



Cell biology

Eukaryotes and prokaryotes

- Nucleus – B; cytoplasm – C.
 - Any two from:* This cell has a nucleus, or prokaryotic cells do not have a nucleus; This cell has does not have a cell wall, or prokaryotic cells have a cell wall; This cell does not contain plasmids, or prokaryotic cells can contain plasmids.
 - $1.2 \times 1000 = 1200 \mu\text{m}$
 - 0.6 mm

Animal and plant cells

- Absorbs sunlight for photosynthesis – Chloroplasts; Provides strength to the cell – Cellulose cell wall; Filled with cell sap to keep the plant turgid – Permanent vacuole.
- A, cellulose cell wall; B, chloroplast; C, nucleus.
 - Cells near the top of a leaf have more chloroplasts to absorb more sunlight; for photosynthesis.

Microscopy

- The cells are not plant cells; There are no visible cellulose cell walls, permanent vacuole or chloroplasts.
 - Magnification = $\frac{5 \text{ cm}}{0.5 \mu\text{m}} = \frac{50000 \mu\text{m}}{0.5 \mu\text{m}} = \times 100\,000$
- Higher magnification/resolution; Able to see sub-cellular structures clearly/in detail.
- Size of image = magnification \times size of real object;

$$= 200 \times 10;$$

$$= 2000 \mu\text{m} \text{ or } 2 \text{ mm.}$$

Using a light microscope

- Move the lowest magnification objective lens over the specimen; Move the stage by moving the coarse focus, until the cells are in focus; Move the objective lens to a higher magnification, and focus using the fine focus.
 - $\times 400$
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	Number of cells after 12 hours			
	1	2	3	Mean
With mitotic inhibitor	12	10	11	11
Without mitotic inhibitor	108	110	106	108

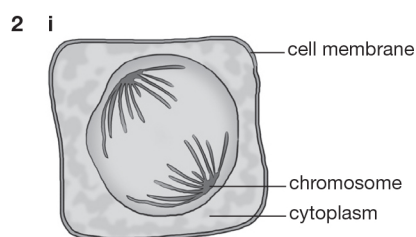
- Any two from:* Type of cells; Starting number of cells; Temperature; Volume of nutrient broth/culture medium.
- Use different concentrations of mitotic inhibitor.

Cell specialisation and differentiation

- Many mitochondria
 - Any two from:* Xylem cells; Phloem cells; Muscle cells.
 - The phloem cells are joined end to end to form a tube; The sugars can pass through the sieve plates.
- A cell that is undifferentiated and can become any type of cell.
 - Embryo
 - Take stem cells and grow them in a laboratory; Expose cells to chemicals/hormones to make them differentiate into a type of specialised cell; Grow the specialised cells on a Petri dish so that they form tissues; Use the tissues to form the new organ.

Mitosis and the cell cycle

- G2 phase – Chromosomes are checked; S phase – Chromosomes are replicated; M phase – The cell divides into two daughter cells.
 - So that when the cell divides during mitosis; each daughter cell has the correct number of sub-cellular structures.



- The replicated chromosomes are separating; to the opposite sides of the cell.

Stem cells

- B
- Any two from:* Replacing/repair of cells; Growth; Used in medical research/treatments; Meristem used in plant cloning.
- Meristem tissue
- Stem cells can be used to make organs for transplants, so there is no waiting time for organ donors; However, there is an ethical objection to using embryos, as they could potentially grow into humans/animals; Using stem cells in medical treatments means that the body will not reject the cells;

but there is a risk of transfer of viral infection from putting stem cells into the body.

Diffusion

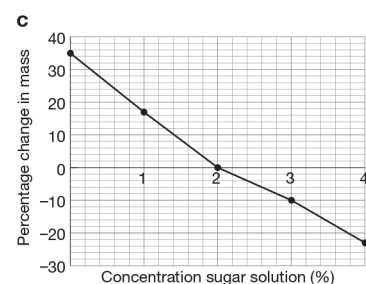
- Diffusion is the spreading out of the particles of any substance in solution, or particles of a gas; resulting in a net movement from an area of higher concentration to an area of lower concentration.
 - Any one from:* In the lungs for exchange of oxygen/carbon dioxide; In the small intestines for the movement of the products of digestion.
- $24:8 = 3:1;$
 $96:64 = 3:2 = 1.5:1;$
Organism B has the smallest surface area to volume ratio.
 - They cannot get all the substances they need by diffusion alone; They need to increase the rate of diffusion; by increasing the surface area/providing a short diffusion pathway.

Osmosis

- Osmosis is the diffusion of water from a dilute solution to a concentrated solution; through a partially permeable membrane.
- From inside the cell to outside the cell.
- Percentage increase = $\frac{(14 - 10)}{10} \times 100\%$
 $= 40\%$
- 3% sugar solution; because the plotted line crosses the x-axis at 3%.
 - The same volume of water left the cell as moved into the cell.

Investigating the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue

- In order, the percentage change is: 16.7; 0.0; -25.0; -34.1
 - No units in third column; should be (g). 4 in second column; should be given as 4.0



- 14%