SCIENCE 10 UNIT C: BIOLOGY

Water Transport In Plants

Review:

Match each function with the correct structure from the following list.

i. cuticle	ii. stomata	iii. xylem
iv. root hairs	v. ground tissue	vi. companion cells
vii. epidermis	viii. guard cells	

_____ a. moves water and dissolved minerals from roots up the stem to the leaves

_____ b. outer layer that covers all of non-woody plants; responsible for the exchange of matter and gases into and out of plants

_____ c. form tiny pores on the under side of leaves

_____ d. tiny pores on the under side of leaves that allow for movement of gases in and out of leaves

_____ e. prevents excess evaporation of water

_____ f. directs activities of sieve tube cells

_____ g. increases absorption capacity of roots

_____ h. provides strength and support for plant; stores food and water for plant; is the location of photosynthesis

$$6\ CO_{2(g)} + 6\ H_2O_{(l)} + \text{energy} \longrightarrow 1\ C_6H_{12}O_{6(s)} + 6\ O_{2(g)}$$

This is the process of _____.

$$1\ C_6H_{12}O_{6(s)} + 6\ O_{2(g)} \longrightarrow 6\ CO_{2(g)} + 6\ H_2O_{(l)} + \text{energy}$$

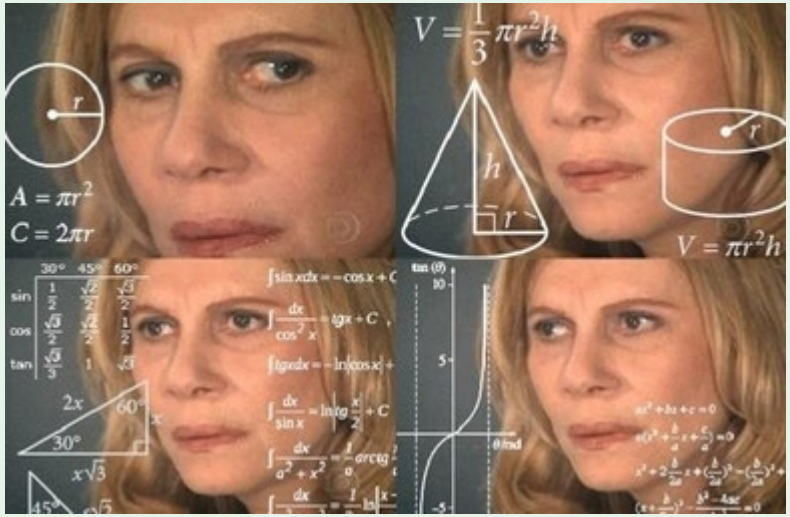
This is the process of _____.

The process of photosynthesis and cellular respiration are critical to the survival of the plant.

As you can tell from the equations, there is a lot of movement of things into and out of the cell.

TRANSPORT IN PLANTS

- How does all this transportation take place?
- We're going to examine the tissues again and find out



TRANSPORT IN THE DERMAL TISSUE

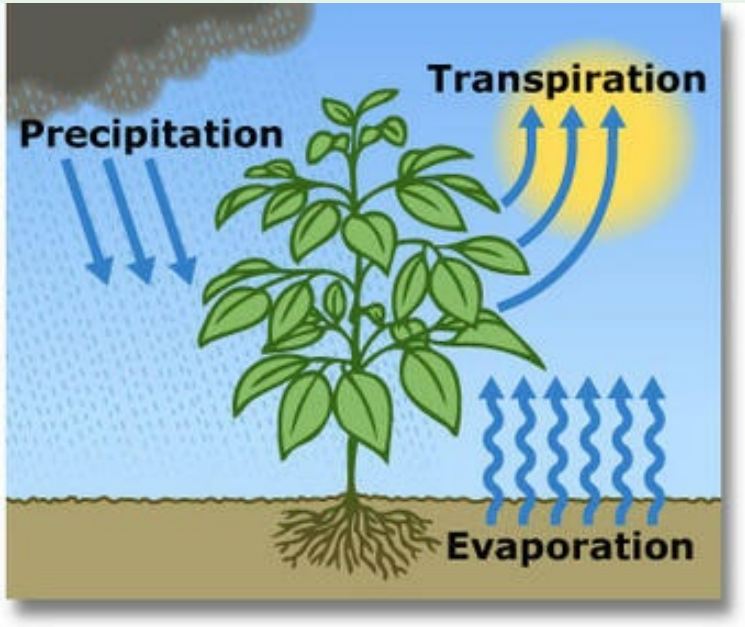
- Recall the dermal tissue is the outer layer
- Has holes implanted called the **stomata**, created by two **guard cells**

TRANSPORT IN THE DERMAL TISSUE

- When **light** hits the guard cells, they absorb potassium ions, making them **hypertonic**
- Water then enters, causing the stomata to **open**

TRANSPORT IN THE DERMAL TISSUE

- The open stomata allows for the movement of CO2, O2, and water by **diffusion**
- The loss of water through the stomata is called **transpiration**
  - If the stomata were always open, plants would die of dehydration
  - https://www.youtube.com/watch?v=5jJLfwTkGe8



TRANSPORT IN THE DERMAL TISSUE

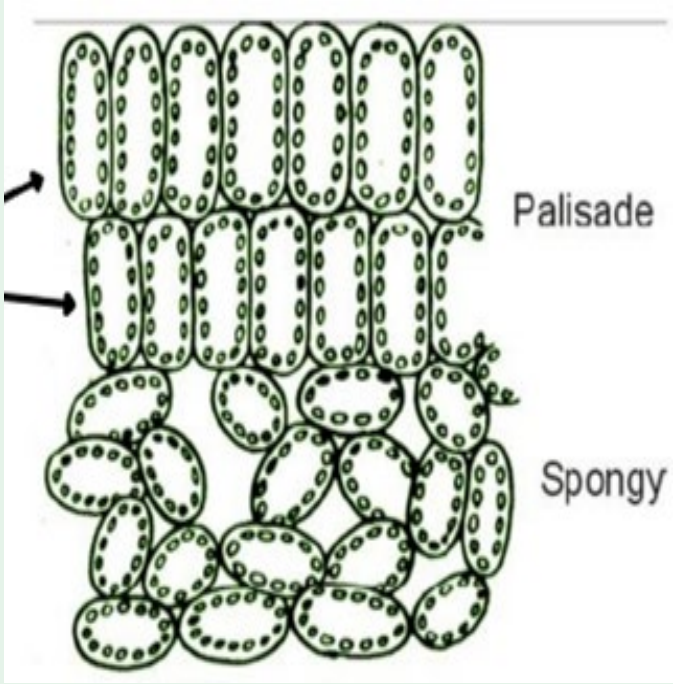
- Stomata light sensitivity varies
- Plants in dry climates only open when necessary, less sensitive to light
- Gas exchange can also take place through slits in the bark called **lenticels**

TRANSPORT IN THE GROUND TISSUE

- Recall that ground tissue makes up most of the inside layer of the plant
- Some is made up of a specialized tissue called **mesophyll**
- There are **two** kinds of mesophyll
  - **Palisade**
  - **Spongy Mesophyll**

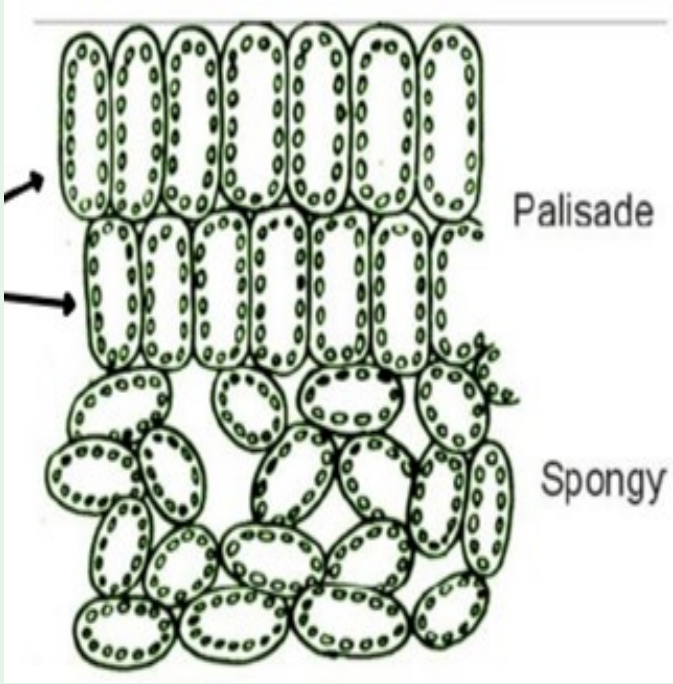
TRANSPORT IN THE GROUND TISSUE

- **Palisade tissue** is found just below the dermal layer in **leaves**
- Long, rigid, tightly packed cells
- Responsible for **photosynthesis**, packed with chloroplasts



TRANSPORT IN THE GROUND TISSUE

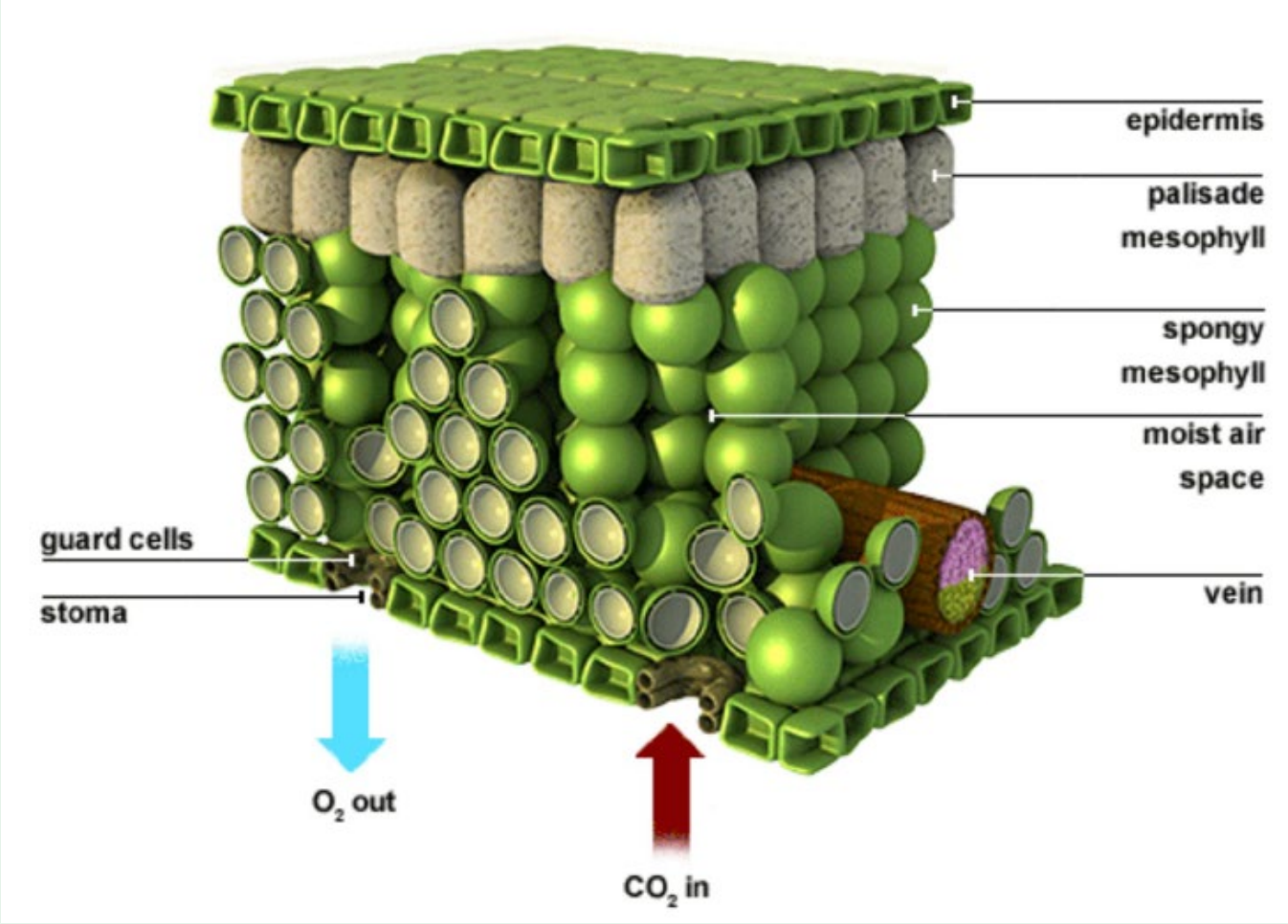
- **<u>Spongy mesophyll</u>** is found just below palisade in **<u>leaves</u>**
- Soft, round cells packed loosely
- Responsible for gas exchange, moving O2, CO2, and water around for photosynthesis
- Still contains some chloroplasts



TRANSPORT IN THE VASCULAR TISSUE

- Recall that vascular tissue consists of **xylem** and **phloem**
- Together, they form the **vascular bundle**, seen as veins on leaves
- Xylem moves water up, phloem moves glucose down

COMBINED TISSUE DIAGRAM

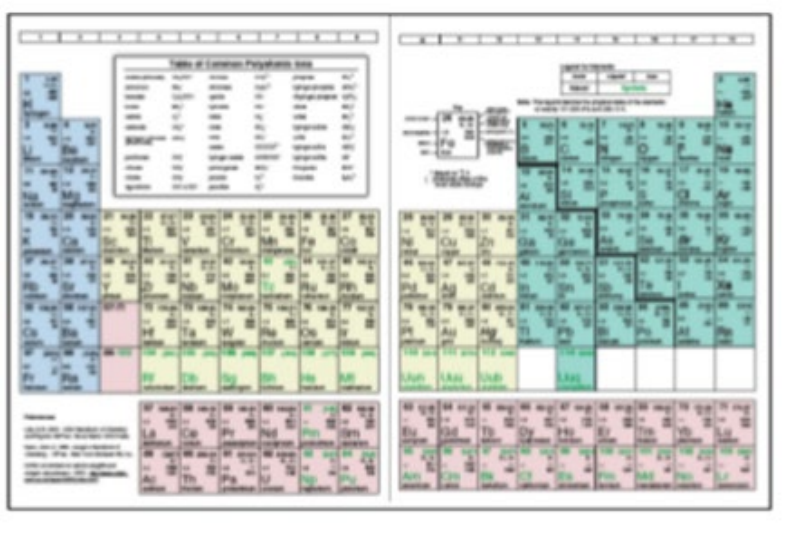


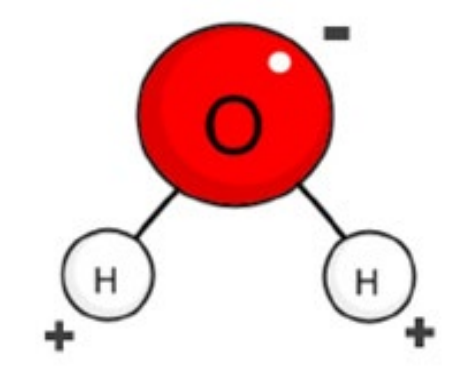
TRANSPORT IN THE VASCULAR TISSUE

- How is xylem able to pull water from the roots all the way to the leaves without pumping it?
- To answer that, we'll have to review some chemistry

PROPERTIES OF WATER

- Recall that **negative** ions are found on the left of the table, and **positive** ones on the right
- Water is made of hydrogen (**positive**) and oxygen (**negative**)
- This makes it **polar**





PROPERTIES OF WATER

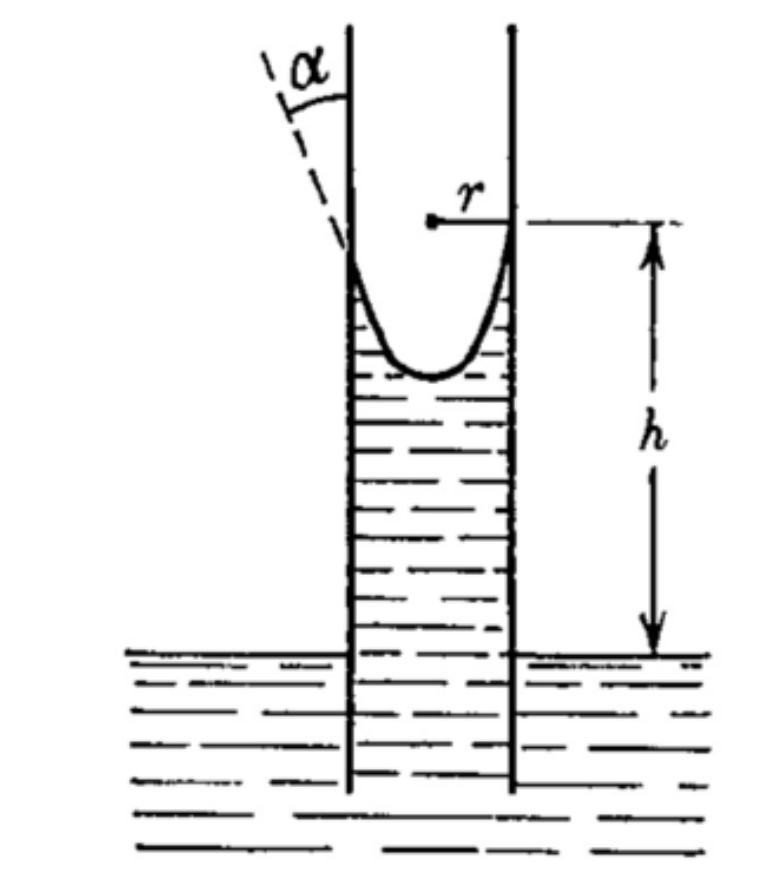
- Water's **polarity** causes two important properties
- The first is **cohesion**, where water sticks to itself. This happens because the positive hydrogen is attracted to the negative oxygen.

PROPERTIES OF WATER

- Water's **polarity** causes two important properties
- The second is **adhesion**, where water sticks to other substances. This happens because its partial charges are attracted to those in other substances.

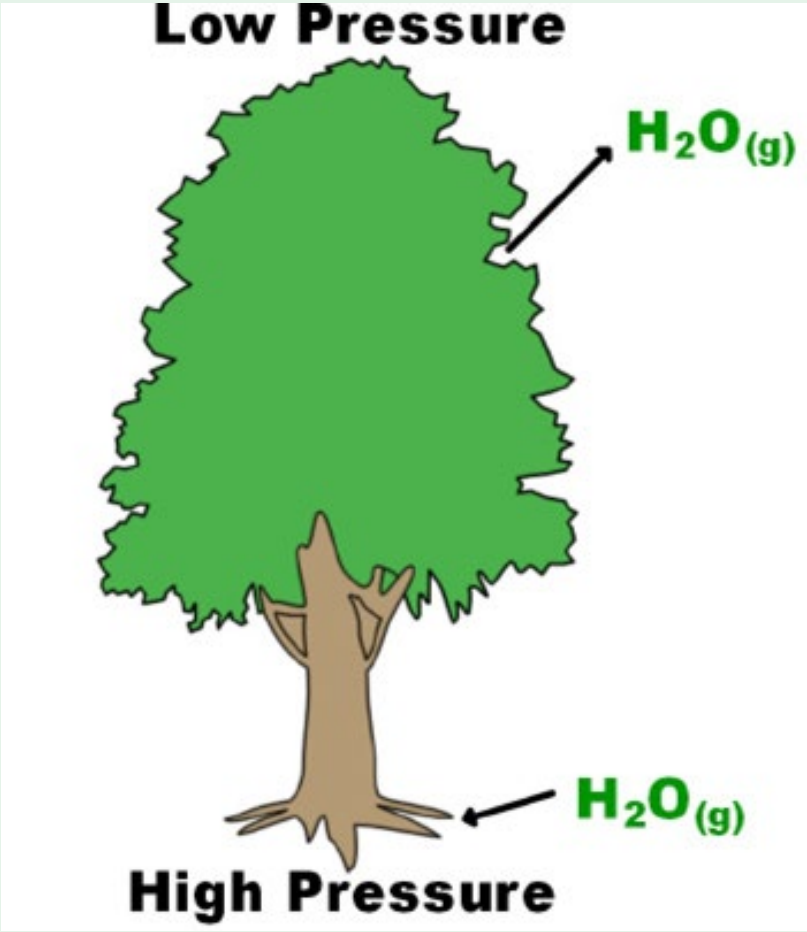
PROPERTIES OF WATER

- Combined, these cause **capillary action**
- This is the ability for water to move upward through porous materials or thin tubes, **such as xylem**
- But this isn't the whole story



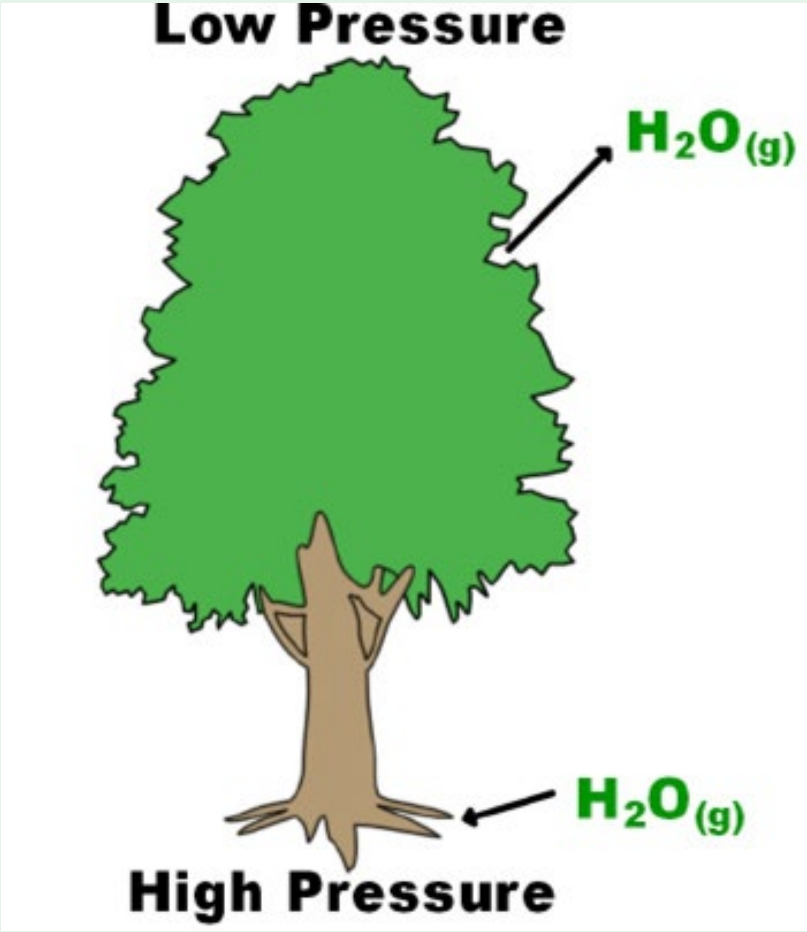
PROPERTIES OF WATER

- Recall that a plant loses water through the **stomata** due to **transpiration**
- This leaves a lower water pressure at the leaves



PROPERTIES OF WATER

- Meanwhile water is constantly coming into the roots due to **active transport** of **nutrients**
- This causes **transpiration pull,** forcing water up the xylem without the plant spending any energy on moving the water



TURGOR PRESSURE

- Plants need water for **turgor pressure**
- Pressure of the cell membrane against the cell wall due to the vacuole filling with water
- Maintains rigidity, without it plants **wilt**