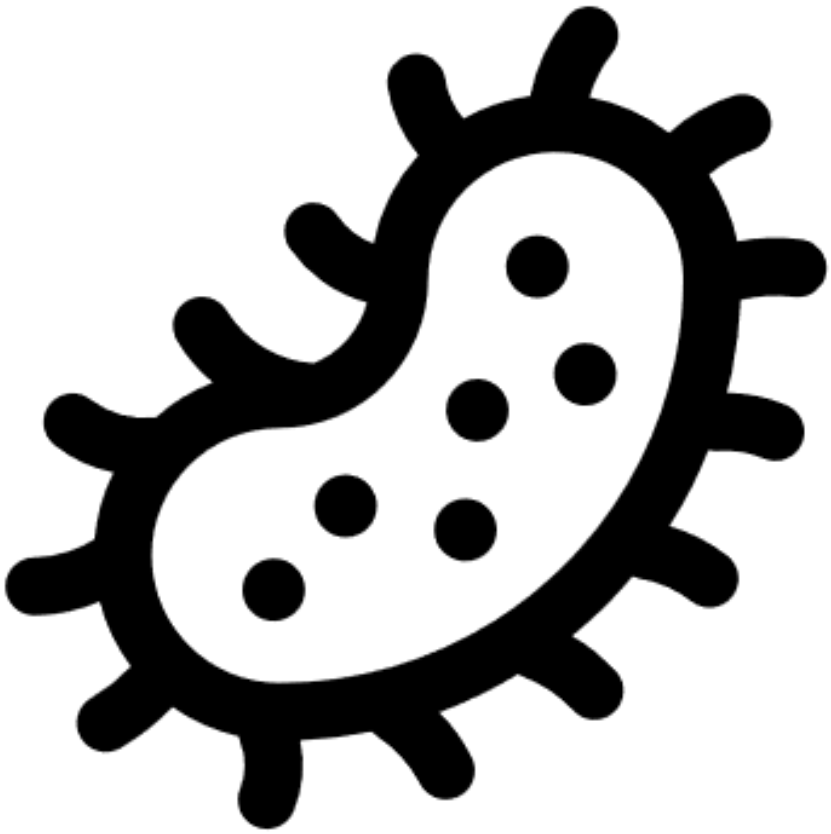
Cell



Biology

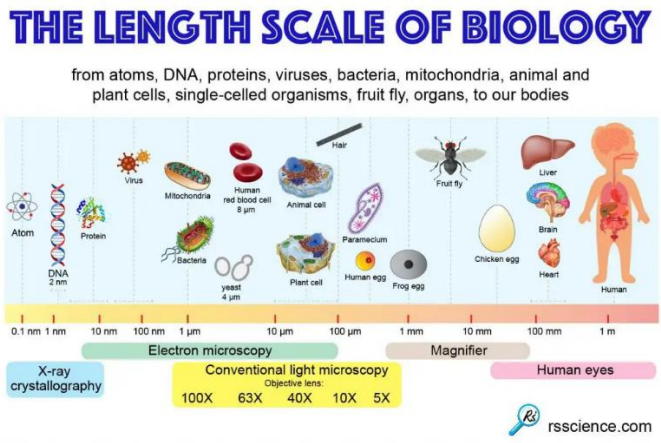
Name _____

Class _____

Teacher _____

Microscopes and Scale of cells

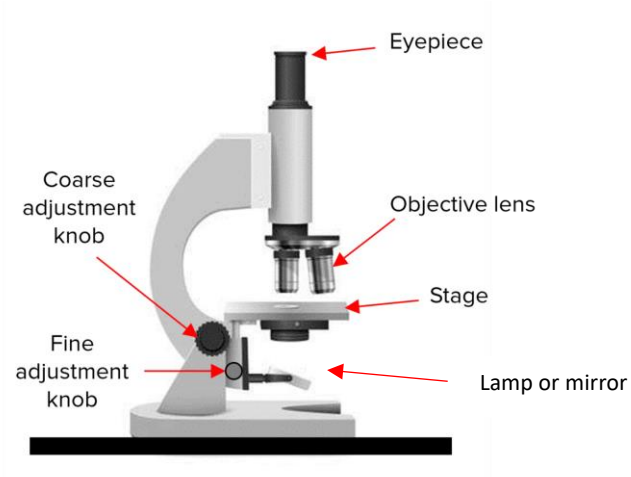
If you look at your skin with your naked eye you might see tiny wrinkles, hairs, and tiny sweat pores. Your eye has a limit to the size of object it can see. If it was able to look at smaller objects, your eye would be able to see that your skin was made up of tiny parts called cells. Cells are the basic building blocks of all animals and plants. They are so small; you need to use a light microscope to see them. The average human cell size is 0.003cm in diameter.



A light microscope uses a series of lenses to produce a magnified image of an object:

- the object is placed on a rectangular glass slide.
- the slide is placed on a stage with a light source below.
- light shines through the object and into the objective lens.
- the light passes through the eyepiece lens and from there into your eye.
- Use the coarse and fine focus to focus the image in view.

Microscopes have three objective lenses. Always start observing an object using the lowest magnification lens first. You may need to adjust the focus and the amount of light as you move to higher magnifications. While a light microscope uses light to illuminate specimens and glass lenses to magnify images, an electron microscope uses a beam of electrons to illuminate specimens and magnetic lenses to magnify images. The resolution (the level of image detailing) is the main difference between these two microscopes.



Independent Practice Questions

1. What are the basic building blocks of all animals, plants, and bacteria?
2. Why can't you see these with the naked eye?
3. What do you need to see these cells?
4. What does a light microscope use to produce a magnified image?
5. List all the parts in a light microscope.
6. Describe what each part looks like.
7. Explain what each part does.
8. Describe how to use a light microscope to see tiny objects.
9. What would we need to use to see an object which is 10nm in diameter.
10. Why would we need to use this?
11. What is resolution?
12. A student puts a whole blueberry on a microscope slide, why wont they be able to see the cells in the blueberry?
13. A student forgets to turn the light on the microscope. Explain why they won't see anything.
14. A student moves from a low powered objective lens to a high-powered objective lens. What might they need to do?
15. A student puts a sample on a slide, puts the slide on the lamp, chooses the highest objective lens, and looks through the objective lens to see the cells. What have they done wrong?

Magnification

Imagine we have two Lego bricks. One is 1cm in length and one is 2cm in length. We would say that the second Lego brick is two times bigger or x2 in size.

The idea is the same for images which have been produced by lenses. Lenses can be used to make an image of an object which is bigger than the actual object. If the image is twice the size of the actual object, we would say that the **magnification** is x2. Just like when we compare the Lego bricks!

So, **magnification** is the number of times bigger an image is than the actual size of an object. We can calculate magnification using the Equation below:

Magnification Equation: ***Image Size = Actual Size x Magnification***

Image Size: The size of the object with the magnification, this can be found by measure the object under the microscope.

Actual Size: The size of the object, in real life, without magnification. This can be calculated for I you know the magnification and image size.

Here's an example:

Example 1: Magnification

*Question: Calculate the magnification of an object that is actually **0.01mm** long but looks **10mm** long in the image.*

Steps	**What it looks like in your book**
Step 1: write out the values. These are the numbers in your question.	V: 0.01mm = actual 10mm = image
Step 2: write out the equation. This is the equation above	E: ***Image Size = Actual Size x Magnification***
Step 3: Substitute the values into your equation	S: Image size = 0.01mm x 10mm
Step 4: Re-arrange if needed	R: There is no need
Step 5: Answer – put the sum into a calculator	A: 0.001
Step 6: write the units.	U: X

Independent practice

1. If a fish is 50cm in length and another fish is 100cm in length how many times longer is the second fish?
2. If an image of a fly is 10cm and the fly is 10cm how many times bigger is the image than the fly?
3. What is magnification?
4. How do you calculate it?

Calculation practice

Basic

5. Calculate the magnification when:

a. Actual = 10cm Image = 1 cm
b. Actual = 20cm Image = 5 cm
c. Actual = 5 cm Image = 2.5 cm
d. Actual = 0.1cm Image = 1 cm
e. Actual = 0.5cm Image = 2cm
f. Actual = 0.01cm Image = 10cm

Medium

6. Calculate the magnification when

a. Actual = 5mm Image = 1 cm
b. Actual = 30mm Image = 5 cm
c. Actual = 10 cm Image = 25mm cm
d. Actual = 1mm Image = 2.5 cm
e. Actual = 10 Image = 2cm
f. Actual = 0.01cm Image = 10cm

Top tips
1mm = 10cm
To convert mm to cm divide by 10

Hard

7.

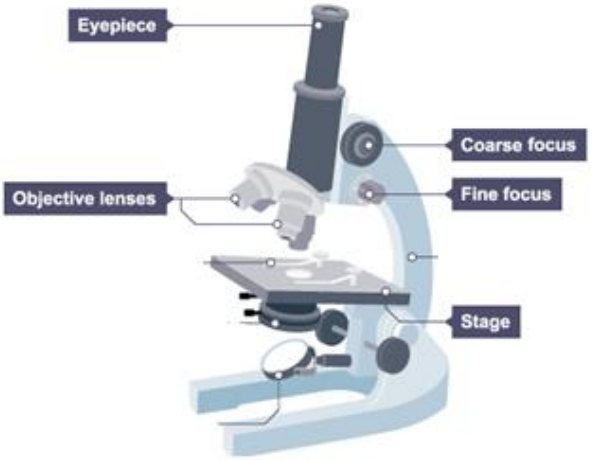
a) A cell measures 112mm. The actual size is 0.28mm. Calculate the magnification.
b) A cell measures 230mm. The actual size is 0.12mm. Calculate the magnification.
c) A cell measures 345mm. The actual size is 0.65mm. Calculate the magnification.
d) If an object has an actual size of 5mm long but you magnify it by 100x, what will the image size be?
e) A cell has a magnification of 400x. The actual size is 1.85mm. Calculate the image size.
f) A cell has a magnification of 200x. The actual size is 0.34mm. Calculate the image size.
g) A cell has a magnification of 100x. The actual size is 0.24mm. Calculate the image size.
h) A cell is magnified x2000 and measures 6mm. Calculate the actual size in mm.
i) A cell is magnified x1000 and measures 4mm. Calculate the actual size in mm.
j) A cell is magnified x6000 and measures 7mm. Calculate the actual size in mm.
k) Some students measured the size of a cheek cell on a scaled diagram. It was 78 mm long. The magnification used was 400X. Calculate the actual size of the cell. Give the unit.
l) The picture below shows an image of a euglena at 150x magnification. Calculate the actual size of the Euglena. Give the unit.

SAPF

Microscope

A student wants to view a sample under the microscope. The sample is prepared for them.

Write a step-by-step method on how the pupil would use the microscope to see a clear image of the sample.



Method (6 marks)

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

Tick	Where I went wrong	Next steps to success
	Write in common misconceptions pupils have with the question here	*Write in questions which the pupil can answer to improve their answer*
	I did not state which objective lens to start with.	Explain why the lowest objective lens is used first.
	I did not refer to the coarse focusing wheel.	State the function of the coarse focus wheel.
	I did not refer to the fine focusing wheel.	State the function of the fine focus wheel.
	I did not mention changing objective lens.	What does changing the objective lens do?
	I did not mention adjusting the focus after changing the objective lens.	Explain why the stage needs to be moved slowly.
Make it Right:		
Complete neatly in your book in RED pen. Answer in full sentences.		

Life processes

What makes something alive? Is a seed alive? Is a plant alive? Biologists group things which are alive by looking at whether they do all of the 7 life processes; Movement, respiration, sensitivity, growth, reproduction, excretion and nutrition. We remember this by using the first letters from each word: MRSGREN.

Life Processes		
M	Movement	All living things move, even plants
R	Respiration	Getting energy from food
S	Sensitivity	Detecting changes in the surroundings
G	Growth	All living things grow
R	Reproduction	Making more living things of the same type
E	Excretion	Getting rid of waste
N	Nutrition	Taking in and using food

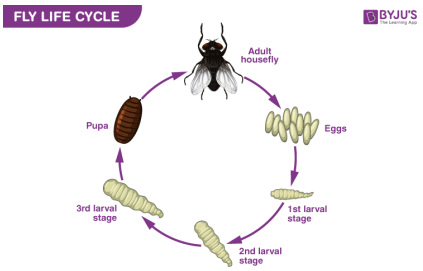
Life cycles

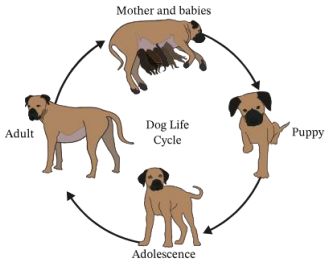
A life cycle is the different stages of life for a living thing. All animals, including humans, have a life cycle as all animals are born, grow, reproduce, and die.

In science, it's usually displayed as a circular diagram showing each stage in words and/or pictures. A life cycle is presented as a circle to show that seeds/offspring are created as part of the cycle.

Independent practice

1. How do scientists group things which are alive?
2. Describe each of the seven life processes?
3. Is a cactus plant alive. Explain your answer.
4. A student says a seed is not alive. Evaluate the student's comment.
5. Describe the life cycle of a chicken.





6. The diagrams above show the life cycle of a dog and a fly. Compare the life cycle of a dog to a fly.
7. Complete the following sentences:
   a. A housefly is living thing because…
   b. A housefly is a living thing so….
   c. A housefly in a living thing but…..

What's inside cells?

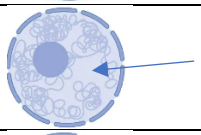
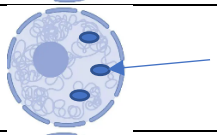
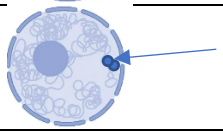
All life on Earth is made from cells. Without cells, there can be no life. Almost all cells are so small that you need a microscope to see them. You are made up of billions of tiny cells working together. All cells have a specific purpose which help organisms to survive. They need food and oxygen to grow and maintain themselves. They produce waste products like carbon dioxide which they need to remove from inside them.

Some organisms are made up of lots of cells working together. We call these multicellular organisms, and some organisms are made up of only one cell on its own. We call these unicellular organisms. Examples of multicellular organisms are animals and plants. Examples of unicellular organisms are bacteria and amoebae.

Inside these cells there are individual parts called organelles. Each organelle has a different function (job).

<u>What does each organelle do?</u>

The table below shows what each common organelles in all types of cells do.

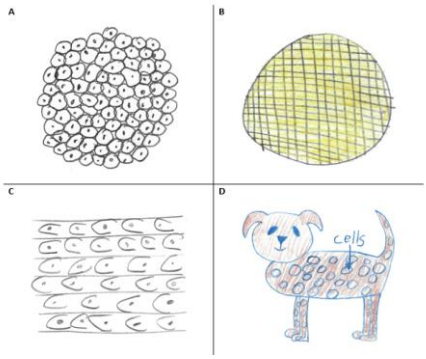
Organelle name	Function (job)	Common Picture used by scientists
Nucleus/genetic material	Carries instructions to make proteins	
Cell membrane	Allows the movement of substances in and out of the cell	
Cytoplasm	Liquid which fills the cell where chemical reactions happen	
Mitochondria	Release energy when the cell needs it	
Ribosomes	Make proteins to help the cells repair and function	

Independent practice

1. What do organisms need to survive?
2. How are organisms grouped by number of cells?
3. What is an organelle?
4. What are the key organelles/structures found in all types of cells?
5. What is the function of the cell membrane?
6. What is the function genetic material or nucleus?
7. What is the function of the cytoplasm?
8. What is the function of the ribosomes?

9. Compare how scientists draw cells to how cells look?
10. A student puts some animals cells on a slide, on the stage of a microscope and looks down the eyepiece. They can see some blurry blobs. What part of the microscope do they use to focus the image?
11. The student focusses the image and sees that there are tiny spots inside they cell and thinks they might be mitochondria. They need to increase the magnification. What do they do?
12. Imagine there's an alien visiting Earth.
    The alien is very hungry.
    The alien can only eat organisms made from **a single cell**.

    Which of these can the alien eat, explain why the alien can or cannot eat each thing:
    a) Cows,
    b) Humans,
    c) Bacteria,
    d) Cactus,
    e) Amoeba's
13. Some children were asked to draw what they think cells look like.



a. Which is the best drawing of animal cells?
b. Why do you think it's the best?
c. What is wrong with the other three drawings?

Comparing Cells

Animals and plants are made of cells. Animals and plants are made up of lots of cells working together; they are multicellular. When we compare animal and plants cells they have got lots of organelles in common but some organelles which are different.

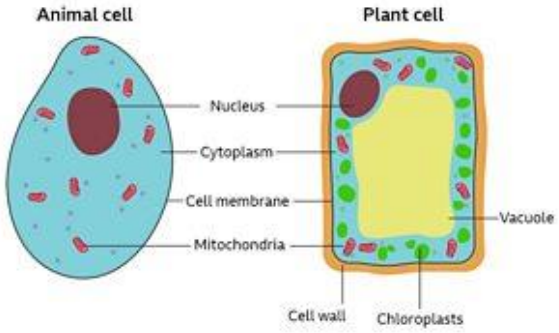
Animal cells usually have an irregular shape. This is because animal cells do not have a cell wall. Animal cells contain cell membrane, cytoplasm, nucleus, ribosomes, and mitochondria.

Like all living things, plants are made up of cells. Plant cells have a very regular shape because they, unlike animal cells have a cell wall which provides structure and support. Plant cells are made up of smaller parts called organelles.

Plant cells also have vacuoles which are filled with water. The vacuole helps the plant cell stay full and shaped; we call this turgid.

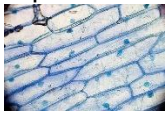
The chloroplast is a very special organelle, it is filled with a pigment (a coloured substance) called chlorophyl. Chlorophyl is green. The chlorophyl, along with other parts of the chloroplast take water and carbon dioxide and produce a substance called glucose. This is a chemical reaction called photosynthesis. The glucose gives living things energy.

Finally, the plant cell has a thick wall on the outside of the cell membrane. The cell wall provides strength to cells shape. It is made of a very durable chemical called cellulose.



<u>Independent practice</u>

1. Which organelle in the plant provides structure to the cell.
2. Which organelles are only present in plant cells?
3. What is the function of the nucleus?
4. What do we mean by the word pigment?
5. What is the pigment in chloroplasts?
6. What is the chemical reaction which happens in a chloroplast called?
7. Explain what the chloroplast does?



8. The image above shows onion cells. The actual size of an onion cell is 0.25mm. calculate the magnification of the image above. Clue: you need a ruler
9. Explain why plant cells have a rigid regular structure.
10. Compare an animal cell to plant cells.
11. Which person is most correct? Explain why the others are wrong.

Jim: Plant cells are completely different to animal cells.

Neena: Plant cells are like animal cells but have a few extra organelles.

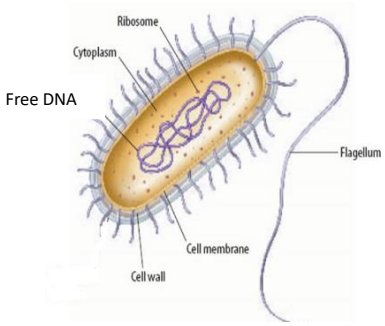
Haim: Plant cells are pretty much the same as animal cells.

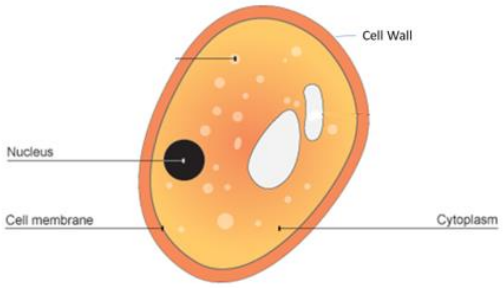
Unicellular organisms

A unicellular organism is a living thing that is just one cell. One type of unicellular organism that you may have heard of is bacteria. You may know bacteria as something that cause illness and infection, but bacteria can also have lots of useful functions too. For example, some bacteria lives in your gut and can help you to absorb important nutrients from your food. There are many different types of unicellular organism, including: bacteria, protozoa, and unicellular fungi.

You might be tempted to think that these organisms are very simple, but in fact they can be very complex. They have adaptations that make them very well suited for life in their environment.

a) **Bacteria** (left picture) are very tiny, unicellular organisms. The structure of a bacterial cell is different to an animal or plant cell. For example, it does not have a nucleus.
b) **Yeast Cells** (right picture) are a unicellular fungi organism. Yeast have a cell wall, like plants do but do not have chloroplasts.





Functions of Cell Parts

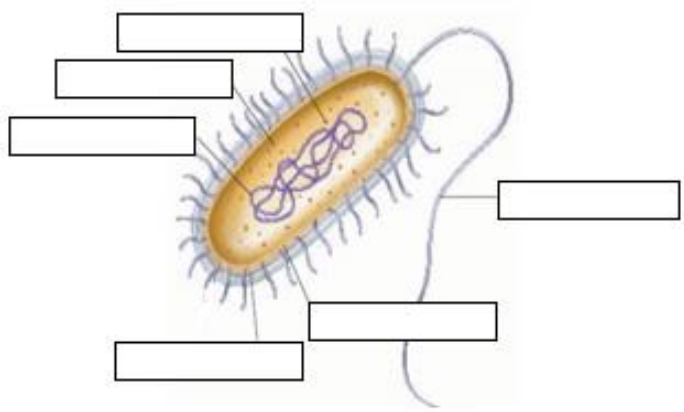
Free DNA	Controls the cells features
Flagellum	A tail like structure which allows the bacteria to move
Cell Membrane	Allows nutrients in (nutrition) and waste products out (excretion)
Ribosome	Makes protein to support growth
Cytoplasm	Where many reactions take place

Classifying Organisms:

Biologists put things into groups to make it easier to understand them. This is called classification. We can put organisms broadly into 2 different groups. To do this we must look at the cells which they have. Some organisms have their genetic information stored in a nucleus in their cells. We call these Eukaryotes. A yeast cell is an example of a eukaryote. Some organisms have their genetic information as free DNA or chromosomes. We call these Prokaryotes. A bacterium is an example of a prokaryote.

Independent practice

1. State 4 features of a bacterial cell.
2. State the features you find in a yeast cells.
3. Name one organelle that a bacteria cell does not have that a plant and animal cell do have.
4. What is the function of the flagellum?
5. What is the function of the cell membrane?
6. Label the cell below:



7. Name one organelle that is in both a yeast cell and a plant cell.
8. What is the function of a ribosome?
9. State the three types of unicellular organisms.
10. What are the two major groups of scientists can classify organisms into depending on their cells?
11. How do we know that a bacterium is prokaryotic?
12. Finish the sentences:
    a) A yeast cell is a eukaryotic organism because…
    b) A yeast cell is a eukaryotic organism but….
    c) A yeast cell is a eukaryotic organism and….

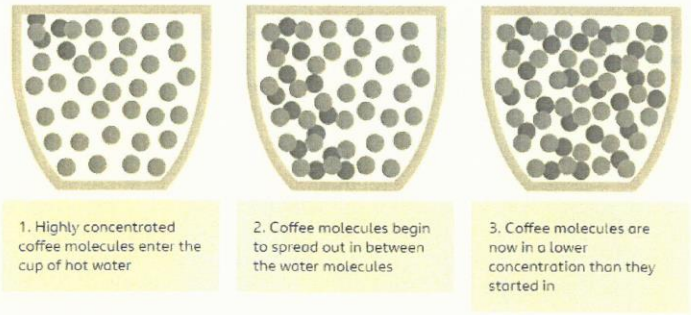
Getting substances in and out of cells

All cells need oxygen and glucose to make energy to keep them alive and perform their functions. They also need water to keep them functioning as well. These substances must be transported into the cells. Cells also produce waste substances like carbon dioxide and a chemical call urea. These substances must be transported out of the cell. The cell does not have arms to collect the substances it needs, and it does not have a mouth to put them in. Neither does it have a hole in it through which waste materials come out of. The cell uses a very important process to get substances into it and waste substances out of it. This process is called diffusion.

Diffusion is the overall movement of any substance from an area of higher concentration (where there are lots of particles of the substance) to an area of lower concentration (where there are less particles of the substance). This can be within a cell or between them. Diffusion only happens in liquids and gases because their particles move randomly from place to place. It is an important process for living things; it is how substances move in and out of cells. It happens naturally and so does not require energy.

The particles collide with each other or with their container. This makes them change direction. Eventually, the particles are spread through the whole container. Diffusion happens on its own, without stirring, shaking, or wafting.

Because diffusion is the movement of particles from a higher to lower concentration, we call this down the concentration gradient.

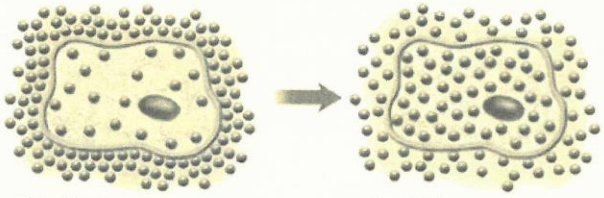


1. Highly concentrated coffee molecules enter the cup of hot water

2. Coffee molecules begin to spread out in between the water molecules

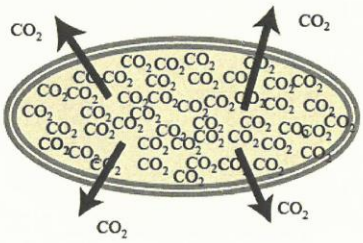
3. Coffee molecules are now in a lower concentration than they started in

In cells diffusion carries oxygen into cells because there is a lower concentration of oxygen inside the cells than outside it. The process stops when the concentration is equal inside and outside of the cells. Diffusion carries carbon dioxide out of the cells because there is more carbon dioxide inside the cells than outside of the cells. If the cell has less water, then water will diffuse into the cell and if the cell has more water then water will diffuse out of the cell.



Before Diffusion
There is a higher concentration of oxygen molecules outside the cell than inside the cell

After Diffusion
The concentration of oxygen molecules is the same outside and inside the cell



Independent practice

1. What substances must be transported into the cells?
2. What substances must be released from cells?
3. What is the process which cells use to transport most of the substances inside and out of them?
4. What do we mean by high concentration?
5. What do we mean by low concentration?
6. What is diffusion?
7. What types of substances can diffusion happen in?
8. How much energy is required for diffusion?
9. What do we mean by the phrase "down the concentration gradient"?
10. What do cells take in through diffusion?
11. What do cells give out through diffusion?
12. A teacher places a drop of concentrated blackcurrant juice in a beaker of water.
    a. Describe what you would see.
    b. Explain why this happens.
13. A cell produces a waste substance called urea, urea is soluble (can dissolve) and must be transported out of the cell before it becomes toxic to the cell. Describe and explain how the substance is transported.
14. If you open a window the amount of carbon dioxide in a room will reduce, explain why this happens.
15. Read the following statement by a student:
    Red blood cells carry oxygen. Oxygen diffuses from the bodies muscles where there is lots of it into the red blood cells. When the red blood cells get to the lungs the oxygen diffuses into the lungs where there is less of it and is breathed out.
    a. What mistakes has the student made?
    b. Re-draft a correct statement?