GCSE Review 5 – Transport in Cells & Gas Exchange

Basic Revision Aims:
5.1. Diffusion & surface area to volume ratio
5.2. Osmosis
5.3. Active Transport
5.4.1. Gas exchange in the lung

Extending Further:
5.4.2. Fick's Law

Resources
Use the GCSE Bitesize sections below and your GCSE textbook, class notes and GCSE revision guide.
Transport in Cells
https://www.bbc.co.uk/bitesize/guides/zc7k2nb/revision/1 (AQA)
https://www.bbc.co.uk/bitesize/guides/z22vw6f/revision/1 (Edexcel)

Gas Exchange
https://www.bbc.co.uk/bitesize/guides/zyptv9q/revision/2 (AQA)
https://www.bbc.co.uk/bitesize/guides/zyjbqhv/revision/1 (Edexcel)

Fick's Law (Extending Further)
https://www.bbc.co.uk/bitesize/guides/zyjbqhv/revision/6 (Edexcel)

5.1. Diffusion & Surface Area to Volume Ratio

What do particles in a liquid and a gas do constantly? …………………………………………

In diffusion, particles move from ………………………………………………………………………………………………

to ……

The particles move down a ………………………………………………………………………………………………………

It is important to remember that the particles:

-

-

Diffusion of particles can take place:

a) between different regions within a …………………………… or a ……………………., or

b) across or through a ………………………………………… between the outside and inside of cells.

What happens when the particles reach the same concentration on both sides of a membrane?

………

………

What has been reached? …………………………………………

The rate of diffusion can be affected by a number of things. For each factor, describe how a specific change (i.e. increase or decrease) in the factor affects the rate of diffusion.

Concentration gradient: ……

……

Temperature: ……

……

Surface area of the cell membrane: ……………………………………………………………………………………

……

Surface Area to Volume Ratio

Explain why unicellular organisms (i.e. bacteria) and simple multicellular organisms (i.e. mosses) can survive by just taking in substances over their body surface.

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……

What happens as organisms increase in size?

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Surface area to volume ratio can be calculated by **dividing an organism's total surface area by its volume.** Always express the ratio in its lowest form as *n* : 1, where *n* = the surface area.

Complete the table below, the first cube has been completed for you:

Cube Size (cm)	Surface Area	Volume	SA:V Ratio
1	*1 cm x 1 cm x 6*	*1 x 1 x 1 = 1 cm^3*	*6:1*
2			
3			
4			

Describe the relationship between the increase in the volume and the surface area.

………

………

5.2. Osmosis

Osmosis is ………

………

………

A dilute solution contains a ……………… concentration of water molecules.

A concentrated solution contains a ……………… concentration of water molecules.

What happens when the concentration of water is the same on both sides of a membrane?

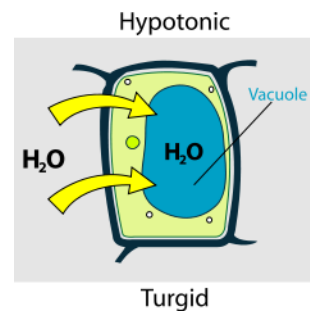………

………

Plant Cells

Plant cells have a strong ……………………………………………………………………………… outside the cell membrane.

Describe its features ………

………

………

Describe the movement of water molecules and what happens to plant cells when they are put in solutions with different concentrations of solute.

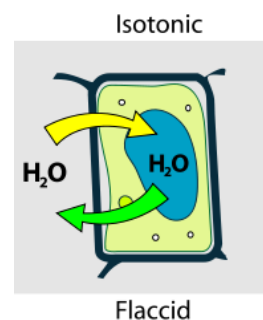*Pure water / no solute (Hypotonic)*

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

Hypotonic

H_2O H_2O Vacuole

Turgid

A concentrated solution (Isotonic)

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

Isotonic

H_2O H_2O

Flaccid

A very concentrated solution (Hypertonic)

………

………

………

………

………

Hypertonic

Plasmolyzed
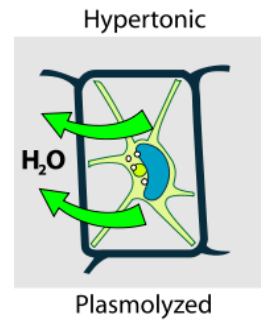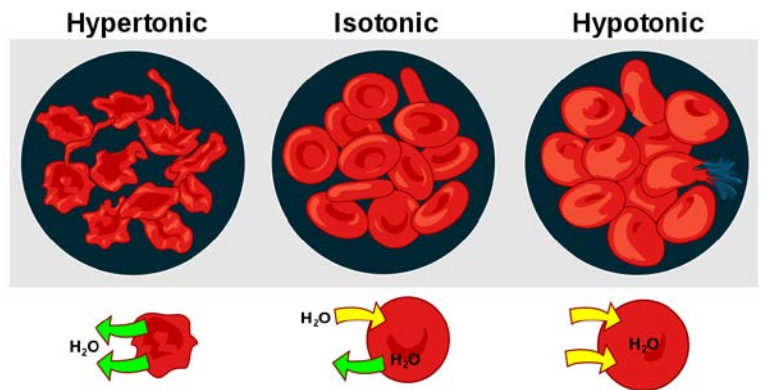
<u>Animal Cells</u>

Describe the movement of water molecules and what happens to animal cells when they are put in solutions with different concentrations of solute.

Pure water / no solute (Hypotonic)

………………………………………………………………………

………………………………………………………………………

………………………………………………………………………

……

Hypertonic   Isotonic   Hypotonic

Normal / concentrated solution (Isotonic)

………

………

………

A very concentrated solution (Hypertonic)

………

………

………

Why do animal cells behave so differently to plant cells?

………

5.3. Active Transport

Active transport is ……

…………………………………………………………………………………Transport in Cells & Gas Exchange…………

Substances have been moved from a ………………… concentration to a ………………… concentration.

What is required for active transport? ……………………………………………………………………………………………………

Describe how and when plants use active transport

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Describe how and when animals use active transport

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....

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....

Comparison of the 3 Processes

Complete the table below to compare diffusion, osmosis and active transport:

Process	Descriptions	Substances moved	Energy required?
Diffusion			
Osmosis			
Active Transport			

5.4.1 Gas Exchange in the Lungs

The Need for Exchange Surfaces & Transport Systems

On page 2 you looked at the relationship between increasing the volume of an organism and its effect on its surface area.

Let's remind ourselves …

Small Organisms (e.g. bacteria)

Their surface area : volume ratio is ……………………………

How do these organisms exchange essential and waste substances with their environment?

……

……

……

Why is this process enough to keep them alive?

……

Important:

For organisms, the size of their surface area defines ………………………………………………………………

……

However, the size of their volume defines ………………………………………………………………………………

……

Larger Organisms (e.g. birds)

Their surface area : volume ratio is ……………………………

Complete the table below to identify the problems faced by larger organisms and their solutions:

	Problem	**Solution**
Their surface area does not increase as fast as the volume		
Their volume increases		

In summary, in order for larger organisms to move substances, such as oxygen, around their body they need ……………………………………………………………. such as the ……………………………………………………………

What do larger organisms also need?

……

……

All exchange surfaces are adapted to ……………………………………………………………………………………………………

……

The Lungs

The human lungs provide an exchange surface adapted for

-

-

What is ventilation?

………

………

………

Label the diagram below of the lungs and their surrounding anatomy:
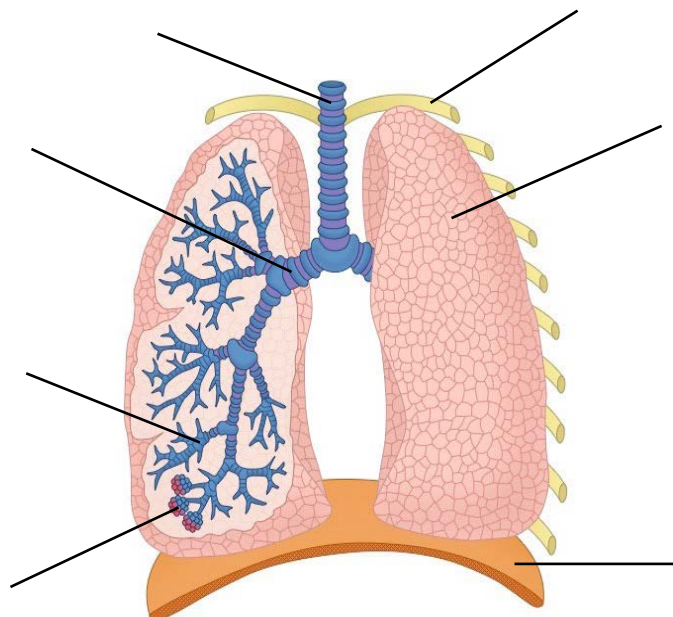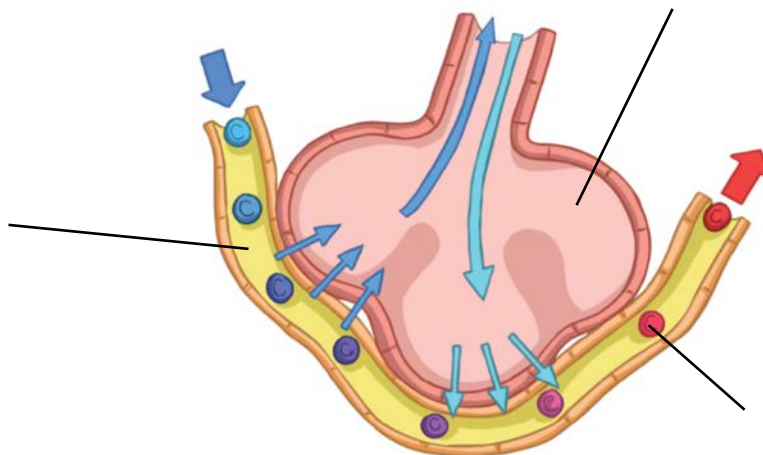
What are positioned between the ribs to help them move? ……………………………………………………………………

Gas exchange happens in the ……………………………………………………

Label the diagram below that shows their outer surface:
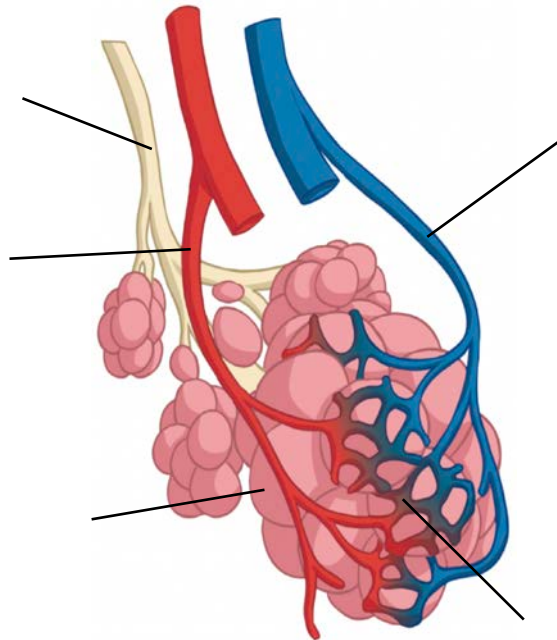
The exchange of gases occurs between the ………………………………………………………………………………………………………

………

Label the diagram and the arrows on the cross sectional image below to show the exchange of gases:

Adaptations of the Lungs

There are 3 important factors that affect the rate of diffusion across an exchange surface:

- Surface area
- Diffusion distance
- Concentration gradient

Explain how a change in each leads to a faster rate of diffusion:

Surface area:

……

……

Diffusion distance:

……

……

Concentration gradient:

……

……

Complete the table below to link each adaptation of the lung to one of the 3 factors to explain how the lungs is such an efficient gas exchange organ:

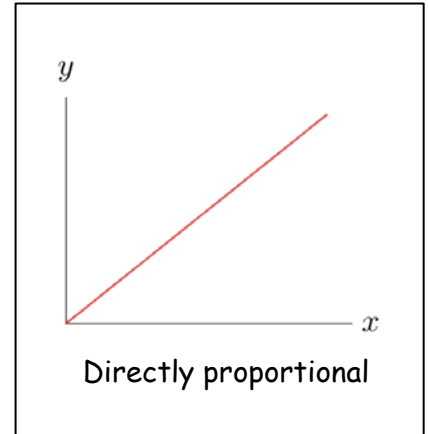| Adaptation	How the adaptation increases rate of diffusion
Many alveoli and capillaries	
Small size of alveoli	
Walls of alveoli and capillaries are 1 cell thick	
Film of moisture in alveoli	
Ventilation of air in the alveoli	
Blood flow in the capillaries	

5.4.2. Fick's Law (Extending Further)

Fick's Law describes ……

……

Fick's Law states that …

………

………

………

………

………

Write Fick's Law in the space below:

State the effect on rate of diffusion in the following three situations:

The surface area is doubled

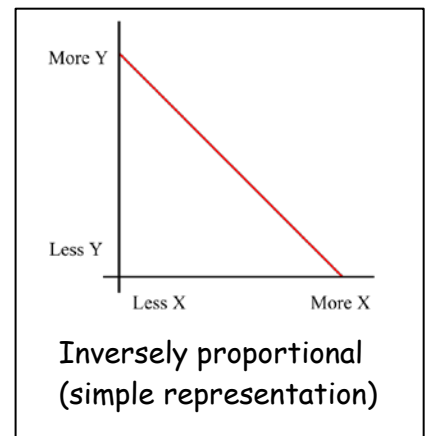……

The concentration difference is doubled

……

The thickness of the membrane is doubled

……

Well done! You have completed all of the GCSE review packs to help you prepare for the first part of the A-level Biology course!

Make sure that you bring all the completed packs with you when you come to College so that you can use them to help you!