Transpiration: Student Activity Lesson Plan

Subject/Strand/Topic:	Grade(s) / Course(s):	Ontario Expectations:
Science–Cells, Tissues, Organs, Systems - Transpiration	8	8s10, 8s12

Key Concepts: transpiration, roots, xylem, stomata, guard cells, cuticle, temperature, humidity

Link: http://plantandsoil.unl.edu/croptechnology2005/pages/?what=animationList *Select Transpiration (5th from the bottom)

Required Materials: Pre-Assessment/Answer Key, Student Activity Handout, Student Activity Answer Key, Post-Assessment/Answer Key

Introduction (10 min including pre-assessment)

1. Ask students how a plant takes in water (through the roots) and what causes a plant to loose water (making food, heat, light, wind, and low humidity)
2. Introduce the learning object (this online activity will look at transpiration – the process by which a water looses water through its leaves)
3. Distribute the pre-assessment quiz and allow 5 min to complete; collect
4. This activity works best with students in pairs, pair students at this point
5. Ensure students are in front of their computers prior to moving on

Explanation of Activity Sheet (5 min)

1. Distribute Activity sheet to each student
2. Provide direction on the organization and structure of the Activity sheet as needed; students will complete the activity sheet as they progress through the learning object
3. If projector is available, demonstrate to students how to access the various sections of the learning object as shown on the first page of their Activity Sheet
4. Tell students to follow the directions on their Activity sheet as three of the sections (Root Detail, Xylem Detail, and Stomata Detail) will only be looked briefly although the learning object presents additional screens and further details – ensure students only go as far as their Activity sheet instructs them to

Use of Learning Object with Activity Sheet (40-55 minutes)

1. Teacher should circulate throughout the activity and ensure students are on task
2. Encourage students who have completed their Activity sheet to assist those who are having difficulties

Consolidation and Post-Assessment (10 minutes)

1. Ask students to predict (Think-Pair-Share) the behaviour of stomata on a plant in the desert vs. a plant in the rainforest (a plant in the desert would have their stomata open at little as possible due to the immense heat whereas a plant in the rainforest would not have problems with water uptake as rainforests are very moist environments with high humidity conditions). After students have had a change to discuss this with their partners, share these answers with the class
2. Distribute post-assessment quiz and allow 5 min to complete; collect
3. Activity sheet can be taken up as a class or collected and marked

Transpiration
Student Activity Pre-Assessment

Name: _____ **Birthday:** _____

_____
6

1. Complete the blanks in the sentence below. [2 marks]

   A plant absorbs water through its _____, and looses water through its _____.

2. Name 1 way in which a plant loosing water is helping to the plant. [1 mark]

3. What is **transpiration**? [1 mark]

4. What are **stomata**? [1 mark]

5. What are **guard cells**? [1 mark]

Transpiration
Student Activity Pre-Assessment

Name: _____ **Birthday:** _____

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5. What are **guard cells**? [1 mark]

Transpiration
Student Activity Pre-Assessment

Name: **Answer Key**

_____
6

1. Complete the blanks in the sentence below. [2 marks]

A plant absorbs water through its _**roots**_____, and looses water through its __**leaves**_____.

2. Name 1 way in which a plant loosing water is helping to the plant. [1 mark]

Answers will vary. Cooling the plant, allowing nutrients to be absorbed through the roots, allowing carbon dioxide to enter and/or oxygen to exit

3. What is **transpiration**? [1 mark]

Transpiration is the evaporation of water from plants through openings in their leaves.

4. What are **stomata**? [1 mark]

The openings in leaves allowing water to evaporate and carbon dioxide to enter.

5. What are **guard cells**? [1 mark]

Cells that surround the stomata and open and close to allow water to exit.

Transpiration
Student Activity Handout

Name: _____
Date: _____

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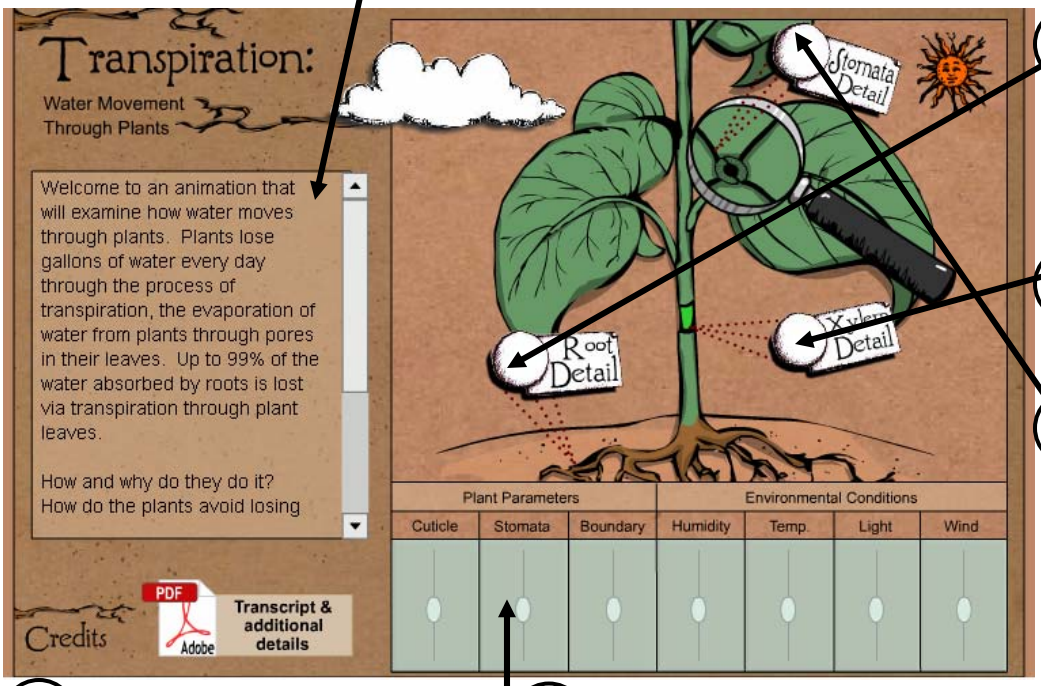
LINK: http://plantandsoil.unl.edu/croptechnology2005/pages/?what=animationList

- Select Transpiration (5th from the bottom)

Instructions: Follow the instructions for each section to answer the questions. Instructions are in the grey boxes such as this one. The image below shows you where you will need to go for each section.

1 Read the first 2 paragraphs



2 **Select Root Detail,** follow the directions below, then **select Exit, NOT Next**

3 **Select Xylem Detail**, follow the directions below, then **select Exit**

4 **Select Stomata Detail**, follow the directions below, then **Select Exit**

5 Look at **Plant Parameters** and **6** **Environmental Conditions** by using the **Sliders** and following the directions below.

Warning! There are yellow pop-up windows that appear periodically. Read the information in these yellow windows, then close it by pressing the X in the corner of the window.

Part 1: Transpiration: Read the first 2 paragraphs in the column on the left hand side of the introductory screen and answer the questions below.

1. **What is transpiration? [1 mark]**

_____

2. **What part of the plant absorbs water and what part of the plant is water lost from? [2 marks]**

_____

Part 2: Root Detail: Select Root Detail and read the large yellow text box that appears. After reading, select the Exit button, NOT the Next button.

3. **How does water enter the roots of a plant (what process)? [1 mark]**

_____

Name: _____
Date: _____

Part 3: Xylem Detail: Select Xylem Detail and read the text in the column on the left hand side of the screen. Look at the large diagram in the circle on the right and answer the questions below.

4. **What is xylem? [1 mark]**

5. **Why do you think the xylem is the longest pathway water must take on its way to the leaves of a plant? [2 marks]**

Part 4: Stomata Detail: Select Stomata Detail and read the text in the column on the left hand side of the screen. Next, read the yellow text box at the bottom of the screen. Finally, Select the Top button to show a Side view of Stomata. Select the Closed and Open buttons to show this action in the stomata.

6. **What are stomata (singlular stoma)? [1 mark]**

7. **Name 3 reasons why plants loose 99% of water they absorb through transpiration. [3 marks]**

   - _____
   - _____
   - _____

8. **Why are stomata usually found on the underside of leaves? [1 mark]**

9. **What are the 4 environmental conditions that will cause the stomata to <u>close</u>? [4 marks]**

10. **After viewing the Side view of the stomata and watching them open and close, describe the exact role that guard cells play. [2 marks]**

Name: _____
Date: _____

Part 5: Plant Parameters: Look at each plant parameter by using the sliders to increase the size/rate of the parameter or decrease it. When you click on a parameter, you will see blue lines representing water rising from the roots to the leaves. Move the sliders to see if the water moves quickly or slowly through the plant as conditions change. The questions will give you further directions on what to do.

Select the Cuticle box until it appears green.

11. What is the cuticle and what is its role in the plant? [1 mark]

_____

12. Move the slider as far to the top of the box as it can go to thicken the cuticle. Does a thicker cuticle increase or decrease the rate of transpiration? Why? [2 marks]

_____

_____

Select the Stomata box until it appears green. After you have answered question 12, read the text in the left hand column and use this to help you answer any questions in Part 4: Stomata Detail if needed.

13. Move the slider down to close the stomata. Describe what happens to the water in the plant. [1 mark]

_____

Part 6: Environmental Conditions: Look at each environmental condition by selecting it, reading the text in the left hand column, and using the sliders to increase the rate of the condition. When you click on a condition, you will see blue lines representing water rising from the roots to the leaves. Move the sliders to see if the water moves quickly or slowly through the plant as conditions change. The questions will give you further directions on what to do.

14. Complete the table below. [4 marks]

	Increase or Decrease Rate of Transpiration?
High Humidity	
High Temperature	
Large amount of Light	
Strong Winds	

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- Select Transpiration (5th from the bottom)

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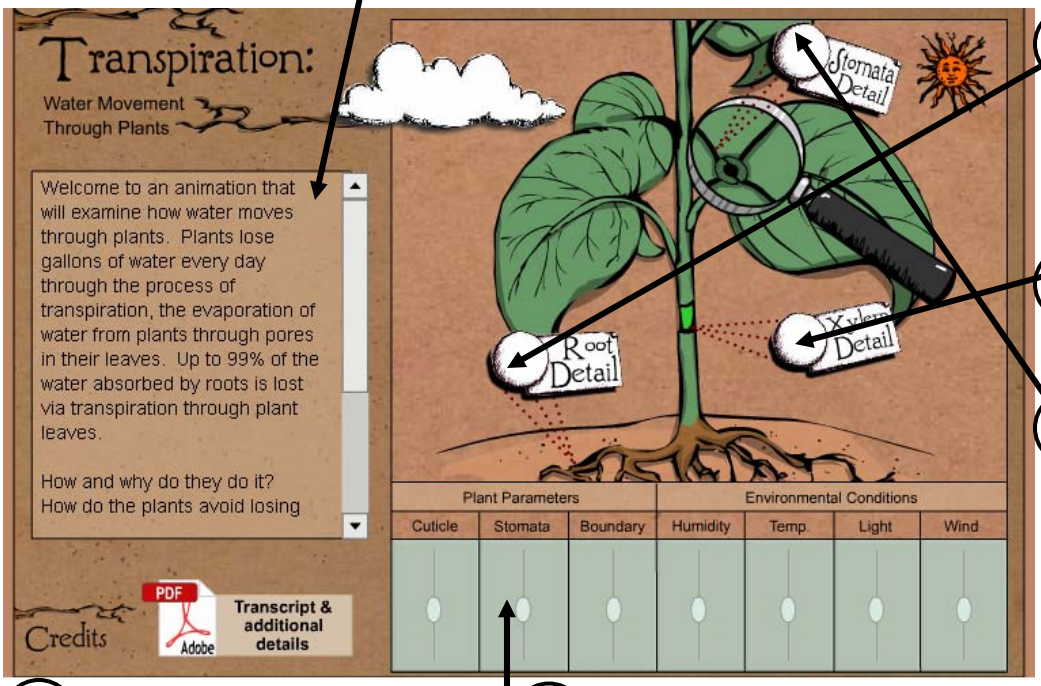

2 **Select Root Detail,** follow the directions below, then **select Exit, NOT Next**

3 **Select Xylem Detail**, follow the directions below, then **select Exit**

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Warning! There are yellow pop-up windows that appear periodically. Read the information in these yellow windows, then close it by pressing the X in the corner of the window.

Part 1: Transpiration: Read the first 2 paragraphs in the column on the left hand side of the introductory screen and answer the questions below.

1. **What is transpiration? [1 mark]**

Transpiration is the evaporation of water from plants (through pores in their leaves).

2. **What part of the plant absorbs water and what part of the plant is water lost from? [2 marks]**

The roots absorb the water and it is lost from the leaves.

Part 2: Root Detail: Select Root Detail and read the large yellow text box that appears. After reading, select the Exit button, NOT the Next button.

3. **How does water enter the roots of a plant (what process)? [1 mark]**

Diffusion

Part 3: Xylem Detail: Select Xylem Detail and read the text in the column on the left hand side of the screen. Look at the large diagram in the circle on the right and answer the questions below.

4. What is xylem? [1 mark]

A series of pathways that water can take as it heads to the leaves.

5. Why do you think the xylem is the longest pathway water must take on its way to the leaves of a plant? [2 marks]

The xylem is the longest pathway water must take on its way to the leaves of a plant because it carries water from the roots at the bottom of the plant to the leaves at the tips of the plant. This is longer than within the roots of within the leaves.

Part 4: Stomata Detail: Select Stomata Detail and read the text in the column on the left hand side of the screen. Next, read the yellow text box at the bottom of the screen. Finally, Select the Top button to show a Side view of Stomata. Select the Closed and Open buttons to show this action in the stomata.

6. What are stomata (singlular stoma)? [1 mark]

Stomata are tiny openings in the leaf of the plant that open and close allowing water to exit the plant by evaporation (transpiration).

7. Name 3 reasons why plants loose 99% of water they absorb through transpiration. [3 marks]

- Cooling the plant through evaporation
- Allowing for nutrients to be absorbed (with the water)
- Allowing carbon dioxide to enter the plant

8. Why are stomata usually found on the underside of leaves? [1 mark]

Stomata are usually found on the underside of leaves because this minimizes water loss by keeping the stomata openings directly away from the environmental conditions that increase transpiration.

9. What are the 4 environmental conditions that will cause the stomata to <u>close</u>? [4 marks]

Environmental conditions that will cause the stomata to close are: darkness, limited amounts of water available, CO_2 accumulation in the plant, and high temperatures.

10. After viewing the Side view of the stomata and watching them open and close, describe the exact role that guard cells play. [2 marks]

The role of guard cells is to protect and cover the opening of the stomata. The guard cells separate open and shut close allowing or preventing transpiration from occurring.

Part 5: Plant Parameters: Look at each plant parameter by using the sliders to increase the size/rate of the parameter or decrease it. When you click on a parameter, you will see blue lines representing water rising from the roots to the leaves. Move the sliders to see if the water moves quickly or slowly through the plant as conditions change. The questions will give you further directions on what to do.

Select the Cuticle box until it appears green.

11. What is the cuticle and what is its role in the plant? [1 mark]

The cuticle is a waxy layer present on the entire plant that helps to create a barrier to water.

12. Move the slider as far to the top of the box as it can go to thicken the cuticle. Does a thicker cuticle increase or decrease the rate of transpiration? Why? [2 marks]

A thicker cuticle decreases the rate of transpiration because it becomes harder for water to move through a thicker and waxier layer.

Select the Stomata box until it appears green. After you have answered question 12, read the text in the left hand column and use this to help you answer any questions in Part 4: Stomata Detail if needed.

13. Move the slider down to close the stomata. Describe what happens to the water in the plant. [1 mark]

When the stomata are closed, the water remains in the plant and cannot move out.

Part 6: Environmental Conditions: Look at each environmental condition by selecting it, reading the text in the left hand column, and using the sliders to increase the rate of the condition. When you click on a condition, you will see blue lines representing water rising from the roots to the leaves. Move the sliders to see if the water moves quickly or slowly through the plant as conditions change. The questions will give you further directions on what to do.

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	Increase or Decrease Rate of Transpiration?
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High Temperature	Increase
Large amount of Light	Increase
Strong Winds	Increase

Transpiration
Student Activity Post-Assessment

Name: _____ **Birthday:** _____

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1. Complete the blanks in the sentence below. [2 marks]

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The openings in leaves allowing water to evaporate and carbon dioxide to enter.

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Cells that surround the stomata and open and close to allow water to exit.