

Gas exchange

Why does gas exchange become harder as organisms increase in size?

Gas exchange

Four properties of a gas-exchange surface

Gas exchange

Three ways animals maintain concentration gradients at exchange surfaces

Gas exchange

Surfactant

Gas exchange

How does the branched network of bronchioles help gas exchange?

Gas exchange

Why are the alveoli covered in extensive capillary beds?

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Muscle actions during inspiration

Gas exchange

Muscle actions during forced expiration

Permeable, thin tissue layer, moist and large surface area.

Surface area-to-volume ratio decreases and the distance from the centre to the exterior increases.

Fluid lining the alveoli that reduces surface tension, so alveoli do not stick together and collapse when air is breathed out.

Dense networks of blood vessels, continuous blood flow, and ventilation with air (lungs) or water (gills).

Blood flows close to all of the surface, removing O_2 and bringing CO_2 to keep gradients steep.

It carries air to and from hundreds of millions of alveoli, giving a very large surface area.

Internal intercostals contract, ribs move down and in; abdominal muscles contract, pushing the diaphragm up. Thorax volume falls, pressure rises.

Diaphragm contracts and flattens; external intercostals contract, ribs move up and out; abdominal muscles relax. Thorax volume rises, pressure falls.

Gas exchange Vital capacity	Gas exchange Tidal volume
Gas exchange Role of the waxy cuticle and epidermis in gas exchange	Gas exchange Role of spongy mesophyll and air spaces
Gas exchange Plan diagram	Gas exchange Transpiration
Gas exchange Four factors that increase the rate of transpiration	Gas exchange How is stomatal density calculated?

The volume of air breathed in or out in one normal breath.

Tidal volume + inspiratory reserve volume + expiratory reserve volume: the most air that can be breathed out after the deepest breath in.

Air spaces let gases diffuse through the leaf; moist spongy mesophyll walls give a large surface for gas exchange.

Reduce water loss by evaporation; the transparent epidermis protects the leaf and lets light through.

Loss of water vapour from the leaves and stems of plants, a consequence of opening stomata for gas exchange.

A diagram showing the distribution of tissues as outlined areas, with no individual cells drawn.

Number of stomata in the field of view $\div$ area of the field of view (πr^2), usually in stomata per mm^2 .

Higher light intensity, higher temperature, lower humidity and higher wind speed.