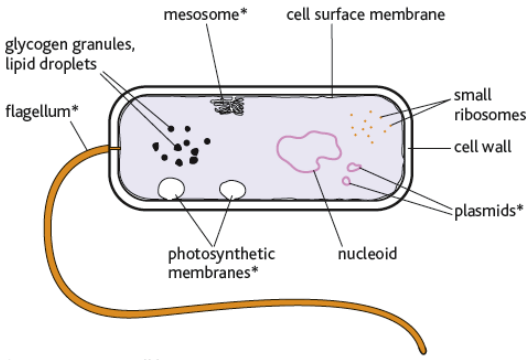
Summary sheet 1: Cell structure

Prokaryotes are single celled organisms, including bacteria. They are simpler and smaller than Eukaryotic cells.

Bacterial cells have:

- no nucleus with circular DNA free in the cytoplasm
- cell wall made from peptidoglycan
- no membrane-bound organelles
- small ribosomes.

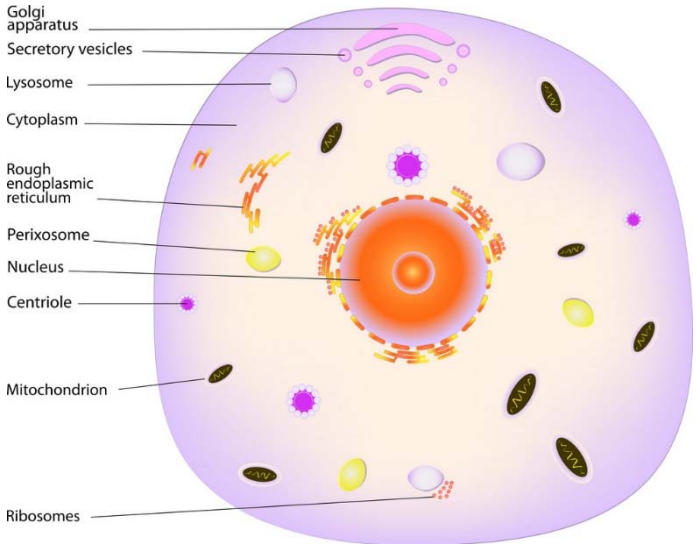


* = not present in all bacteria

Eukaryotic cells include animal and plant cells. They are larger and more complex than prokaryotic cells.

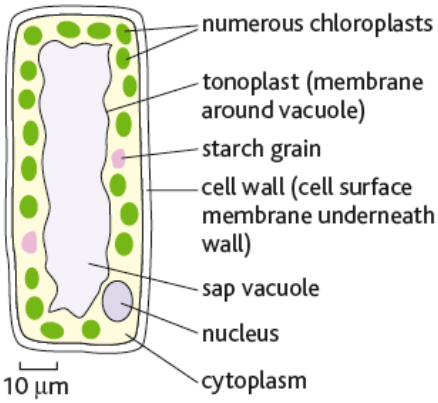
Animal cells have:

- linear DNA contained inside a nucleus
- no cell wall
- larger ribosomes and many membrane-bound organelles including mitochondria where aerobic respiration occurs and endoplasmic reticulum and golgi which are involved in the processing of proteins.

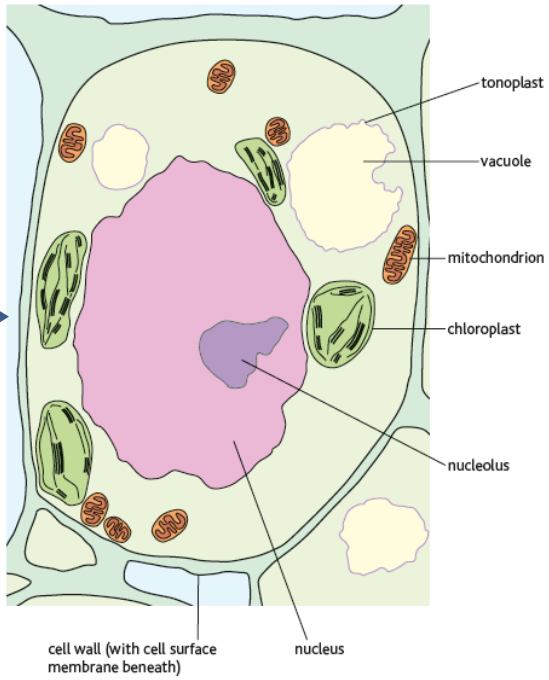


Plant cells have the same organelles as animal
cells but they also have:

- a cell wall
- a large vacuole containing cell sap
- chloroplasts for photosynthesis.



greater detail

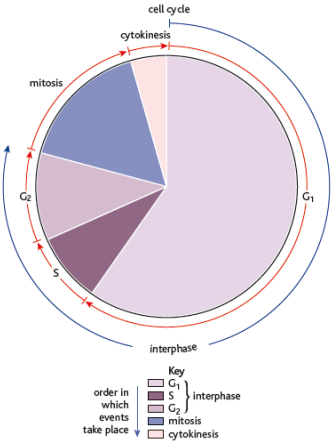


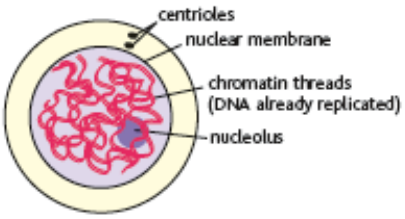
Summary sheet 2: Mitosis

Mitosis results in the production of two genetically identical diploid body cells. It occurs during growth, repair and asexual reproduction.

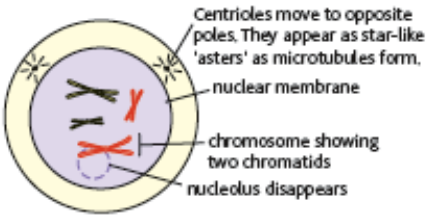
Mitosis occurs during the cell cycle. The cell cycle consists of a period of cell growth and DNA replication known as interphase and then a period of cell division called mitosis followed by cytokinesis where the cytoplasm divides and the cell membrane constricts to form the two daughter cells.

Mitosis is broken down into stages – prophase, metaphase, anaphase and telophase, followed by cytokinesis.

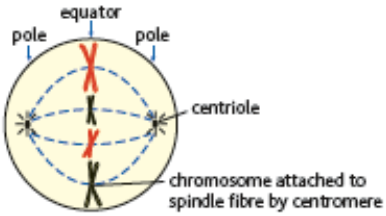




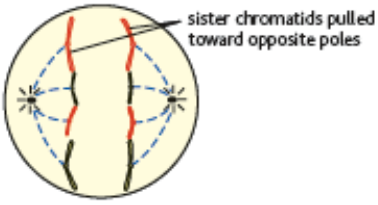
A Interphase: before mitosis the tangled, uncoiled mass of chromosomes fills the nucleus. DNA is replicated during this stage.



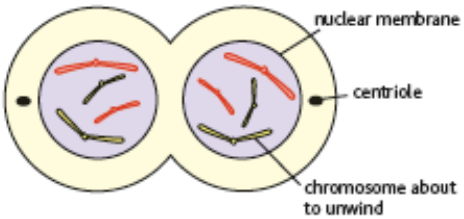
B Prophase: the chromosomes coil and condense, each one appearing as two chromatids. The nucleolus breaks down and the centrioles begin to separate and start to form the spindle.



C Metaphase: the nuclear membrane breaks down. Spindles made of microtubules have been formed by the centrioles. The chromatids line up on the equator.



D Anaphase: the centromeres separate and each chromatid is pulled along a along a spindle tubule towards one of the poles centromere first.



E Early telophase: the chromatids reach the poles of the cell where they are now known as chromosomes. The membrane begins to reform and the cytoplasm to divide.

F Late telophase: the chromosomes begin to 'decondense'. The nuclear membranes and nucleoli are fully reformed and centrioles are present again. The division of the cytoplasm continues until two new identical cells are formed which once more enter interphase.

Summary sheet 3: Microscopy

Magnification is how much bigger the image is than the specimen on the microscope slide.

The size of the specimen can be calculated using the formula:

$$\textbf{length of the specimen} = \frac{\textbf{length of the image}}{\textbf{magnification}}$$

With a light microscope the magnification is the combination of the magnification of the objective lens and the eye piece lens.

For example a 40× objective lens and a 10× eye piece lens produce a total magnification of 400×.

When you are doing magnification calculations you must have all the lengths in the same units.

1 cm	10 mm
1 mm	1000 µm
1 µm	1000 nm

Calculation

Calculate the actual size of a cell with a diameter of 8 mm using 100× magnification.

$$\text{Actual size} = \frac{8}{100} = 0.08 \text{ mm}$$

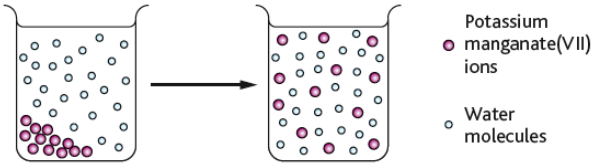
$$= 80 \text{ µm}$$

Resolution is a measure of how easy it is to distinguish between two points that are close together i.e. how much detail can be distinguished. Electron microscopes have a better resolution than light microscopes so they can see more detail.

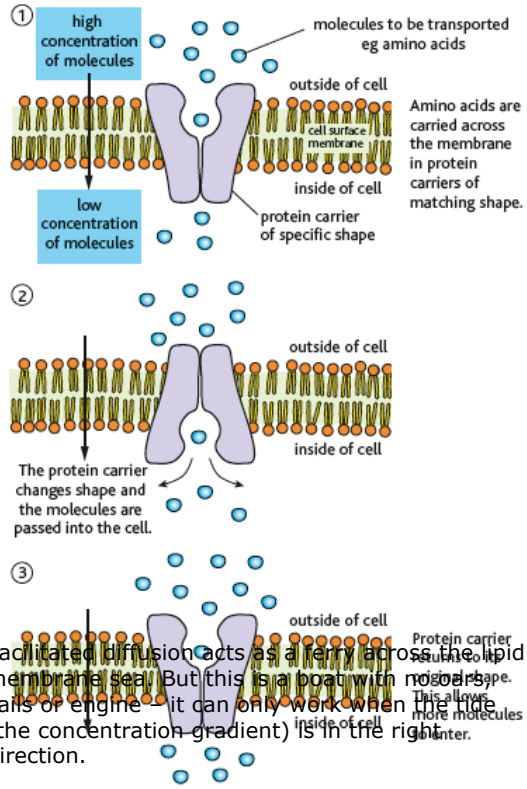
Summary sheet 4: Diffusion, osmosis and active transport

Diffusion

Liquid and gas particles are constantly moving which causes particles to move from an area of high concentration to an area of low concentration.



Observing the process of diffusion. If the beaker is left to stand the random motion of both the water and the purple manganate(VII) ions will ensure they are eventually evenly mixed.

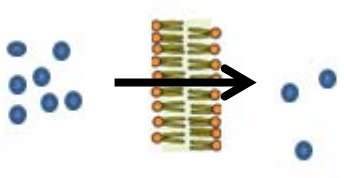


Facilitated diffusion acts as a ferry across the lipid membrane seal. But this is a boat with no oars, sails or engine – it can only work when the tide (the concentration gradient) is in the right direction.

Small particles can diffuse across cell membranes and no energy is required. Some molecules, such as glucose, are too large to diffuse across the cell membrane so they must be helped by carrier proteins. Each molecule has its own carrier protein that allows the molecule through the cell membrane without the need for energy. This is known as facilitated diffusion.

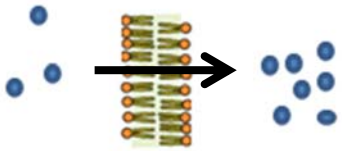
Osmosis

Osmosis is the diffusion of water molecules from an area of higher concentration of water molecules to an area of lower concentration of water molecules across a partially permeable membrane.



Active transport

Active transport uses energy to transport substances across membranes from an area of lower concentration to an area of higher concentration



Worksheet 1: Cell structures 1

Extracting key information from text is an important study skill for A-level candidates.

Read through the passage below about animal, plant and bacterial cells. Use the information and your own knowledge to complete the table to list some of the structural features of animal, plant and bacterial cells.

The plant cell and the animal cell possess a nucleus containing chromosomes and a nucleolus. In a bacterial cell the DNA is located in the cytoplasm. Only the bacterial cell and the plant cell have a cell wall but all three cells have a cell membrane. The plant cell wall is made of cellulose and the bacterial cell wall is made of peptidoglycan.

Centrioles are present only in the animal cell and chloroplasts are found only in the plant cell. Mitochondria and rough endoplasmic reticulum are not present in the bacterial cell. All three cells contain structures called ribosomes which are involved in the synthesis of protein. Bacterial cells can have pili or a capsule.

Features present in animal cells	Features present in plant cells	Features present in bacterial cells

Extension activity – research a function for each feature listed.

Worksheet 2: Cell structures 2

Extracting key information from text is an important study skill for A-level candidates.

Read through the passage below about animal, plant and bacterial cells. Use the information and your own knowledge to draw and label an animal, plant and bacterial cell. You should include the features listed if appropriate.

The plant cell and the animal cell possess a nucleus containing chromosomes and a nucleolus. In a bacterial cell the DNA is located in the cytoplasm. Only the bacterial cell and the plant cell have a cell wall but all three cells have a cell membrane. The plant cell wall is made of cellulose and the bacterial cell wall is made of peptidoglycan.

Centrioles are present only in the animal cell and chloroplasts are found only in the plant cell. Mitochondria and rough endoplasmic reticulum are not present in the bacterial cell. All three cells contain structures called ribosomes which are involved in the synthesis of protein. Bacterial cells can have pili or a capsule.

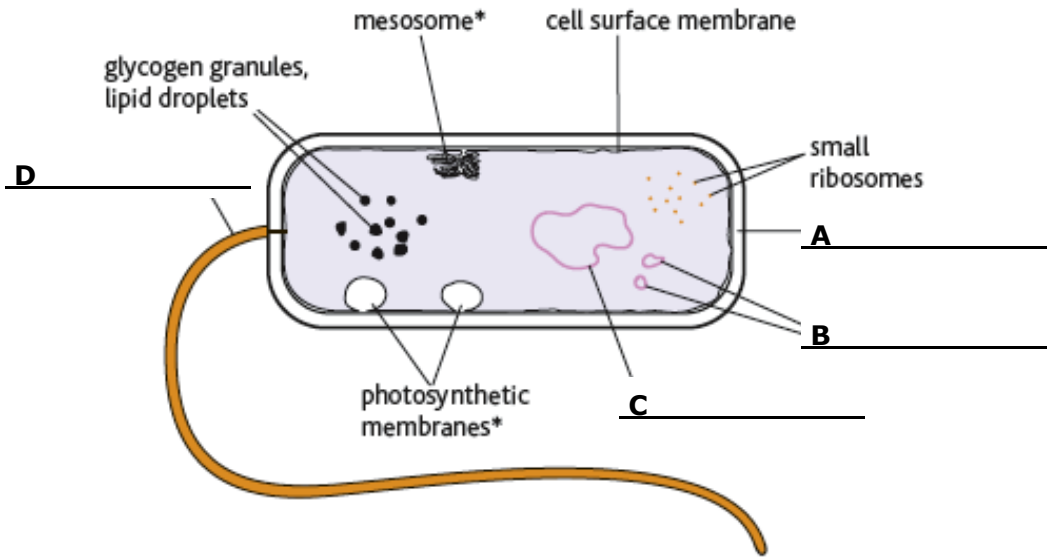
cell wall	nucleus	cell membrane	ribosome	capsule
mitochondria	cytoplasm	chloroplast	plasmid	chromosome

Animal cell	**Plant cell**
Bacterial cell	

Extension activity – research any unfamiliar features and add them to your cell diagrams.

Practice questions

1 The diagram shows a bacterial cell with some of the key features labelled.



a Label cell features A, B, C and D.

b Complete the table to identify three features present in animal cells and describe their function.

Animal cell feature	Function

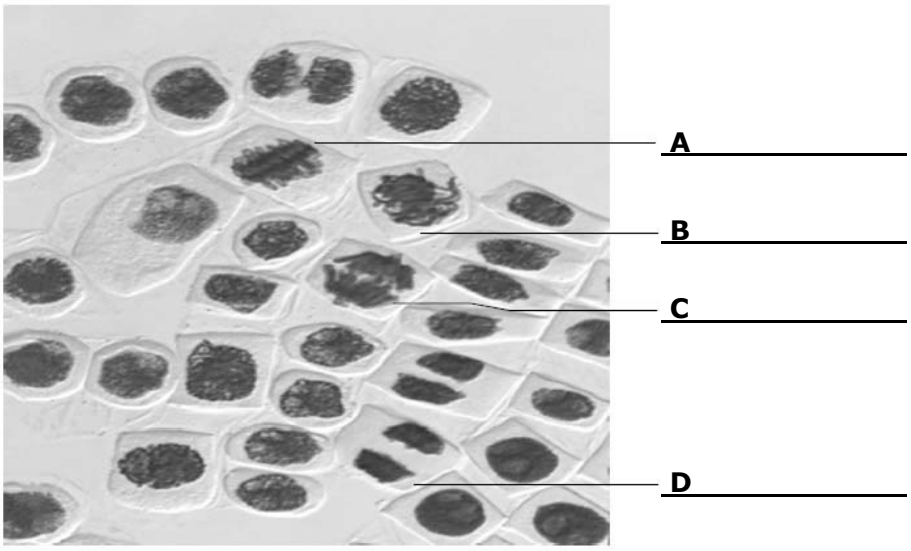
c Some antibiotics prevent protein synthesis by targeting the ribosome.

Ribosomes in eukaryotes have a different structure to prokaryotes.

In no more than 50 words, explain why these types of antibiotics can be used to treat bacterial infections without effecting human cells.

Concise writing which refers to key scientific ideas is effective.

2 The image shows root tip cells at different stages of the cell cycle.

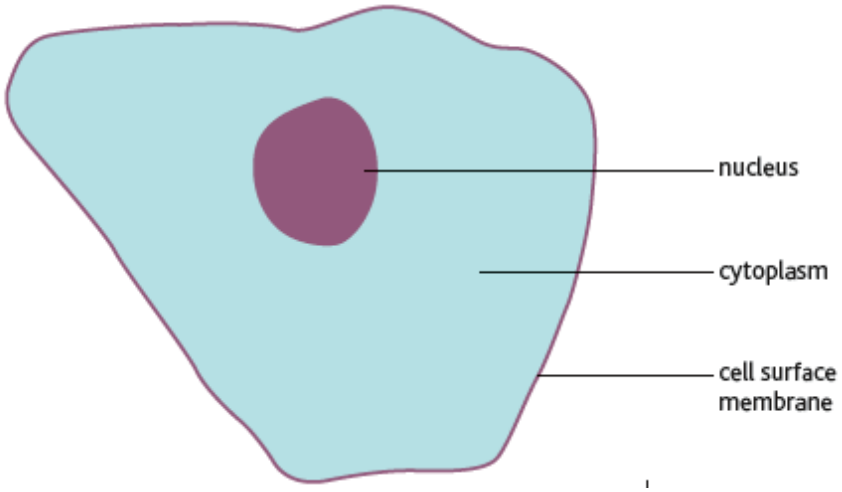


a Identify the stages of mitosis for cells A, B, C and D.

b The microscope used to view the cells had a 10× eye piece lens. Which objective lens was needed to view the cells at this magnification level?

c Calculate the length of cell A.

3 The diagram shows an animal cell with three key features labelled.



a Identify three additional features which are found in animal cells and describe their functions.

1

2

3

b An image of an animal cell nucleus with a diameter of 6 μm was obtained using a 10× eye piece lens and 20× objective lens. Calculate the diameter of the nucleus on the image.

Substances can be transported into cells through diffusion, osmosis and active transport.

4 Write a definition for diffusion, osmosis and active transport.

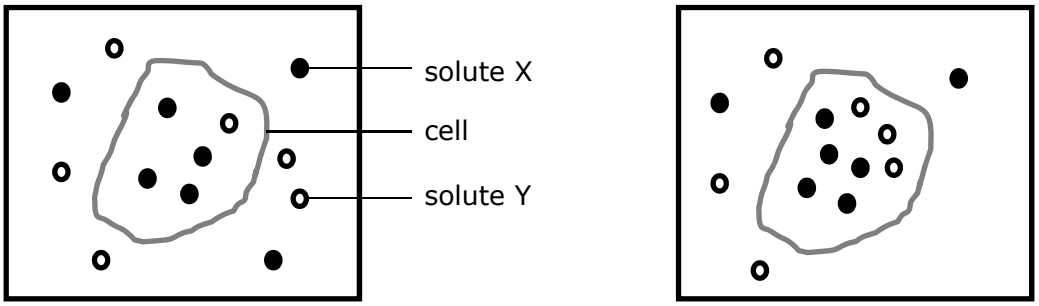
Diffusion:

Osmosis:

Active transport:

5 Cells were placed in a solution containing solute X and solute Y.

The diagram below represents the concentration of the two solutes inside and outside one of the cells, when this cell was placed in the solution and then after 30 minutes.



Explain the movement of solute X and solute Y into the cell.

6 A red blood cell was placed in a solution of distilled water.

Explain the effect on the red blood cell of being placed in a solution of distilled water.

7 Explain the key word 'isotonic'.

8 A student took 15 identical sized potato chips. The mass of each chip was recorded and the chips were placed in 4 salt solutions (0.1M, 0.2M, 0.3M and 0.4M) and pure water for 30 minutes. The chips were dried and the mass recorded. The mass change and % change in mass was calculated.

Design a table to record the students raw and processed data.

When recording data in tables units must be included in headers of the tables. All units should be SI.