



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; 'Prokaryotes can have flagella' is allowed.
 - $0.1 \times 1000 = 100 \mu\text{m}$
 - 0.6mm

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.

Cell specialisation and differentiation

- Many mitochondria
 - Any *two* from: Xylem cells; Phloem cells; Muscle cells.
 - To move mucus; out of the lungs OR To move an ovum; along the fallopian tube/oviduct.
- 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.

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;
= 200×10 ;
= $2000 \mu\text{m}$ or 2mm.

Culturing microorganisms

- Binary fission
 - Sterilise an agar plate; Spread bacteria over the surface of an agar plate using a sterile inoculating loop; Tape down the lid of the Petri dish and store the Petri dish upside down; Grow the bacteria at 25°C .
 - Cross-sectional area = 3.142×2.5^2
= 3.142×6.25
= 19.64 mm^2
 - Number of divisions = 24
Number of bacteria = 10×2^{24}
= 167 772 160
or 1.7×10^8

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.
 - To see the cells/tissues more clearly; different stains can be used to identify tissues/organelles.
 - $\times 400$

	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.

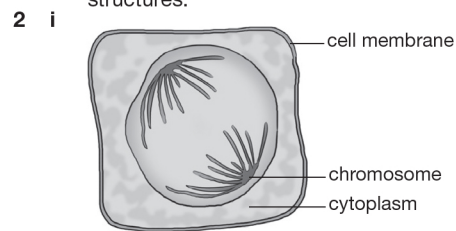
Investigating the effect of antiseptics or antibiotics

- B
 - To prevent unwanted microorganisms from growing on the agar plate.
 - The clear area shows that no bacteria are growing there; Antiseptic D is inhibiting the growth of the bacteria.
 - Cross-sectional area = 3.142×4^2
= 3.142×16
= 50.27 mm^2

Mitosis and the cell cycle

- G2 phase – Chromosomes are checked; S phase – Chromosomes are replicated; M phase – The cell divides into two daughter cells; Cytokinesis – Physical process of cell division.

- 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.

3 26 (lb)

Stem cells

- B
- Any *two* from: Replacing/repair of cells; Growth; Used in medical research/treatments; Meristem used in plant cloning.
- Meristem tissue; found in the shoots, roots and flowering parts of the plant.
- 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.
- Extract solution from outside the Visking tubing; at regular intervals/named time interval; test for the presence of glucose. Factors – surface area, concentration gradient and diffusion thickness.

Osmosis

- Osmosis is the diffusion of water from a dilute solution to a concentrated