# Diffusion

Answer the questions below:

1. Describe the process of gas exchange in the lungs.
   Oxygen enters the lungs and diffuses into the alveoli. Carbon dioxide diffuses out of the alveoli.

2. Describe the movement of particles in liquids and gases.
   Particles in a liquid can move past each other whereas particles in a gas can move freely. Particles in both move randomly in all directions.

3. Explain why a stain is added to a specimen on a microscope slide.
   To allow the structures to be seen more easily.

4. Calculate the volume of this cube (side 2 cm).

   Volume = length x width x height
   = 2 cm x 2 cm x 2 cm
   = 8 cm^3

   2 cm
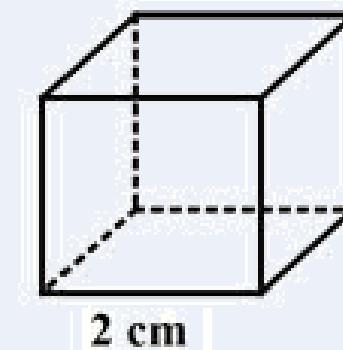
5. Calculate the surface area of the same cube.
   Surface area = length x width x number of faces
   = 2 cm x 2 cm x 6
   = 24 cm^2
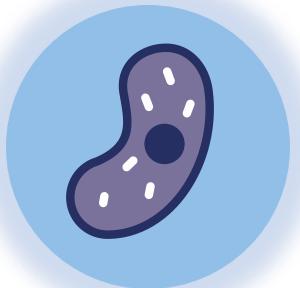
Diffusion

B3.1.7

Science
Mastery
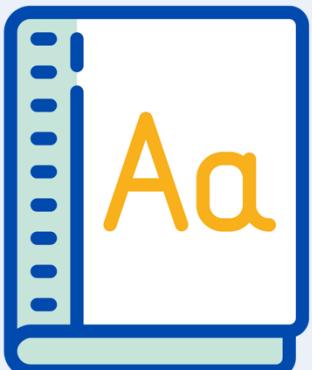
Following this lesson, students will be able to:

- Define diffusion

- Describe what is meant by concentration gradient

- Explain why surface area to volume ratio decreases with size

Key Words:

| diffusion	concentration	gradient
permeable	surface area to volume ratio	

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.

Fix-it

Exit ticket

Exit ticket

1. Which statement is correct?
   - ☐ Light microscopes are able to show cell organelles in great detail
   - ☑ Light microscopes are useful for looking at relative sizes of cells
   - ☐ Light microscopes are useful for discovering new cell structures
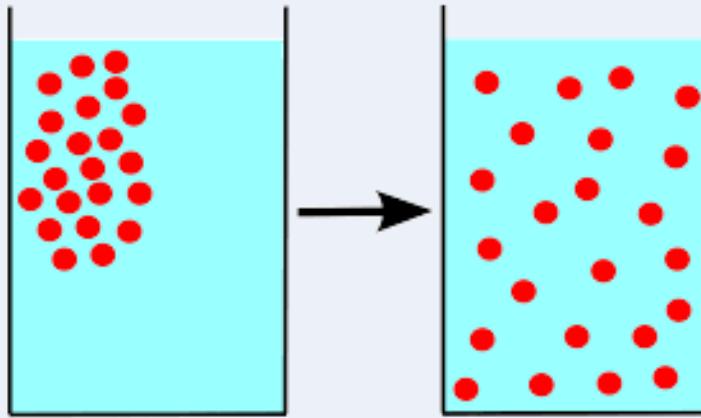
2. Which is a precaution for looking at slides under a light microscope?
   - ☐ Ensure that there is no stain on the slide so it does not obstruct the sample
   - ☐ Ensure that the cover slip is carried and applied from the middle
   - ☑ Ensure that the sample of cells is a very thin layer

3. Which states the correct functions of the focusing wheels?
   - ☐ The fine focusing wheel is used to get the cells into the frame and the coarse focusing wheel is used to focus closely
   - ☐ The coarse focusing wheel is used to get the slide into the right position and the fine focusing wheel is used to get the cells into the frame
   - ☑ The coarse focusing wheel is used to get the cells into the frame and the fine focusing wheel is used to sharpen the image

Diffusion

Diffusion is the **spreading out of particles**, of liquid or gas, resulting in **net movement** from an area of **high<u>er</u> concentration** to **low<u>er</u> concentration**

Diffusion can occur through a **selectively permeable membrane**, such as a cell membrane

During gas exchange, oxygen and carbon dioxide diffuse between the alveoli and the blood

Urea (a waste product made by cells) diffuses from the cells into the blood so it can then travel to the kidneys and excreted from the body.

# Diffusion

The **rate of diffusion** can be increased by:

- An increase in **temperature**

- An increase in the **concentration gradient** (the difference between the high and low concentration

- An increase in **surface area**

Surface area to volume ratio
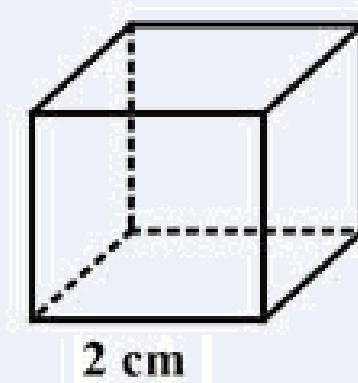
Surface area to volume ratio can be calculated by dividing the surface area by the volume of a cell, an organ or organism

E.g. for this cube we have already calculated surface area to be 24 cm^2 and volume to be 8 cm^3.

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

$= \dfrac{24 \text{ cm}^2}{8 \text{ cm}^3}$

$= 3$

2 cm

Quick Quiz
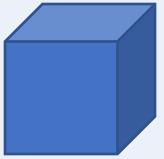
Determine whether each statement is true or false:

1. Diffusion is the spreading out of solid, liquid and gas particles from an area of higher concentration to an area of lower concentration.**False**

2. Rate of diffusion can be increased by increasing the temperature.**True**

3. Surface area to volume ratio is calculated by dividing the volume by the surface area. **False**

4. During the process of gas exchange oxygen diffuses into the bloodstream and carbon dioxide diffuses in to the bloodstream.**False**

5. Diffusion can take place through a semi-permeable membrane. **True**

6. Diffusion enables urea to be transported out of cells and into the **True** blood for excretion from the body.

Is this correct?

The larger the surface area to volume ratio, the larger the object
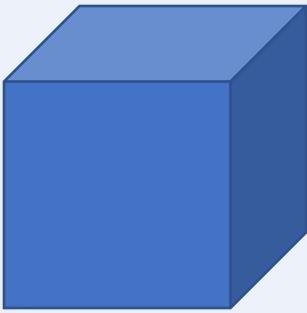
Answer

1 cm
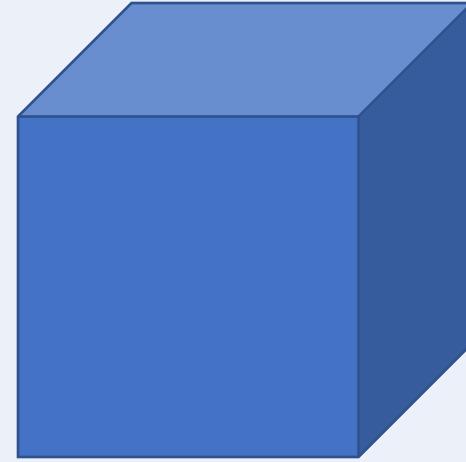
SA = 6 cm^2
Vol = 1 cm^3

SA:Vol = 6

2 cm

SA = 24 cm^2
Vol = 8 cm^3

SA:Vol = 3

3 cm
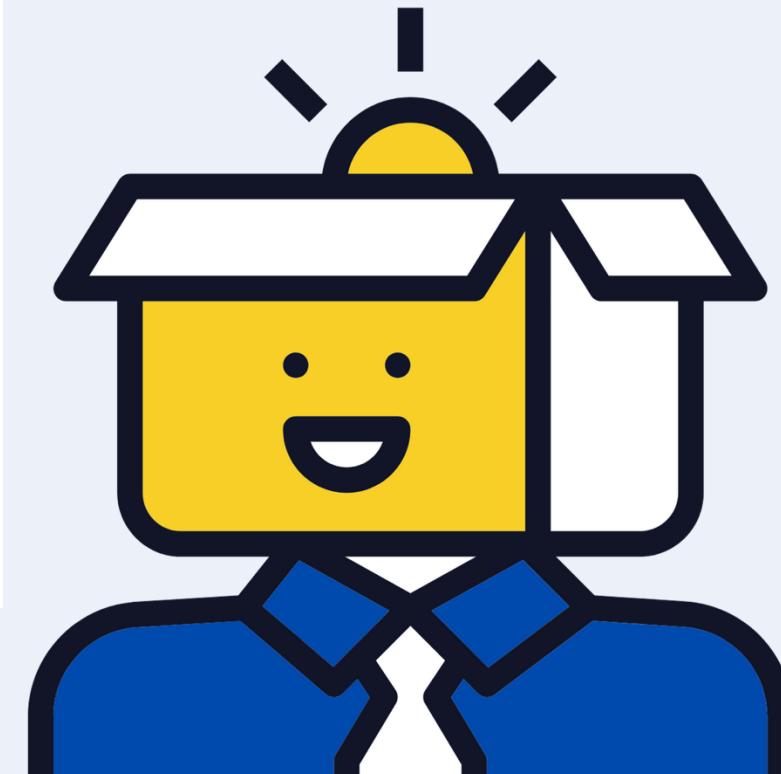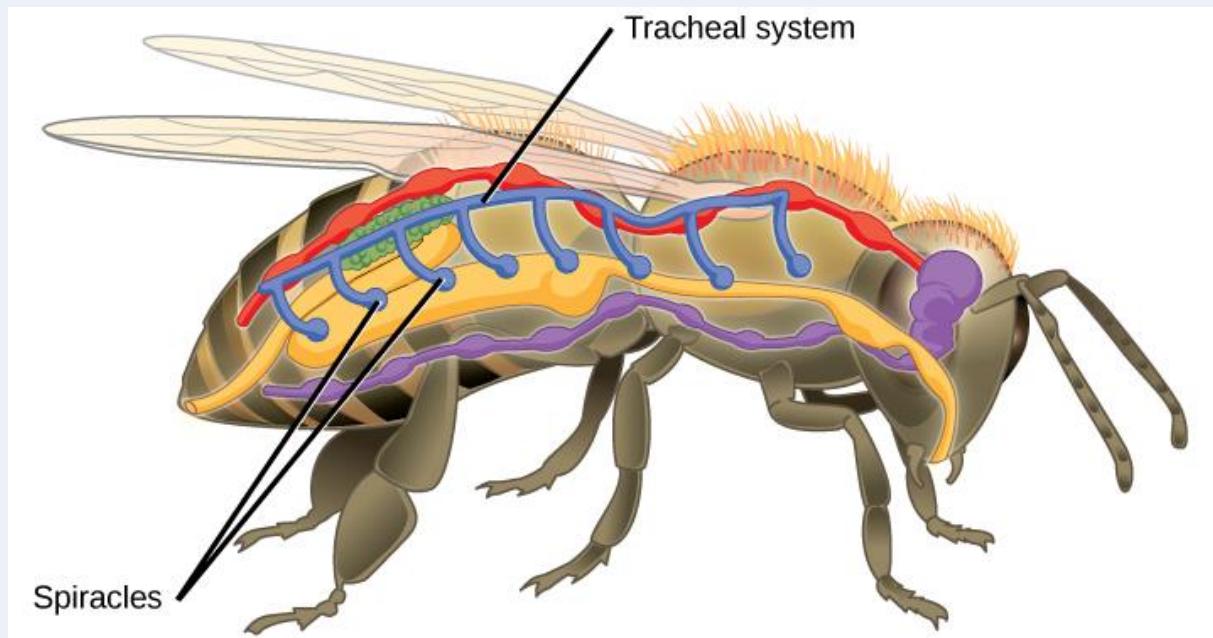
SA = 54 cm^2
Vol = 27 cm^3

SA:Vol = 2

Think outside the box!

How do you think the structure of an insect is adapted for gas exchange?
HINT – the structures labelled below are involved in gas exchange

Tracheal system

Spiracles

Drill

1. Define diffusion
2. Name the two gases which diffuse between the blood and alveoli during gas exchange in the lungs
3. State three factors which can affect the rate of diffusion
4. Write the equation used to calculate surface area to volume ratio
5. Explain how increasing the temperature increases the rate of diffusion
6. Each side of a cube is 2cm long. Calculate:
   a) The area of one face of the cube
   b) The total surface area of the cube
   c) The volume of the cube
   d) The surface area to volume ratio of the cube

Drill answers

1. Diffusion is the spreading out of particles, of liquid or gas, resulting in net movement from an area of higher concentration to lower concentration
2. Oxygen and carbon dioxide
3. Temperature, concentration gradient, surface area.
4. Ratio = <u>Surface area</u>
                     Volume
5. Particles gain more kinetic energy, so the particles move more and therefore spread out more quickly.
6.   a) $4cm^2$
      b) $24cm^2$
      c) $8cm^3$
      d) 3:1

I: Describe the effect of a variable

Example question:

Describe and explain the effect of increasing temperature on the rate of diffusion.

Model answer:
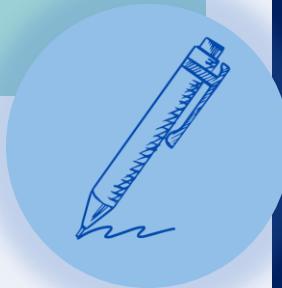
- Increasing the temperature **increases** the rate of diffusion

- This is because a higher temperature means the particles have more **kinetic energy**, <u>so</u> they move around more and **spread out more** quickly

To 'describe', your answer should:
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.

To 'explain' your answer should:
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.

We: Describe the effect of a variable

Example question:

Describe and explain the effect of increasing the surface area of an object on the rate of diffusion.

Model answer:

- Increasing the surface area **increases** the rate of diffusion

- This is <u>because</u> there is more surface available for diffusion to take place across

To 'describe', your answer should:
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.

To 'explain' your answer should:
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.

You: Describe the effect of a variable

Example question:

Describe and explain the effect of increasing the concentration gradient on the rate of diffusion

Model answer:
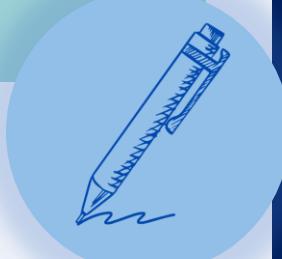
- Increasing the concentration **increases** the rate of diffusion

- This is <u>because</u> there is a larger difference in concentration

To 'describe', your answer should:
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.

To 'explain' your answer should:
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.

Writing like a scientist

Answer the questions below.

1. Which is the best definition for diffusion?
☑ A. Spreading out of liquid or gas particles resulting in net movement from higher concentration to lower concentration.
❑ B. Spreading out of particles resulting in net movement from a lower concentration to higher concentration.
❑ C. Bits of liquid or gas moving around to make the concentration the same everywhere

2. Which of these changes would not increase the rate of diffusion?
❑ A. Increasing temperature
❑ B. Increasing surface area
☑ C. Decreasing concentration gradient

3. Which of these correctly states a stage in the process of gas exchange?
☑ A. Oxygen diffuses from the alveoli into the bloodstream.
❑ B. Carbon dioxide diffuses from the alveoli into the bloodstream.
❑ C. Urea diffuses from the bloodstream into cells.

Lesson B3.1.7	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!