

Life Sciences: Gaseous exchange

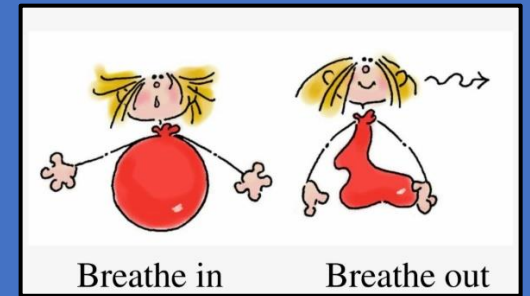
Grade 11

Lesson 34

GASEOUS EXCHANGE

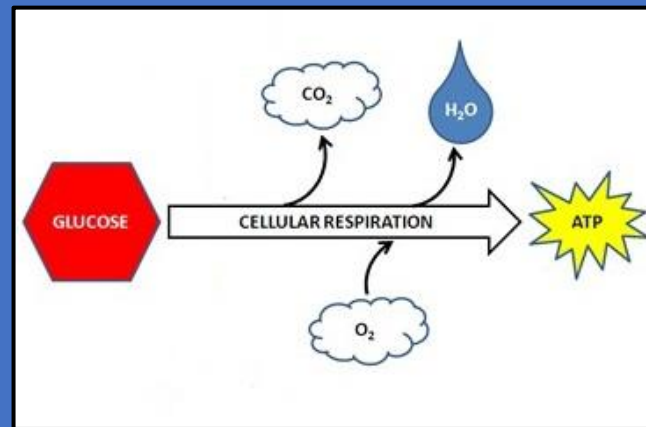
Breathing

This is a mechanical process taking oxygen into the lungs.



Cellular respiration

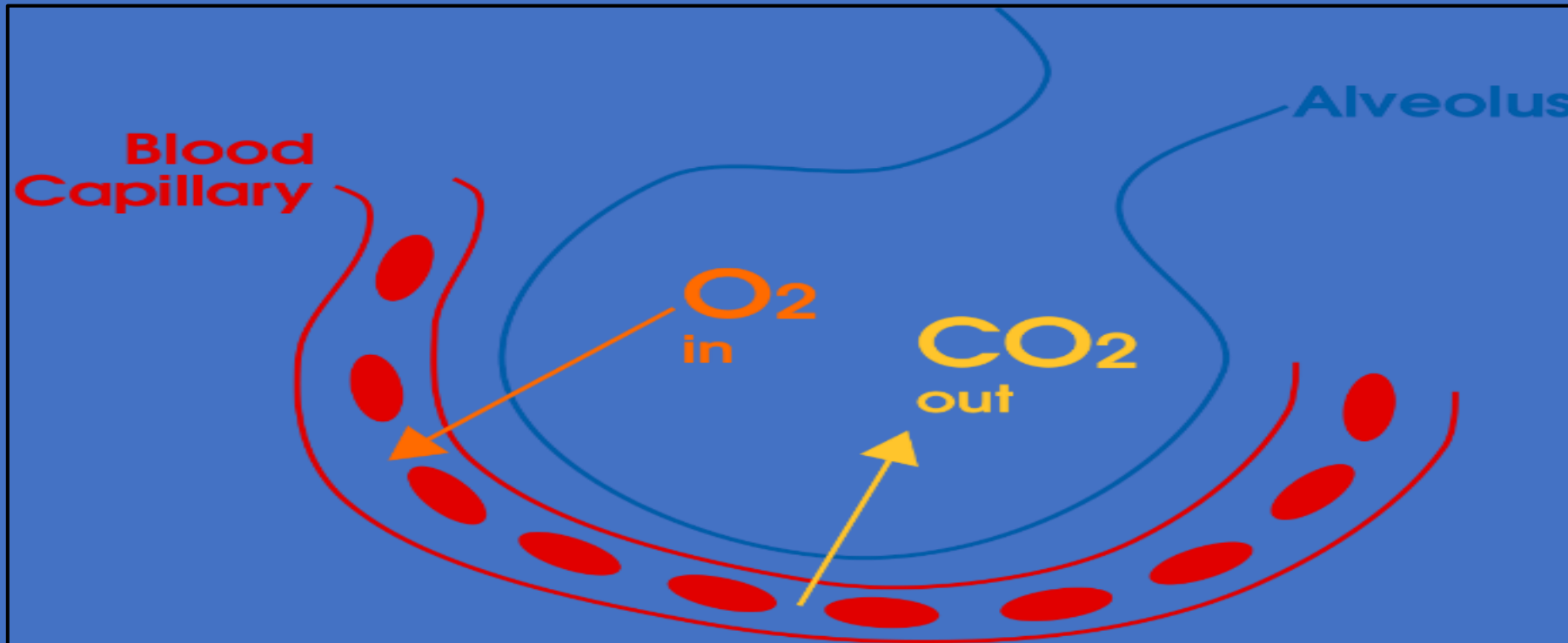
A chemical process which takes place in the cells to release energy.



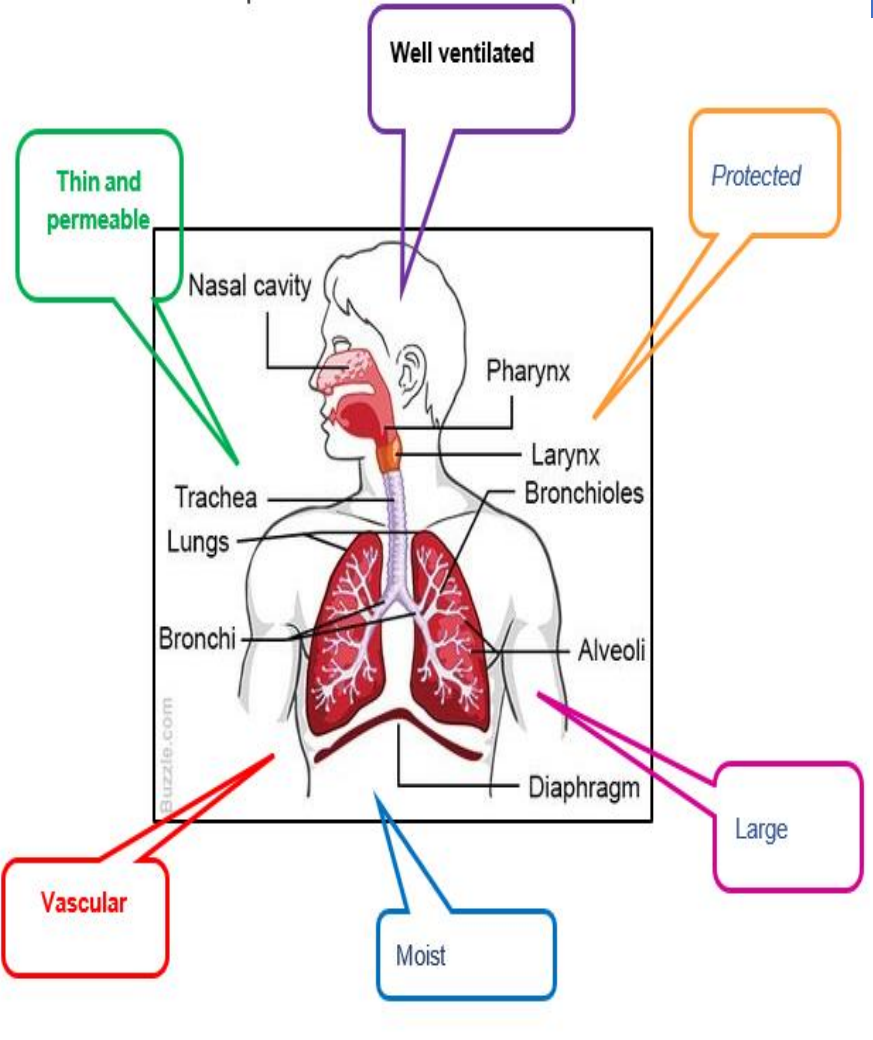
GASEOUS EXCHANGE

Gaseous exchange

A physical process which involves the exchange of gases between the air and blood in the lungs.



REQUIREMENTS FOR EFFICIENT GASEOUS EXCHANGE



Requirement	Reason
large	a large surface area to volume ratio allows enough oxygen and carbon dioxide to diffuse
thin and permeable	diffusion can occur more rapidly and efficiently if the surface is thin and permeable
moist	oxygen and carbon dioxide diffuse when in dissolved in water
protected	all gaseous exchange surfaces need to be protected from mechanical injury as well as from drying out (desiccation)
well-ventilated	ensuring that oxygen rich air for terrestrial organisms and oxygen rich water for aquatic organisms are continually brought into contact with the gaseous exchange surface
vascular	an efficient method of transporting gases to and from the gaseous exchange surfaces is required

RATIO OF SURFACE AREA TO VOLUME

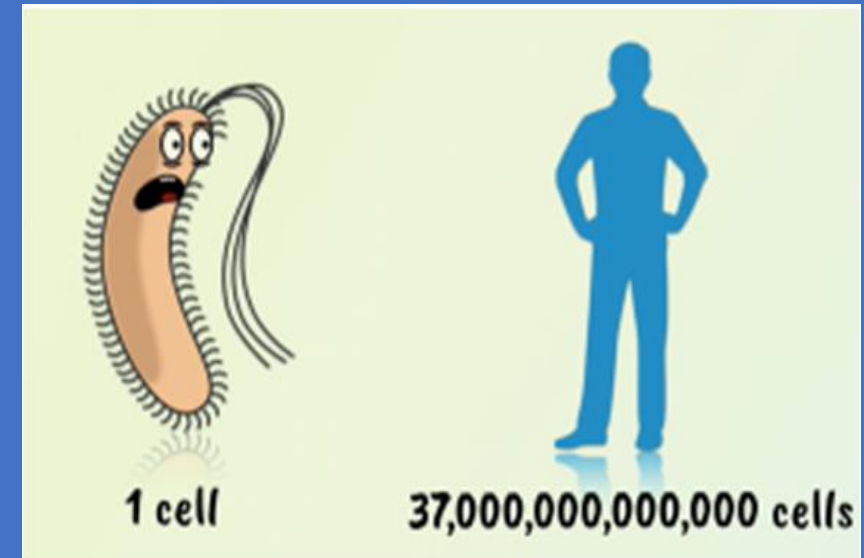
- All organisms, from simple unicellular to complex multicellular, rely on gaseous exchange for survival.
- The amount of O₂ taken up and CO₂ released depends on **the ratio of surface area to volume** of the organism.

- $$\frac{\text{Surface area}}{\text{Volume}}$$

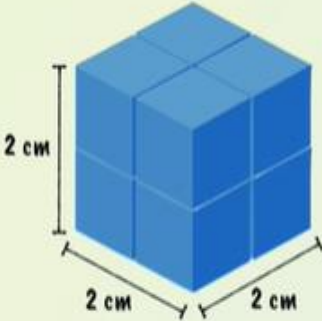
RATIO OF SURFACE AREA TO VOLUME

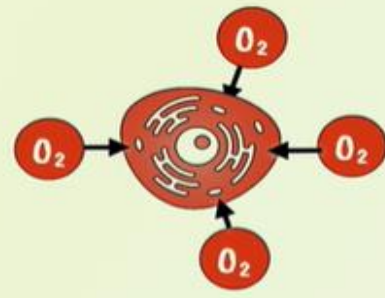
What does this mean?

- **Surface area is the combination of all the exposed surfaces of the organism.**
- **The volume is the space taken up by the same organism.**
- **Therefore, the surface area to volume ratio would be the amount of surface an organism has relative to its size.**
- **In general, the smaller the organism the larger the surface area to volume ratio.**



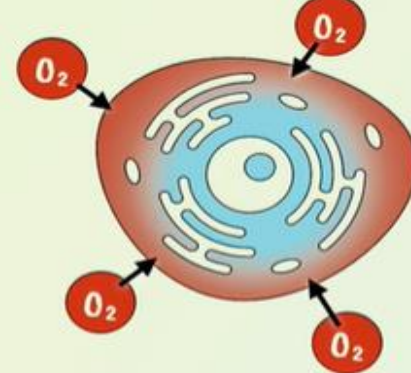
RATIO OF SURFACE AREA TO VOLUME

		
Surface Area (cm ²)	6	24
Volume (cm ³)	1	8
SA:Vol	6 : 1	3 : 1



Every 1 cm³ is provided
oxygen by 6 cm² Surface
area

SA:Vol **6 : 1**

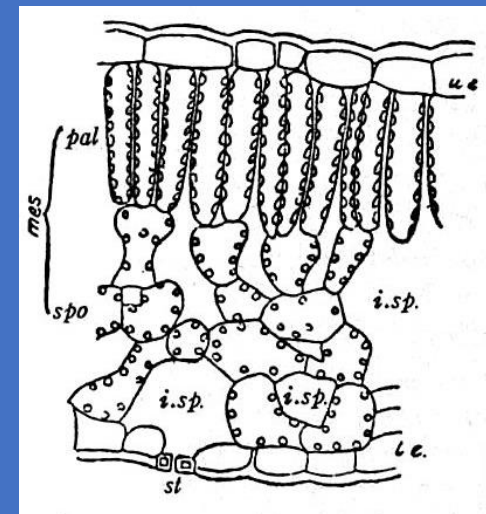
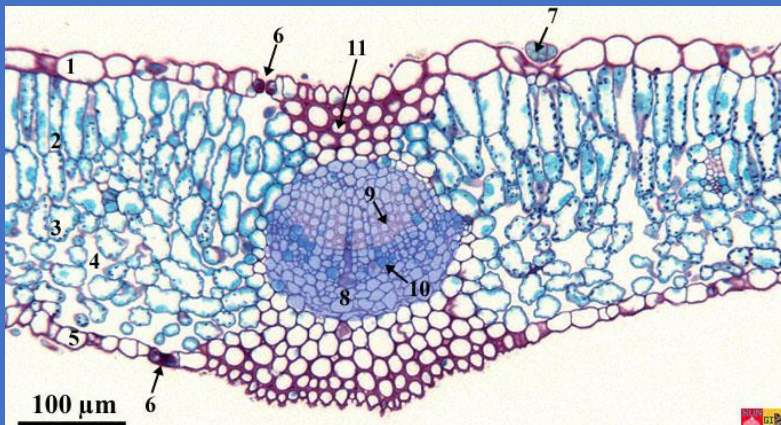


Every 1 cm³ is provided
oxygen by 3 cm² Surface
area, not so efficient

3 : 1

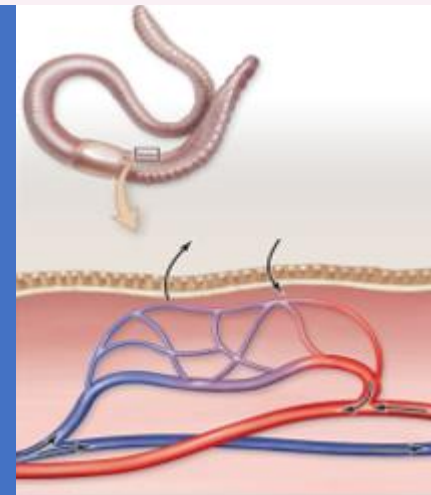
REQUIREMENT FOR EFFECTIVE GASEOUS EXCHANGE

Requirement for effective gaseous exchange surface					
large	thin & permeable	moist	well-ventilated	protection	transport system
dicotyledonous plant (leaf and spongy mesophyll cells)					
flat surface increases exposure to air	thin-walled cells allow for diffusion	water vapour passes through stomata	air movement around leaves	cuticle and lower epidermis	simple diffusion



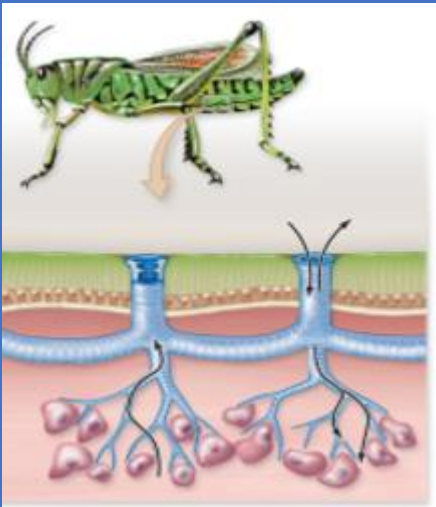
REQUIREMENT FOR EFFECTIVE GASEOUS EXCHANGE

Requirement for effective gaseous exchange surface					
large	thin & permeable	moist	well-ventilated	protection	transport system
earthworm (skin)					
elongated, cylindrical shape	body surface is thin	mucous glands keep the worm moist	not needed – gas exchange surface on outside of body		through the skin



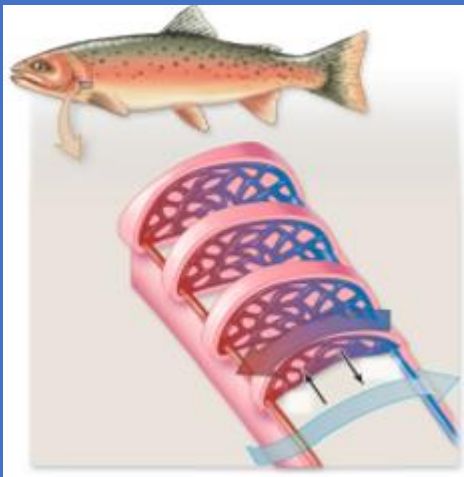
REQUIREMENT FOR EFFECTIVE GASEOUS EXCHANGE

Requirement for effective gaseous exchange surface					
large	thin & permeable	moist	well-ventilated	protection	transport system
insect (tracheal system)					
extensively branched tracheoles	lining of tracheoles thin	tracheoles are moist	rhythmic body movements move air in and out	exoskeleton	gases in direct contact with tissues



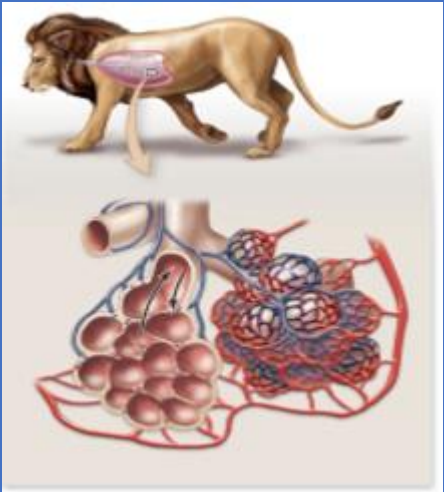
REQUIREMENT FOR EFFECTIVE GASEOUS EXCHANGE

Requirement for effective gaseous exchange surface					
large	thin & permeable	moist	well-ventilated	protection	transport system
bony fish (gills)					
branched gill filaments increase surface area	thin membranes	aquatic animals live in water	water taken in through mouth is forced out over gills	gills protected by bony cover, the operculum	heart and blood vessels present



REQUIREMENT FOR EFFECTIVE GASEOUS EXCHANGE

Requirement for effective gaseous exchange surface					
large	thin & permeable	moist	well-ventilated	protection	transport system
mammals (lungs)					
bronchiole divide into many alveoli	alveoli have thin squamous epithelium	alveoli have thin layer of moisture	inhalation and exhalation during breathing	ribs protect the lungs	circulatory system



ACTIVITY

Animal 1:

Surface area = 3.5cm^2

Volume = 7.7 cm^3

Animal 2:

Surface area = 6cm^2

Volume = 8 cm^3

Which animal has the highest surface area to volume ratio?

(5)

ACTIVITY

Animal 1:

Surface area = 3.5cm^2
Volume = 7.7 cm^3

Animal 2:

Surface area = 6cm^2
Volume = 8 cm^3

In which animal will oxygen reach all cells through the process of diffusion? (1)

Give a reason for your answer in the previous question. (1)

ACTIVITY

Animal 1:

Surface area = 3.5cm^2
Volume = 7.7 cm^3

Animal 2:

Surface area = 6cm^2
Volume = 8 cm^3

What systems are in place for an animal with a small surface area to volume ratio to ensure that all cells receive oxygen in the shortest possible time? (2)

ACTIVITY

Animal 1:

Surface area = 3.5cm^2
Volum = 7.7 cm^3

Animal 2:

Surface area = 6cm^2
Volume = 8 cm^3

Predict what will happen if an animal with a small surface to volume ratio does not have specialized systems in place for oxygen to reach all the cells.

(2)

ACTIVITY

Name FOUR structural requirements of an efficient gaseous exchange surface. (4)

THANK YOU