



**Kultivate Learning Centre**

**Primary 5 Science Programme**

**Systems - Cells**

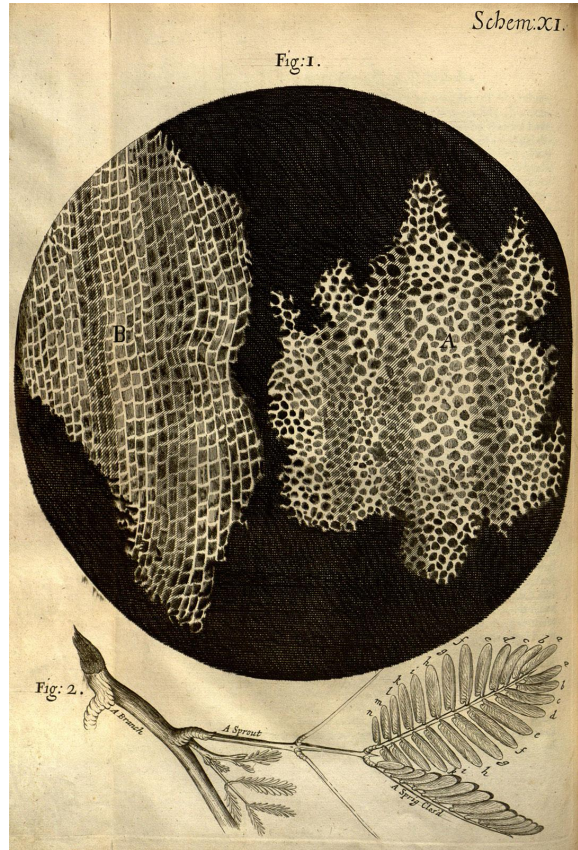
**Student's Notes**

Name:

Student ID:

Date:

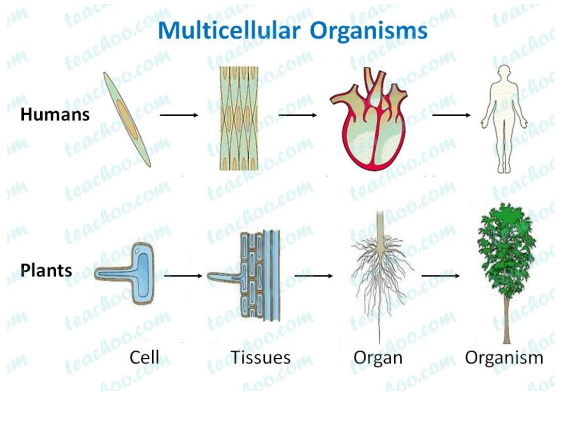
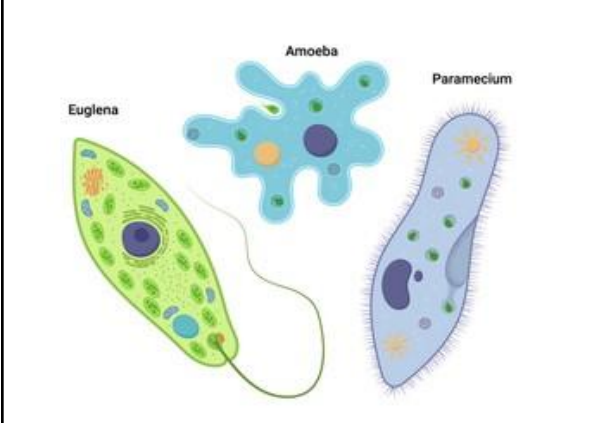
Teacher:



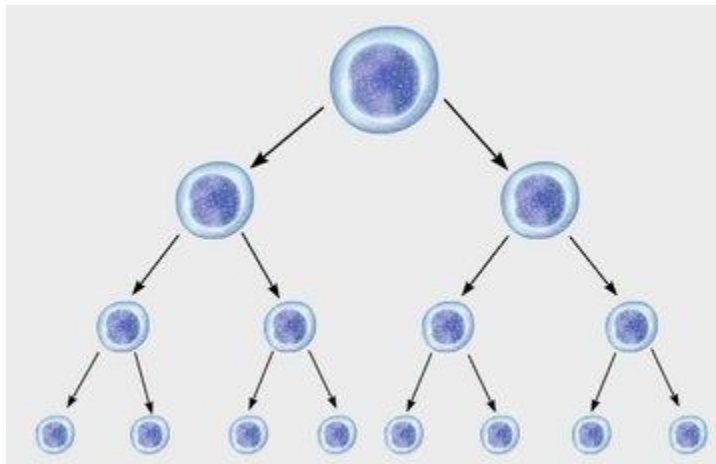
In 1665, Robert Hooke first observed cells by looking at cork under an early microscope.

## 1. Introduction to Cells

- Cells are the basic unit of life.
- Cells → tissues → organs → organ systems → organism.

| Multicellular   | Unicellular/single-celled organism   |
|---|--|
| Organisms consisting of many cells  | Organisms consisting of only one cell  |
| Spirogyra, Fungi, Humans, Animals, Plants   | Asexual bacteria, Paramecium, Yeast, Amoeba, Euglena   |
| Can make its own food (plants), Cannot make its own food (humans, animals)  | Can make its own food  |
| Cell cannot move around on its own (except for sperm, eggs cannot move)   | Can move around on its own (usually with a tail/flagellum)   |
| Reproduce by cell division  | Can reproduce asexually (through cell budding)<br>Budding occurs when the cell grows a bud, which grows in size and then breaks off from the cell. Cells like yeast undergo budding. |
| <p style="text-align: center;"><b>Multicellular Organisms</b></p>  |    |

- Cell division:
  - Produce genetically identical daughter cells (except for production of sperm and egg).
  - Never stops in one's lifetime.
  - Needed to replace old and damaged cells. Needed for organism growth.
  - Our cells do not grow bigger as we grow, they stay the same size.
  - Exponential growth
  - Uncontrolled division results in the formation of tumors and cancer.



(Credit: <https://www.omnicalculator.com/biology/cell-doubling-time>)

### **Video Time**

Asexual Reproduction-Fission-Budding-Fragmentation-Spores by MooMoo Math and Science [3 mins]

<https://www.youtube.com/watch?v=F89XgjHyt0Q>



Budding of Yeast Cells by Umass [1 min 50 secs]

[https://www.youtube.com/watch?v=GFEgB\\_ytDZY](https://www.youtube.com/watch?v=GFEgB_ytDZY)



How do cancer cells behave differently from healthy ones? - George Zaidan/Ted-ED [3 mins 50 secs]

<https://www.youtube.com/watch?v=BmFEoCFDi-w>



- The purpose of cell division in a single celled organism is to ensure the continuity of the same species.
- Traits that can be passed down are:
  - attached/detached earlobes, ability to roll tongue, colour blindness, skin colour, dimples.
- Traits that cannot be passed down are:
  - length of fingernails and hair, height, fingerprints.
  - twins have different fingerprints.

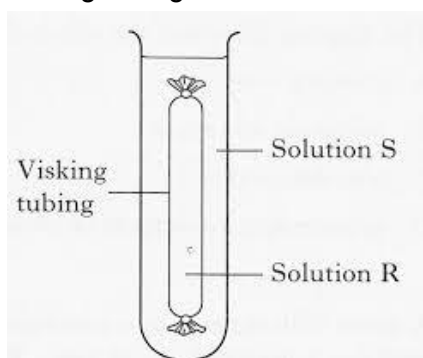
## 2. Cell Organelles and Their Functions

### ➤ Cell wall

- Fully permeable membrane.
- Support and give the cell its regular shape.
- Prevents the cell from bursting.
- DOES NOT control movement of substances in and out of the cell.

### ➤ Cell membrane

- Partially permeable membrane.
- Controls the movement of substances (like simple substances, like vitamins, iodine, minerals and water) in and out of the cell.
- Visking tubing acts like the cell membrane



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### ➤ Cytoplasm

- Jelly-like substance
- Site of chemical reactions in the cell.
- Contains cell organelles.

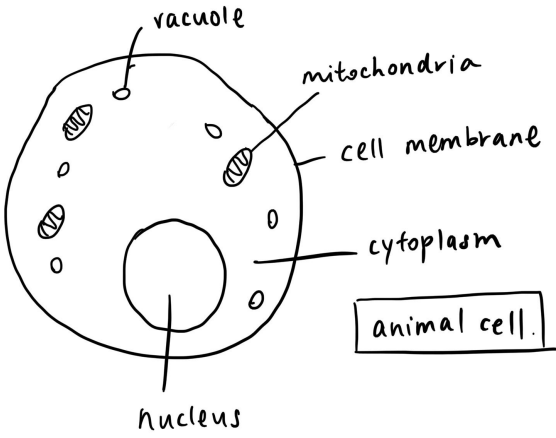
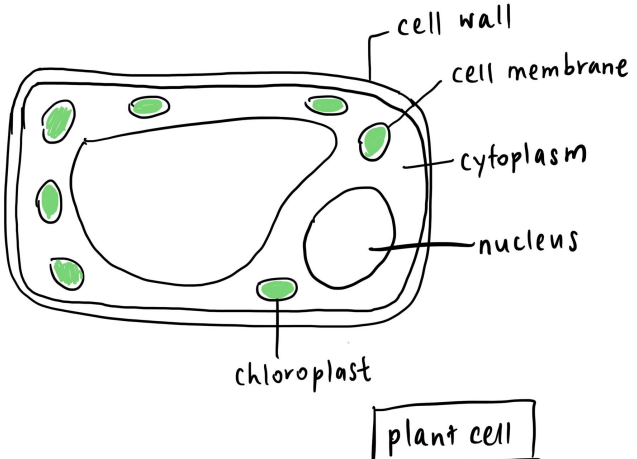
### ➤ Chloroplasts

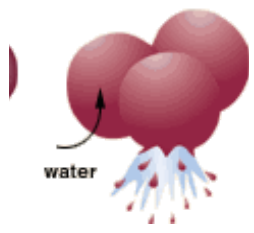
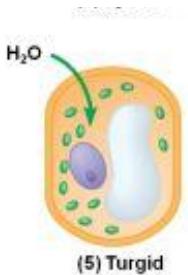
- Contains chlorophyll to trap sunlight for photosynthesis.
- Only parts of the plant (leaf or stem) that carries out photosynthesis will have chloroplasts. Root hair cells do not have chloroplasts as they are found underground and do not photosynthesize. Flowers and fruits do not have chloroplasts too. Onion cells do not have chloroplasts.
- Starch may be present in cells that can photosynthesize. Iodine test will be positive (iodine turns from brown to blue-black).

### ➤ Nucleus (singular) / Nuclei (plural)

- Contains genetic information/DNA.
- Controls cellular activities and characteristics of the cell.
- Needed for cell division because no activities in the cell can occur without the nucleus as the nucleus controls all cell activities including cell division.

- Mitochondria
  - 'Powerhouse' of the cell
  - Site of cellular respiration to produce energy for the cell.
  
- Vacuoles
  - Stores proteins (in animal cells)
  - Contains cell sap (in plant cells)
  
- Flagellum/Tail
  - Present in sperm and unicellular organisms
  - Helps the cell to move from one location to another.
  - Helps the sperm to move towards the egg for fertilization (see Reproduction in Humans)

| Animal Cell  | Plant Cell   |
|--|--|
|  |  <p data-bbox="824 1333 1453 1396">*take note of the position of the cell wall and cell membrane.</p> |
| Has cell membrane, nucleus, and cytoplasm.   | Has cell wall, cell membrane, nucleus and cytoplasm.   |
| No cell wall   | Has cell wall  |
| No chloroplasts  | Has chloroplasts   |
| Has mitochondria and vacuoles  | Has mitochondria and vacuoles  |

|                            | <b>Animal Cell</b>   | <b>Plant Cell</b>  |
|----------------------------|--|--|
| When water enters the cell | <p>Cell will burst<br/>Cell cannot be found.</p> <p><b>Hypotonic</b></p>  | <p>Cell becomes turgid but remains the same shape due to the cell wall.</p>  |

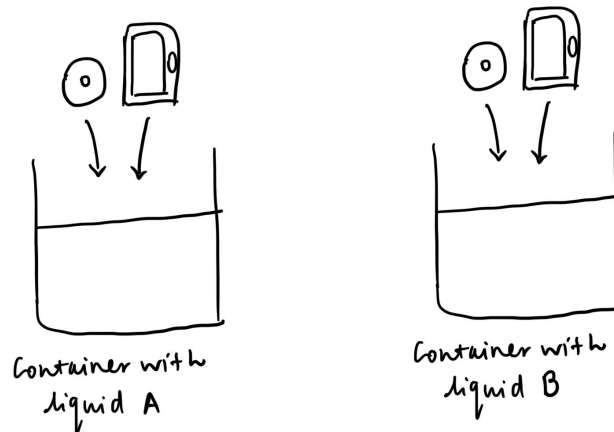
### 3. Scientific Drawing

| <b>Criterion</b>   | <b>Accomplished</b>  |
|--------------------|--|
| Scientific drawing | <p>The following criteria must be met:</p> <ul style="list-style-type: none"> <li>(a) Solid lines are used                             <ul style="list-style-type: none"> <li>(i) No broken lines.</li> </ul> </li> <li>(b) Drawing and labelling must be done in pencil</li> <li>(c) All parts are labelled with straight lines                             <ul style="list-style-type: none"> <li>(i) No arrows.</li> <li>(ii) Labelling lines should not cross over each other.</li> </ul> </li> <li>(d) Drawing is accurate ie. there are no missing objects and the objects are proportional to one another.</li> <li>(e) Drawing takes up about <math>\frac{2}{3}</math> of the space provided.</li> <li>(f) No shading of objects.</li> </ul> |

#### 4. Section Review Questions:

Q1.

Ella observed two plant cells and two animal cells under a microscope. She placed one pair of plant and animal cells in a container filled with liquid A. She placed another similar pair of plant and animal cells in a similar container filled with liquid B.



After some time, she made the following observations:

|          | Plant Cell                  | Animal Cell             |
|----------|-----------------------------|-------------------------|
| Liquid A | Cell remains the same shape | Cell cannot be found    |
| Liquid B | Cell remains the same shape | Cell looks shriveled up |

Which statement best describes the above observations?

- (1) The animal cell does not have chloroplasts to trap light energy.
- (2) The animal cell has cytoplasm to fill the cell with a jelly-like substance.
- (3) The plant cell has a cell wall to keep its shape.
- (4) The plant cell has a cell membrane to allow the liquid to move in and out of the cell.

Q2. Draw and label an animal and plant cell.

Q3. Why does an animal cell not require a cell wall?

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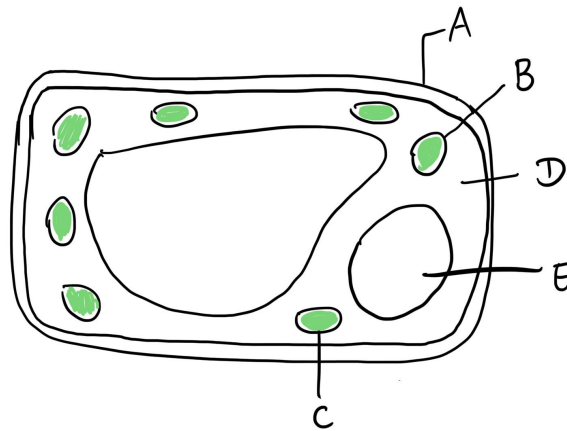
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Q4. What happens to cells without:

- (a) chloroplasts?
- (b) nucleus?
- (c) cell wall?
- (d) cell membrane?

Q5.  
The diagram below shows a plant cell.

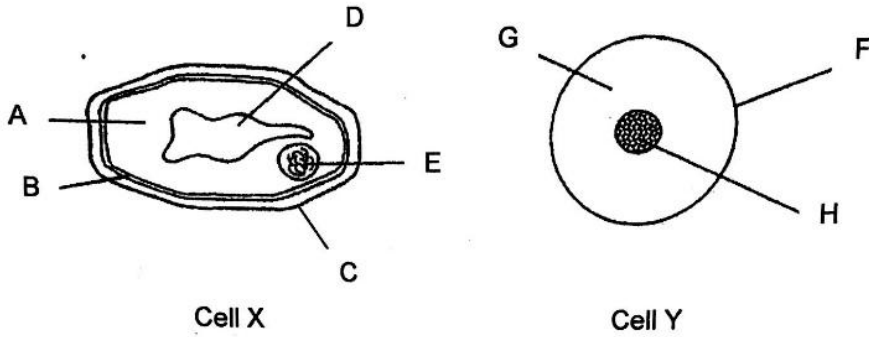


Which of the following correctly describes parts A to E?

|     | It controls the movement of substances in and out of the cell. | It contains information that is passed from one generation to the next. | It can also be found in animal cells |
|-----|--|---|--------------------------------------|
| (1) | B  | E   | B, D, E                              |
| (2) | D  | E   | A, B, D, E                           |
| (3) | B  | C   | B, C, D, E                           |
| (4) | A  | D   | A, B, E                              |

Q6. (GEP, 2019)

The diagram below shows two cells, X and Y.

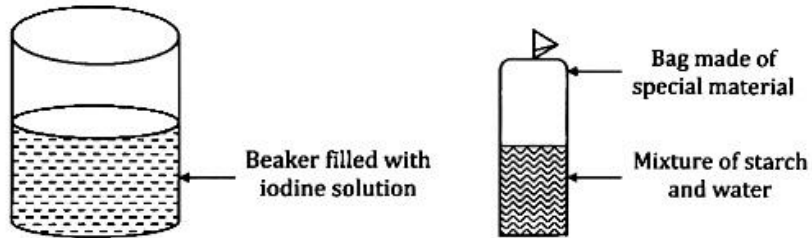


Which one of the following correctly identifies the different parts of cells X and Y?

|     | <b>Contains hereditary information</b> | <b>Allows activities to take place in the cells</b> | <b>Controls substances entering or leaving the cells</b> |
|-----|--|---|--|
| (1) | E, H                                   | D, G  | C, F   |
| (2) | D, H                                   | G, A  | C, F   |
| (3) | A, H                                   | D, G  | B, F   |
| (4) | E, H                                   | G, A  | B, F   |

Q7:

Michael wanted to build a model that shows the function of a cell membrane. He filled a bag made of a special material with water and starch. He placed the bag into a beaker filled with iodine solution and left it there for 5 hours as shown below. He noticed at the end of 5 hours that the mixture of starch and water which was originally white had become dark blue while the water containing iodine solution remained the same.



(a) Why did the mixture of starch and water become dark blue? (1 m)

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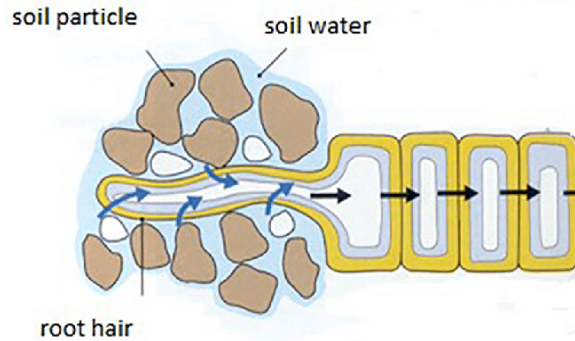
(b) Why did the iodine solution remain the same? (1 m)

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## 5. Specialized Cells

### ➤ Root hair cell

- Has a long protrusion to increase surface area to volume ratio to absorb MORE water (do not say that the root hair cell can absorb water FASTER. Amount of water not time.)
- NO chloroplasts, hence it CANNOT photosynthesize.



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### ➤ Red blood cell

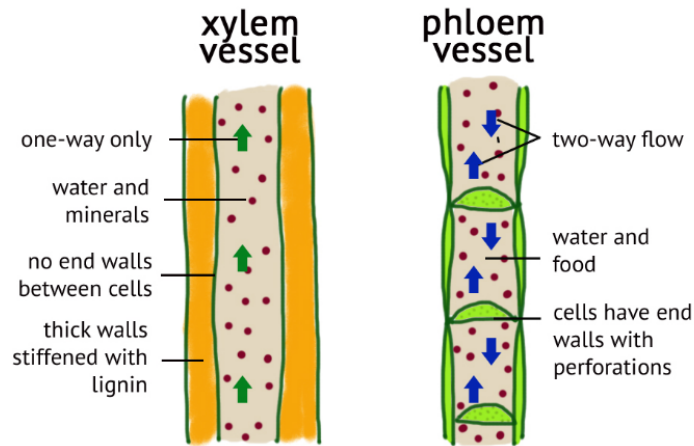
- Does not have a nucleus.
- Cannot reproduce/divide.
- Carries oxygen around the body.



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### ➤ Xylem/Vascular

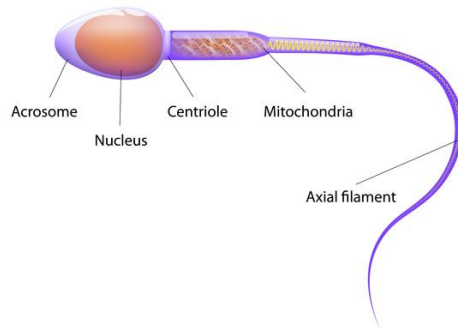
- Not a living cell.
- Does not have nucleus, cytoplasm or chloroplasts.
- Has cell wall and lignin for support.



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➤ Sperm

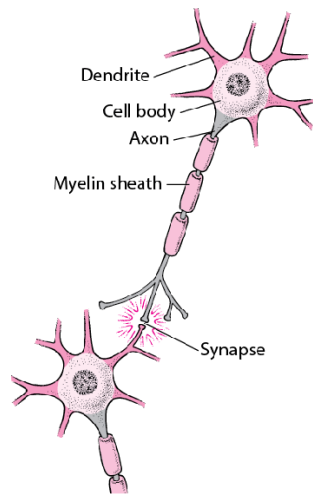
- Has half the amount of genetic information/DNA compared to a normal body cell.
- Has a flagellum/tail to move/swim towards the egg.



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➤ Nerve

- Delivers nerve impulses around the body.



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## 6. Section Review Questions

Q:

Draw and label an animal cell, a leaf cell and a root hair cell.

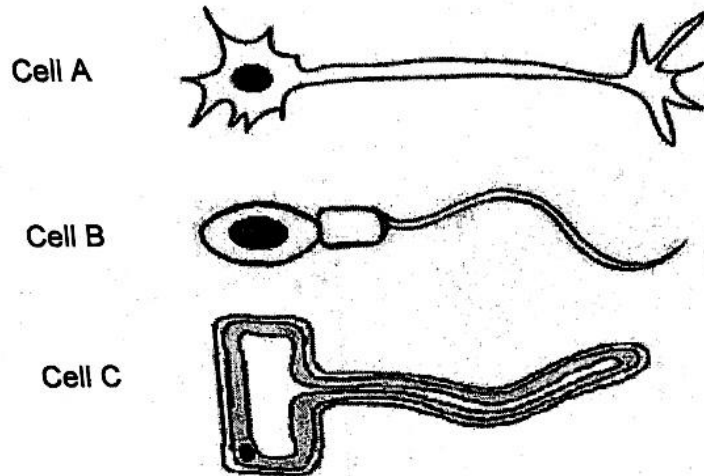
Q1.

All cells have a nucleus T / F

All plant cells have chloroplasts T / F

Q2. (GEP, 2019)

The diagram below shows three different types of cells, A, B and C.



Which one of the following correctly classifies them?

|     | Animal cell(s) | Plant cell(s) |
|-----|----------------|---------------|
| (1) | A and B        | C             |
| (2) | B and C        | A             |
| (3) | C              | A and B       |
| (4) | B              | A and C       |



Q3.

The table below provides some information on cells A, B and C. A tick (✓) indicates the part of the cell that is present.

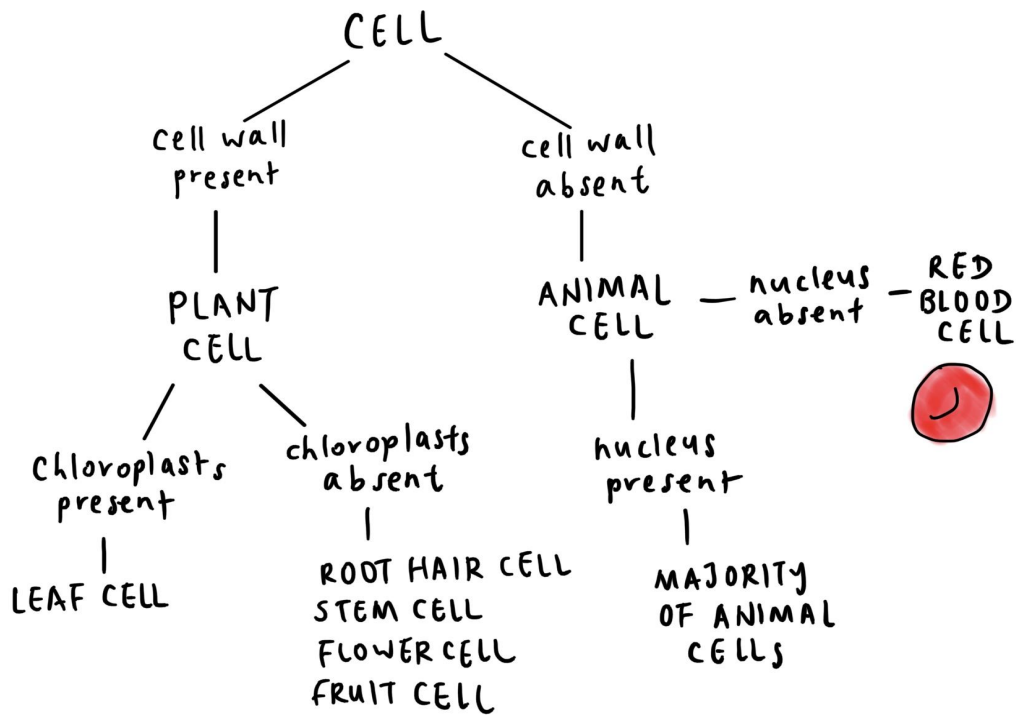
| Parts of a cell | Cell A | Cell B | Cell C |
|-----------------|--------|--------|--------|
| Chloroplast     |        | ✓      |        |
| Cell wall       | ✓      | ✓      |        |
| Cell membrane   | ✓      | ✓      | ✓      |
| Nucleus         | ✓      | ✓      |        |

Where are cells A, B and C likely to be found?

|     | Cell A      | Cell B      | Cell C      |
|-----|-------------|-------------|-------------|
| (1) | Root        | Human cheek | Leaf        |
| (2) | Leaf        | Root        | Human cheek |
| (3) | Root        | Leaf        | Human cheek |
| (4) | Human cheek | Leaf        | Root        |

## 7. Keywords and Revision

- Common types of questions:
  - Comparative
  - Memory work
  - Mostly MCQ

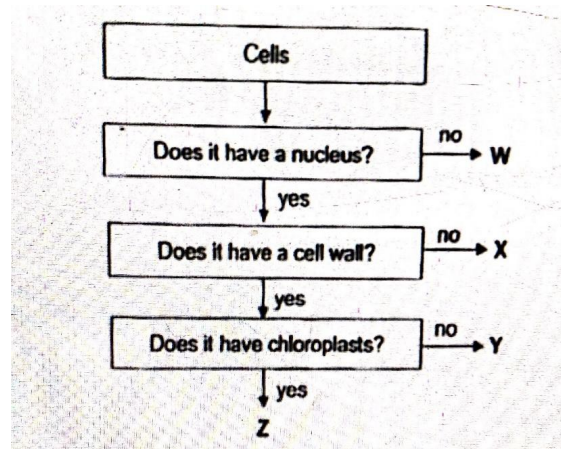


| <b>Keywords</b>   |           |               |
|---|-----------|---------------|
| Nucleus   | Cytoplasm | Cell membrane |
| Chloroplast   | Cell wall |               |
| Cell membrane - controls substances moving in and out of the cell.  |           |               |
| Cell wall - supports and gives the plant cell its shape.  |           |               |
| Chloroplast - contains chlorophyll and traps sunlight for the plant to carry out photosynthesis.                                      |           |               |
| Cytoplasm - jelly-like substance where cell activities take place.  |           |               |
| Nucleus - controls all the activities in the cell and contains (genetic) information that is passed down from parents to their young. |           |               |
| Not all plant cells have chloroplasts. Cells from roots do not have chloroplasts.   |           |               |

| <b>Learning Checklist</b> |  |
|---------------------------|--|
| 1                         | What is a cell?  |
| 2                         | Draw and label the parts of an animal cell.  |
| 3                         | What are the functions of the different parts of the animal cell?                  |
| 4                         | What are the similarities and differences between a plant cell and an animal cell? |
| 5                         | Is it true that the cells grow bigger when you grow?                               |
| 6                         | Do non-living things have cells?   |

Q1.

Study the flowchart below.



(a) Which cell, W, X, Y or Z, cannot reproduce?

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(b) Which cell, W, X, Y or Z, is most likely taken from the root of a plant? Explain your answer.

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### **Wrap-Up Videos**

Introduction to Cells: The Grand Cell Tour  
<https://www.youtube.com/watch?v=8llzKri08kk>



Types of Cells | Don't Memorise  
<https://www.youtube.com/watch?v=192M4oDLTdc>

