OCR (A) Biology A-level

3.1.1 - Exchange surfaces

Flashcards

Why do multicellular organisms require specialised gas exchange surfaces?

Why do multicellular organisms require specialised gas exchange surfaces?

Their smaller surface area to volume ratio means the distance that needs to be crossed is larger and substances cannot easily enter the cells as in a single-celled organism.

How is surface area to volume ratio calculated?

How is surface area to volume ratio calculated?

$$\text{Ratio} = \frac{\text{Surface area}}{\text{Volume}}$$

Name three features of an efficient gas exchange surface.

Name three features of an efficient gas exchange surface.

1. Large surface area, e.g. root hair cells.
2. Thin/short distance, e.g. alveoli.
3. Steep concentration gradient, maintained by blood supply or ventilation, e.g. gills.

Describe the trachea and its function in the mammalian gaseous exchange system.

Describe the trachea and its function in the mammalian gaseous exchange system.

- Wide tube supported by C-shaped cartilage to keep the air passage open during pressure changes.
- Lined by ciliated epithelium cells which move mucus, produced by goblet cells, towards the throat to be swallowed, preventing lung infections.
- Carries air to the bronchi.

Describe the bronchi and their function in the mammalian gaseous exchange system.

Describe the bronchi and their function in the mammalian gaseous exchange system.

- Like the trachea they are supported by rings of cartilage and are lined by ciliated epithelium cells and goblet cells.
- However they are narrower and there are two of them, one for each lung.
- Allow passage of air into the bronchioles.

Describe the bronchioles and their function in the mammalian gaseous exchange system.

Describe the bronchioles and their function in the mammalian gaseous exchange system.

- Narrower than the bronchi.
- Do not need to be kept open by cartilage, therefore mostly have only smooth muscle and elastic fibres so that they can contract and relax easily during ventilation.
- Allow passage of air into the alveoli.

Describe the alveoli and their function in the mammalian gaseous exchange system.

Describe the alveoli and their function in the mammalian gaseous exchange system.

- Mini air sacs, lined with epithelium cells, site of gas exchange.
- Walls only one cell thick, covered with a network of capillaries, 300 million in each lung, all of which facilitates gas diffusion.

Explain the process of inspiration and the changes that occur throughout the thorax.

Explain the process of inspiration and the changes that occur throughout the thorax.

- External intercostal muscles contract (while internal relax), pulling the ribs up and out.
- Diaphragm contracts and flattens.
- Volume of the thorax increases.
- Air pressure outside the lungs is therefore higher than the air pressure inside, so air moves in to rebalance.

Explain the process of expiration and the changes that occur throughout the thorax.

Explain the process of expiration and the changes that occur throughout the thorax.

- External intercostal muscles relax (while internal contract), bringing the ribs down and in.
- Diaphragm relaxes and domes upwards.
- Volume of the thorax decreases.
- Air pressure inside the lungs is therefore higher than the air pressure outside, so air moves out to rebalance.

Explain how a spirometer works.

Explain how a spirometer works.

Used to measure **lung volume.** A person breathes into an airtight chamber which leaves a trace on a graph which shows the volume of the breaths.

Define vital capacity.

Define vital capacity.

The maximum volume of air that can be taken in or expelled from the lungs in one breath. Can be calculated from the spirometer graph by finding the maximum amplitude.

Define tidal volume.

Define tidal volume.

The volume of air we breathe in and out during each breath at rest. Can be calculated from the spirometer graph by finding the amplitude at rest.

Define breathing rate.

Define breathing rate.

The number of breaths we take per minute. Can be calculated from the spirometer graph by counting the number of peaks in one minute.

Name and describe the two main features of a fish's gas transport system.

Name and describe the two main features of a fish's gas transport system.

Gills = located within the body, supported by arches, along which are multiple projections of gill filaments, which are stacked up in piles.

Lamellae = at right angles to the gill filaments, give an increased surface area. Blood and water flow across them in opposite directions (countercurrent exchange system).

Explain the process of gas exchange in fish.

Explain the process of gas exchange in fish.

- Buccal cavity volume increased to enable water to flow in, reduced to increase pressure.
- Water is pumped over the lamellae by the operculum, oxygen diffuses into the bloodstream.
- Waste carbon dioxide diffuses into the water and flows back out of the gills.

How does the countercurrent exchange system maximise oxygen absorbed by the fish?

How does the countercurrent exchange system maximise oxygen absorbed by the fish?

Maintains a steep concentration gradient, as water is always next to blood of a lower oxygen concentration. Keeps rate of diffusion constant and enables 80% of available oxygen to be absorbed.

Name and describe the three main features of an insect's gas transport system.

Name and describe the three main features of an insect's gas transport system.

- Spiracles = holes on the body's surface which may be opened or closed by a valve for gas or water exchange.
- Tracheae = large tubes extending through all body tissues, supported by rings to prevent collapse.
- Tracheoles = smaller branches dividing off the tracheae.

Explain the process of gas exchange in insects.

Explain the process of gas exchange in insects.

- Gases move in and out of the tracheae through the spiracles.
- A diffusion gradient allows oxygen to diffuse into the body tissue while waste CO_2 diffuses out.
- Contraction of muscles in the tracheae allows mass movement of air in and out.