FORM 5 BIOLOGY WEEK 1 NOTES

UNIT 1: CELL STRUCTURE

Learning Outcome

At the end of this unit, student should be able to:

- Identify cellular organelles and state their functions
- Compare mitosis and meiosis and state their significance in life continuity
- State the main features of mitosis and meiosis (names and recall of stages in cell division are not examinable)
- Understanding crossing over as a source of heritable variation
- Describe the structure of the DNA and chromosomes
- Describe DNA replication

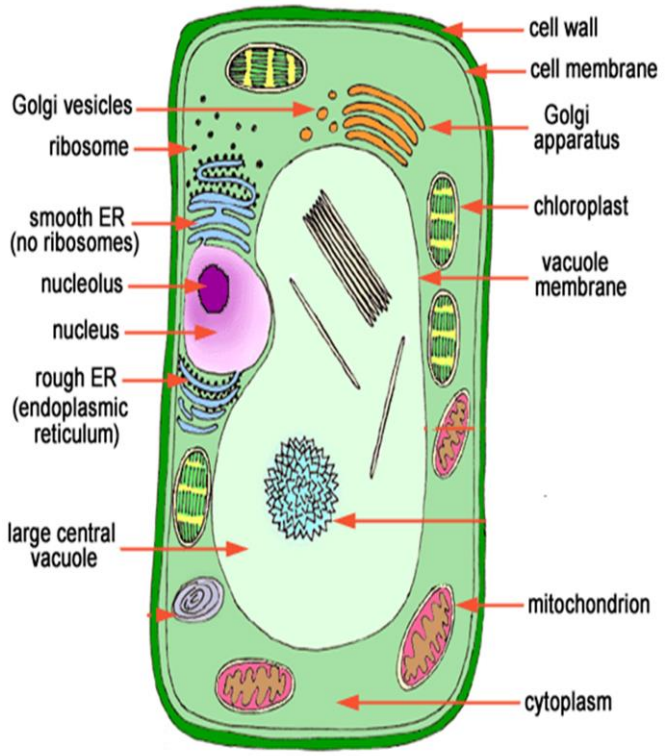
CELLS

- Cells are the most basic units of life. Cells are the structural and functional units of all living organisms.
- Cells can only be seen under microscope because they are extremely small.
- Each cell type has a different structure and function.

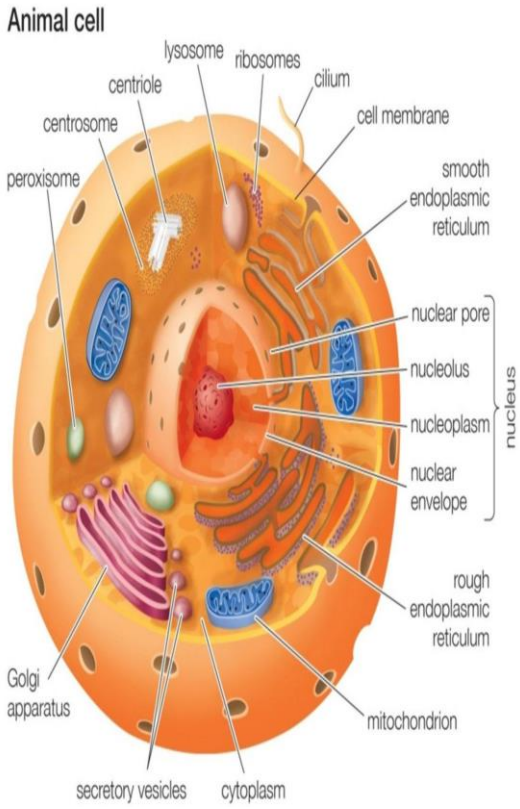
Two Types of Cell

1. Plant Cell
2. Animal Cell

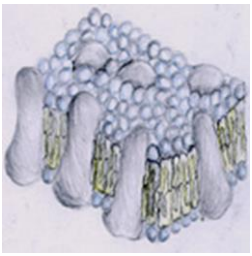
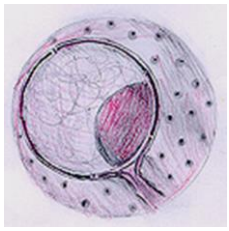
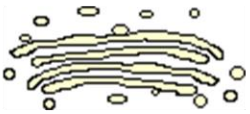
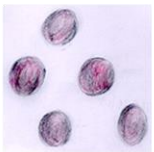
PLANT CELL

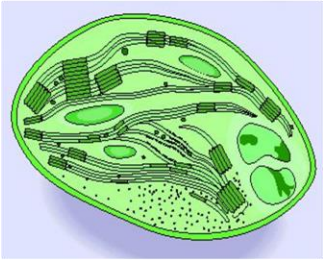
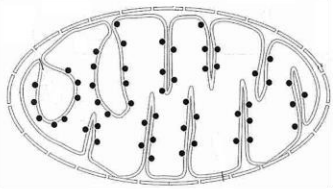
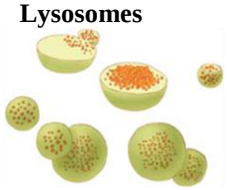
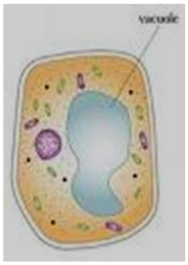


ANIMAL CELL

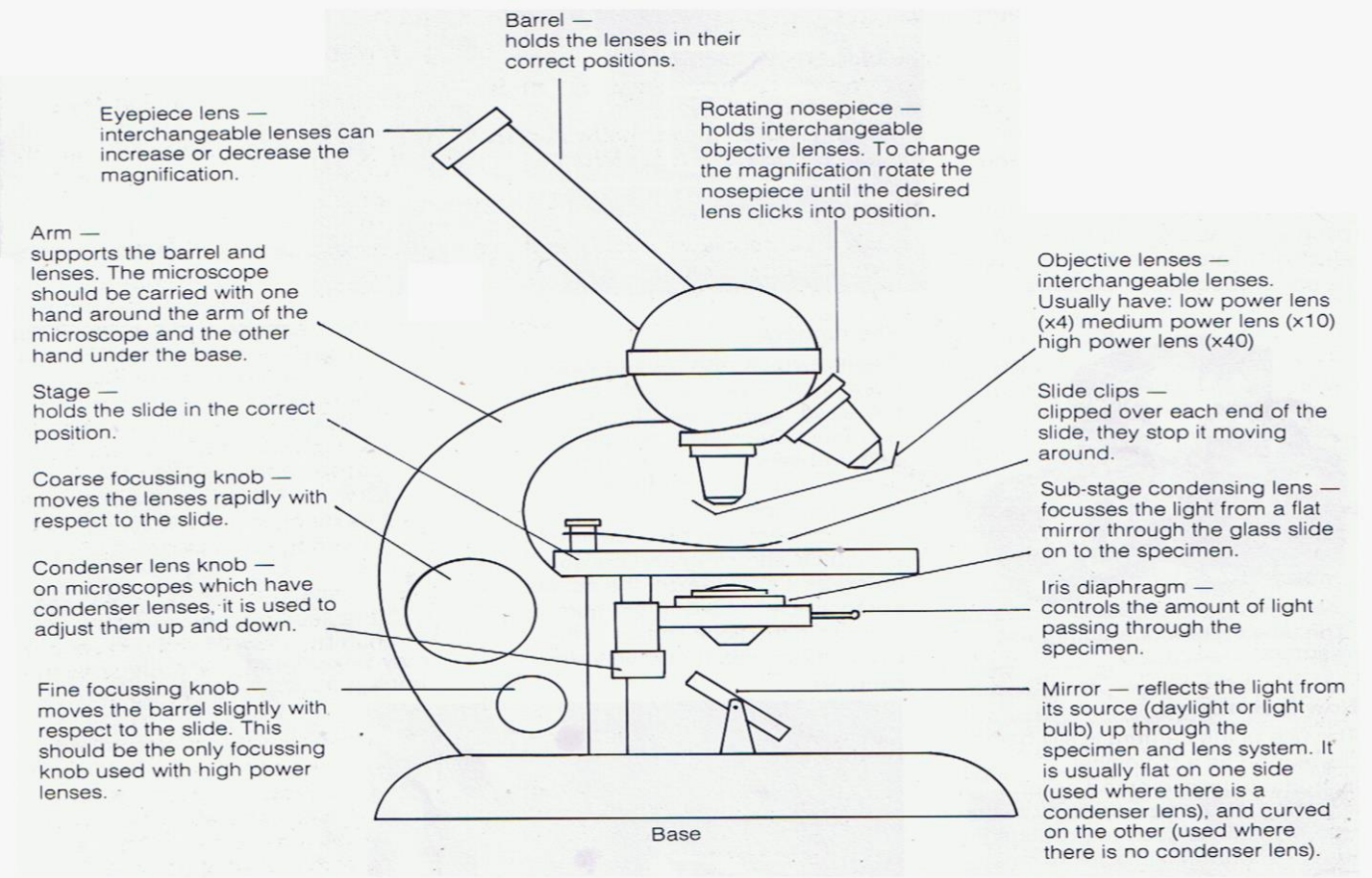


SUMMARY OF CELL ORGANELLES – THEIR STRUCTURES AND FUNCTIONS

NAME	LOCATION	FEATURES	FUNCTION	Present in	
				Plant	Animal
1. Cell Membrane 	Surrounds cell – outside in animal cell and inside the cell wall in plants	• Contains proteins (left, gray) that span through the membrane and allow passage of materials. • Proteins are surrounded by a double phospholipid bi-layer. • It is semi-permeable (only allow a few particles to pass through)	• Regulates the transport of materials entering and exiting the cell.	Yes	Yes
2. Nucleus 	Cytoplasm (centre)	• Made of nuclear envelope surrounding nuclear material with holes (pores) to allow substances in and out. • Contains chromatin (chromosomes) • Contain nucleolus	• The nucleus is the control centre of a cell as such it is the most important part of the cell. The control arises from the genetic information stored in the nucleus.	Yes	Yes
3. Endoplasmic Reticulum (ER)  	Cytoplasm	• Tubular network fused to nuclear membrane. • Goes through cytoplasm onto cell membrane. • Stores, separates, and serves as cell's transport system • Rough ER (pictured): ribosomes embedded in surface • Smooth ER (pictured below): lacks the ribosome.	• This folded membrane forms sacs to **store proteins** or other substances.	Yes	Yes
4. Golgi Bodies (Golgi Apparatus) 	Cytoplasm	• The Golgi complex looks like a stack of pancakes made of membranes with smaller vacuoles or vesicles on either side of the main structure.	• The Golgi bodies takes proteins made by the endoplasmic reticulum and exports them out of the cell as needed. • It is like a packaging department ready to deliver the protein products made in the cell.	Yes	Yes
5. Ribosomes 	Cytoplasm	• Cells normally have millions of ribosomes; each ribosome has two parts which come together during protein synthesis. A ribosome is made of numerous proteins and RNA.	• Ribosomes are responsible for protein synthesis	Yes	Yes

NAME	LOCATION	FEATURES	FUNCTION	Present in	
				Plant	Animal
6. Chloroplasts 	Cytoplasm	• A membrane bound sac lysosomes are a small vacuoles or vesicles in the cytoplasm filled with digestive enzymes. They bud off from the Golgi complex and fuse with food vacuoles	• Lysosomes are only needed by animal cells. They help break down and remove old worn out cell parts. They are also involved in the digestion of food particles brought into the cell through infoldings in the plasma membrane	Yes	No
7. Mitochondrion 	Cytoplasm	• Second largest organelle in the cell. • Double-layered outer membrane with inner folds called *cristae*	• Mitochondria found in both plants and animals are called the power houses of the cell. • This is the site where respiration occurs in cells to generate energy for the cell to use.	Yes	Yes
8. Lysosomes 	Cytoplasm	• A membrane bound sac lysosomes are a small vacuoles or vesicles in the cytoplasm filled with digestive enzymes. They bud off from the Golgi complex and fuse with food vacuoles	• They help break down and remove old worn out cell parts. • They are also involved in the digestion of food particles brought into the cell through infoldings in the plasma membrane	Yes	Yes
9. Centriole 	Cytoplasm	• Paired cylindrical organelles near nucleus. • Composed of nine tubes, each with three tubules	• Forms the spindle fibres during cell division	No	Yes
10. Cell Walls	Outside cell	• Extracellular structure surrounding plasma membrane	• Most commonly found in plant cells • Controls turgity	Yes	No
11. Vacuole 	Cytoplasm	• Vacuoles are membrane bound sacs with little or no internal structure.	• Vacuoles are generally used to store cell products. • The large central vacuole of plant cells is used to store water and cellular wastes and helps maintain the necessary internal pressure of plants called **turgor pressure.**	Yes	Yes

LIGHT MICROSCOPE



LIGHT MICROSCOPE

Advantages

- Very easy to handle
- Cheaper to buy
- Easy preparation of a slide
- Can be used to view living organisms

Disadvantages

- Requires light at all time in order to function well.
- It cannot be used on cloudy days
- Does not have a high resolving power
- It only gives a 2-dimensional view of the specimen

ELECTRON MICROSCOPE

Advantages

- Has a high resolving power
- Can magnify objects to a great extent i.e high resolving power.
- Gives a 3-dimensional view of the specimen.

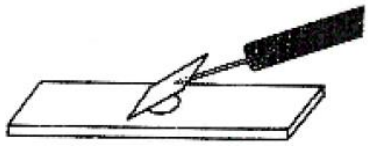
Disadvantages

- Expensive
- Can only view dead specimen

Resolving power: *is the ability of the microscope to separate in space that which the eye cannot separate. The higher the resolving power, the clearer the specimen that is viewed.*

How to use Light Microscope;

Part 1: Prepare a wet (or temporary) mount.



- Use alcohol to clean a slide and coverslip (hold them by their edges)
- Place the material onto the slide. The material to be viewed must be very thin in order to allow light to pass through it.
- Put a drop of water (the mounting medium) on the section.
- Place one edge of the coverslip on one side of the water droplet.
- Let the coverslip gently "fall" onto the water droplet; this should mean there are no air bubbles under the coverslip.

Staining a section if necessary

- Cells are usually colourless, so the different parts within cells often need to be highlighted using stains.
- Stains attach to specific cell components, making them coloured and appear clearly when viewed under a microscope.

Example of stains:

- **Giesma** stains chromosomes purple.
- **Iodine solution** stains the cell walls and nucleus of plant cells.
- **Methylene blue** stains the nuclei of animal cells.

Part 2: Viewing the Specimen

- Put the microscope close to the window or the light.
- Adjust the mirror so that it reflects the light through the specimen on the stage.
- Once the specimen has been put on the stage, select the objective lens with the **lowest** magnification.
- Wind the microscope down with the coarse focus adjustment until the microscope stops or the objective lens is just above the coverslip. Watch the slide from the side, not through the eyepiece lens when doing this to avoid winding the lens into the slide causing it to break.
- Looking down the eyepiece lens, wind the microscope back up using the **coarse adjustment** knob until the section comes into focus.
- Bring the section into sharp focus using the fine **focus adjustment knob.**
- If a higher magnification is required, click the objective lens of the next highest magnification into place, and **fine focus** again. (Coarse adjustment is not necessary).
- Repeat the previous steps if further information is required.

NOTE:
Re-read the part 1 and part 2 of how to use Light Microscope and try to understand it. Once the lockdown for COVID19 is finished we will do a lab experiment using microscope.

Calculating the Magnification of a Specimen

Magnification = Eye piece Magnification x Objective Lens Magnification

Example:

If eyepiece magnification of a microsope used to view a specimen has 10X and objective magnification of 40X, calculate the magnification of the specimen.

Total magnification = 10 x 40
= x400

As the magnification increases, the clarity of the view increases and the better the quality of the specimen to be viewed.

NOTE:
Make sure to stick all your handouts to your Biology book and please answer all questions given below. If you have any question, contact me;
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Phone Number: 7710288

Self-check #1: Cell Form and Functions

1. Which of the following cell structures could not be seen using a light microscope?

   A. Vacuole
   B. Ribosome
   C. Chloroplast
   D. Nucleus

2. Four similar microscopes are set up in the laboratory as follows.

Microscope	Objective	Eyepiece Lens
1	10x	5x
2	20x	10x
3	30x	5x
4	40x	10x

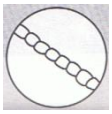
   If a slide showing living organisms is examined with each of the microscopes, in which two microscopes will the micro-organisms appear to move with the same degree of speed?

   A. 1 and 2
   B. 1 and 4
   C. 2 and 3
   D. 3 and 4

3. A student set up a microscope and measured the diameter of a root hair with a x10 eyepiece and x10 objective as 2.0mm. When he changed the objective lens to x40, he would find the diameter of the root hair to be:

   A. 0.20 mm
   B. 0.50 mm
   C. 2.0 mm
   D. 4.0 mm

4. The diagram shows an alga as seen under a compound microscope. It is magnified 100x. How many cells will be seen when the magnification increases to 400x?



   A. 2 cells
   B. 4 cells
   C. 8 cells
   D. 16 cells

5. Which of the following is the most correct sequence when setting up a microscope on high power and having a slide ready for viewing?

   A. Adjust light, arrange slide, focus low power, focus high power.
   B. Focus low power, focus high power, arrange slide, focus high power.
   C. Adjust light, focus low power, focus high power, arrange slide
   D. Arrange slide, focus low power, focus high power, adjust light.

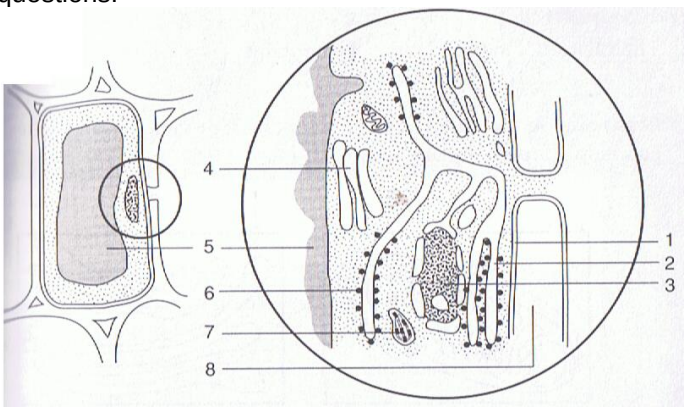
6. The functioning of a cell is controlled by the:

   A. Nucleus
   B. Ribosome
   C. mitochondria
   D. organelles

7. All materials within a cell membrane and outside the nucleus is called the:

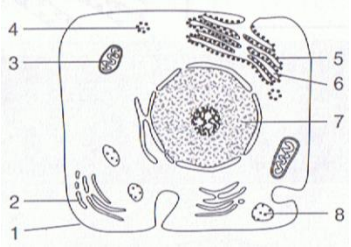
   A. Plasma
   B. Cytoplasm
   C. vacuole
   D. Nucleolus

8. Study the diagram below and answer the following questions.



   a) Name the parts labelled 1 – 8 on the diagram.
   b) Indicate the functions of the parts labelled 1-4.
   c) State in *one word* if the cell illustrated is an animal or plant cell.
   d) Give the numbers of three structures used to distinguish this cell as either an animal or plant cell.

Use the diagram below to answer Questions 9 – 12.



9. Which label corresponds to a structure commonly found in cells concerned with secretion, such as in the pancreas?
   A. 2 B. 3 C. 4 D. 5

10. The site of protein synthesis would be:
    A. 1 B. 3 C. 4 D. 5

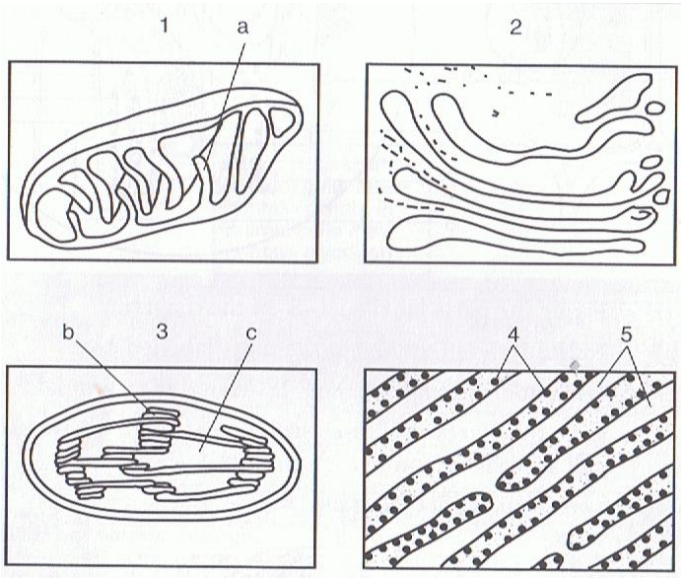
11. Regulation of cell contents is determined by:
    A. 1 and 7 B. 2 C. 4 D. 6

12. Energy production occurs in organelle:
    A. 1 B. 2 C. 3 D. 4

13. The vacuole of a typical plant cell contains:

    A. Air C. Water
    B. A solution D. Oil

14. Below are four diagrams of electron microscope views of organelles commonly found in plant cells:



    Name all the organelles shown (1 – 5) and the parts indicated (a – c).

15. Select a structure from the keylist below that best applies to the following:

Keylist:	A. Golgi bodies B. Endoplasmic Reticulum C. Ribosome D. Lysosome

    a) A site for messenger RNA
    b) Stores hydrolytic enzymes
    c) Transports intracellular materials
    d) Produces cell secretions

16. In rare disease in human beings, mitochondria have an abnormal structure. This disease is most likely correlated with a disturbance in cell:

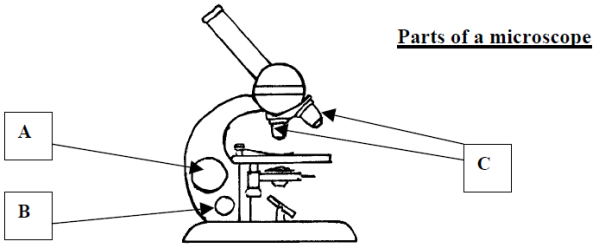
    A. Division C. Food supply
    B. Protein formation D. Energy supply

17. What would be one substance present in greater concentration inside the organelle shown below?

    A. ATP C. RNA
    B. DNA D. Starch

18. Use the diagram below to answer the following questions.

    a) Fill in the table below. The name for Part C and its function have been filled in for you.



Label	Name	Function
A		
B		
C	Objective lens	Can increase or decrease magnification

    b) There are 3 objective lenses on the microscope with 4x, 40x and 100x magnifications. The eye piece lens is 10x. What is the total Low Power and High Power magnification for this microscope?

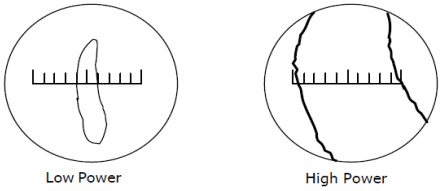
    Low Power = _____

    High Power = _____

    c) Give ONE advantage and ONE disadvantage of using light microscope (LM) to view specimens in school instead of an electron microscope.

19. The diagram shows a light microscope fields of view of a biological specimen during low power magnification?

    How much greater is the high power magnification than the low power magnification?



    A. 2x B. 5x C. 10x D. 20x

20. Which cellular organelle contains enzymes that are considered digestive?

    A. Nucleus C. Ribosomes
    B. Lysosome D. Golgi bodies