PENANG SANGAM HIGH SCHOOL
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LESSON NOTES

Year/Level: 12C/D week 17 **Subject:** Biology

Strand	1 structure & life processes
Sub Strand	1.4 comparative form and function in plants and animals
Content Learning Outcome	Describe the gas exchange in plants

GAS EXCHANGE

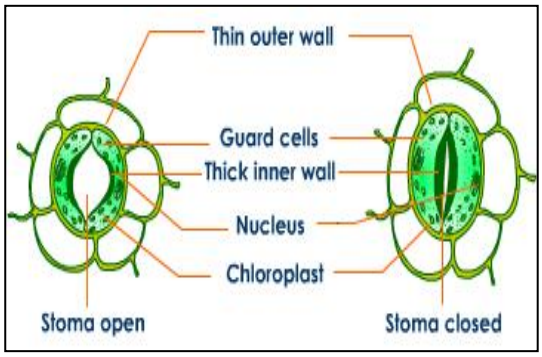
- Organisms release energy from the food they digest by "burning" the food with oxygen - *respiration*.
- Respiration occurs in both plants and animals. Organisms must take in oxygen and then excrete the carbon dioxide waste produced, as the respiration reaction releases energy from glucose.
- The more energy an organism requires, the more oxygen it needs to oxidise food.
- The more oxygen it needs, the faster it must exchange gases.
- Active organisms need a large energy supply and so must have a very efficient gas exchange system while sessile organisms do not need as much energy and so their gas exchange systems are less efficient.

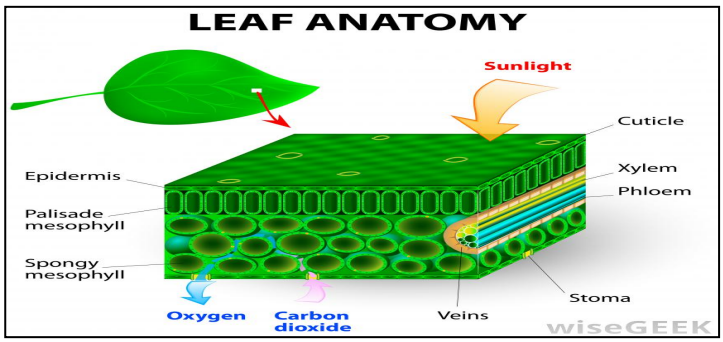
Gas Exchange in Plants

- Plants need carbon dioxide for photosynthesis and oxygen for respiration.
- They rely solely on direct diffusion for gas exchange.
- Plants are sessile and do not need rapid gas exchange therefore; they are adapted for a slow diffusion method.

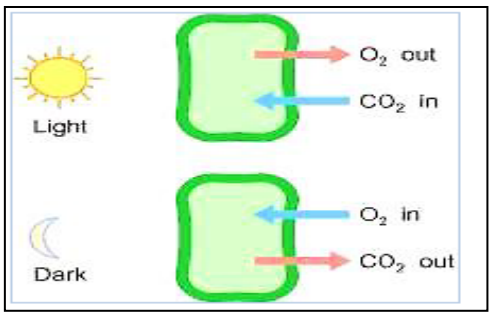
Factors affecting rate of gas exchange in plants	**Efficient gas exchange systems must**
• The area available for diffusion. • The distance over which diffusion occurs. • The concentration gradient across the gas exchange surface. • The speed with which molecules diffuse through membranes.	• have a large surface area to volume ratio • be thin • have mechanisms for maintaining high concentration gradients • be permeable to gases.

Flowering plants exchange gases through their stomata present on the leaves:

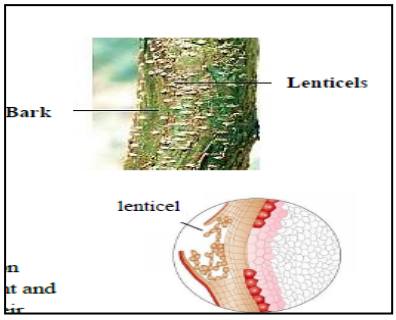


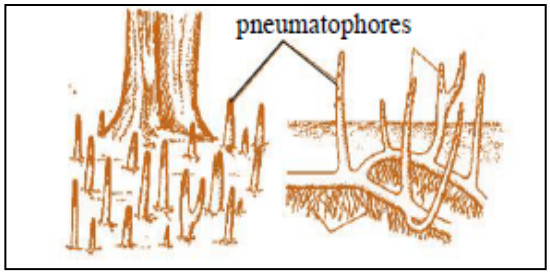


- In the light there is a net intake of carbon dioxide for photosynthesis and a net output of oxygen from respiration.
- In the dark there is a net intake of oxygen for respiration and a net output of carbon dioxide.



- Terrestrial plants get plenty of air so they usually have stomata on the bottom of their leaves.
- Aquatic plants have their leaves near or under the water, but they also need to breathe.
- Plants that float on the surface of the water have their stomata on top, where they have access to air.
- Plants that live completely under water gather CO_2 from the water. When they release O_2 you can see tiny air bubbles gathering around them.
- *Woody plants* use **lenticels** for exchanging gases.
- Lenticels are raised lose cork tissue in woody stems, roots and some fruits which function in gas exchange for aerobic respiration.
- Live non-photosynthetic cells tissue cells below the dead cork layer need oxygen gas.
- They also need to get rid of carbon dioxide waste gas.
- Lenticels allow oxygen in and carbon dioxide out.
- Plants can open their stomata to get gases by direct diffusion but they face water loss at the same time. Therefore, at night and during water shortages plants conserve water by closing their stomata.





Gas exchange in Pneumatophores

Pneumatophores are erect roots with specialized structures that allow for respiration. E.g. root mangroves

Adaptation for Gas Exchange in Plants

Adaptation	Description
Stomata	Small openings in the underside of most leaves, which allow gases to diffuse in and out.
Air spaces	In the spongy layer of a leaf to allow carbon dioxide to diffuse more quickly to the photosynthesising palisade layer
Thin leaves with broad surfaces	To maximise surface area to volume ratio for faster diffusion to cells.
Lenticels (small holes in the bark)	In woody plant stems and small gaps in the stem surfaces of herbaceous plants that allow plants to respire.

Exercise

1. Why do organisms need oxygen?

   _____

2. Water lily leaves, which float on the surface of the water, have stomata on the upper surfaces of their leaves instead of the lower. Why are their stomata on the upper leaf surfaces?

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3. How would stomata arrangements be a problem for land plants?

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   _____
   _____

4. The term ‘gas exchange’ refers to the exchange of what gases?

   _____
   _____