Cell City Works

Grade/ Grade Band: 7th – 10th	**Topic:** Cells	**Lesson #__1__in a series of__1__lessons**

Brief Lesson Description: Students learn about animal and plant cells, as well as the organelles that make them up

Performance Expectation(s):

- SWBAT create 3-D models of both animal and plant cells IOT demonstrate the organization and function of a cell.
- SWBAT relate a cell to a real-world system IOT explain the function of a cell and its organelles via analogies.
- SWBAT create 3-D shapes similar to the cell IOT reinforce their knowledge of geometric shapes.
- SWBAT calculate the volume of a cell IOT reinforce their understanding of measurement and volume calculation.

Specific Learning Outcomes:

• MS - LS2 - 2	• Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function
• CC.2.3.8.A.1	• Apply the concepts of volume of cylinders, cones, and spheres to solve real-world and mathematical problems
• SL.11-12.5	• Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest
• WHST.11-12.9	• Draw evidence from informational texts to support analysis, reflection, and research
• WHST.9-12.2	• Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes

Narrative / Background Information

Prior Student Knowledge:

- All living things are made of cells
- There are two types of cells: animal and plant
- Cells have organelles that fulfil specialized roles

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
• **MS - LS2 - 2** – Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function	• **LS1.A: Structure & Function** – Systems of specialized cells within organisms help them perform the essential functions of life	• **Systems & Models** – Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales

Possible Preconceptions/Misconceptions:

- There is no difference between animal and plant cells
- Cells constitute a living organism (i.e. viruses are alive)
- Cells continue to grow as the organism matures and that it is cell size that is the determinant of organism size

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

DAY 1

- 10-20 minutes
- "What are some differences between a human and a plant?"
  - Students will identify structures, processes (photosynthetic vs. not), and if they produce their own food
- Instructor passes out worksheets
- "Observe the following images on the first page. What are some differences you can identify between them? Label them as either a plant cell or animal cell"

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

- 5-10 minutes
- Students will watch a video and fill out a worksheet (provided)

EXPLAIN: Concepts Explained and Vocabulary Defined:

- 20 – 25 minutes
- Class discusses the various differences between animal and plant cells
- Review of provided worksheet

- Last 5 minutes
    - Exit Ticket (provided)
        - Questions revolved around topics discussed on Day 1 of Lesson

Vocabulary:

• Cell	Life's fundamental unit of structure and function; the smallest unit of organization that can perform all activities required for life
• Organelle	Any of several membrane- enclosed structures with specialized functions, suspended in the cytosol of eukaryotic cells.

ELABORATE: Applications and Extensions:

DAY 2

- Students will complete the extension portion of the worksheet (patient treatment plan)
    - Evaluates content comprehension and math component
- Students learn how to use TinkerCad and create 3D models of an animal and plant cell
    - This will be used in their summative assessment

EVALUATE:

Formative Monitoring (Questioning / Discussion):

- Quiz may be given, based on the following information:
    - Function of particular cell organelles
    - Plant/Animal cell differences
    - Movement of molecules into and out of the cell

Summative Assessment (Quiz / Project / Report):

- Students will:
    - Design a plant and animal cell using TinkerCad
    - Create an analogy between a city/town and the cell
- Literacy component will be based on a GRASP model
- Grading rubric and outline included

Elaborate Further / Reflect: Enrichment:

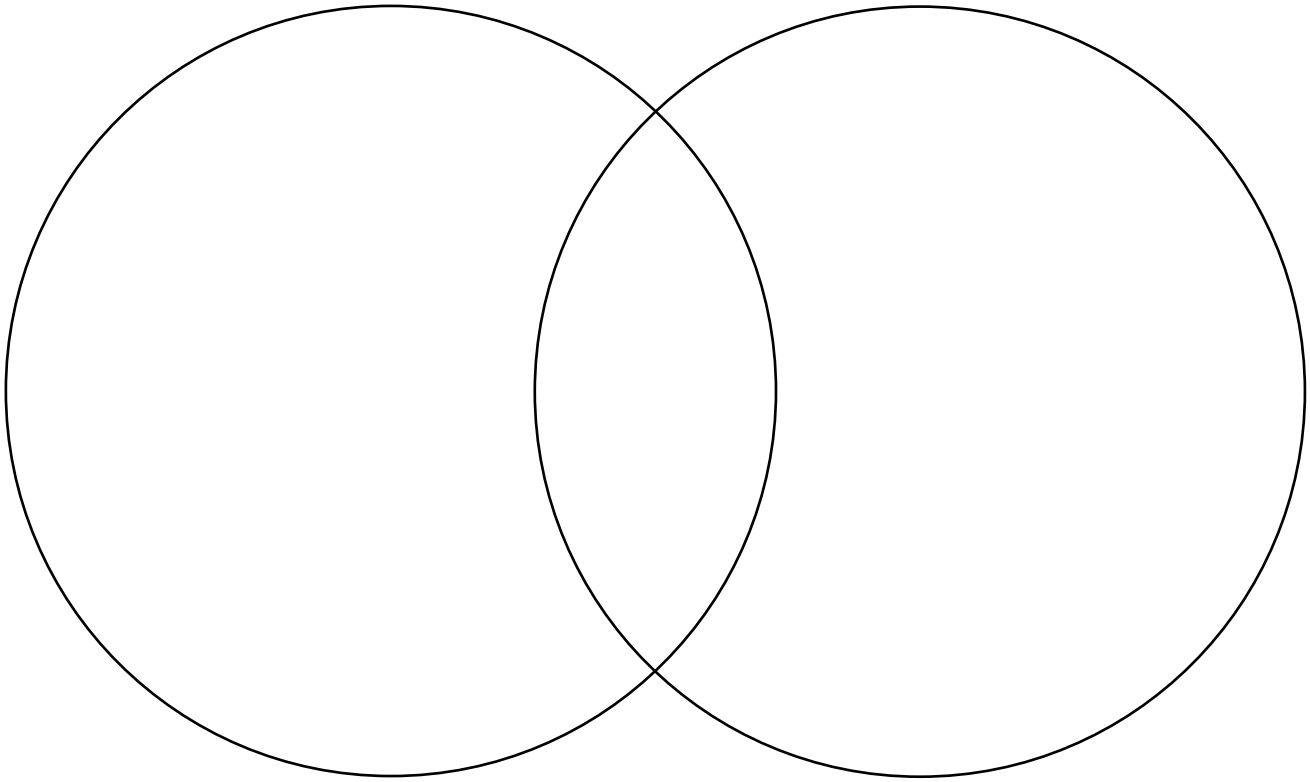
- Instructor may extend lesson to talk about other organisms with cells (i.e. bacteria, viruses, etc.)
- Additional TinkerCad designs may be done for each organism the instructor has discussed
- Students may have their cells 3-D printed, if available, at the discretion of the instructor

	5	4	3	2	1
Completeness Submission includes two cells (animal and plant) and a written				The submission is complete with no missing components.	The submission is not complete. One or more components are missing.
Correctness The cells have the correct number of organelles and are correctly labelled	The student includes the current number of organelles in the cells and they are correctly labelled.	The student is missing or mislabeled one of the organelles that make up the cells.	The students is missing or mislabeled 1-3 organelles that make up the cell.	The student is missing or mislabeled more than 3 organelles that make up the cell.	The student did not include nor label the organelles that make up the cell.
Accuracy The organelles are the right shape/size and the explanation connects a city to the cell	The organelles are the correct shape/size. The analogy to the city clearly explains their function in the cell.	The organelles are the correct shape/size. The analogy to the city somewhat explains their function in the cell.	The organelles are the correct shape. The analogy of the cell is brief and does not clearly explain their function in the cell.	The organelles are the correct shape. The analogy does not explain their function in the cell.	The organelles are not the correct shape nor size. The analogy does not explain their function in the cell.
Creativity Analogy of the cell to a city is creative and clever	The cell and their organelles are distinguishable from one another. The connection to the city is very creative.	The cell and their organelles are distinguishable. The connection to the city is somewhat creative.	The cell and their organelles are somewhat distinguishable. The connection to the city is somewhat creative.	The cell and their organelles are not distinguishable. The connection to the city is not creative.	The cell and their organelles are not distinguishable. The connection to the city is lacking in creativity.
Grammar Are there any run on sentences, grammatical errors, etc.			The student provides a clear and concise explanation. There are no grammatical, spelling, or format errors.	The student provides an explanation, but it contains grammatical, spelling, and/or format errors.	The student does not provide a clear explanation. The writing contains several grammatical, spelling and/or format errors.

Name:_____Date:_____

Cells: the Foundation of Life

_____ _____



NAME	TASK	PLANT	BOTH	ANIMAL
Cell Membrane				
Nucleus & Nucleolus				
Ribosomes				
Golgi Apparatus				
Endoplasmic Reticulum (Smooth & Rough)				
Vacuole(s)				

Mitochondria				
Chloroplasts				
Lysosome				
Centrosomes				
Plasmodesmata				
Centrioles				

Name:_____Date:_____

Exit Ticket

1. List two primary differences between an animal cell and a plant cell.

2. What is the cell's first line of defense against viruses?

3. List three cell organelles and describe their function. (Hint: you can use the answer from Question 2).

Bonus: Draw a picture of an animal or plant cell. Correctly draw and label the organelles within the cell.

Evaluation Provider: _____ Patient DOB: _X_
Patient Name:_____X_____ Room: __X__
Admission Date: _____X_____

Patient Evaluation

Identifying Information: The patient is an 11-year-old female, living with her parents, who presented to the Emergency Room in acute distress. Admitted voluntarily.

Chief Complaint: The patient has been exhibiting symptoms for 7 days. The patient first exhibited a fever of 103.7°F, to which her pediatrician administered Acetaminophen. Fever improved after 2 days. On day 4, patient was sent home from school for vomiting. Signs of rash appeared. Symptoms continued until day 5, where patient began experiencing breathing difficulty. Mother commented that patient was experiencing confusion as well.

History of Illness: Patient has **NO** history of Asthma. Patient has **NO** history of allergy.

Patient has experienced fever of ~103°F for 7 days.

Patient exhibits signs of confusion, difficulty breathing, abdominal pain, and vomiting.

Diagnosis: Patient has been diagnosed with Marbug virus disease (MVD). Her primary symptom is hemorrhagic fever (high fever with internal bleeding).

Treatment: TBD

Task: As a Doctor of Nano Medicine, it is your job to produce a viable treatment option for the patient. Design a nanobot that is small enough to fit within her cells (cell diameter = 0.5μm; cell height = 0.25μm) and kill the virus cells. Assume that her cells are perfect spheres ($Volume = \pi r^2 h$).

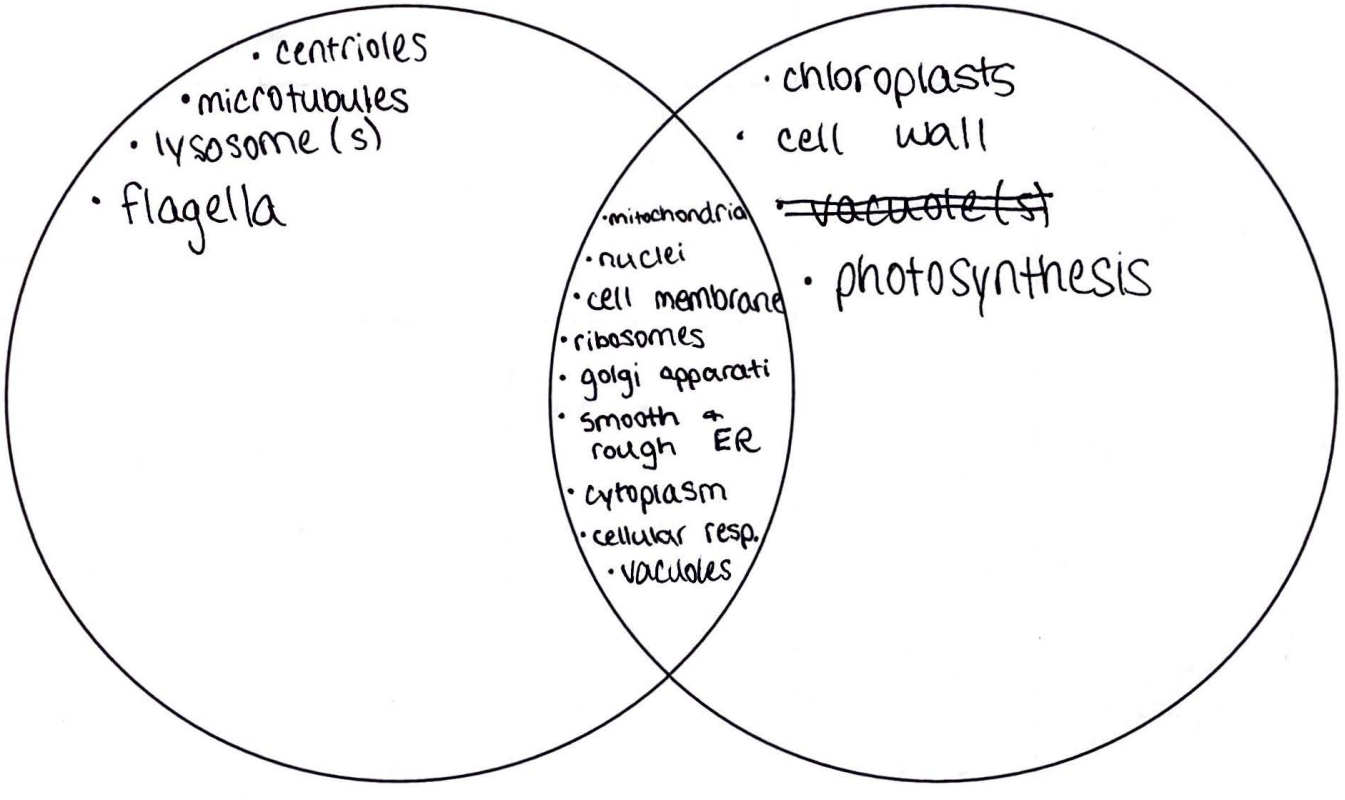
Name:_____Date:_____

Patient Treatment Plan

Please describe your treatment plan for the patient. Include not only your calculations, but also an explanation of why you chose this. Be sure to explain how the nanobot will enter the cell to attack the virus and eliminate the internal bleeding.

Name: Answer Key Date: _____

Cells: the Foundation of Life



Name:_____ Date:_____

Exit Ticket

1. List two primary differences between an animal cell and a plant cell.

   - plant cells contain chloroplasts whereas animal cells do not
   - plant cells have cell walls whereas animal cells do not

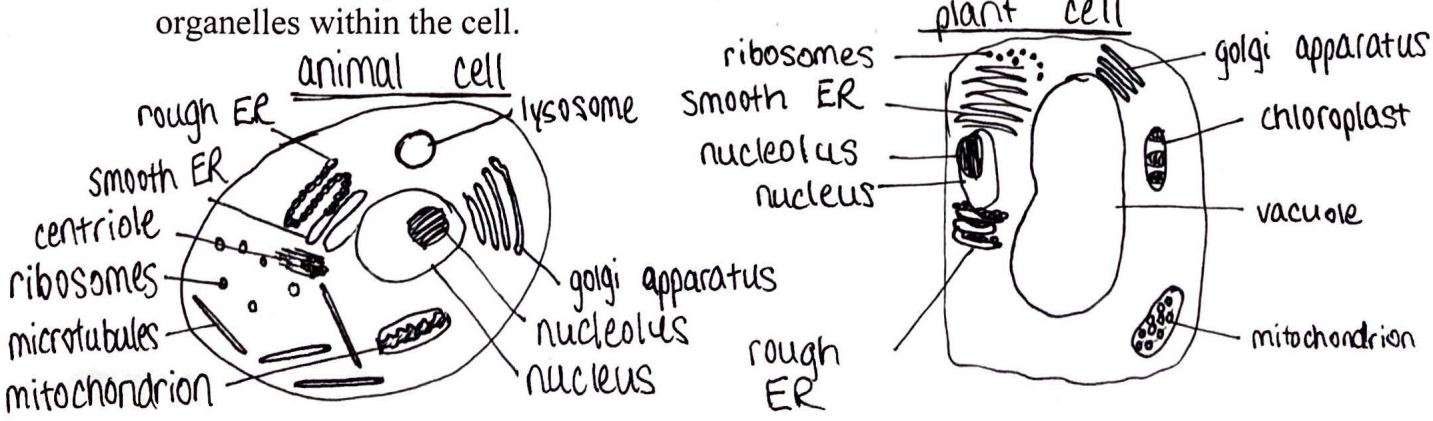
2. What is the cell's first line of defense against viruses?

   the cell wall / membrane

3. List three cell organelles and describe their function. (Hint: you can use the answer from Question 2).

   answers may vary / based on table

Bonus: Draw a picture of an animal or plant cell. Correctly draw and label the organelles within the cell.



Name:_____ Date:_____

Patient Treatment Plan

Please describe your treatment plan for the patient. Include not only your calculations, but also an explanation of why you chose this. Be sure to explain how the nanobot will enter the cell to attack the virus and eliminate the internal bleeding.

$d = 0.5\ \mu m$

$\Downarrow$

$r = 1.0\ \mu m$

$h = 0.25\ \mu m$

$V = \pi r^2 h$

$V = \pi (1.0\ \mu m)^2 (0.25\ \mu m)$

$V = \pi (1.0\ \mu m^2)(0.25\ \mu m)$

$V = \pi (0.25\ \mu m^3)$

$V = 0.785\ \mu m^3$

nanobot $\ll 0.785\ \mu m^3$

- the nanobot must be smaller than $0.785\ \mu m^3$
- it must first be able to penetrate the cell membrane
- it must be able to repair the inside of blood vessels