

Edexcel Biology GCSE

Topics 8.1 to 8.5B - Exchange of materials

Flashcards

Why do large multicellular organisms
require specialised exchange surfaces?

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- Small SA/V ratio
- Diffusion insufficient to provide all cells with the required oxygen and nutrients, and to remove all waste products
- Exchange surfaces increase rate of diffusion and shorten diffusion distance

Why do some multicellular organisms
(e.g. trees) not require specialised
exchange surfaces?

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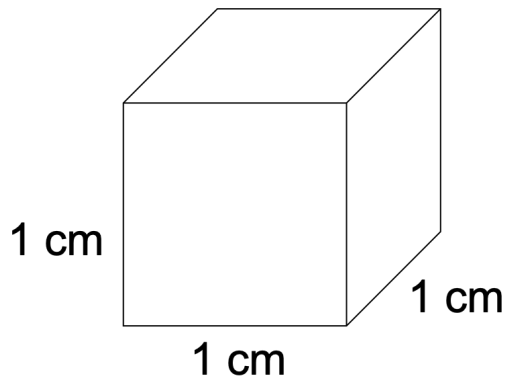
Trees have a large number of leaves which provide a large SA/V ratio for diffusion.

How does the size of an organism affect its surface area to volume ratio?

How does the size of an organism affect its surface area to volume ratio?

The larger the organism, the smaller the SA/V ratio.

Calculate the surface area to volume ratio of a cube that is $1 \times 1 \times 1$ cm



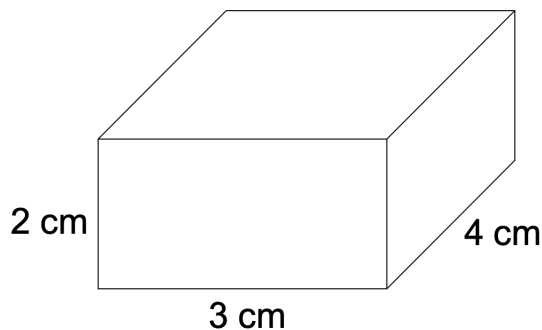
Calculate the surface area to volume ratio of a cube that is $1 \times 1 \times 1$ cm

$$\text{Surface area: } (1 \times 1) \times 6 = 6 \text{ cm}^2$$

$$\text{Volume: } 1 \times 1 \times 1 = 1 \text{ cm}^3$$

$$\text{Surface area : Volume} = \mathbf{6:1}$$

Calculate the surface area to volume ratio of a cuboid that is $2 \times 3 \times 4$ cm



Calculate the surface area to volume ratio of a cube that is $2 \times 3 \times 4$ cm

Surface area:

$$2(2 \times 3) + 2(2 \times 4) + 2(4 \times 3) = 52 \text{ cm}^2$$

$$\text{Volume: } 2 \times 3 \times 4 = 24 \text{ cm}^3$$

$$\text{Surface area : Volume} = 52:24 = \mathbf{13:6}$$

Name some of the substances
transported into and out of the human
body

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- Oxygen
- Carbon dioxide
- Water
- Dissolved food molecules
- Urea

How does oxygen enter and carbon dioxide leave cells?

How does oxygen enter and carbon dioxide leave cells?

They diffuse into and out of cells.

How does water enter cells?

How does water enter cells?

It diffuses into cells by osmosis.

How do food molecules and mineral ions enter cells?

How do food molecules and mineral ions enter cells?

They are dissolved in water which diffuses into cells.

Why must urea be excreted from the body?

Why must urea be excreted from the body?

It is a waste product so must be excreted.

How is urea excreted from the body?

How is urea excreted from the body?

- Urea diffuses out of cells into the blood plasma
- The kidney filters urea out of the blood
- Urea is excreted in urine

Why must the human body exchange oxygen and carbon dioxide with the environment?

Why must the human body exchange oxygen and carbon dioxide with the environment?

- Oxygen is required for respiration so diffuses into the body
- Carbon dioxide is a toxic waste product of respiration so diffuses out of the body

How does oxygen enter and carbon dioxide leave the bloodstream?

How does oxygen enter and carbon dioxide leave the bloodstream?

- Oxygen diffuses from air in the alveoli (high O_2 conc) into blood in the capillaries (low O_2 conc)
- Carbon dioxide diffuses from blood in the capillaries (high CO_2 conc) into air in the alveoli (low CO_2 conc)

How are alveoli adapted for gaseous exchange? (6)

How are alveoli adapted for gaseous exchange? (6)

- Large surface area
- Network of capillaries provide a good blood supply
- Rapid blood flow maintains a steep concentration gradient
- Thin walls give a short diffusion distance
- Cell walls have partially permeable membranes enabling diffusion
- Moist lining, enables gases to dissolve

What factors affect the rate of diffusion?
(3) (biology only)

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(biology only)

- Diffusion distance
- Concentration gradient
- Surface area

How does diffusion distance affect the
rate of diffusion? (biology only)

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The greater the diffusion distance, the further the molecules must travel and the slower the rate of diffusion.

How does concentration gradient affect
the rate of diffusion? (biology only)

How does concentration gradient affect the rate of diffusion? (biology only)

The steeper the concentration gradient, the faster the rate of diffusion.

How does surface area affect the rate of diffusion? (biology only)

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The larger the surface area, the greater the number of molecules that can diffuse across in a given time, so the faster the rate of diffusion.

How can the rate of diffusion be
calculated? (biology only)

How can the rate of diffusion be calculated? (biology only)

Using Fick's law:

$$\text{rate of diffusion} \propto \frac{\text{surface area} \times \text{concentration gradient}}{\text{thickness of membrane}}$$