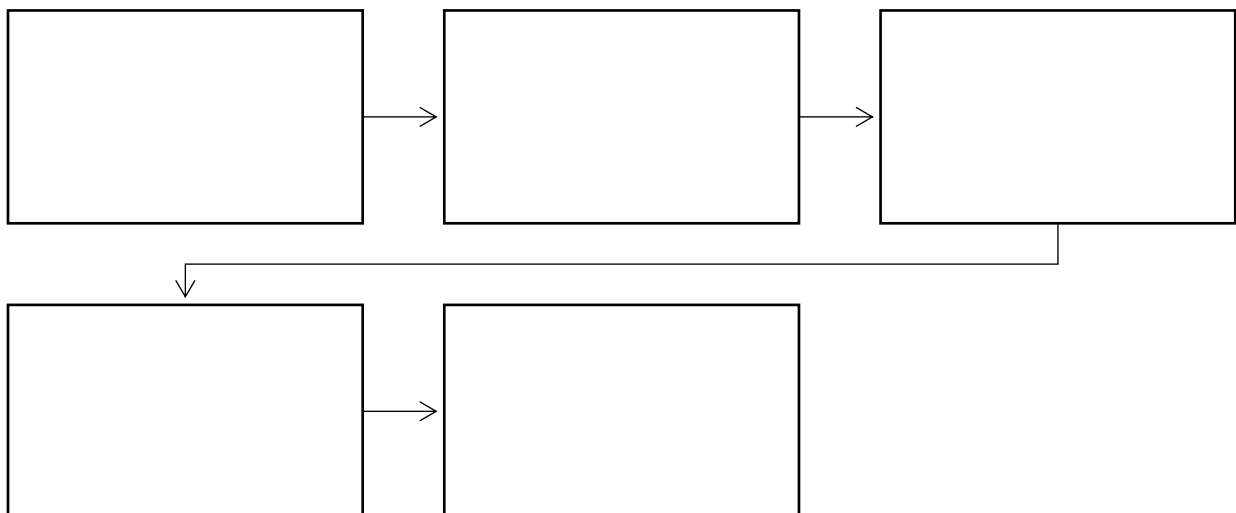
Lesson Exemplar	2	Date	
Lesson Title/Topic:	Microscopes		
Name		Grade & Section	

Direction: Read the webpage/reading material provided by your teacher. Identify the data needed and complete the table below for each kind of microscope.

SCANNING ELECTRON MICROSCOPE

Component / Structure	Function in Image Formation
Electron Source (Gun)	
Electromagnetic Lenses / Scan Coils	
Specimen Stage	
Detectors (Secondary & Backscattered Electron Detectors)	
Vacuum Chamber	

Based on your reading, complete the flow chart below on how an image is formed in light microscope.



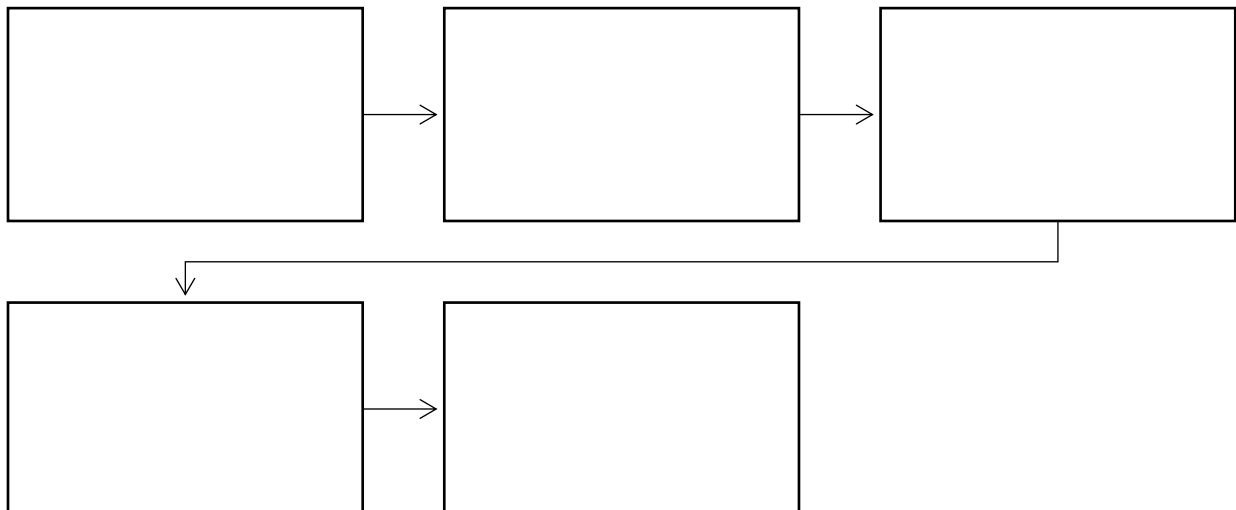
Lesson Exemplar	2	Date	
Lesson Title/Topic:	Microscopes		
Name		Grade & Section	

Direction: Read the webpage/reading material provided by your teacher. Identify the data needed and complete the table below for each kind of microscope.

TRANSMISSION ELECTRON MICROSCOPE

Component / Structure	Function in Image Formation
Electron Source (Gun)	
Electromagnetic Lenses	
Ultra-Thin Specimen Holder / Stage	
Projector / Intermediate Lenses	
Detectors / Fluorescent Screen / Camera	
Vacuum System	

Based on your reading, complete the flow chart below on how an image is formed in light microscope.



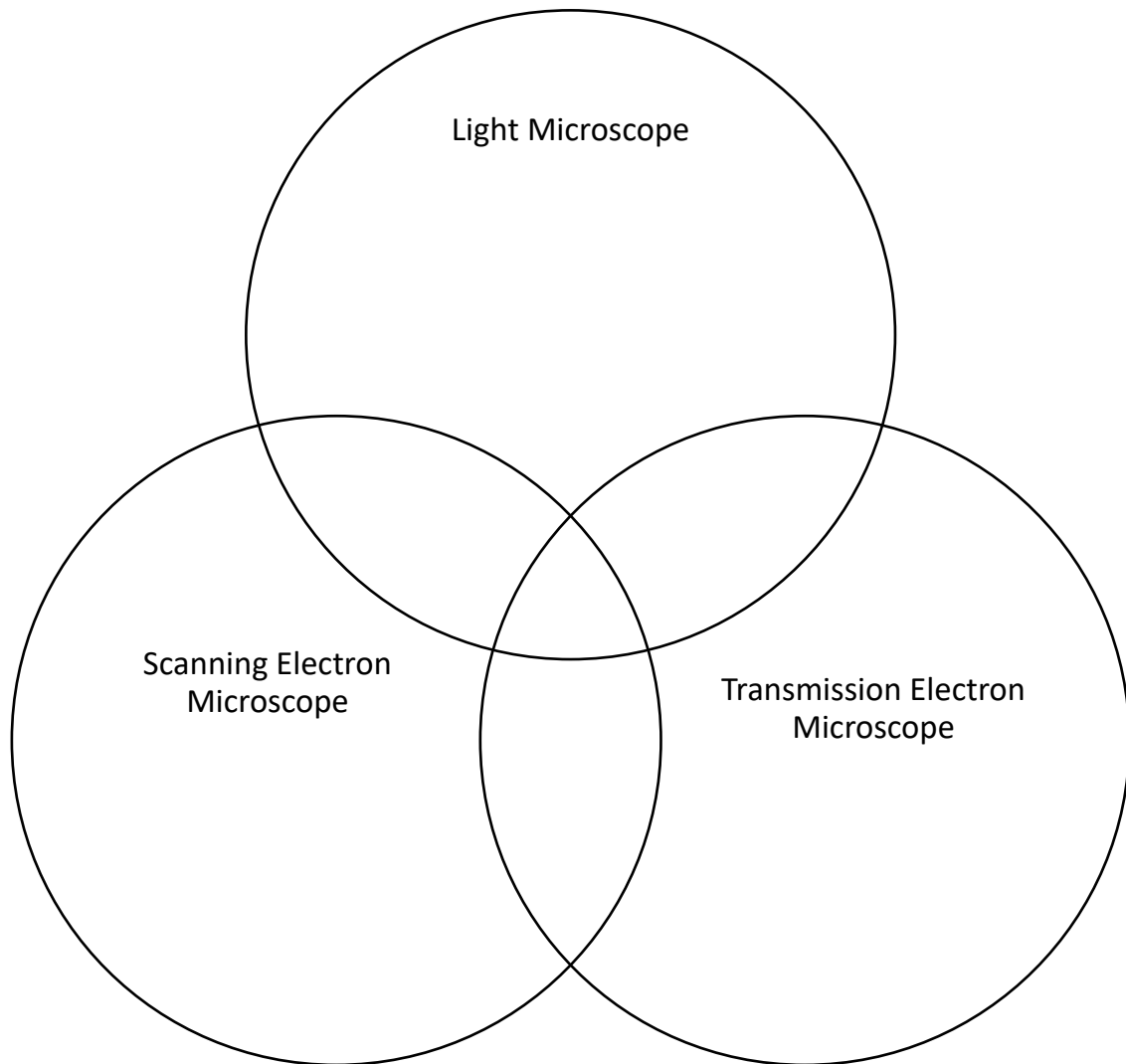
Lesson Exemplar	2	Date	
Lesson Title/Topic:	Microscopes		
Name		Grade & Section	

Direction: Complete the H-map below by providing the necessary information from your previous activities.

Light Microscope (LM)	Similarities	Electron Microscope (EM: SEM / TEM)
<u>Resolution:</u> _____		<u>Resolution:</u> _____
<u>Magnification:</u> _____		<u>Magnification:</u> _____
<u>Specimen Preparation:</u> _____		<u>Specimen Preparation:</u> _____
<u>Image Formation:</u> _____		<u>Image Formation:</u> _____
<u>Applications:</u> _____		<u>Applications:</u> _____

Lesson Exemplar	2	Date	
Lesson Title/Topic:	Microscope		
Name		Grade & Section	

Direction: Complete the Venn Diagram below.



SAMPLE ACCOMPLISHED TABLE:

LIGHT MICROSCOPE

Component	Structure / Description	Function
Light Source	<i>Lamp, LED, laser, or mirror for early instruments.</i>	<i>Provides illumination to the sample for visualization. Controls intensity, angle, and quality of light.</i>
Condenser Lens	<i>Lens system under the stage.</i>	<i>Collects and focuses light onto the specimen to optimize illumination and contrast.</i>
Illumination Filters	<i>Optical filters in illumination path.</i>	<i>Modifies light spectrum or polarization; used for specialized imaging like fluorescence.</i>
Specimen Stage	<i>Flat platform holding slide.</i>	<i>Positions and supports the specimen; may include mechanical controls to move the slide.</i>
Objective Lenses	<i>Set of lenses near specimen, often on a rotating turret.</i>	<i>First magnification system; gathers light from sample and forms an intermediate image. Higher magnification (e.g., 40–100x).</i>
Eyepiece (Ocular Lens)	<i>Lens at the top where the eye views.</i>	<i>Further magnifies the image formed by the objective and relays it to the eye or camera. Typically ~10x.</i>
Imaging Filters/Apertures	<i>Additional elements in imaging path.</i>	<i>Selects specific light (e.g., color, scattered light) to enhance contrast or highlight features.</i>
Focus Knobs (Coarse & Fine)	<i>Adjustment dials linked to stage or objective tube.</i>	<i>Moves objective relative to specimen to achieve sharp focus.</i>

SAMPLE ACCOMPLISHED TABLE:

SCANNING ELECTRON MICROSCOPE

Component / Structure	Function in Image Formation
Electron Source (Gun)	<i>Produces a focused electron beam that scans the surface of the sample.</i>
Electromagnetic Lenses / Scan Coils	<i>Focus and steer the electron beam across the specimen in a raster pattern.</i>
Specimen Stage	<i>Holds the sample and allows precise movement to scan different areas.</i>
Detectors (Secondary & Backscattered Electron Detectors)	<i>Collect electrons emitted/scattered from the sample surface to generate the image.</i>
Vacuum Chamber	<i>Maintains a high vacuum so electrons travel without scattering by air molecules.</i>

SAMPLE ACCOMPLISHED TABLE:

TRANSMISSION ELECTRON MICROSCOPE

Component / Structure	Function in Image Formation
Electron Source (Gun)	<i>Generates high-energy electrons that pass through the sample.</i>
Electromagnetic Lenses	<i>Focus and direct the electron beam through the thin sample.</i>
Ultra-Thin Specimen Holder / Stage	<i>Holds the specimen so electrons can transmit through it.</i>
Projector / Intermediate Lenses	<i>Magnify the transmitted electron image before it reaches the detector or screen.</i>
Detectors / Fluorescent Screen / Camera	<i>Capture transmitted electrons to form a detailed 2D image of internal structure.</i>
Vacuum System	<i>Maintains electron path without interference from air molecules.</i>

SAMPLE FLOW CHART RESPONSES:

LIGHT MICROSCOPE

1. *Light is emitted from a source and may be filtered or shaped to improve contrast and resolution.*
2. *The condenser lens focuses illumination onto the specimen for consistent and intense light.*
3. *Light passes through or reflects from the specimen; characteristics of transmitted/scattered light carry sample information.*
4. *Objective lens collects light and creates a magnified intermediate image.*
5. *Eyepiece further magnifies the image formed by the objective.*
6. *The viewer's eye or camera detects the final enlarged image.*

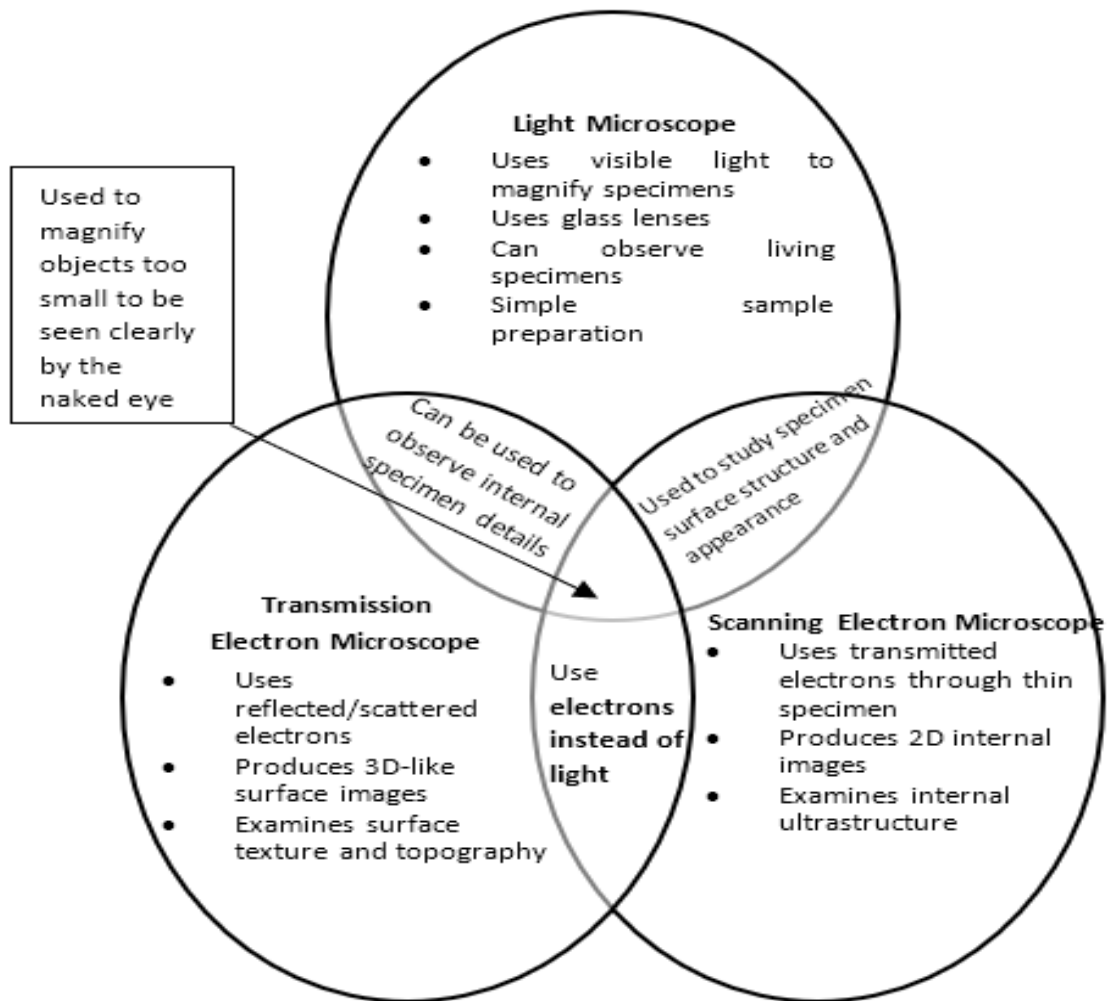
SCANNING ELECTRON MICROSCOPE

1. *Electrons are emitted from the electron source.*
2. *Electromagnetic lenses focus the beam onto the sample surface.*
3. *The beam scans the surface in a raster pattern.*
4. *Interactions with the sample produce secondary or backscattered electrons.*
5. *Detectors collect these electrons and convert signals into a 3D-like image of surface topography.*

TRANSMISSION ELECTRON MICROSCOPE

1. *Electrons are emitted and accelerated by the electron gun.*
2. *Lenses focus the beam and direct it through the ultra-thin sample.*
3. *Electrons interact with internal structures; some are absorbed, scattered, or transmitted.*
4. *Transmitted electrons are collected and magnified by lenses.*
5. *A 2D high-resolution image showing internal details is projected on a screen or recorded by a detector.*

SAMPLE VENN DIAGRAM:



LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	3	Date	
Lesson Title/Topic:	CELL THEORY IN ACTION (LAB ACTIVITY ON THE SPONTANEOUS GENERATION OF MAGGOTS)		
Name		Grade & Section	

Introduction:

Spontaneous generation or abiogenesis is the idea that life could appear from nonliving material. On the other hand, biogenesis is the belief that life originates from preexisting life.

Objective:

Determine if maggots can be spontaneously generated from meat using a controlled experiment.

Materials:

3 glass jars of the same size, 3 slices of fresh meat (e.g., pork, beef, or chicken) or mashed fruits (e.g., potato, banana, or papaya) as a substitute, rubber bands, clean stockings or gauze, marker for labelling.

Estimated Time Frame: 1-2 weeks

Procedure:

1. Prepare the following materials:
 - 3 glass jars of the same size
 - 3 slices of fresh meat (pork, beef, or chicken) or mashed fruits (potato, banana, papaya) as a substitute
 - Clean stockings or gauze
 - Rubber bands
2. Clean and dry the 3 glass jars.
3. Put a piece of fresh meat (about the size of a matchbox) or fruit at the bottom of the three jars.
4. Keep the first jar open and leave it outside where it will be exposed to flies. Label this Jar A.
5. Seal the mouth of the second jar with clean stockings or gauze using a rubber band. Keep it beside Jar A. Label this Jar B.
6. Tightly put the cap and seal the third jar. Keep it in a dry area. Label this Jar C.
7. Observe the appearance of maggots after several days. Continue your observation until you observe the growth of maggots.
8. Record your observations.

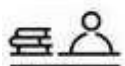
Observations after 1-2 weeks

Indicators	JAR A	JAR B	JAR C
Growth of maggots			
Smell			
Color of Meat or Fruit			
Growth of Fungi			

Answer the following questions. Write your answer in the space provided in each item.

1. How do you relate the generation of maggots with the cell theory?

2. Why do we observe the growth of fungi in all setups after several days of the experiment?

**LAB ACTIVITY SCORING RUBRICS**

Criteria	Beginning (1)	Developing (3)	Mastery (5)
Preparation & Safety	Did not follow lab rules or needed reminders	Followed most lab rules with minor lapses	Consistently followed lab rules and safety measures
Procedure Execution	Needed frequent guidance to set up jars correctly	Completed most steps with some teacher support	Independently completed all steps accurately
Observation & Recording	Incomplete or unclear notes	Notes are mostly complete but lack detail	Detailed, accurate observations recorded
Explanation of Results	Struggles to connect findings to cell theory	Partial explanation of how maggots disprove spontaneous generation	Clear explanation linking experiment to “cells come from pre-existing cells.”

Checking Guide for Teachers

Expected Observations after 1-2 weeks of the Lab Activity

Note: Observations may differ due to external factors.

Indicators	JAR A	JAR B	JAR C
Growth of maggots	Present	Present	None
Smell	Foul	Foul	Foul
Color of Meat or Fruit	Whitish	Whitish	Whitish
Growth of Fungi	Present	Present	Present

The expected outcomes in the experiment follow directly from the principle that maggots come from flies' eggs, not from spontaneous generation:

- **Jar A (open):** Flies can land on the meat, lay eggs, so maggots appear. Meat decays, producing foul smell, a whitish color, and fungal growth.
- **Jar B (gauze-covered):** Flies cannot reach the meat but can lay eggs on the gauze, so maggots appear on the gauze. Meat still decays, giving a foul smell, a whitish color, and fungal growth.
- **Jar C (sealed):** Flies cannot enter, so no eggs and no maggots. Meat still decays internally, producing foul smell, a whitish color, and fungal growth.

👉 The key point: **maggots only develop where flies can deposit eggs**, while decay (smell, color change, fungi) happens in all jars because decomposition is caused by microorganisms, not spontaneous generation. This outcome disproves the idea that maggots arise “from nothing” and shows that life comes from pre-existing life.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	4	DATE	
Lesson Title/Topic:	PROKARYOTIC CELL VS. EUKARYOTIC CELL		
Name		Grade & Section	



BACKGROUND INFORMATION FOR LEARNERS

Prokaryotic cell vs Eukaryotic cell

All living things can be divided into three basic domains: Bacteria, Archaea, and Eukarya. The primarily single-celled organisms found in the Bacteria and Archaea domains are known as **prokaryotes**. These organisms are made up of prokaryotic cells — the smallest, simplest, and most ancient cells.

Organisms in the **Eukarya** domain are made of more complex eukaryotic cells. These organisms, called eukaryotes, can be unicellular or multicellular and include animals, plants, fungi, and protists.

Common features of prokaryotic and eukaryotic cells (Pedersen 2019)

All living things have cells that share fundamental structural parts, which include:

- **DNA:** It is a genetic code that determines all the characteristics of living things.
- **Cell (or plasma) membrane:** It is the outer layer that separates the cell from the surrounding environment and acts as a selective barrier for incoming and outgoing materials.
- **Cytoplasm:** It is a jelly-like fluid within a cell that is composed primarily of water, salts, and proteins.
- **Ribosomes:** These are organelles that make proteins.

Summary of Differences (Pedersen, 2019)

- **Nucleus:** Eukaryotes have a membrane-bound nucleus with multiple chromosomes; prokaryotes lack a nucleus, with DNA in a nucleoid and plasmids.
- **Organelles:** Eukaryotes contain membrane-bound organelles (mitochondria, ER, Golgi); prokaryotes lack these but may have appendages (flagella, pili) and specialized structures like carboxysomes.
- **Ribosomes:** Eukaryotic ribosomes are larger (60S + 40S) and can attach to membranes; prokaryotic ribosomes are smaller (50S + 30S) and free-floating.
- **Reproduction:** Eukaryotes mainly reproduce sexually or via mitosis; prokaryotes reproduce by binary fission, with variation through transformation, transduction, and conjugation.
- **Cell Walls:** Some eukaryotes (plants, fungi) have cell walls of cellulose or chitin; prokaryotes have rigid walls of peptidoglyc

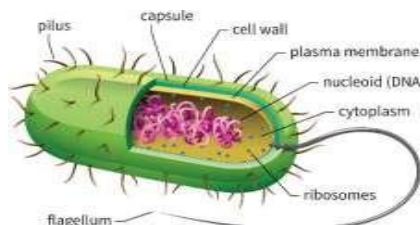


Figure 1. A general structure of a prokaryotic cell ©Aliotta (2017). Prokaryotic cell vs. Eukaryotic cell

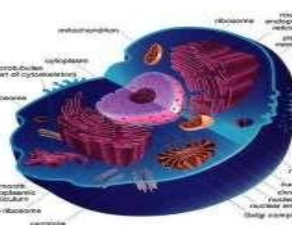


Figure 2. A general structure of a eukaryotic cell (animal) ©Biologydictionary.net

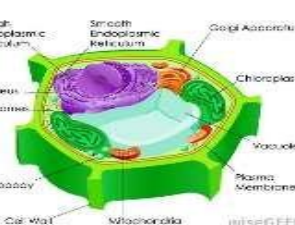
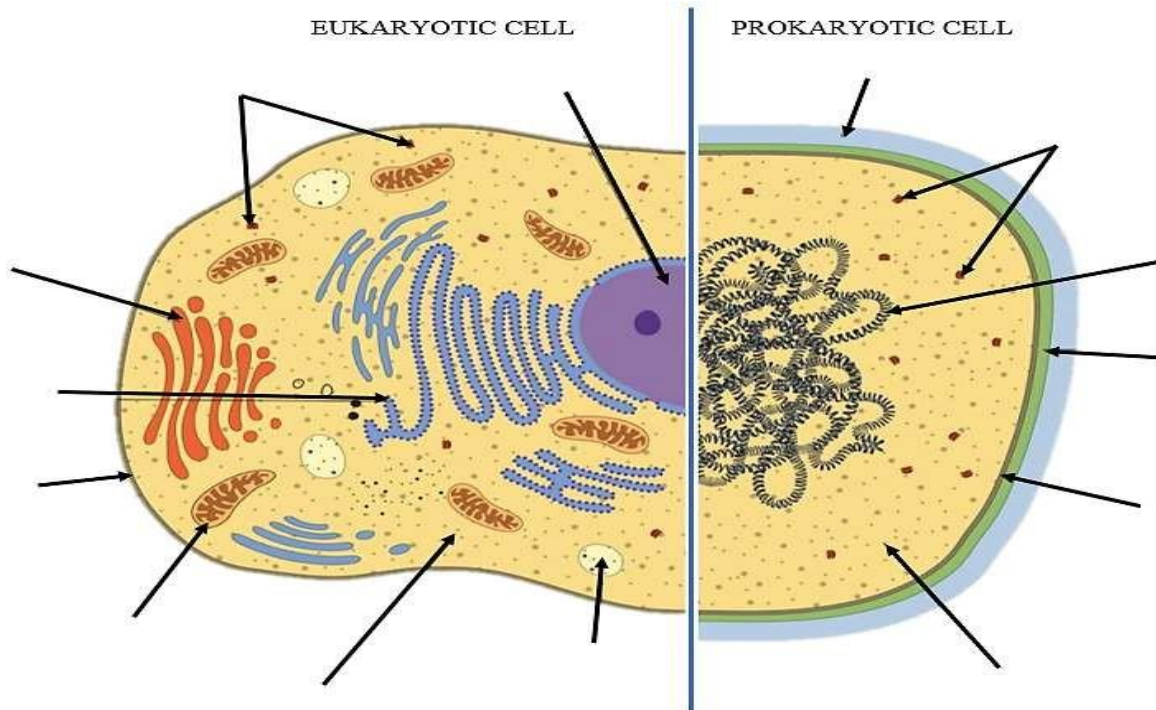


Figure 3. A general structure of a eukaryotic cell (plant) © Sonu Academy

DIAGRAM COMPARISON + LABELING

Label the parts of a eukaryotic cell and a prokaryotic cell. Refer to your previous learnings.

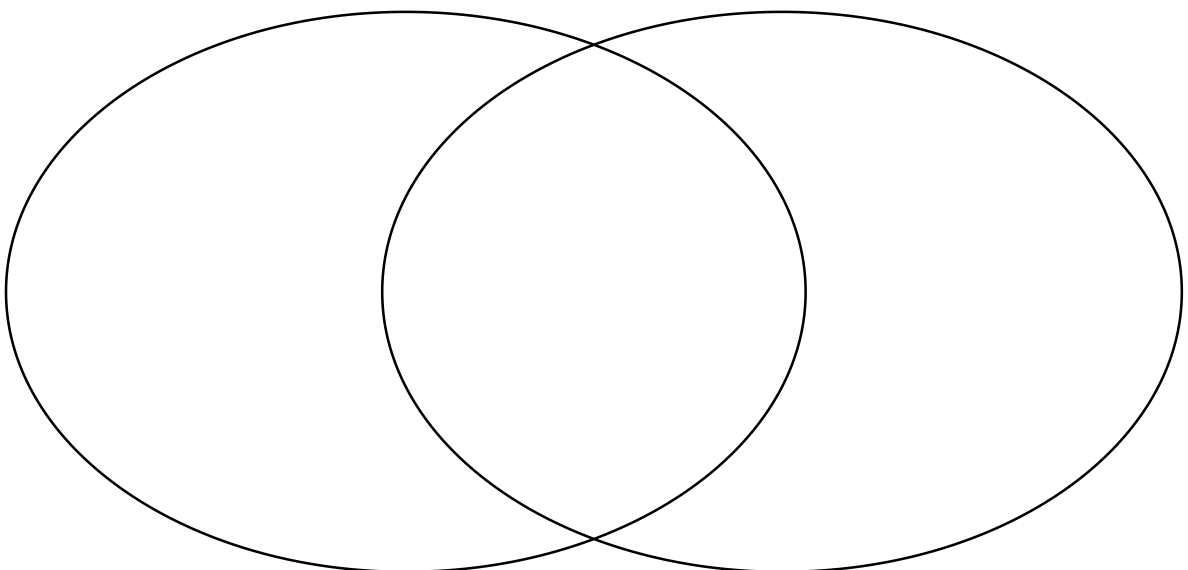


SIMILARITIES AND DIFFERENCES

Based on your thorough readings about prokaryotic and eukaryotic cells, compare and contrast them through a Venn diagram.

Prokaryotic Cell

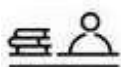
Eukaryotic Cell



Lesson Exemplar	4	DATE	
Lesson Title/Topic:	PROKARYOTIC CELL VS. EUKARYOTIC CELL		
Name		Grade & Section	

CELLS IN 3D

Create a 3D model of either a prokaryotic or eukaryotic cell made up of recyclable/indigenous materials. Label your 3D model and give a short description of the model. Be guided by the given rubric below.



RUBRICS FOR SCORING

Diagram	Below Average (1-3 points)	Average (4-6 points)	Above Average (7-8 points)	Excellent (9-10 points)
Model components	A few required items are represented in the model.	Some required items are represented in the model.	Most required items are represented in the model.	All required items are represented in the model.
Text and labels	Few labels are present.	Some labels are present and correctly placed.	Most labels are Present and are correctly placed.	All labels are present and are correctly placed.
Creativity and appearance	The 3D model's appearance shows the least effort required.	The 3D model appearance meets lesson requirements.	Creative 3D model	Highly creative, exceptional 3D model
Resourcefulness	The 3D model did not use any recyclable material.	Few recyclable materials are used in the 3D model	Recyclable materials are used in the 3D model	Smart use of recyclable materials
Score				

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	5	Date	
Lesson Title/Topic:	Cell Cycle Checkpoints		
Name		Grade & Section	

Cell Cycle Checkpoints Activity Sheet

Instructions:

Read each real-life situation below. Identify the checkpoint involved and explain why that checkpoint is important in preventing abnormal cell growth.

Situation 1:

A skin cell detects major DNA damage after sun exposure. Division must pause to repair the DNA.

Checkpoint involved: _____

Why this checkpoint matters:

Situation 2:

A cell finishes copying its DNA, but some chromosomes did not duplicate correctly.

Checkpoint involved: _____

Why this checkpoint matters:

Situation 3:

During cell division, chromosomes fail to line up in the middle. The cell must stop to fix spindle attachment.

Checkpoint involved: _____

Why this checkpoint matters:

Situation 4:

A cell continues dividing rapidly even though DNA is severely damaged. A tumor begins to form.

Checkpoint involved (which one failed?): _____

Explain what went wrong:

Rubric for Checkpoint Activity & Short Response

Real-Life Situations (Identify Checkpoint + Explain Importance)

Criteria	Excellent (4)	Proficient (3)	Developing (2)	Beginning (1)
Checkpoint Identification	Correctly identifies the specific checkpoint in all situations	Correctly identifies most checkpoints (3 out of 4)	Identifies some checkpoints but with errors (2 out of 4)	Few or no checkpoints identified correctly
Explanation of Importance	Provides clear, accurate reasoning showing how the checkpoint prevents abnormal growth	Provides mostly accurate reasoning with minor gaps	Provides partial reasoning, vague or incomplete	Provides little or no reasoning, misconceptions evident
Connection to Real-Life Context	Explicitly links checkpoint function to real-life consequences (e.g., cancer, mutation repair)	Mentions real-life relevance but not fully explained	Minimal connection to real-life context	No connection to real-life context

Checking Tips for teachers:

- Probe for specific checkpoint names (G1, G2, M).
- Check that students explain why the checkpoint matters, not just identify it.
- Watch for misconceptions (e.g., thinking all cells are synchronized in the same stage).
- Encourage connections to real-life health outcomes to deepen understanding.

LEARNING ACTIVITY SHEET (LAS)

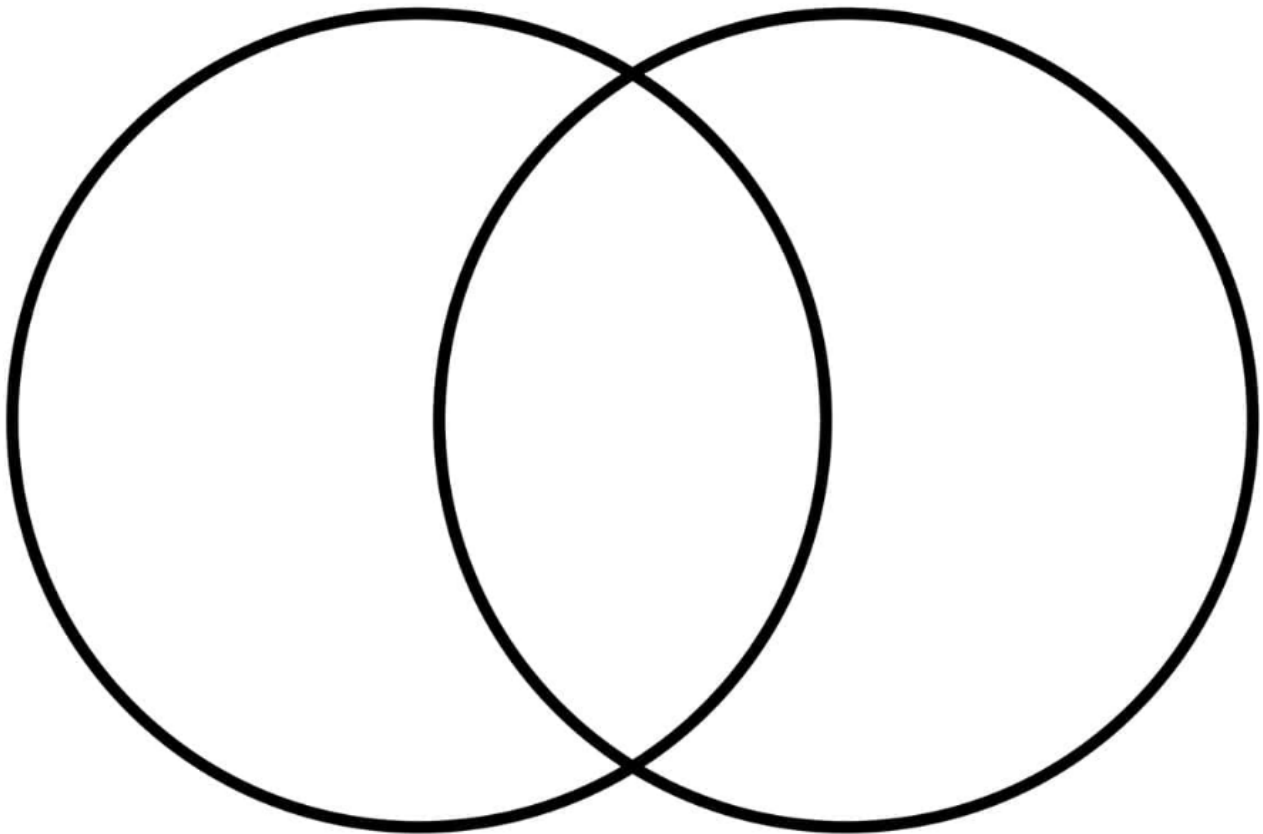
Lesson Exemplar	6	Date	
Lesson Title/Topic:	Differentiating Structural Features of Prokaryotic vs. Eukaryotic Division		
Name		Grade & Section	

Activity Sheet: Differentiating Structural Features of Prokaryotic vs. Eukaryotic Division

Activity 1: Written Response

- A. Complete the **Venn diagram** comparing prokaryotic and eukaryotic cell division.

VENN DIAGRAM



Task Overview

You learners will apply your knowledge of prokaryotic and eukaryotic cell division by analyzing real-life scenarios and presenting solutions or explanations. This performance task integrates description, sequencing, comparison, and application of concepts into one authentic output.

1. Group Work Each group will be assigned one case scenario:

- **Case 1:** Food left unrefrigerated overnight caused food poisoning. Explain how bacterial cell division (binary fission) contributed to the rapid spread of illness. _____

- **Case 2:** A patient's wound healed within a week. Explain how mitosis and cytokinesis enabled tissue repair.

- **Case 3:** Two siblings inherit different trait combinations from the same parents. Explain how crossing over and recombination during meiosis contributed to these differences. *(Use a chromosome diagram in your group presentation.)*

Part II: After the group presentation, write a short reflection in 5–7 sentences.

Reflection Question: *How does understanding cell division help us in everyday life?*

Checking Guide for Teachers:

Here's a **teacher's reference guide with sample answers** for the Venn diagram activity on comparing prokaryotic and eukaryotic cell division. This can help you quickly check student work and ensure they captured the essential points:

Prokaryotic Cell Division (Binary Fission)	Shared Features (Overlap)	Eukaryotic Cell Division (Mitosis/Meiosis)
Simple process, no spindle fibers	Both involve DNA replication before division	Complex process with spindle fibers
DNA is circular, single chromosome	Both ensure genetic material is passed to daughter cells	DNA is linear, multiple chromosomes
Division is rapid, allowing fast reproduction	Both are essential for survival and reproduction	Involves nucleus breakdown and reformation
No nucleus involved	Both maintain continuity of life	Includes stages (prophase, metaphase, anaphase, telophase)
		Meiosis produces gametes with genetic variation

Differentiating Structural Features of Prokaryotic vs. Eukaryotic Division

Rubric Highlights (for teacher use)

- Content Accuracy (40%) – Correct explanation of cell division concepts
- Application (30%) – Clear link between science and real-life scenario
- Creativity (20%) – Effective use of visual model or analogy
- Presentation Skills (10%) – Clarity, teamwork, and engagement

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	7	Date	
Lesson Title/Topic:	Cell Cycle		
Name		Grade & Section	

Activity: Build- A- Chromosome

Objectives:

1. Construct homologous chromosomes (maternal and paternal) using simple materials to visualize genetic organization.
2. Distinguish between sister and non-sister chromatids, recognizing that crossing over happens between non-sister chromatids of homologous chromosomes

Procedure

1. **Build Chromosomes**
 - Use clay, yarn, or strips to make two long shapes (maternal and paternal).
 - Label them clearly.
2. **Add Alleles**
 - Place beads or dots along each chromosome to represent alleles.
 - Example: maternal chromosome has red beads, paternal has blue beads.
3. **Crossing Over**
 - Choose matching segments on each chromosome.
 - Exchange them by swapping beads/segments.
 - Reattach securely.
4. **Observe Changes**
 - Compare allele patterns before and after.
 - Notice how new combinations appear.

Process Questions

1. What changed after you exchanged segments?
2. Which chromatids exchanged segments—sister or non-sister?
3. Why are new allele combinations formed after crossing over?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	8	Date	
Lesson Title/Topic:	Cell Cycle		
Name		Grade & Section	

Activity: Cell Division Case Investigation

1. Identify whether mitosis or meiosis is occurring in a given case scenario.
2. Explain the process involved, including chromosome behavior and cell outcomes.
3. Justify the biological significance of the process (growth, repair, reproduction, species continuity).

Procedure:

1. Read the Case File carefully (look at diagrams/images and text).
2. Identify the Process: Decide if it is mitosis or meiosis.
3. Explain the Evidence: Describe what the cells are doing and what traits/outcomes appear.
4. Justify the Significance: Explain why this process is important for survival or species continuity.
5. Work Individual or in pair. Provides evidence about:
 1. *What happened?*
 2. *What are the cells doing?*
 3. *What visible traits or outcomes appear?*

Case File 1: Gamete

Diagram of sperm/egg formation showing chromosome number reduction.

Task:

Identify → Meiosis

1. Explain → Gamete formation and haploid cells
2. Justify → Prevents chromosomes doubling and ensures species continuity

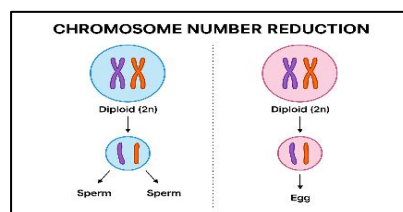


Fig.2 Sperm and Egg formation

Case File 2. Growth and Repair Scenario

A microscope image of skin cells dividing after a cut and a child's growth chart.

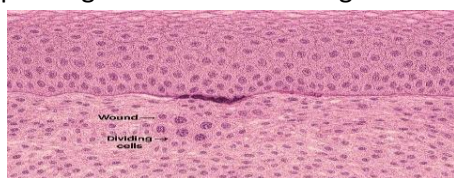


Fig.3 Microscopic Image of Skin Cells Dividing After a Cut



Fig.4 Growth Chart

1. Answer Process Questions:

1. What process of cell division is happening, and what evidence supports your answer?
2. How does this type of cell division contribute to survival or continuation of the species?

Sample Worksheet for Students

Cell Division Case Investigation Worksheet

Name: _____ **Date:** _____

Case File 1: Gamete Formation

Evidence Provided: Diagram of sperm/egg formation showing chromosome number reduction.

Tasks:

1. **Identify the Process:** _____
2. **Explain:** What is happening to the cells?
3. **Justify:** Why is this process important for species continuity?

Case File 2: Growth and Repair

Evidence Provided: Microscope image of skin cells dividing after a cut + child's growth chart.

Tasks:

1. **Identify the Process:** _____
2. **Explain:** What is happening to the cells?
3. **Justify:** How does this process help the organism survive?

Process Questions

1. What process of cell division is happening in each scenario, and what evidence supports your answer?
2. How does the type of cell division shown in the scenario contribute to:
 - **Survival of the organism?**
 - **Continuation of the species?**

Reflection

- In your own words, explain why both **mitosis and meiosis** are essential for life.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	9	Date	
Lesson Title/Topic:	Cell Transport Mechanism- Cell Membrane – Selective Permeability		
Name		Grade & Section	

Activity Title: Simple Dialysis Tubing Demonstration

I. Objectives

By the end of this activity, students should be able to:

1. Identify how dialysis tubing models the selective permeability of the cell membrane.
2. Differentiate passive transport (diffusion/osmosis) from active transport.
3. Explain how selective permeability contributes to homeostasis.

II. Materials

- Dialysis tubing (soaked and prepared)
- Starch solution (inside the tubing)
- Iodine solution (outside the tubing in a beaker)
- Beaker, string/rubber bands, dropper

III. General Directions

1. Prepare the dialysis tubing by filling it with starch solution and tying both ends securely.
2. Place the tubing into a beaker containing iodine solution.
3. Observe after several minutes: iodine molecules pass through the tubing and react with starch, turning the inside blue-black, while starch molecules remain inside.
4. Record your observations and answer the guided questions.

Step/Condition	Observation (What did you see?)	Explanation (Why did it happen?)
Before immersion (starch inside tubing, iodine outside)		
After immersion (several minutes)		

Molecule movement		
Overall effect		

IV. Guided Questions

Passive Transport (Diffusion/Osmosis):

1. How does the movement of iodine into the tubing demonstrate passive transport?

2. Why were iodine molecules able to pass through the tubing without energy input?

3. How does this experiment show the principle of selective permeability?

Active Transport (Protein Pumps & Energy Use):

4. Why couldn't starch molecules move out of the tubing, even though there was a concentration difference?

5. How would the cell move very large molecules like starch if needed?

6. Why do cells require ATP energy and protein pumps to move certain molecules against their concentration gradient?

7. Why can some substances cross the membrane easily, while others need proteins or vesicles?

Homeostasis Connection:

8. How does selective permeability help the cell maintain balance in changing environments?

9. Why is it important for cells to regulate which molecules enter and exit, rather than allowing everything to pass freely?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	10	Date	
Lesson Title/Topic:	Cell Membrane – Structure and Function		
Name		Grade & Section	

Activity Title: What's in the Cell Membrane

I. Objectives

By the end of this activity, students should be able to:

1. Identify and recognize terms related to the structure of the cell membrane.
2. Differentiate structural components (phospholipids, proteins, cholesterol, carbohydrates) and connect them to their functions.

II. Materials

- Printed activity sheet with terms list or word puzzle
- Red pen or marker

III. General Directions

1. Carefully read the activity sheet provided.
2. Encircle all the terms you can find that are related to the structure of the cell membrane using a red pen.
3. Review the terms you identified and connect them to their functions.
4. Answer the guided process questions in complete sentences.

WORD SEARCH

O	H	Y	D	R	O	P	H	O	B	I	C	T	A	I	L
L	S	P	I	G	I	R	U	P	J	I	G	N	I	T	T
T	O	M	R	H	T	H	T	S	K	F	L	T	N	Y	R
H	G	S	G	F	M	O	R	H	C	N	O	R	T	H	A
J	I	L	U	E	S	S	E	W	V	R	B	O	E	G	N
R	E	Z	Y	C	D	P	A	Z	L	B	U	P	G	D	S
E	W	A	B	C	E	H	C	L	M	O	L	H	R	E	M
C	G	B	S	I	O	O	H	P	E	L	A	O	A	F	E
E	B	A	C	H	O	L	E	S	T	E	R	O	L	W	M
P	I	J	T	M	W	I	I	U	L	T	E	L	P	A	B
T	K	E	I	R	X	P	L	P	T	Q	W	I	R	C	R
O	P	Y	L	Y	L	I	E	T	I	S	A	C	O	G	A
R	Q	R	Q	Q	T	D	S	S	J	D	R	S	T	Y	N
S	L	O	R	E	T	S	S	D	K	W	D	T	E	I	E
K	L	P	N	C	R	U	F	O	K	D	S	E	I	Y	L
V	C	I	L	I	H	P	O	R	D	Y	H	R	N	K	L

IV. Guided Questions

1. What is a cell membrane?

2. Which terms did you encircle that you already recognize as parts of the cell membrane?

3. Can you describe certain terms related to its function?

Lesson Exemplar	10	Date	
Lesson Title/Topic:	Cell Membrane – Selective Permeability		
Name		Grade & Section	

Activity Title: Plasma Membrane – Sandwich Analogy

I. Objectives

By the end of this activity, students should be able to:

1. Model the plasma membrane using a simple food analogy.
2. Explain how selective permeability is demonstrated in the activity.
3. Predict what happens to a cell if selective permeability is lost.
4. Evaluate the strengths and limitations of using analogies in science learning.

II. Materials

- Two slices of bread
- Softened butter
- Water
- Dropper

III. General Directions

1. Get a slice of bread and spread softened butter on it.
2. Place the second slice of bread on top to form a sandwich.
3. Using a dropper, pour water onto the sandwich.
4. Observe what happens to the water and the butter layer.
5. Record your observations and answer the guided questions.

Step/Condition	Observation (What did you see?)	Explanation (Why did it happen?)
Water dropped on sandwich		
Butter layer effect		

Overall sandwich behavior		
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IV. Guided Questions

1. What happens when you drop water on top of the butter sandwich? Write your answer on a sheet of paper.

2. How does this analogy show the importance of selective permeability?

3. What might happen to a cell if its membrane lost this property.

4. In what ways this analogy help you understand the cell membrane? What is lacking on this analogy. Justify your answer.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	11	Date	
Lesson Title/Topic:	Story Challenge		
Name		Grade & Section	

ACTIVITY INSTRUCTIONS

You will write a short story that explains, in simple but scientifically accurate terms, how a cellular abnormality leads to a disease and its physical symptoms. Your story must be 300 words or less and must be simple enough for a younger student to understand, without sacrificing scientific accuracy.

1. **Choose your Disease:** Cancer, Type II Diabetes, Generic Disorder (Sickle Cell Anemia is preferred)
2. **Cast your Characters:** Assign everyday objects or people to represent the biological parts in your story. Complete the table below. (If the table is not enough write the other biological component and equivalent characters on the space below the table)

Biological Component (e.g., DNA)	Character (Object or Person) (e.g., The blueprint / the manual)

3. Plan your Plot

Your story must follow this three-act structure. Plan each act below before you write.

Normal Beginning	Conflict	Problem Ending
How does the normal cell work? Describe its structure and job. This is what a healthy cell looks like.	What goes wrong at the cellular level? How is the abnormal cell different from the normal one?	Name one physical symptom the person experiences. Explain how the cellular abnormality directly caused it.

Important: Your "Problem ending" must name a specific physical symptom (e.g., a lump, fatigue, pain in the bones) and connect it directly back to the cellular abnormality — not just say "the person got sick."

4. **Write your story (300 words or less)**

Write your story here. Use your characters from Step 2 and your plot from Step 3. It must be simple enough for a younger student to understand. It must remain scientifically accurate.

5. **Cite your source**

Source: _____

Source Type: _____

SCORING RUBRIC				
Criterion	Mastered (4)	Proficient (3)	Developing (2)	Beginning (1)
Describes the cellular abnormality	Accurately and clearly describes the cellular abnormality with correct scientific terms (e.g., mutation, uncontrolled division, insulin resistance). Explanation is complete and precise.	Describes the abnormality correctly but with minor gaps or imprecise language. Key ideas are present and accurate.	Describes the abnormality in general terms but lacks scientific accuracy or omits key details. Some understanding is evident.	Abnormality is vaguely described, missing, or scientifically incorrect.
Compares normal and abnormal cells	Clearly and explicitly contrasts the structure or function of normal cells with abnormal cells. Both states are described with accurate detail.	Comparison is present and mostly accurate, but one side (normal or abnormal) is less developed or detailed.	Mentions both normal and abnormal cells but do not directly compare them. Contrast is implied rather than stated.	Only one state (normal or abnormal) is described. No comparison attempted.
Connects abnormality to disease	Clearly and accurately explains the cause-and-effect pathway from cellular abnormality to the disease. Uses information from the secondary source to support the explanation.	Connects the abnormality to the disease with minor gaps in the causal chain. Source is cited but connection to story is loose.	A connection is attempted but the causal chain is incomplete or partially inaccurate. Source is cited but not used meaningfully.	No clear connection between cellular abnormality and the disease. Source is missing or irrelevant.
Links abnormality to physical symptom	Names a specific, accurate physical symptom and traces it directly back to the cellular abnormality with a clear, logical explanation.	Names a correct symptom and links it to abnormality, but the explanation of how one causes the other is brief or partially developed.	Names a symptom but the link to the cellular abnormality is vague or missing.	No specific symptom named, or symptom is incorrect for the disease chosen.
Use of secondary source	Cites a relevant, credible source and explicitly states what it contributed to the story. Information from the source is clearly reflected in the narrative.	Cites a relevant source with a source note. Connection to story is stated but could be more specific.	Source is cited but the "this source helped me understand" line is missing or too vague to verify use.	No source cited, or source is not relevant or credible.
Total Score				

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	12	Date	
Lesson Title/Topic:	Growing Munggo Seeds Experiment		
Name		Grade & Section	

MATERIALS NEEDED

- Munggo (mung bean) seeds
- 2 small containers or cups per group
- Cotton or tissue paper
- Water
- Ruler (optional, for measuring growth)

ACTIVITY INSTRUCTIONS

Before You Begin — Make a Prediction:

What do you think will happen to the munggo seeds placed in sunlight compared to the seeds in the dark? Write your prediction below.

Procedure:

1. Work with your group to prepare two containers with munggo seeds placed on moist cotton.
2. Label the containers:
 - **Container A** — Place in a location with sunlight.
 - **Container B** — Place in a shaded or dark location.
3. Keep the cotton moist by adding a small amount of water daily.
4. Observe both containers daily for 10 days. Record your observations in the table below.
5. After 10 days, compare the two plants and discuss the differences with your group.
6. Report your findings to the class.

OBSERVATION RECORD TABLE

Directions: Record your daily observations for both containers. Be specific about color, height, and overall health.

Day	CONTAINER A (Sunlight)		CONTAINER B (Dark / Shade)		Notes / Other Observations
	Height (mm)	Leaf Color	Height (mm)	Leaf Color	
Day 1					
Day 2					
Day 3					
Day 4					
Day 5					
Day 6					

Day 7					
Day 8					
Day 9					
Day 10					

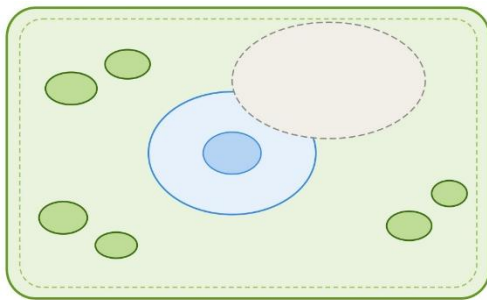
GUIDE QUESTIONS

Directions: Answer the following questions based on your observations and what you have learned.

Basic Questions:

- a. Which munggo seeds grew better? Describe the differences you observed between the two containers (A&B) after 10 days.

- b. Look at the plant cell diagram below. Draw an arrow and label the organelle you think is most responsible for the differences you observed between the two containers. Then explain your choice.



- c. Using your labeled diagram, explain why the leaves of Container B turned pale and yellowish.

Dig Deeper:

Directions: Answer each question thoughtfully and in complete sentences. Use what you learn from the experiment cells to support your answer.

- a. The seeds in the dark still sprouted and grew a little at first. Where did that energy come from?

- b. If a classmate says "Both plants are still alive after a week, so sunlight doesn't really matter." Do you agree or disagree?

- c. Imagine you are a plant cell in Container B. Which organelle is unable to do its job, and why?

- d. Imagine that A gardener keeps a potted *pechay* inside a windowless storage room for two weeks. When she takes it out, the leaves are pale and yellowish instead of green. Using what you know about chloroplasts and photosynthesis, explain what most likely happened inside the plant's cells during those two weeks.

RUBRIC FOR REPORTING

Criteria: Content of Observations & Reporting of Findings

CRITERIA	MASTERED (4)	PROFICIENT (3)	DEVELOPING (2)	BEGINNING (1)
Completeness of Observations	All 10 days recorded for both containers with specific details on height, leaf color, and health.	At least 7 days recorded for both containers with most details present.	At least 5 days recorded but details are vague or missing for one container.	Fewer than 5 days recorded or observations are largely incomplete.
Accuracy of Content	Observations are scientifically accurate and clearly distinguish differences between Container A and B.	Observations are mostly accurate with minor errors that do not affect overall understanding.	Some observations are accurate but comparisons between containers are unclear or inconsistent.	Observations are largely inaccurate or no meaningful comparison between containers is made.
Connection to Concepts (Autotrophs & Chloroplasts)	Guide question answers and summary clearly and correctly connect observations to chloroplasts, photosynthesis, and autotrophs.	Answers mostly connect observations to the key concepts with minor gaps in explanation.	Some connection to key concepts is attempted but explanations are shallow or partly incorrect.	Little to no connection made between observations and the concepts of chloroplasts or autotrophs.
Quality of Reporting (HOTS Responses)	HOTS answers are well-reasoned, use scientific vocabulary, and are supported by evidence from the experiment.	HOTS answers show good reasoning and mostly use scientific vocabulary with adequate support.	HOTS answers show some reasoning but lack depth, evidence, or proper use of scientific terms.	HOTS answers are minimal, vague, or show little understanding of the concepts.
Oral / Written Presentation of Findings	Findings are presented clearly and confidently; group communicates results in an organized and logical manner.	Findings are presented adequately; most members contribute and the report is mostly organized.	Findings are presented but the report lacks organization or only one member presents.	Findings are unclear, disorganized, or the group is unable to present their results.
TOTAL SCORE				

Teacher's Remarks:

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	12	Date	
Lesson Title/Topic:	Photosynthesis in the Locality		
Name		Grade & Section	

ACTIVITY INSTRUCTIONS

- List 3 places in your municipality and write them in the observation chart below.
- Identify autotrophs and heterotrophs that live in each location.
- Identify whether photosynthesis is likely occurring there. Use the presence of green plants (and therefore chloroplasts), exposure to sunlight, and the organisms found in the area to support your reasoning. If photosynthesis is not occurring, explain why.
- Answer the guide questions.

Before You Begin — Make a Prediction:

Which of the 3 places you chose do you think has the most photosynthesis happening? Why?

OBSERVATION TABLE

Location	List of autotrophs	List of heterotrophs	Photosynthesis? (Y/N)	Explain — include evidence of green plants and sunlight exposure

GUIDE QUESTIONS

Directions: Answer the following questions based on your observations and what you have learned.

1. What is an autotroph? Give two examples of autotrophs you would find in your community.

2. What conditions must be present in a location for photosynthesis to occur? Explain each condition briefly. Then, inside which organelle in a plant cell do these conditions come together to produce food?

3. If a classmate says, "Photosynthesis happens in the park." Is this statement completely accurate? Rewrite it to make it more scientifically precise. Think about not just where it happens, but what is happening inside the organisms there.

4. Based on your observations, which location in your community supports the most photosynthesis? What evidence from your chart supports this conclusion? What would happen to the heterotrophs in that area if all the autotrophs were removed?

5. Choose one autotroph from your chart. Explain how the chloroplasts inside its cells support not just that organism, but the entire food chain in that location. What would happen to the heterotrophs you listed if the chloroplasts in those autotrophs suddenly stopped working?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	13	Date	
Lesson Title/Topic:	Cell Requirements: Chlorophylls and Other Pigments		
Name		Grade & Section	

I. Multiple Choice. Encircle the Letter of the Best Answer.

- Which of the following correctly describes the relationship between wavelength and photon energy?
 - Longer wavelength → higher energy per photon
 - Shorter wavelength → higher energy per photon
 - Wavelength and energy are unrelated
 - Longer wavelength → stronger absorption
- Which of the following visible light colors has the shortest wavelength?
 - Red
 - Yellow
 - Blue
 - Green
- A scientist is designing a lamp to provide the least energetic visible light for a plant experiment. Which color should the lamp emit?
 - Violet
 - Blue
 - Green
 - Red
- A leaf is illuminated with pure red light in a dark room. How will the leaf most likely appear?
 - Bright green
 - Dark or nearly black
 - Bright blue
 - White
- When a light hits a surface and the surface appears darker, this indicates that the light is:
 - Reflected
 - Absorbed
 - Both Reflected and Absorbed
 - Neither
- Which of the following is true about chlorophyll a?
 - It is the primary pigment for photosynthesis
 - It is an accessory pigment only
 - It reflects red and blue light
 - It is stored in vacuoles
- Which statement correctly compares chlorophyll a and chlorophyll b?
 - Chlorophyll a is accessory; chlorophyll b is primary
 - Chlorophyll a converts light to chemical energy; chlorophyll b assists in light absorption
 - Both are stored in vacuoles and reflect green light
 - Both are found only in red algae

8. Chlorophyll a and b differ mainly in the wavelengths they absorb. Which of the following is correct?
 - A. Chlorophyll a absorbs mainly green light; chlorophyll b absorbs blue light
 - B. Chlorophyll a absorbs blue-violet and red; chlorophyll b absorbs blue and red-orange.
 - C. Chlorophyll a and b both absorb green light efficiently
 - D. Chlorophyll a absorbs UV; chlorophyll b absorbs infrared
9. Which pigment is red or blue, found in phycobilisomes, and helps cyanobacteria and red algae absorb green and yellow light?
 - A. Chlorophyll a and b
 - B. Carotenoid
 - C. Phycobilin
 - D. Anthocyanin
10. Carotenoids are found in chloroplasts and serve what purpose?
 - A. Reflect green light for photosynthesis
 - B. Accessory pigments that broaden light absorption and provide photoprotection
 - C. Produce glucose directly
 - D. Store water and minerals

II. Critical Thinking. Answer the following answers briefly.

11-15. Plants usually appear green to the human eye. Why?

16-20. Create a concept map summarizing the concept regarding pigments. Describing their roles in the cells containing them, the concept map should depict the following the Difference between chlorophyll a and chlorophyll b. Highlight other accessory pigments: carotenoids, anthocyanins, phycobilins and their examples.

Item Placement

Wavelength and photon energy:	1–3, 11-15
Reflected vs absorbed light:	4–5, 11-15
Why chlorophyll appears green:	11-15
Chlorophyll a vs b:	6,7,8, 16-17
Accessory pigments:	9,10, 18-20

Cognitive Level Summary:

Level	Frequency	Item Placement
Remembering	4	2, 6, 8, 9
Understanding	4	1, 5, 7, 10
Applying	2	3, 4
Analyzing		5 11-15
Evaluating & Creating	5	16-20

Teacher Notes:

- In item #4: Real appearances depend on illumination strength and surface properties.

Answer Key**I. Multiple Choice**

1. B
2. C
3. D
4. B
5. B
6. A
7. B
8. B
9. C
10. B

II. Critical Thinking**11-15. Scoring Rubrics**

Points	Criteria / Descriptor
5	Complete and scientifically accurate. <ul style="list-style-type: none"> • Chlorophyll reflects green light, absorbs red/blue. • Explains how absorption efficiency relates to light wavelengths. • Optional: mentions accessory pigments' contribution.
4	Mostly correct. <ul style="list-style-type: none"> • Chlorophyll reflection or absorption described, minor details missing. • Light wavelength concept partially explained.
3	Partially correct. <ul style="list-style-type: none"> • Only chlorophyll or light wavelength concept mentioned. • Explanation lacks clarity or depth.
2	Minimal understanding. <ul style="list-style-type: none"> • Mentions pigments vaguely, little or no link to light wavelength.
1	Very poor. <ul style="list-style-type: none"> • Very limited correct info; mostly confused or inaccurate.
0	No credit. <ul style="list-style-type: none"> • No answer or completely wrong.

16-20. Scoring Rubrics

Points	Criteria / Descriptor
5	Complete, organized, accurate. <ul style="list-style-type: none"> • Correctly differentiates chlorophyll a vs. b (role & absorption). • Accessory pigments listed with examples & roles in adaptation. • Connections/relationships clearly shown.
4	Mostly correct. <ul style="list-style-type: none"> • Minor omissions in pigments or roles. • Map mostly organized.
3	Partially correct. <ul style="list-style-type: none"> • Some pigments missing, roles vague. • Relationships not fully clear.
2	Minimal understanding. <ul style="list-style-type: none"> • Only 1–2 pigments correctly listed. • Roles unclear or disorganized map.
1	Very poor. <ul style="list-style-type: none"> • Map shows very little understanding; mostly incorrect.
0	No credit. <ul style="list-style-type: none"> • Map missing or completely wrong.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	14	Date	
Lesson Title/Topic:	Photosynthesis: An Overview		
Name		Grade & Section	

Laboratory Experiment Option 1: Observation of Hydrilla (or Elodea or Any Aquatic Plant Available) Photosynthesis

Objective

This activity aims to investigate how different light conditions affect the rate of oxygen production in an aquatic plant and relate observed bubble formation to photosynthetic activity.

Materials Needed:

Hydrilla (or Elodea or Water Hyacinth, 3 equal sprigs per group)
Baking Soda (Sodium Bicarbonate, 0.6 g per 300 mL solution × 3 setups)
Distilled Water (900 mL total, 300 mL per setup)
4 Beakers (300 mL capacity each)
3 Glass Funnels
Light source (lamp or sunlight setup)
Cardboard or opaque cover (for Partial Light and No Light conditions)
Timer or stopwatch
Optional: Test tubes (for oxygen collection extension)

Ethical Guidelines

1. Responsible collection of plant samples (Hydrilla or other aquatic plants). Natural populations should not be excessively disturbed during sample collection.
2. Respect for living organisms. The plant specimens should only be used for educational purposes during the activity.
3. Proper disposal or return of specimens
After the activity, plant materials should be disposed of properly. If possible, plants should be returned to their original habitat.
4. Minimizing environmental impact.
Avoid introducing non-native aquatic plants into local water systems, as this may disrupt local ecosystems.
5. Use of sustainable alternatives when necessary. If Hydrilla is unavailable, locally available aquatic plants should be used to reduce ecological disturbance.

Safety Precautions

1. Wear proper Laboratory PPE (e.g., gloves, lab gowns). Handle glassware carefully. Test tubes, beakers, and glass containers should be handled carefully to avoid breakage and injury.
2. Avoid direct exposure to strong light sources. If lamps are used as a light source, ensure they are placed at a safe distance to prevent overheating.
3. Keep electrical devices away from water. Ensure that electrical lamps or devices are kept away from water to avoid electrical hazards.
4. Wash hands after handling plant materials. Students should wash their hands after the activity to maintain hygiene.
5. Maintain an organized workspace. Keep the laboratory area clean and dry to prevent slipping or accidents.

6. Be aware of fire hazards. Keep flammable materials such as paper, alcohol, or plant debris away from heat sources or lamps. Do not leave heat or light sources unattended, and ensure they are turned off after the activity.

I. Basic Observation Procedure (For Developing Mastery)

1. Add 0.6 g of baking soda (sodium bicarbonate) to 300 mL of distilled water in a beaker.
2. Stir gently to ensure the baking soda is dissolved.
3. Place a healthy sprig of Hydrilla or Elodea in a glass funnel. After positioning the plant, submerge the funnel into the beaker, inverted. Ensure the leaves are fully submerged, and the sprig is undamaged.
4. Observe oxygen production. Watch the leaves closely. Tiny bubbles of oxygen should begin to form along the leaves. The appearance of bubbles indicates that photosynthesis is occurring and oxygen is being produced as a byproduct.

II. Experimental Procedure (Light Condition Investigation)

1. Prepare three beakers and label them according to light conditions: Full Light, Partial Light, and No Light (Dark Control).
2. Add 300 mL of distilled water mixed with 0.6 g of baking soda (sodium bicarbonate) into each beaker and stir until fully dissolved.
3. Place an equal-sized sprig of Hydrilla (or Elodea/Water Hyacinth) into each glass funnel and invert each funnel into the prepared beakers, ensuring the plant is fully submerged and undamaged.
4. Position a light source at a fixed distance for the Full Light setup, partially block light using a barrier (e.g., cardboard) for the Partial Light setup, and completely cover the Dark Control setup to prevent light exposure.
5. Allow the setups to stabilize for a few minutes before observation.
6. Observe each setup for a fixed time interval (e.g., 10–15 minutes) and count the number of oxygen bubbles produced on the plant surface or rising from the funnel.
7. Record and compare the rate of bubble formation across the three light conditions as an indicator of photosynthetic activity.
8. Analyze how light availability affects oxygen production and relate observations to the role of light in photosynthesis.

References

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- Mercy Education Media. "Oxygen Is Evolved During Photosynthesis – Hydrilla Experiment." YouTube video. Published circa 2019. Accessed March 12, 2026. <https://www.youtube.com/watch?v=3F3l9z1s9n0>.
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Laboratory Experiment Option 2: The Leaf Disk Assay

Objective

This activity aims to investigate how light availability and carbon dioxide concentration affect photosynthetic rate in leaf disks by measuring oxygen production over flotation time.

Materials Needed

Malunggay leaves (fresh, 1–2 leaves per group)
Leaf puncher or hole punch
Syringe (10–20 mL, needle removed)
Baking soda (Sodium bicarbonate, 0.6 g per 300 mL solution)
Dish soap (1–2 drops per 300 mL solution)
Distilled water (about 1,200 mL total for 4 setups × 300 mL each)
Beakers (4 × 300 mL capacity)
Light source (sunlight, lamp, projector, or UV light)
Opaque cover or cardboard (for no-light condition)
Stopwatch or timer

Ethical Guidelines

1. Use plant materials responsibly. Leaves used in the experiment should be taken from plants in a minimal and responsible manner to avoid unnecessary damage to the plant.
2. Avoid excessive waste of materials. Only the required number of leaf disks should be prepared to minimize waste.
3. Proper disposal of experimental materials. Used leaf disks and solutions should be disposed of properly after the activity.
4. Respect for living organisms. Even though the experiment uses plant tissues, they should still be handled responsibly as part of a biological study.
5. Promote environmental awareness. Teachers may emphasize the importance of plants and photosynthesis in sustaining ecosystems.

Safety Precautions

1. Handle syringes carefully. Syringes used to infiltrate leaf disks should be handled gently, without needles, to avoid injury.
2. Avoid ingestion of laboratory materials. Baking soda solution and other materials used in the activity should not be ingested.
3. Use scissors or hole punchers carefully. When preparing leaf disks, students should use cutting tools carefully to prevent injuries.
4. Avoid splashing of solutions. Handle solutions carefully to prevent spills that may create slippery surfaces.
5. Follow the teacher's instructions at all times. Students should follow proper laboratory procedures and instructions throughout the experiment.

I. Developmental Procedure

1. Add 0.6 g of baking soda to 300 mL of distilled water.
2. Using a pipette, add a drop of diluted dish soap to the beaker. Ensure the solution does not become soapy, as this produces suds. If suds form, dilute the solution with water.
3. Prepare the leaf disks. Punch 10 holes (or more) in the fresh leaves. Do not punch a hole in big veins.
4. Place the leaf disks inside a syringe. Making sure that only a tiny volume of air remains, pull around 5 mL of the solution.
5. Invert the syringe, then give it a few taps to make sure the disks are suspended in the solution. Push the plunger until no air remains in the barrel.

6. To create a vacuum, hold your finger over the syringe opening and pull back on the plunger, holding the vacuum for seconds while occasionally swirling the syringe to make sure the disks are suspended.
7. After 10 seconds, release the vacuum gently. The plunger should spring back to indicate that the vacuum was successful. The leaf disks should sink, suggesting that the solution has replaced the airspaces. If unsuccessful, repeat the procedure until the desired outcome is met. *Note: Repeated trials will damage the disks (you may want to replace them).* This part is crucial for eliminating other gases inside the leaves so that, by the time of observation, only oxygen molecules (the byproduct of photosynthesis) are present, which cause the bubbles. After confirming that the leaf disks sank, you can pour the syringe contents back into the beaker.
8. Observe Photosynthesis Occur Live: Bubbles form around the disks until they float. The disks initially sink because air spaces are replaced with solution. As photosynthesis occurs, oxygen accumulates within the leaf disks, causing them to float to the surface.

II. Experimental Procedure (Leaf Disk Assay: Light and CO₂ Conditions)

1. Prepare **four setups** labeled: Sunlight + Baking Soda, Sunlight + Pure Water, No Light + Baking Soda, and No Light + Pure Water.
2. For each setup, prepare 300 mL of solution: dissolve 0.6 g baking soda in the appropriate beakers (leave pure water setups without baking soda).
3. Add a drop of diluted dish soap to each beaker and mix gently without producing suds.
4. Punch equal-sized leaf disks (avoid major veins) using malunggay leaves.
5. Place 10 leaf disks into a syringe and draw in about 5 mL of the assigned solution.
6. Remove air by inverting the syringe and tapping gently until disks are fully submerged.
7. Create a vacuum by covering the syringe tip, pulling the plunger, and holding for several seconds until leaf disks sink. Repeat if necessary.
8. Transfer the infiltrated leaf disks into their respective beakers.
9. Expose each setup to its assigned condition: sunlight or controlled darkness (covered container or shaded area).
10. Observe and record the time it takes for leaf disks to float, indicating oxygen production during photosynthesis.
11. Compare flotation rate across all setups as evidence of the effects of light and carbon dioxide availability on photosynthesis.

References

- Lohner, Svenja. "Use Floating Leaf Disks to Study Photosynthesis." *Science Buddies*. October 20, 2020. Accessed March 17, 2026. https://www.sciencebuddies.org/science-fair-projects/project-ideas/PlantBio_p053/plant-biology/photosynthesis-leaf-disk-assay.
- Lohner, Svenja. "Study Photosynthesis with the Floating Leaf Disk Assay." *Science Buddies*. Accessed March 17, 2026. <https://www.sciencebuddies.org/teacher-resources/lesson-plans/photosynthesis-leaf-disk-assay>.

Title of Laboratory Experiment

Last Name, First Name, Middle Initial

Last Name, First Name, Middle Initial

Last Name, First Name, Middle Initial

Group #

Objective

State what the experiment aims to observe and understand.

Introduction

Discuss your current knowledge about photosynthesis and why you conducted the experiment. You may add a citation to support your claims and strengthen your write-up.

Methods

Describe the steps followed (can be summarized in your own words), along with materials used. Entail what actually happened relative to the procedure provided in the laboratory activity performed.

Results and Discussion

Discuss what you have observed and your experiences in doing the laboratory activities. Do your research and relate your observations to existing literature. Avoid copy-paste/plagiarized content. Supplement with figures and tables when necessary. Make sure that your write-up follows APA Style.

Conclusion

Summarize your findings. Were the objectives attained?

References

List all your sources. Use APA Style in Referencing.

Analytical Rubric:

Criteria	5 Excellent	4 Proficient	3 Satisfactory	2 Needs Improvement	1 Poor
Introduction	Introduces the topic excellently with engagement, clear understanding of objectives	Introduces the topic adequately, with clear objectives	Introduces the topic adequately, but the objectives are unclear	Introduces the topic, but details are missing, and the objectives are unclear	No introduction observed, objectives unclear
Materials and Methods	Materials and methods are clearly presented, easily replicable	Materials and methods are presented, but the details can be clearer	Materials and methods are presented, but some details are missing	Materials and methods are not clearly presented	Presentation of materials and methods was not observed
Results and Discussion	Results and discussion are coherently presented, objectives-focused, and ideas are supported by literature	Results and discussion are coherently presented, objectives-focused, but the literature support needs improvement	Results and discussion are presented, but the objectives require refinement and may need literature support	Results and discussion are incoherent, deviated from objectives, and have no literature support	Results and discussion are insufficient, no objective alignment, and no literature support
Conclusion	Conclusion maintains engagement, clear objective alignment	The conclusion made the points clear, but with less engagement	Conclusion made points, but deviates from the objectives	Conclusion is inadequate, did not meet objectives	No Conclusion is noted
Technical Elements (Grammar, Proper Citation, and Referencing)	Well-written, no errors observed	Well-written with minor improvements on grammar and/or proper citation	Requires re-writing, with minor corrections on grammar and/or proper citation	Requires re-writing, with major errors in grammar and/or proper citation	Requires major revision
Laboratory Etiquettes, Safety, and Ethical Compliance	Observed maximum compliance to safety and ethical protocols (e.g., wearing of proper Laboratory attire, proper behavior)	Observed compliance with safety and ethical protocols	Demonstrated satisfactory compliance with safety and ethical protocols	Demonstrated compliance with safety and ethical protocols, but mishaps and misbehaviors are noted	Chaotic, unethical, did not follow protocols

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	15	Date	
Lesson Title/Topic:	Metabolism-Photosynthesis (Light-dependent reactions and light-independent reactions)		
Name		Grade & Section	

“Matching Energy Path Activity”

Instructions: The learners will sort the cue cards into “Made in Light Reactions” VS. “Used in Calvin Cycle.”

Instructions:

1.You will receive cue cards with the following terms:

- ATP
- NADPH
- Oxygen (O₂)
- Carbon dioxide (CO₂)
- Glucose (C₆H₁₂O₆)
- Water (H₂O)

2.Sort the cards into two groups:

Category 1- **Made in Light Reactions**

Category 2- **Used in Calvin Cycle**

Activity Table (Learners Fill In)

Made in Light reactions	Used in Calvin Cycle

Lesson Exemplar	15	Date	
Lesson Title/Topic:	Metabolism-Photosynthesis (Light-dependent reactions and light-independent reactions)		
Name		Grade & Section	

Concept Mapping Activity

Directions: Create a concept map that shows the complete pathway of photosynthesis. (light-dependent reactions, ATP/NADPH formation, Calvin cycle, glucose synthesis) through concept mapping and reflection. Use arrows, labels, and connecting words to show relationships between concepts.

Instructions:

- Write "Photosynthesis" at the center of your paper.
- Draw branches to show the following key processes:
 - Light energy absorption
 - Light-dependent reactions
 - ATP and NADPH formation
 - Calvin cycle (light-independent reactions)
 - Glucose synthesis
- Include the following terms in your concept map:
 - Sunlight
 - Chlorophyll
 - Water (H₂O)
 - Oxygen (O₂)
 - Carbon dioxide (CO₂)
 - ATP
 - NADPH
 - G3P
 - Glucose (C₆H₁₂O₆)

Draw/illustrate your concept map here:

Photosynthesis

Lesson Exemplar	15	Date	
Lesson Title/Topic:	Metabolism-Photosynthesis (Light-dependent reactions and light-independent reactions)		
Name		Grade & Section	

Written Response Task Activity:

Instructions: Read each question carefully and provide clear, well-organized answers in complete sentences. Support your explanations with appropriate scientific terms.

1.Explain how ATP and NADPH are produced during the light-dependent reactions?

2.Describe how the Calvin cycle uses ATP and NADPH to synthesize glucose?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	16	Date	
Lesson Title/Topic:	Metabolism-Photosynthesis (Photosynthesis and carbon dioxide reduction in the atmosphere)		
Name		Grade & Section	

“KWL Chart Activity”

Instructions: Write what you Know, want to know, and later learn. Provided with a three-column chart on your handouts. After reading secondary sources (textbooks, articles, infographics, or environmental reports), please fill in this column.

<i>K-NOW</i>	<i>W-ANT TO KNOW</i>	<i>L-EARNED</i>
<ul style="list-style-type: none"> Write down what you already know about the topic. Think about prior lessons, experiences, or ideas you have encountered. 	<ul style="list-style-type: none"> Write questions or things you are curious about regarding the topic. What do you want to learn more about? 	<ul style="list-style-type: none"> After reading the provided materials (textbooks, articles, infographics, or reports), fill in this column with new information, answers to your questions, and important concepts you discovered.

Lesson Exemplar	16	Date	
Lesson Title/Topic:	Metabolism-Photosynthesis (Photosynthesis and carbon dioxide reduction in the atmosphere)		
Name		Grade & Section	

Matching Analogy Activity

Directions:

Match each part of the analogy with its scientific term in photosynthesis. After matching the analogy, identify one part that accurately represents photosynthesis, one part that is limited, and one correction they can make based on the secondary source they examined. Then, explain how they are related. Write your answers clearly in the table.

Analogy Part	Scientific Term	Your Explanation (How are they related?)
Factory building	Chloroplast	
Electricity	Sunlight (light energy)	
Raw materials	Carbon dioxide + Water	
Finished products	Glucose + oxygen	
Workers in the factory	Enzymes	
Machines inside the factory	Thylakoid membranes	
Storage room	Stored glucose	

Guided Questions:

1. Which parts of the analogy clearly explain photosynthesis? Which parts might be incomplete or misleading?

2. If the “electricity supply” (sunlight) is cut off, what happens to the factory’s production? How does this compare to real plants during nighttime or cloudy days?

3. Based on the table presented, identify one part that accurately represents photosynthesis, one part that is limited, and one correction they can make based on the secondary source they examined.

One part that accurately represents photosynthesis:

One part that is limited:

One correction they can make based on the secondary source they examined:

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	17	Date	
Lesson Title/Topic:	Metabolism-Respiration		
Name		Grade & Section	

Activity No. 1: The Cellular Energy Pipeline Simulation (Performance Task)

I. Objectives

At the end of the activity, you should be able to:

- Create a digital or physical model of the entire cellular respiration as a pipeline from glucose to cellular work.
- Demonstrate how ATP acts as the universal energy carrier.
- Connect respiration stages (glycolysis, Citric Acid Cycle, ETC) to physiological work sites.
- Analyze the impact of ETC disruption on energy delivery.

II. Materials

- **Tokens or props** to represent glucose, intermediates, ATP, NADH, and FADH₂
- **Role cards** for each station:
 - Glucose Source
 - Glycolysis
 - Citric Acid Cycle
 - Electron Transport Chain (ETC)
 - Work Stations (Sodium-Potassium Pump, Sarcomere)
- **Labels or posters** for station names and outputs
- **String, arrows, or connectors** to build the “pipeline” linking stations to work sites
- **Chart paper/markers** for recording ATP flow and outputs
- **Digital modeling software** (optional, if groups choose a virtual pipeline model)
- **Space in the classroom** designated as the “matrix” for the simulation (optional, if digital modeling software is not feasible)
- **Presentation tools** (video recording device or projector) for group outputs

III. Procedures

1. Your team will act as engineers designing the “Cellular Energy Pipeline.”
2. Each group will build its own version of the pipeline.
3. Begin with glucose arriving at the “cell membrane.” Represent this with a token or label.
4. Build the Processing Plants
 - **Station 1: Glycolysis** – Show glucose breaking down into pyruvate and producing a small amount of ATP and NADH.

- **Station 2: Citric Acid Cycle** – Represent Acetyl-CoA entering the cycle, releasing CO₂, and generating NADH/FADH₂.
 - **Station 3: Electron Transport Chain (ETC)** – Demonstrate how NADH/FADH₂ deliver electrons, leading to ATP production.
5. Connect the ETC station to “Work Stations” using a pipeline (string, arrows, or digital connectors). The work stations should include:
 - A **Sodium-Potassium Pump** model (ion transport).
 - A **Sarcomere** model (muscle contraction).
 6. Show how ATP moves from the ETC to each work station, enabling cellular processes. Use tokens or animations to represent ATP being “delivered.”
 7. Each team should explain their pipeline in either a physical demonstration or a short video presentation. Highlight how ATP acts as the universal energy carrier.
 8. Answer the guide questions provided, connecting your simulation to real cellular processes.

IV. Guide Questions

1. What serves as the delivery vehicle for energy between the production stations and the work stations?
2. If the ETC (the final station) is disrupted, which work stations run out of energy first?
3. How does the “pipeline” analogy help explain the flow of energy in the cell compared to real-world energy systems (like electricity or water supply)?
4. Why is glucose considered the “fuel source” of the pipeline, and what happens if the source is cut off?
5. In your model, which stations produced the most ATP directly, and which produced mostly energy carriers (NADH/FADH₂)? Why is this division important?
6. How does the ETC act like a “final processing plant” before energy is delivered to work stations?
7. What would happen to the sodium-potassium pump and sarcomere contraction if ATP were replaced by another molecule that cannot release energy efficiently?
8. How does compartmentalization (cytoplasm vs. mitochondrial matrix vs. inner membrane) affect the efficiency of the pipeline?
9. If one station in the pipeline malfunctions (e.g., glycolysis is blocked), how does this affect downstream stations?
10. How does oxygen function in this pipeline, and why is it essential for the ETC to keep operating?
11. Compare the energy pipeline in muscle cells versus neurons. Which work stations would be prioritized in each case?
12. How does this simulation illustrate the concept of ATP as the “universal currency” of energy in living systems?

Rubric (100 points):

Scientific accuracy of processes – 25 pts

Clear representation of structures and functions – 25 pts

Explanation and communication during presentation – 25 pts

Creativity and effort – 25 pts

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	18	Date	
Lesson Title/Topic:	Metabolism-Respiration		
Name		Grade & Section	

Activity 1: Proton Gradient in a Bottle

Objectives

At the end of the activity, you should be able to:

- Demonstrate concentration differences and diffusion.
- Connect proton gradient to ATP synthesis.
- Understand why mitochondria prevent free mixing.

Materials

- Two clear bottles/jars
- Warm water
- Food coloring
- Dropper
- Salt or sugar (optional)

Instructions

A. Prepare Bottle A

Bottle A serves as the control with plain water.

- Fill Bottle A with **plain water**
- Ensure no solute or color is added

Bottle A



Bottle B



Image illustrated through copilot

B. Prepare Bottle B

Bottle B represents a concentrated solution with solute.

- Add **colored water** to Bottle B
- Dissolve a small amount of **solute** (e.g., salt or sugar)
- Mix until evenly distributed

C. Compare Concentrations

Notice the difference between the two bottles. Complete the table below to record your observation.

Observation	Color of the concentration (clear/colored)	Presence of solute
Bottle A		
Bottle B		

D. Drip Mixing Experiment

Simulate diffusion by dripping Bottle B into Bottle A.

- Slowly drip colored water from Bottle B into Bottle A
- Watch as the color disperses and mixes
- Note how concentration differences drive movement



Image illustrated through copilot

E. Relate to Proton Gradient

Connect the experiment to mitochondrial function by answering the following questions.

1. Which bottle has the higher concentration?
2. Which structure of the mitochondrion has the same function/concentration?
3. Which bottle has the lower concentration?
4. How does the dripping simulation relates to the function of the mitochondria to proton gradient movement?
5. Relate your answer from questions no. 3 to ATP synthase using the gradient to produce energy

Reflection Questions

1. What happened when concentrations mixed?

2. Why must mitochondria prevent mixing?

3. How does the intermembrane space maintain the gradient?

4. What happens to ATP if protons escape freely?

Rubric (10 pts)

- Observation accuracy – 4 pts
- Connection to gradient – 3 pts
- Participation – 2 pts
- Effort – 1 pt

LEARNING ACTIVITY SHEET

Lesson Exemplar	19	Date	
Lesson Title/ Topic:	Metabolism- Respiration		
Name		Grade & Section	

Activity 1: The “Balloon and Yeast” Race (Demonstration)

Title: *Balloon and Yeast Race: Demonstrating Anaerobic Respiration*

Objective:

To observe, analyze, and explain how yeast metabolizes sugar under limited oxygen conditions, producing carbon dioxide that inflates a balloon, thereby demonstrating anaerobic respiration.

Materials:

- 5 plastic bottles (one per group)
- Balloons (1 per bottle)
- Warm water
- Sugar
- Yeast
- Measuring cups/spoons

Procedure:

1. Divide the class into 5 groups.
2. Each group prepares a plastic bottle with warm water, sugar, and yeast.
3. Stretch a balloon tightly over the mouth of the bottle to ensure it is airtight.
4. Observe bubble formation inside the bottle and the inflation of the balloon.
5. Record how long the bubble formation lasted and whether the rate of bubble formation was consistent throughout the experiment.

Observation:

Questions:

a. If the yeast is “trapped in the bottle without new air , why is the balloon inflating?

b. Is this similar to what you have studied previously on aerobic respiration?

c. What visible evidence shows that yeast is metabolizing sugar?

d. What gas is likely inflating the balloon?

e. Why does this setup model an anaerobic condition for yeast after the available oxygen is used up?

f. Why must the balloon fit tightly around the bottle neck with no air leak in the bottle-balloon setup?

g. How would a leak affect your interpretation of gas production and fermentation?

h. Based on the setup, what variables could be changed to test how fermentation rate is affected?

Conclusion:

Rubric for Assessment (Total: 25 points):

Criteria	Developing (1)	Proficient (3)	Exemplary (5)
Observation Skills	Notes very few or vague observations; misses key visible evidence (e.g., bubble formation).	Records clear observations of bubble formation and balloon inflation, but with limited detail.	Provides detailed, accurate observations of bubble formation, rate changes, and balloon inflation with precise timing.
Scientific Explanation	Gives incomplete or incorrect explanation of why the balloon inflates.	Explains balloon inflation correctly, linking it to CO ₂ production by yeast.	Thoroughly explains balloon inflation, connecting CO ₂ release to anaerobic respiration and metabolic pathways.
Use of Evidence	Rarely refers to data or guide questions; answers are mostly guesses.	Refers to some evidence from the demonstration or guide questions to support claims.	Consistently uses evidence from observations and guide questions to support claims about respiration pathways.
Application to Real-Life	Provides little or no connection to real-life examples (e.g., baking).	Makes a basic connection to real-life applications such as bread rising.	Provides insightful connections to commercial baking, fermentation, or other practical uses of yeast metabolism.
Critical Thinking	Struggles to form hypotheses or predictions (e.g., fruit juice variation).	Forms a reasonable hypothesis or prediction with limited justification.	Develops a well-reasoned hypothesis or prediction, supported by scientific reasoning and comparison of variables.

LEARNING ACTIVITY SHEET

Activity: Complete Me Activity

I. Objective Compare Aerobic and Anaerobic Respiration

II. Instruction

Complete the table below using the following features: oxygen requirement, location, major steps, ATP yield, efficiency, and byproducts. After completing the table, write two to three sentences explaining why aerobic respiration is generally more efficient than anaerobic pathways.

<i>Feature</i>	<i>Aerobic Respiration</i>	<i>Anaerobic respiration</i>
<i>Presence of Oxygen</i>		
<i>Location</i>		
<i>Major Steps</i>		
<i>Byproducts</i>		
<i>ATP Production / Efficiency / ATP Yield</i>		

Criteria	Developing (1)	Proficient (3)	Exemplary (5)
Accuracy of Content	Provides incomplete or mostly incorrect entries; major misconceptions about respiration pathways.	Provides mostly correct entries with minor errors; shows basic understanding of aerobic vs. anaerobic respiration.	Provides fully accurate entries for all features; demonstrates clear and precise understanding of both pathways.
Completeness of Table	Fills in only 1–2 features; leaves most blank or vague.	Completes most features (3–4) with reasonable detail.	Completes all features thoroughly with clear, specific details (oxygen presence, location, steps, byproducts, ATP yield).
Clarity of Differentiation	Struggles to distinguish aerobic from anaerobic processes; answers overlap or confuse.	Shows clear differences in most features but lacks depth in explanation.	Clearly and consistently distinguishes aerobic vs. anaerobic respiration across all features with well-structured comparisons.
Application of Concepts	Provides little or no connection to prior learning or real-life examples.	Makes basic connections to prior lessons or simple applications (e.g., exercise, fermentation).	Provides insightful connections to prior learning and real-life applications (e.g., endurance vs. sprinting, bread making).
Critical Thinking	Does not attempt to explain ATP yield or efficiency.	Explains ATP yield in general terms but lacks detail.	Explains ATP yield with specific numbers (36–38 vs. 2 ATP) and interprets efficiency differences meaningfully.

LEARNING ACTIVITY SHEET

Lesson Exemplar	20	Date	
Lesson Title/ Topic:	Metabolism- Respiration		
Name		Grade & Section	

Title: *Tracing Energy Pathways in Daily Life*

Activity 1: The “ATP Delivery Service” Case Study (Running)

Objective:

Trace the flow of energy from secondary sources (e.g., biology textbooks, journals) to the physical act of running.

Materials:

- Biology textbooks or peer-reviewed journals
- Diagrams of the Krebs Cycle and Electron Transport Chain (ETC)
- Paper for “Shipment Tracking Log”

Procedure:

Conclusion:

Activity 2: Brain Power and the Glucose Demand (Thinking)

Objective:

Understand that cellular respiration is a constant process, even without physical movement.

Materials:

- Infographic or data table showing organ metabolic rates (highlighting brain energy use ~20%)

Procedure:

1. Analyze the secondary source to compare brain vs. muscle energy use at rest.
2. Write a short paragraph explaining how thinking requires maintaining ion gradients across neurons, powered by ATP from respiration.
3. Present findings in an “Energy Budget Pie Chart.”

Conclusion:

Activity 3: The Metabolic Loop – Digestion

Objective:

Illustrate how the body uses energy to obtain energy.

Materials:

- Diagram of the human digestive system
- Text explaining the Thermic Effect of Food (TEF)

Procedure:

1. Examine how smooth muscle contractions (peristalsis) and enzyme production require ATP.
2. Discuss why digestion would stop if cellular respiration ceased.
3. Create a cycle diagram showing how respiration powers digestion, which in turn provides glucose for respiration.
4. Present findings in an “Energy ROI (Return on Investment) Analysis.”

Conclusion:

Marking Rubric: *Tracing Energy Pathways in Daily Life*

Criteria	Developing (1)	Proficient (3)	Exemplary (5)
Accuracy of Content	Provides vague or incorrect information; major misconceptions about respiration or energy pathways.	Provides mostly correct information with minor errors; shows basic understanding of ATP flow and respiration.	Provides fully accurate details about respiration steps, ATP yield, and energy use in running, thinking, and digestion.
Completeness of Output	Outputs are incomplete or missing required elements (e.g., shipment log, pie chart, cycle diagram).	Outputs include most required elements but may lack depth or clarity.	Outputs are thorough, include all required elements, and demonstrate depth of explanation.
Clarity of Connections	Struggles to connect respiration processes to daily activities (running, thinking, digesting).	Shows some connections but explanations are limited or unclear.	Clearly and consistently connects respiration processes to each daily activity with well-structured reasoning.
Use of Secondary Sources	Rarely refers to or misuses secondary sources; little evidence of research.	Refers to secondary sources appropriately but with limited integration.	Skillfully integrates secondary sources (diagrams, data tables, texts) to support explanations and outputs.
Creativity & Presentation	Work is difficult to read; minimal effort in layout or design.	Work is neat and organized; uses some visuals or formatting for clarity.	Work is visually engaging, well-organized, and uses creative formats (logs, charts, diagrams) to enhance understanding.
Critical Thinking	Provides little or no reasoning about why respiration is essential in each activity.	Gives basic reasoning for respiration's role in daily activities.	Provides strong reasoning, showing how respiration underpins energy use in physical, cognitive, and digestive processes.

Learning Activity Sheet

Title:

Secondary Source Gallery Walk: Exploring Cellular Respiration in Daily Life

Objective:

To develop mastery of aerobic and anaerobic respiration by analyzing secondary sources and connecting them to real-life activities such as running, thinking, and digestion.

Materials:

- Printed snippets of secondary sources placed around the classroom:
 - Source 1: Data on lactic acid buildup in sprinters (Running)
 - Source 2: Study on how the brain uses ATP to maintain membrane potential (Thinking)
 - Source 3: Article on how the gut uses ATP to absorb nutrients (Digestion)
- 3-2-1 Chart template (per student pair)
- Writing materials (pen, paper)

Procedure:

1. Students will form pairs and move around the classroom to visit each source station.
2. At each station, students will complete a **3-2-1 Chart**:
 - **3** specific steps of respiration mentioned (e.g., “ETC was used to produce ATP”).
 - **2** real-life connections found (e.g., “Lactic acid buildup explains muscle fatigue”).
 - **1** question the source did not answer.
3. After the allotted time, pairs will discuss their completed charts with each other.
4. Teacher will facilitate a class discussion using the following guiding questions:
 - Which among the secondary sources gave the most necessary information for the task?
 - Did you enjoy the activity? Why or why not?
 - What challenges did you encounter in dealing with the task?
 - Did you acquire enough information from the sources provided?
 - How do the data on lactic acid buildup in sprinters show how cellular respiration provides energy for running?
 - How does the study show how the brain uses ATP to maintain membrane potential and how respiration provides energy for thinking?
 - How does the article show how the gut uses ATP to absorb nutrients and how respiration provides energy for digestion?

Conclusion:

Marking Rubric: *Secondary Source Gallery Walk*

Criteria	Developing (1)	Proficient (3)	Exemplary (5)
Accuracy of Content	Few correct details; major misconceptions about respiration or energy pathways.	Most details correct; minor errors in identifying respiration steps or connections.	All details accurate; clearly identifies respiration steps, energy pathways, and their relevance to running, thinking, and digestion.
Completeness of 3-2-1 Chart	Chart is incomplete; missing several required elements (steps, connections, or questions).	Chart includes most required elements but lacks depth or clarity.	Chart is fully complete with 3 clear steps, 2 strong real-life connections, and 1 thoughtful unanswered question.
Collaboration & Participation	Limited teamwork; one partner dominates or minimal effort shown.	Both partners contribute; teamwork is evident but uneven.	Strong collaboration; both partners actively contribute, share ideas, and engage in discussion equally.
Critical Thinking	Provides little reasoning; connections between sources and real-life activities are vague.	Provides basic reasoning; some connections made between sources and daily activities.	Provides insightful reasoning; consistently connects sources to real-life activities with clear cause-effect explanations.
Presentation & Discussion	Outputs are unclear or poorly explained; minimal engagement in class discussion.	Outputs are clear but explanations may be brief or lack depth.	Outputs are well-presented, clearly explained, and actively contribute to class discussion with thoughtful insights.