Lesson 3.15: Plant Cells

Task	Page(s)	Learning Target
1	2-3	I can identify structures and explain functions of plant cells and compare them to animal cells.
2	4	I can draw and label plant cells as they appear under a microscope.
3	5	I can analyze and describe experimental information about plants.
4	6	I can make a model to show how atoms make molecules.
5	7-10	I can follow a multistep procedure in order to model the molecules found in photosynthesis and respiration reactions as well as the law of conservation of matter.
6	11-13	I can use a microscope to observe and record the difference between a plant and an animal cell.

Task 1 Learning Target: I can identify structures and explain functions of plant cells and compare them to animal cells.

1. Plant Cells:

A. similar to animal cells and are composed of organelles that do specific _____

B. Plant cells compare to animal cells (Textbook p. 364-365):

***Complete the following table that compares and contrasts plant and animal cells:

Animal Cell	Both	Plant Cell

**Draw a diagram of a plant cell.

C. (Copy the following question and all options)

Which of the following statements accurately describes the vacuole of a plant?

a. The vacuole of a plant is usually larger than the vacuole of an animal.

b. The vacuole of a plant holds large amounts of water.

c. A drooping plant has lost much of its water and vacuoles shrink.

d. All of the previous statements are true about the vacuoles of plants.

D. Which of the following words describe plants? Explain: *autotroph; heterotroph; producer; consumer*;

2. Photosynthesis occurs in _____

A. (Photo = light Synthesis = Put together)

Light puts together _____

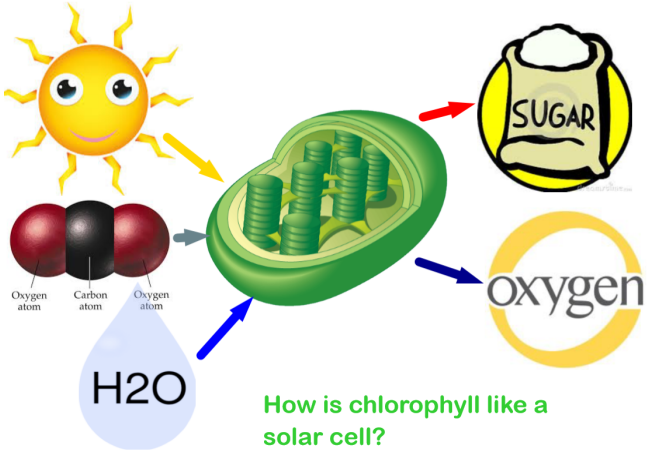
B. Directly and indirectly produces food for all organisms

How does photosynthesis directly provide food for organisms?

How does photosynthesis indirectly provide food for organisms?

C. Removes (oxygen or carbon dioxide) from and adds (oxygen or carbon dioxide) to atmosphere

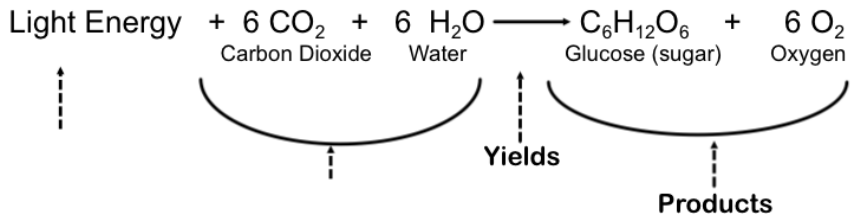
**Copy the following image: -------→



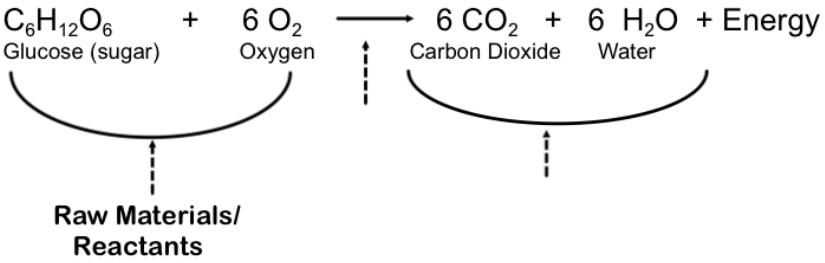
Complete the equations below by:

1. **identifying which equation describes cellular respiration and which describes photosynthesis.**
2. **labeling the "products" and the "reactants"**

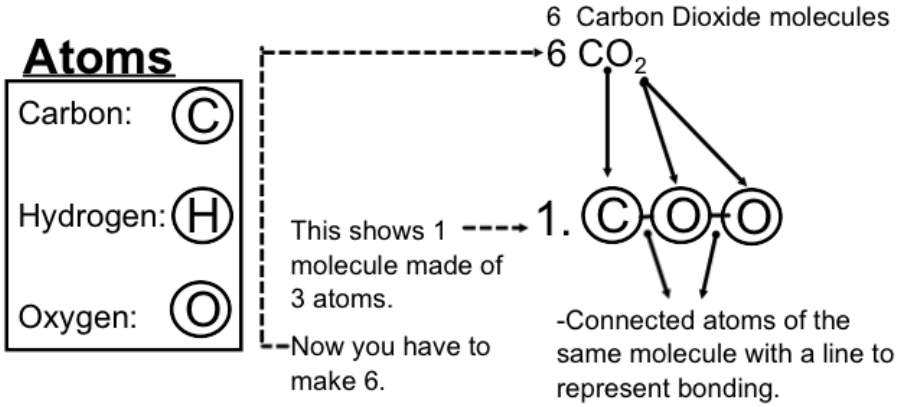
D. Chemical Formula Equation: _____



E. Chemical Formula Equation: _____

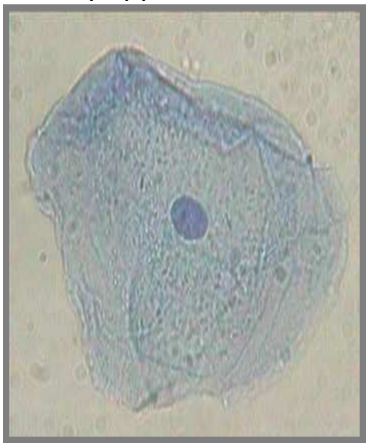


Copy the following example that describes how atoms make molecules.



Task 2 Learning Target: I can draw and label plant cells as they appear under a microscope.

1. Draw the following images as they appear under the microscope.


2. Title the slide as "plant cell" or "animal cell" and explain your reasoning.

3. Label the cell membrane, cell wall, cytoplasm, nucleus

Task 3 Learning Target: I can analyze and describe experimental information about plants.

Base your answers to questions 1-7 on the description and table below and on your knowledge of science.

Photosynthesis is the process during which a plant's chlorophyll traps light energy and sugars are produced. Besides light, plants also need the raw materials carbon dioxide and water for photosynthesis. The overall chemical equation for photosynthesis is shown below:

$$6CO_2 + 6H_2O + \text{light energy} \xrightarrow{\text{chlorophyll}} C_6H_{12}O_6 + 6O_2$$

carbon dioxide — water — glucose — oxygen

A group of students placed the same species of a water plant in five identical test tubes. The test tubes were filled with water and placed at different distances from a light source. After a few minutes, bubbles began to appear in the test tubes, indicating that photosynthesis was occurring. The students counted and recorded the number of bubbles per minute that appeared in each of the test tubes. The results are shown in the data table to the right.

Photosynthesis in a Species of Water Plant

Distance from Light Source (cm)	Number of Bubbles per Minute
10	45
30	30
50	19
70	6
100	1

_____ 1. What is the independent variable in the experiment?

_____ 2. What is the dependent variable in the experiment?

_____ 3. How did the experimenters control variables?

_____ 4. What causes bubbles to appear in each test tube?

_____ 5. Which of the following statements draws a valid conclusion from the results?

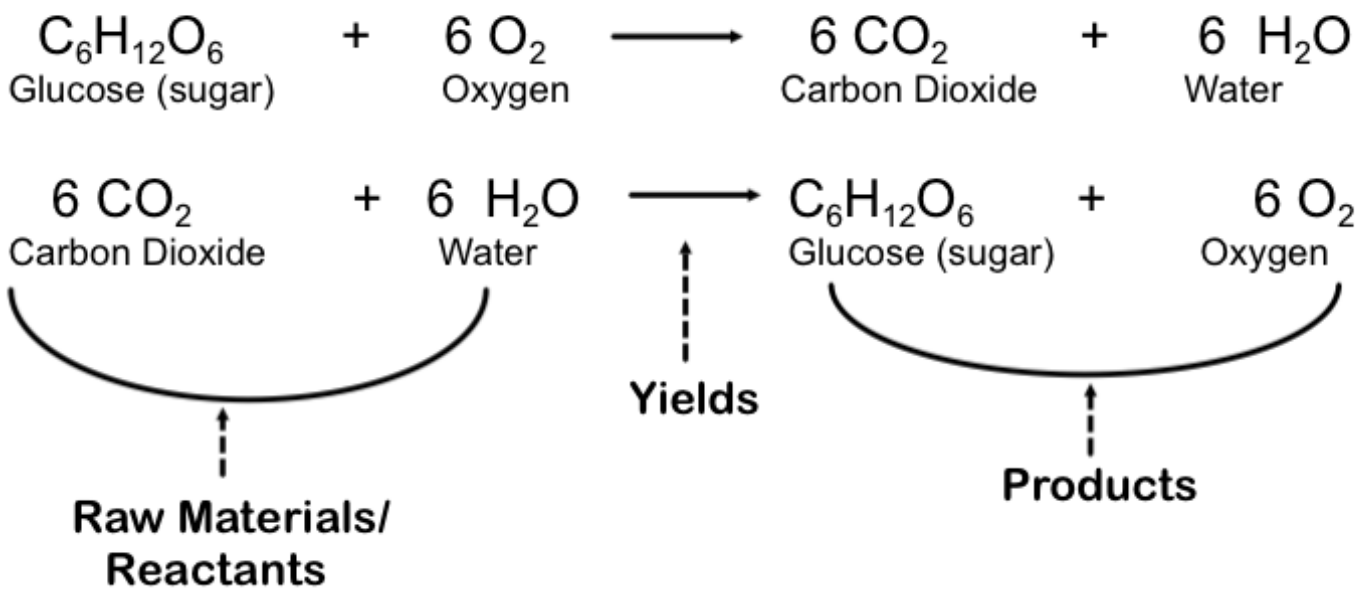
A) Photosynthesis mostly occurs when sugar is added to water.
B) Water plants do not undergo photosynthesis.
C) Plants that are closest to light will produce more oxygen as a product of photosynthesis.
D) Plants that are closest to light will produce less oxygen as a product of photosynthesis.

_____ 6. Which of the following is a reasonable prediction for the number of bubbles per minute that would appear if a test tube were placed 80 cm from the light source?

A) 1
B) 4
C) 35
D) 41

7. Create a graph for the data table.

Task 4 Learning Target: I can make a model to show how atoms make molecules.



Atoms

Carbon:	C
Hydrogen:	H
Oxygen:	O

1. Create a model for 1 H_2O molecule.
2. Create a model for 3 H_2O molecules.
3. Create a model for 4 O_2 molecules.
4. Create a model for 3 CO_2 molecules.
5. Create a model for 1 $C_6H_{12}O_6$ molecule.

Enrichment: Identify each molecule as a product or reactant.

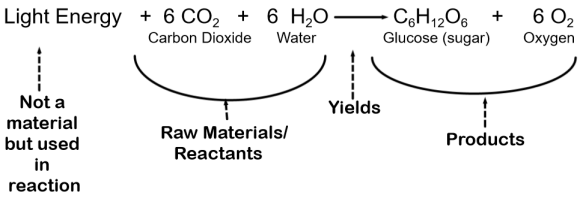
Task 5 Learning Target: I can follow a multistep procedure in order to model the molecules found in photosynthesis and respiration reactions as well as the law of conservation of matter.

Background Text: The law of conservation of matter is a fundamental principle of science that states that matter is neither created nor destroyed; it simply changes form. You will see that during photosynthesis and respiration, the number of atoms in the reactants (the "ingredients" on the left side of the formula) will equal the atoms in the products (the things that are given off after the "ingredients" undergo a chemical reaction), on the right side of the formula. You will also learn the molecules that make up the reactants and products for photosynthesis and respiration.

Procedure: *****(Red disks represent carbon; yellow disks represent hydrogen; blue disks represent oxygen.)**

1. Use the colored disks to show the **reactants** of photosynthesis. Remember that molecules are bonded together.

Photosynthesis Chemical Formula:



Check Your Work- Reactants of Photosynthesis:

_____ To represent 1 carbon dioxide (CO_2) molecule, I have a 1 red disk with 2 blue disks.
_____ I remember that molecules are made of atoms bonded together, so all three disks are stuck together.

_____ To represent 6 molecules of carbon dioxide (CO_2), I made the pattern 6 times and each pattern is separate from the other.

_____ To represent 1 water (H_2O) molecule, I have a 2 yellow disks with 1 blue disk.
_____ I remember that molecules are made of atoms bonded together, so all three disks are stuck together.

_____ To represent 6 molecules of water (H_2O), I made the pattern 6 times and each pattern is separate from the other.

2. After assessing your model, you may put all the remaining disks back in the bag. The number of disks you are using now should be all that you need.

3. **Procedure Prompt A1**: Draw a colored picture of your disk representation of the photosynthesis reactants. * Be sure to leave space for drawing the products of the reaction.

4. Use the same disks to show the products of photosynthesis.

Check Your Work- Products of Photosynthesis:

_____ To represent 1 glucose ($C_6H_{12}O_6$) molecule, I have a 6 red disks with 12 yellow disks with 6 blue disks.
_____ I remember that molecules are made of atoms bonded together, so all twenty-four disks are stuck together.

_____ To represent 1 molecule of glucose ($C_6H_{12}O_6$), I only made the pattern 1 time.

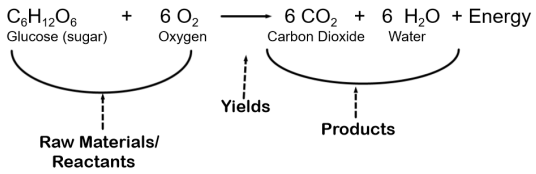
_____ To represent 1 oxygen (O_2) molecule, I have 2 blue disks.
_____ I remember that molecules are made of atoms bonded together, so both disks are stuck together.

_____ To represent 6 molecules of oxygen (O_2), I made the pattern 6 times and each pattern is separate from the other.

5. **Procedure Prompt A2**: After assessing your model, draw a colored picture of your disk representation of the photosynthesis products (next to the reactants). *Be sure to separate with a yield sign.

6. Use the same disks to determine if the same atoms used during photosynthesis can be used for respiration.

Cellular Respiration Chemical Formula:



Check Your Work- <u>Reactants and Products</u> of Cellular Respiration:

<u>Reactants</u> of Respiration:

_____ To represent 1 glucose ($C_6H_{12}O_6$) molecule, I have a 6 red disks with 12 yellow disks with 6 blue disks.
_____ I remember that molecules are made of atoms bonded together, so all twenty-four disks are stuck together.

_____ To represent 1 molecule of glucose ($C_6H_{12}O_6$), I only made the pattern 1 time.

_____ To represent 1 oxygen (O_2) molecule, I have 2 blue disks.
_____ I remember that molecules are made of atoms bonded together, so both disks are stuck together.

_____ To represent 6 molecules of oxygen (O_2), I made the pattern 6 times and each pattern is separate from the other.

<u>Products</u> of Respiration:

_____ To represent 1 carbon dioxide (CO_2) molecule, I have a 1 red disk with 2 blue disks.
_____ I remember that molecules are made of atoms bonded together, so all three disks are stuck together.

_____ To represent 6 molecules of carbon dioxide (CO_2), I made the pattern 6 times and each pattern is separate from the other.

_____ To represent 1 water (H_2O) molecule, I have a 2 yellow disks with 1 blue disk.
_____ I remember that molecules are made of atoms bonded together, so all three disks are stuck together.

_____ To represent 6 molecules of water (H_2O), I made the pattern 6 times and each pattern is separate from the other.

7. **<u>Procedure Prompt B</u>**: Draw a colored picture of your disk representation of the cellular respiration reaction (both the reactants and the products). *<u>Be sure to separate reactants from products with a yield sign.</u>

<u>Conclusion Prompts</u>:

C. Complete a table to compare the total number of atoms in the reactions for photosynthesis and cellular respiration.

	Photosynthesis		**Respiration**	
	Reactants	Products	Reactants	Products
Carbon				
Oxygen				
Hydrogen				

D. Compare the number of each type of atom in the reactants to the number of each type of atom in the products.
Did you use any more or any less of an atom?
Are your reactants and products the same? Describe how the arrangements of atoms have changed.

E. What is the law of conservation of matter and how was it modeled in this lab?

F. Why are the products of the photosynthesis reaction necessary for life on earth?

<u>Enrichment:</u> Molecules do not always form a linear shape.
Research how each of the molecules actually form shapes. What causes the different shapes?

	3	2	1
A-B Disk Representations	Disk drawings are complete, accurate, and neat.	Disk drawings contain 1-3 errors.	Disk drawings contain more than 3 errors.
C Data Table	The table is professional in appearance and is completed thoroughly and accurately with no errors.	The table is neat in appearance and contains 1-2 errors.	The table is not neat in appearance and contains more than 2 errors.
D Comparing Reactants and Products	The reactants and products for photosynthesis and respiration are compared accurately with detail.	The reactants and products for photosynthesis and respiration are compared correctly with little detail.	The reactants and products for photosynthesis and respiration are compared however there are errors and missing details.
E Law of Conservation of Matter	The law of conservation of matter is thoroughly described. Specific examples explain how it was modeled.	The law of conservation of matter is defined. An example explains how it was modeled. Detail is lacking.	The law of conservation of matter is incorrectly described. The way it was modeled is incorrect.
F Necessary for Life	Two reasons correctly and thoroughly describe why the products of photosynthesis are necessary for life on earth.	A description of why the products of photosynthesis are necessary for life on earth is lacking detail.	A description of why the products of photosynthesis are necessary for life on earth is incorrect.

	Comments
A-B Disk Representations	☐ Job well done! Disk drawings are complete, accurate, and neat.
	☐ Be sure to connect atoms to make molecules… but separate different molecules.
	☐ Review products and reactants; Use the checklist.
	☐ Don't forget the yield sign.
C Data Table	☐ Job well done! The table is professional in appearance and is completed thoroughly and accurately with no errors.
	☐ Count how many of each color disk is on the left side and then the right side of each equation.
	☐ According the law of conservation of matter, the number of each color atom should be equal.
D Comparing Reactants and Products	☐ Job well done! The reactants and products for photosynthesis and respiration are compared accurately with detail.
	☐ Review the number of each type of atom in the reactants to the number of each type of atom in the products. Give examples such as…. *How many carbons are in the reactants (left) side of the equation; how many are in the products (right)?*
	☐ Remember: You used the same colored disks from the reactants to make the products; Did the atoms rearrange to make something different or did they stay the same? Give examples.
E Law of Conservation	☐ Job well done! The law of conservation of matter is thoroughly described. Specific examples explain how it was modeled.
	☐ Use the background text to explain how the law of conservation of matter was modeled.
	☐ Use specific examples from the lab to explain how you didn't need any more or any less disks.
F Necessary for Life	☐ Job well done! Two reasons correctly and thoroughly describe why the products of photosynthesis are necessary for life on earth.
	☐ How does photosynthesis directly and indirectly produce food for all organisms?
	☐ What gasses does photosynthesis recycle? Why is this important?
Other	

Participation						
I often contributed good ideas that were relevant to the topic and task. I came to meetings prepared. I did my share of the work.	5	4	3	2	1	I seldom contributed good ideas. Sometimes I was talking off-task. I did not come to meetings prepared. I did not do my share of the work.
Working with Others						
I often compromised and cooperated. I did take initiative when needed and/or listened and respected the ideas of others.	5	4	3	2	1	I seldom compromised and cooperated. I did not take initiative when needed and/or did not listen and respect the ideas of others.
Product						
My part of the task is complete and accurate. My work was submitted on time.	5	4	3	2	1	I did not complete my part of the task. The information I presented was inaccurate and/or not done correctly. It was not completed on time.
Understanding Content						
I can speak about the topic and group work knowledgeably. I can sum-up the lesson.	5	4	3	2	1	I do not understand what I did in my group. I did not ask or answer questions. I cannot sum-up the lesson.

Task 6 Learning Target: I can use a microscope to observe and record the difference between a plant and an animal cell.

"Micro" refers to tiny, "scope" refers to view or look at. Microscopes are used to make more detailed observations and measurements of objects too small for the naked eye. The compound light microscope is the most common instrument used in education today. It is an instrument containing two lenses, which magnifies, and a variety of knobs to resolve the picture. It is a rather simple piece of equipment to understand and use.

Watch the following video to learn how to use a microscope:
https://www.youtube.com/watch?v=-b3Eejf4rDQ&t=107s

Pre Lab Tasks:

- a. Describe how to handle/carry a microscope.
- b. Describe the ocular and objective lenses.
- c. Describe the function of a microscope stage.
- d. Compare/contrast the coarse and fine adjustment knobs. (In your answer, explain why the fine adjustment knob and not the coarse adjustment knob should be used with high power objective lenses.)
- e. Describe how and why light sometimes needs to be adjusted.

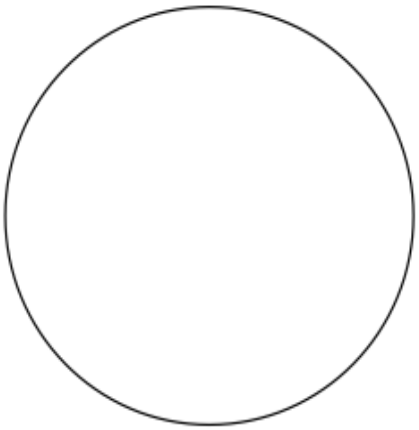
Procedure:

1. Turn the objective lens so that the lowest power objective (scanning) lens (eg. 4x) is clicked into position.
2. Place the microscope slide on the stage and fasten it with the stage clips.
3. Look at the stage from the side and turn the coarse focus knob so the stage moves upward. Move it up as far as it will go without letting the slide touch the lens.
4. Now look into the eyepiece/ocular lens and use the coarse adjustment knob to bring the specimen into focus.
5. Look through the eyepiece/ocular lens and move the fine focus knob until the image becomes sharpened.
6. Adjust the diaphragm and light intensity.
7. Move the microscope slide around until the sample is in the center of the field of view.
   - f. Draw, color and label what you see to scale.
8. When you have a clear image of your sample with the lowest power objective, you can change to the next objective lenses. You might need to readjust the sample into focus using the fine adjustment knob only and/or readjust the diaphragm and light intensity. **Do not let the objective lens touch the slide!**
   - g. Draw, color and label what you see to scale.
9. When finished, lower the stage, click the low power lens into position and remove the slide.

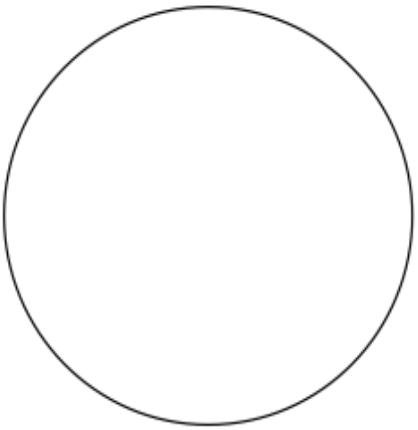
What are you looking for?
Animal (Cheek) Cells: You should see purple or blue wispy cells. Cheek cells are animal cells and so they won't have a rigid shape like plant cells. Some may be layered and difficult to see. A dark dot in the middle of the cell should indicate the nucleus. You may need to practice with the focus and move the slide around before you can see the cells clearly.
Plant (Onion) Cells: You should see purple or blue brick-like cells. They should be much more boxy than the cheek cells. Some may be layered and difficult to see. A dark dot in the middle of the cell should indicate the nucleus. You may need to practice with the focus and move the slide around before you can see the cells clearly.

Name:_____ **Date:** _____ **Class:** _____ **#:** _____

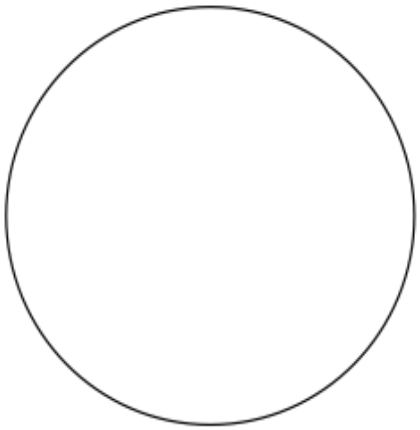
Recording Observations: _____



LOW POWER

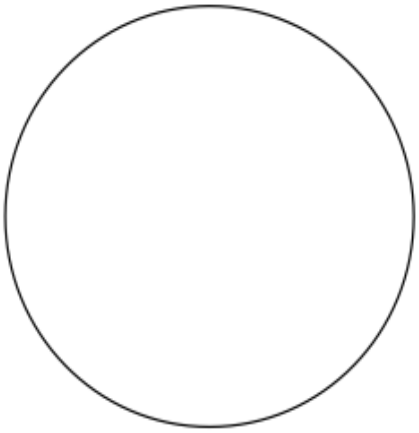


MEDIUM POWER



HIGH POWER

Recording Observations: _____



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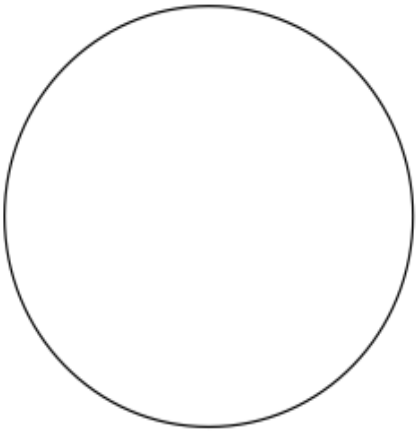

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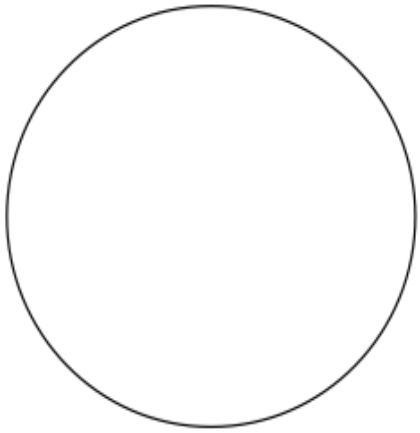

HIGH POWER

Data Table:

Is the cell organelle found in plants, animals, or both? (Place an **X** in the appropriate box) Describe functions.

Organelle	**Plant**	**Animal**	**Function**
Cell Membrane			
Cell Wall			
Cytoplasm			
Nucleus			
Vacuole			
Chloroplast			

Conclusion and Analysis:

1. How many cheek cells did you observe? How did you know they were cheek cells?

2. How many onion cells did you observe? How did you know they were onion cells?

3. Based on your observations, how do cheek cells (animal cells) compare to onion cells (plant cells)? Provide at least two differences and 2 similarities.

4. Onion cells are plants. Therefore, why were there no chloroplasts in the onion cells you observed?

4. Do you think your blood cells or bone cells would look similar under a microscope? Why or why not?

6. A friend tells you that a hippo has larger cells than humans since they are so much bigger. Do you agree or disagree? Explain your reasoning.

	3	2	1
Lab Procedure Understanding	The lab is thoroughly understood. All lab procedure questions/tasks are answered/completed thoroughly and accurately.	The lab is partially understood. Most lab procedure questions/tasks are answered/completed thoroughly and accurately.	The lab is partially understood. Few lab procedure questions/tasks are answered/completed thoroughly and accurately.
Observations	All observations are recorded accurately and precisely.	Most observations are recorded accurately and precisely.	Few observations are recorded accurately and precisely.
Data Table	The data table appears neat and professional. Data is correct and thorough.	The data table is appears neat and most data is correct and thorough.	The data table does not appear neat and/or little data is correct and thorough.
Conclusion Analysis	All conclusion/analysis questions are answered thoroughly and correctly.	Most conclusion/analysis questions are answered thoroughly and correctly.	Few conclusion/analysis questions are answered thoroughly and correctly.

Participation					
I often contributed good ideas that were relevant to the topic and task. I came to meetings prepared. I did my share of the work.	4	3	2	1	I seldom contributed good ideas. Sometimes I was talking off-task. I did not come to meetings prepared. I did not do my share of the work.
Working with Others					
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