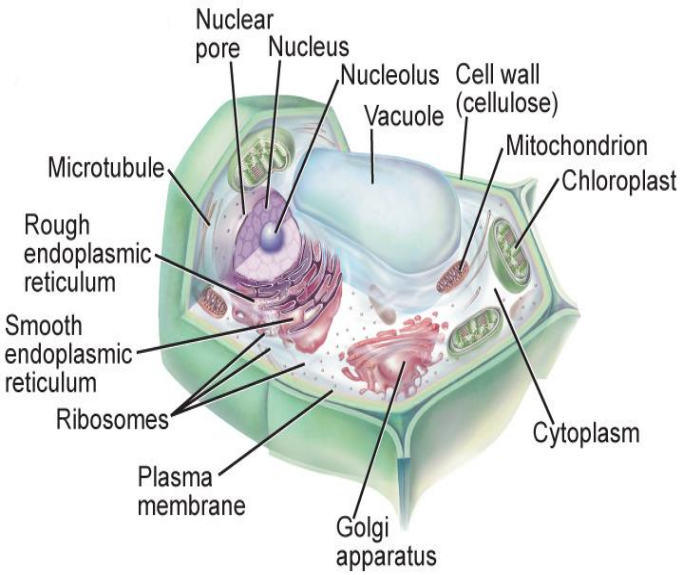
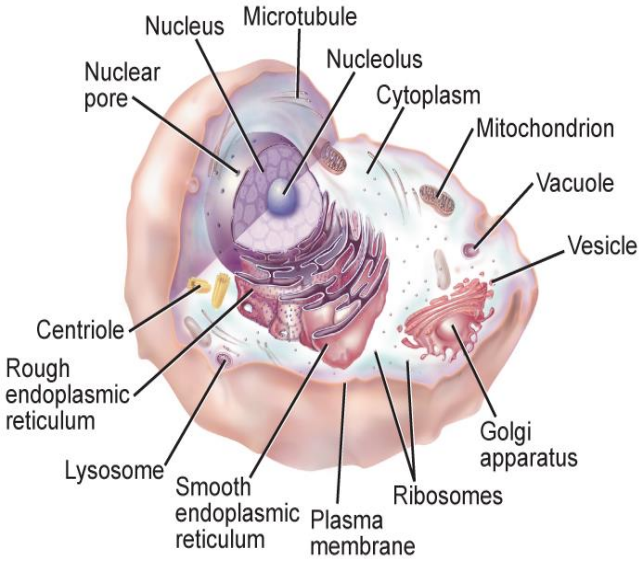
CHAPTER 8: THE CELL

Plant Cell



Animal Cell



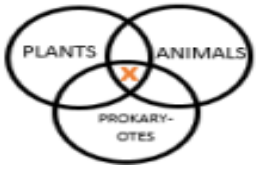
Cell Structure	Example	Function	Cell Type
Cell wall		An inflexible barrier that provides support and protects the plant cell	Plant cells, fungi cells, and some prokaryotes
Centrioles		Organelles that occur in pairs and are important for cell division	Animal cells and most protist cells
Chloroplast		A double-membrane organelle with thylakoids containing chlorophyll; where photosynthesis takes place	Plant cells and some protist cells
Cilia		Projections from cell surfaces that aid in locomotion and feeding; also used to sweep substances along surfaces	Some animal cells, protist cells, and prokaryotes
Cytoskeleton		A framework for the cell within the cytoplasm	All eukaryotic cells
Endoplasmic reticulum		A highly folded membrane that is the site of protein synthesis	All eukaryotic cells
Flagella		Projections that aid in locomotion and feeding	Some animal cells, prokaryotes, and some plant cells
Golgi apparatus		A flattened stack of tubular membranes that modifies proteins and packages them for distribution outside the cell	All eukaryotic cells
Lysosome		A vesicle that contains digestive enzymes for the breakdown of excess or worn-out cellular substances	Animal cells and rare in plant cells
Mitochondrion		A membrane-bound organelle that makes energy available to the rest of the cell	All eukaryotic cells
Nucleus		The control center of the cell that contains coded directions for the production of proteins and cell division	All eukaryotic cells
Plasma membrane		A flexible boundary that controls the movement of substances into and out of the cell	All cells
Ribosome		Organelle that is the site of protein synthesis	All cells
Vacuole		A membrane-bound vesicle for the temporary storage of materials	Plant cells–one large; rarely animal cells–a few small

CHAPTER 8: THE CELL

Part 1: Types of Cells & Its Structure

The cell: a basic unit for structure and organization of all living organisms
Plasma membrane: The cell: a basic unit for structure and organization of all living organisms
Plasma membrane: the flexible boundary that helps control what enters and leaves the cell
Selective permeability: property of the plasma membrane that controls the movement of substances into or out of the cell
Structure of plasma membrane: bilayer of phospholipids
Other structures of the plasma membrane are proteins, cholesterol, carbohydrates
Proteins: help the selective permeability of the membrane
Cholesterol: helps the fluidity of the membrane
Cell structures :
Nucleus: manages cellular functions and contains DNA
Ribosome: simple cell organelle that helps manufacture proteins, produced in the nucleolus
Endoplasmic reticulum: highly folded membrane system that is the site for protein and lipid synthesis. (rough and smooth) the smooth endoplasmic reticulum in the liver removes poisonous materials from the body.
Vacuoles: membrane-bound vesicle for the temporary storage of materials
Lysosomes: vesicle that uses enzymes to digest excess or worn-out cellular substances
Centrioles: organelle that plays a role in cell division
Mitochondria: organelle that converts fuel into energy
Chloroplasts: Photosynthesis occurs in them
Cell wall: is made of cellulose, and provides support and protection to plant cells
Cilia: short, a hair-like projection that functions in cell movement.
Structures only found in plant cells: Cell wall made up of cellulose, Chloroplasts which absorbs sunlight to perform photosynthesis.
Structures only found in animal cells: Centrioles and lysosomes.
Cytoskeleton: Supporting a network of protein fibers that provide a framework for the cell within the cytoplasm.

1 **The following figure represents a Venn diagram to compare between cells, which of the following structure is represented by (x)?**



CH 8 **A** Cell wall **B** Mitochondria **C** Plasma membrane **D** Mitochondria
Plasma membrane: The cell: a basic unit for structure and organization of all living organisms →C

2 **A property in the plasma membrane which controls the movement of substances into and out of cell**
CH 8 **A** Selective permeability **B** Osmosis **C** Simple diffusion **D** Pinocytosis
Selective permeability: property of the plasma membrane that controls the movement of substances into or out of the cell →A

3 **The condition which raises the fluidity of the phospholipid bilayer…..**
CH 8 **A** Decreasing temperature **B** Increasing the number of proteins **C** Increasing cholesterol molecules **D** Increasing amino acids
Cholesterol: helps the fluidity of the membrane →C

4 **What will happen if the number of ribosomes Decrease in the cell?**
CH 8 **A** Cell death **B** Increasing the number of proteins **C** No cell division **D** Energy production will decrease
Ribosome: simple cell organelle that helps manufacture proteins, produced in the nucleolus →D

5 **Which of the following cells contains smooth endoplasmic reticulum?**
CH 8 **A** Blood **B** Liver **C** Muscles **D** Brain
smooth endoplasmic reticulum in the liver removes poisonous materials from the body. →B

6 **The system which packages proteins in the cell….**
CH 8 **A** Mitochondria **B** Centrioles **C** Golgi apparatus **D** Lysosomes
Golgi apparatus: a flattened stack of tubular membranes, that modifies, sorts, and packages proteins and transports them to other organelles or out of the cell →C

7 **The common characteristic between Golgi apparatus, ribosomes, and rough endoplasmic reticulum is….**
CH 8 **A** Cell division **B** Energy storage **C** Protein production **D** Energy production
The common characteristic between Golgi apparatus, ribosomes, and rough endoplasmic reticulum is protein production →C

8 **Which of the following isn't involved in protein production?**
CH 8 **A** Cell division **B** Nucleolus **C** Nucleus **D** Golgi apparatus
Cell division →A

9 **Which is responsible of producing energy in the cell…**
CH 8 **A** Vacuoles **B** Mitochondria **C** Ribosomes **D** Centrioles
Mitochondria: organelle that converts fuel into energy →B

1 **Which of the following living organisms have cell wall in their cells?**
Do It? **A** Rabbit **B** Whale **C** Lizard **D** Lemon

CHAPTER 8: THE CELL

Part 2: Cell Chemistry and Macromolecules

***Carbohydrates*:** Organic compound which contains carbon, hydrogen, and oxygen with ratios 1:2:1. They provide synthetic support and are the source of energy.

Types of carbohydrates:

-Monosaccharides like glucose and fructose -Disaccharides like sucrose, and lactose. - Polysaccharides like glycogen cellulose and starch

Lipids: Contains carbon and hydrogen, they make up fats, oils, and waxes, and store energy

Lipid components: fatty acids, glycerol

Types of fat: Unsaturated, saturated, and steroids like cholesterol, and hormones

Proteins: organic compound made of amino acids joined by peptide bonds; the primary building block of organisms

Proteins functions: -Transporting materials- work as catalysts (enzymes), provide synthetic Support, and makeup hormones

Enzymes: a protein that speeds up a biological reaction

Nucleic acids: are composed of nucleotides that store and communicate genetic information

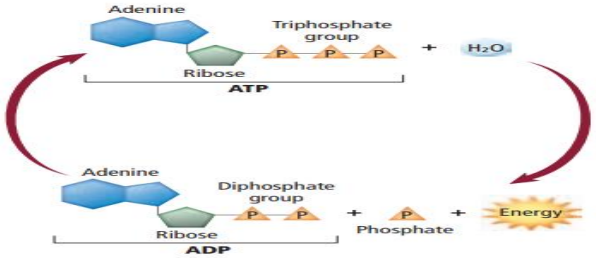
Types of nucleic acids: DNA and RNA

Metabolism: All chemical reactions that occur within the organism.

Types of metabolic pathways: Catabolism and Anabolism.

Catabolic pathways: release energy by breaking down larger molecules into small molecules, like cellular respiration.

Anabolic pathways: use the energy released by catabolic pathways to build larger molecules from smaller molecules, like photosynthesis.



10 **Which of the following is a disaccharide?**

CH 8 **A** Fructose **B** Starch **C** Sucrose **D** Cellulose

Disaccharides like sucrose, and lactose →C

11 **An example of a polysaccharide is …**

CH 8 **A** Glucose **B** Sucrose **C** Lactose **D** Glycogen

Polysaccharides like glycogen cellulose and Starch →D

12 **The main function for … is to store energy.**

CH 8 **A** Carbohydrates **B** Proteins **C** Fats **D** Amino acids

The main function for fat is to store energy. →C

13 **Cholesterol is an example of a(n)….**

CH 8 **A** Phospholipid **B** Unsaturated fats **C** Steroids **D** Amino acids

Types of fat: Unsaturated, saturated, and steroids like cholesterol, and hormones →C

14 **Proteins are composed of….**

CH 8 **A** Fatty acids **B** Carboxylic acids **C** Nucleic acids **D** Amino acids

Proteins: organic compound made of amino acids →D

15 **Photosynthesis is considered as … pathway**

CH 8 **A** Catabolic **B** Anabolic **C** Fragmentation **D** Combustion

Anabolic pathways: like photosynthesis. →C

16 **Which of the following molecules are stored For energy?**

CH 8 **A** ATP **B** NADH+ **C** NAD **D** NADPH

ATP molecules that stores energy →A

17 **Complex macromolecules that store and communicate genetic information are…**

CH 8 **A** Amino acids **B** Fats **C** Nucleic acids **D** Amino acids

Nucleic acids: are composed of nucleotides that store and communicate genetic information →C

18 **All chemical reactions that occur within an organism…**

CH 8 **A** Oxidation reactions **B** Reduction reactions **C** Substitution reactions **D** Metabolism

Metabolism: All chemical reactions that occur within the organism →D

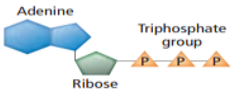
19 **Enzymes are thought to be composed of….**

CH 8 **A** Amino acids **B** Fatty acids **C** Nucleic acids **D** Glycerin

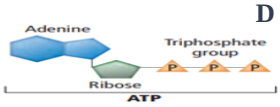
Proteins functions:

Transporting materials- work as catalysts (enzymes), provide synthetic Support, and makeup hormones →A

20 **The following diagram represents ..**



CH 8 **A** ATP **B** NADH+ **C** NAD **D** NADPH



→A

21 **When ATP molecule losses a phosphate group it turns into**

CH 8 **A** ADP **B** AMP **C** UTP **D** GTP

ATP - Phosphate group = ADP →A

22 **Two phosphate groups are present in which molecule.**

CH 8 **A** ADP **B** AMP **C** ANP **D** ATP

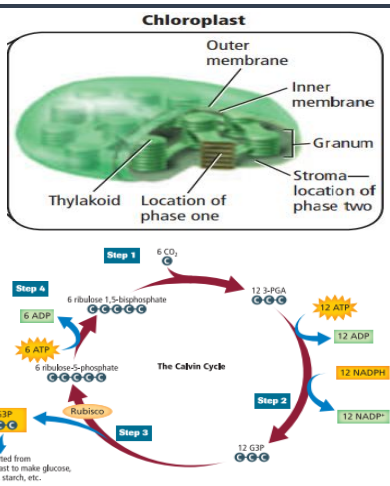
ADP contains 2 phosphate groups →A

Part 3: Photosynthesis

When ATP decomposes into ADP (Adenosine Diphosphate), the phosphate group releases energy supporting cellular activity.
An ***anabolic*** process during which light energy is converted into chemical energy for cell use Light:

$$6CO_2 + 6H_2O \xrightarrow{light} C_6H_{12}O_6 + 6O_2$$

Light-dependent reactions: It depends on the light by absorbing it and converting it into chemical energy in the form of ATP and NADPH
Calvin cycle (light-independent reactions):
Utilizes ATP and NADPH to produce carbohydrates as glucose
Chloroplast Structures:
Thylakoid: in chloroplasts, one of the stacked, flattened, pigment-containing Membranes in which light-dependent reactions occur.
Stroma: fluid-filled space outside the grana in which Light-independent reactions take place



23 **An anabolic process during which light energy is transformed into chemical energy.**
CH 8 **A** Cellular respiration **B** Lipid synthesis **C** Photosynthesis **D** Meiosis
Photosynthesis is an anabolic process during which light energy is converted into chemical energy for cell use Light. →C

24 **A product of photosynthesis that is released into the environment.**
CH 8 **A** CO_2 **B** O_2 **C** H_2O **D** NH_3
$6CO_2 + 6H_2O \xrightarrow{light} C_6H_{12}O_6 + 6O_2$ →B

25 **What is the energy source required to synthesize carbohydrates during Calvin cycle?**
CH 8 **A** CO_2 and ATP **B** NADPH and ATP **C** NADPH and H_2O **D** H_2O and O_2
Calvin cycle (light-independent reactions): Utilizes ATP and NADPH to produce carbohydrates as glucose →B

26 **One of the following compound is produced from the process of photosynthesis.**
CH 8 **A** Glucose **B** Ribose Sugar **C** Lipids **D** Protein
$6CO_2 + 6H_2O \xrightarrow{light} C_6H_{12}O_6 + 6O_2$ →A

27 **Flattened saclike membranes that are arranged in stacks and contain pigments..**
CH 8 **A** Thylakoids **B** Stroma **C** Mitochondria **D** Sheath
Thylakoid: in chloroplasts, one of the stacked, flattened, pigment-containing Membranes in which light-dependent reactions occur. →A

28 **Light-absorbing molecules such as chlorophyll are called …**
CH 8 **A** Thylakoids **B** Mitochondria **C** Stroma **D** Pigments
Light-absorbing molecules such as chlorophyll are called Pigments →D

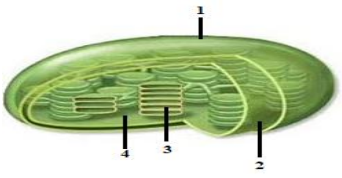
29 **The location of the light-independent reactions in phase two of photosynthesis.…**
CH 8 **A** Thylakoids **B** Stroma **C** Mitochondria **D** Sheath
Stroma: fluid-filled space outside the grana in which Light-independent reactions take place →B

30 **Why is adenosine triphosphate (ATP) such an important biological molecule?**
CH 8 **A** It captures light energy from the sun.
B It is produced in anabolic pathways.
C It stores and releases chemical energy.
D It converts mechanical energy to thermal energy.
Adenosine triphosphate (ATP) is an important biological molecule because its stores and releases chemical energy. →C

31 **Where in the plant cell does photosynthesis take place?**
CH 8 **A** Chloroplasts **B** Golgi apparatus **C** Mitochondria **D** Vacuoles
photosynthesis take place in chloroplasts →A

32 **At the beginning of photosynthesis, which molecule is split to produce oxygen (O_2) as a waste product?**
CH 8 **A** CO_2 **B** H_2O **C** $C_6H_{12}O_6$ **D** NH_3
At the beginning of photosynthesis, H_2O molecule is split to produce oxygen (O_2) as a waste product →B

33 **Which of the parts in the figure indicates where the light-independent reactions take place in the following figure?**

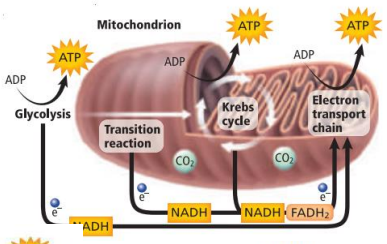


CH8 **A** 1 **B** 2 **C** 3 **D** 4
Stroma: fluid-filled space outside the grana in which Light-independent reactions take place →D

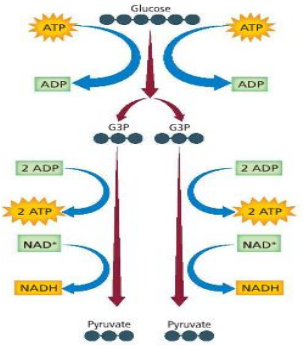
Part 4: Cellular Respiration

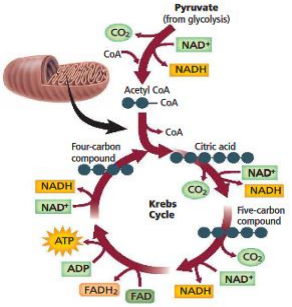
Cellular respiration: catabolic pathway in which organic molecules are broken down to release energy for use by the cell

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$$

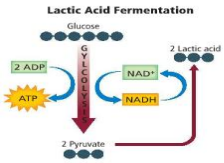


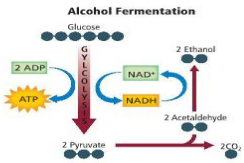
Cellular respiration occurs in two main parts:
Glycolysis and Aerobic respiration
(aerobic respiration includes the Krebs cycle and electron transport)
- ***Glycolysis:*** anaerobic process; the first stage of cellular respiration in which glucose is broken down into two molecules of pyruvate and four molecules of ATP
- ***Krebs cycle:*** series of reactions in which pyruvate is broken down into carbon dioxide inside the mitochondria of cells.
Prior to the Krebs cycle, pyruvate first reacts with coenzyme A (CoA) to form a 2-carbon intermediate called acetyl CoA.
The reaction results in the production of two carbon dioxide molecules and two NADH
The net yield from the Krebs cycle is six carbon dioxide molecules, two ATP, eight NADH, and two FADH2
Electron Transport: the final step in the breakdown of glucose.
It also is the point at which most of the ATP is produced.
Electron transport produces 24 ATP. Each NADH molecule produces three ATP and each group of three FADH2 produces two ATP
NADH and FADH2 are important electron carriers for cellular respiration
In eukaryotes, one molecule of glucose yields 36 ATP





Fermentation: the anaerobic pathway that follows glycolysis, occurs in the cytoplasm in the absence of oxygen.
* ***Lactic acid fermentation***: enzymes convert pyruvate into lactic acid.
* ***Alcohol fermentation:*** pyruvate is converted to ethyl alcohol and CO_2 releases

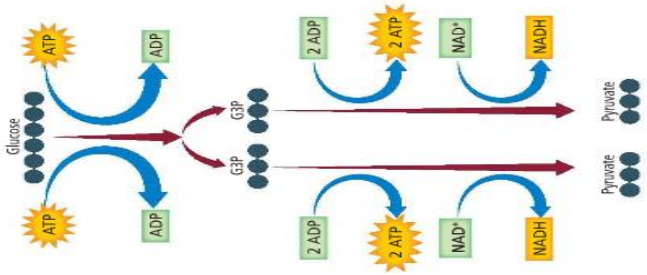




34 **Catabolic pathway in which organic molecules are broken down to release energy for use by the cell…**
CH 8 **A** Photosynthesis **B** Cellular reproduction **C** Cellular respiration **D** Cellular growth
Cellular reproduction is catabolic pathway in which organic molecules are broken down to release energy for use by the cell →B

35 **Which is not a stage of cellular respiration?**
CH 8 **A** Glycolysis **B** Krebs cycle. **C** Electron transport chain **D** Lactic acid fermentation
Cellular respiration occurs in two main parts:
Glycolysis and Aerobic respiration
(aerobic respiration includes the Krebs cycle and electron transport) →D

36 **In the following figure, how many ATP molecules Are produced?**



CH 8 **A** 6 **B** 8 **C** 3 **D** 4
Glycolysis: anaerobic process; the first stage of cellular respiration in which glucose is broken down into two molecules of pyruvate and four molecules of ATP →D

37 **The net end products of glycolysis are…**
CH 8 **A** 4ATP **B** 2ATP **C** 2FAD **D** 4ADP
Glycolysis: anaerobic process; the first stage of cellular respiration in which glucose is broken down into two molecules of pyruvate and four molecules of ATP →B

38 **In which molecule is most of the energy of glucose store at the end of glycolysis?**
CH 8 **A** Pyruvate **B** Acetyl CoA **C** ATP **D** NADH
Glycolysis: anaerobic process; the first stage of cellular respiration in which glucose is broken down into two molecules of pyruvate and four molecules of ATP →A

39 **How many ATP molecules are produced from 8 NADH molecules in the electron transport chain?**
CH 8 **A** 16 **B** 8 **C** 24 **D** 4
Each NADH molecule produces three ATP and each group of three FADH2 produces two ATP →C

40 **Fermentation happens in cells with the absence of…**
CH 8 **A** Hydrogen **B** Lactic Acid **C** Oxygen **D** CO_2
Fermentation: the anaerobic pathway that follows glycolysis, occurs in the cytoplasm in the absence of oxygen →C

41 **Within ……., pyruvate converts to lactic acid**
CH 8 **A** Krebs cycle **B** Alcohol Fermentation **C** Lactic acid Fermentation **D** Glycolysis
Lactic acid fermentation: enzymes convert pyruvate into lactic acid. →C

CHAPTER 8: THE CELL

Part 5: CELL CYCLE

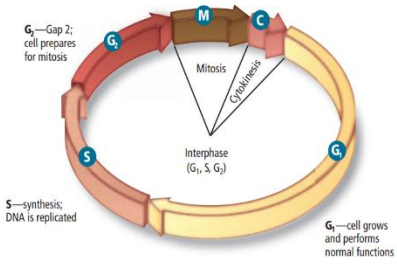
Cells reproduce by a cycle of growing and dividing and pass through three phases: interphase, mitosis, and cytokinesis.

*** Interphase Properties:**

The first stage of the cell cycle, the cell grows and replicates its genetic material and gets ready for division.

Interphase is divided into three phases…

- G1: the cell grows and gets ready for DNA replication.
- S-DNA: the genetic material is replicated
- G2: the cell gets ready for its nucleus division.

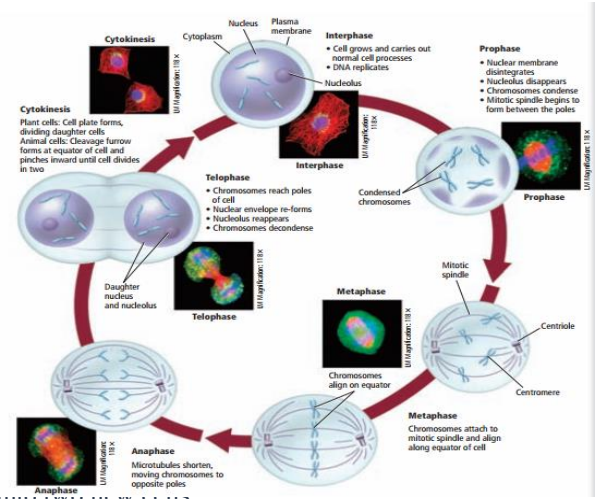


****Mitosis**

Characteristics: the second phase of the cell cycle, the nucleus and its content split, cells become ready to separate, occurs in somatic cells.

Phases of mitosis:

- **Prophase:** longest stage, nuclear membrane disappeared, and the nucleolus disappears, chromosomes condense, spindle apparatus begins to form between the poles.
- **Metaphase**: Chromosomes attach to spindle apparatus and align along the equator of the cell.
- **Anaphase**: Spindle fibers shorten, separating sister chromatids and moving chromosomes to opposite poles.
- **Telophase**: chromosomes reach poles of the cell, nuclear envelope reforms nucleolus reappears.



- Chromosome: the structure that contains the genetic material that is passed from one generation to the next.
- Sister chromatid: structure containing identical DNA copies.
- Centromeres: The structure at the center of the chromosome where the sister chromatids are attached.

Cytokinesis product: Genetically identical cells,

In plant cells: a cell plate forms between the daughter nuclei that divide the cell into two new cells,

In animal cells: cytokinesis begins with a furrow that pinches the cell and eventually splits the two cells apart.

42 **Which of the following describes the growth, division, and the reproduction of the cells?**

CH 8 **A** Krebs cycle **B** Chromatin **C** Cell Cycle **D** Cytoplasm

Cell Cycle: Cells reproduce by a cycle of growing →C

43 **The first stage of the cell cycle**

CH 8 **A** Interphase **B** Mitosis **C** Cytoplasm **D** Cytokinesis

Interphase Properties: The first stage of the cell cycle →A

44 **The amount of genetic material in the end of the interphase stage is 60g, what is the amount of it in G1?**

CH 8 **A** 20g **B** 30g **C** 40g **D** 120g

During S-DNA in inter phase the genetic material is replicated. →B

45 **In which stage of interphase does the cell replicates its genetic material?**

CH 8 **A** G1 **B** S phase **C** G2 **D** Protein synthesis

During S-DNA in inter phase the genetic material is replicated. →B

46 **One of the substages of interphase the cell prepares for its nucleus division**

CH 8 **A** G1 **B** S phase **C** G2 **D** Protein synthesis

G2: the cell gets ready for its nucleus division. →C

47 **A process in which the nucleus of a cell divides…**

CH 8 **A** Interphase **B** Mitosis **C** Cytokinesis **D** Photosynthesis

Mitosis →B

48 **The nucleus disappears during the stage of…**

CH 8 **A** Prophase **B** Metaphase **C** Anaphase **D** Telophase

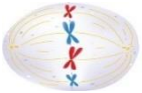
Prophase: longest stage, nuclear membrane disappeared →A

49 **What is the difference between plant and animal cells during prophase?**

CH 8 **A** The nucleus disappears **B** Presence of centrioles **C** Condensation of chromosomes **D** Presence of spindle fibers

In plant cells there is no centrioles. →B

50 **Which stage of mitosis is represented by the figure?**



CH 8 **A** Prophase **B** Metaphase **C** Anaphase **D** Telophase

Metaphase: Chromosomes attach to spindle apparatus and align along the equator of the cell. →B

51 **Which stage of mitosis is represented by the figure?**

CH 8 **A** Prophase **B** Metaphase **C** Anaphase **D** Telophase

Anaphase: Spindle fibers shorten, separating sister Chromatids and moving chromosomes to opposite Poles →C

52 **During what stage of mitosis does the nucleus and nuclear envelop begin to reform?**

CH 8 **A** Prophase **B** Anaphase **C** Metaphase **D** Telophase

Telophase: chromosomes reach poles of the cell, nuclear envelope reforms nucleolus reappears. →D

53 **Structure that contains the genetic material that is passed from one generation to the next.**

CH 8 **A** Chromosome **B** Mitochondria **C** Ribosome **D** Centromere

Chromosome: the structure that contains the genetic Material that is passed from one generation to the next. →A

54 **The structure at the center of the chromosome where sister chromatids are attached is called…**

CH 8 **A** Nucleus **B** Spindle fibers **C** Chromatin **D** Centromere

Centromeres: The structure at the center of the chromosome where the sister chromatids are attached. →D

55 **A stage in the cell cycle that produces genetically identical cells**

CH 8 **A** Interphase **B** Cytokinesis **C** Meiosis **D** Nuclear fission

Cytokinesis product: Genetically identical cell →B

56 **…… cells build a cell plate that split the two Daughter cells.**

CH 8 **A** Animal **B** Prokaryotic **C** Plant **D** Bacteria

In plant cells: a cell plate forms between the daughter Nuclei that divide the cell into two new cells. →C

Part 6: Regulation of Cell Cycle

- **Cyclins:** proteins that regulate the cell cycle and signal the cellular reproduction processes.
- **Cancer:** the uncontrolled growth and division of cells.
- **Carcinogens:** substances and agents that are known to cause cancer like smoking and asbestos.
- **Apoptosis:** programmed cell death.
- **Stem cell:** an unspecialized cell that can develop into specialized cells under the right conditions
- **Types of stem cells:** Embryonic and adult stem cells.

Number of Chromosomes in Cells

- **Haploid cells (n):** have half the number of chromosomes, such as gametes.
- **Diploid (2n):** Most cells carry this number of chromosomes, such as somatic cells.
- **Polyploid (xn):** the occurrence of one or more extra sets of all chromosomes in an organism.
- **Examples of polyploid plants:** wheat and oats (6n), sugar cane and strawberry (8n), and these plants are characterized by rigidity, livelihood, and large size.

57 **Which of the following is a characteristic of cancer cells**

CH 8 **A** Controlled cell division **B** Has mutated genetic information **C** Doesn't undergo cytokinesis **D** Cyclins functions normally

Cancer cells has mutated genetic information. →B

58 **What is the role of cyclins in the cell?**

CH 8 **A** Regulates the movement of microtubules **B** Send signals to begin cell division **C** Stimulates the disintegration of the nuclear membrane **D** Causes the nucleolus to disappear

Cyclins: proteins that regulate the cell cycle and signal the cellular reproduction processes. →B

59 **One of the causes of cancer is…**

CH 8 **A** Exposure to spores/pollen **B** Medication intake **C** Exposure to heat **D** Exposure to asbestos

Carcinogens: substances and agents that are known to Cause cancer like smoking and asbestos →D

60 **Gametes are sex cells with a …….. number of chromosomes**

CH 8 **A** Haploid **B** Diploid **C** Triploid **D** polyploid

Haploid cells (n): have half the number of chromosomes, such as gametes. →A

61 **Which of the following shows the chromosomes of a polyploid organism?**

CH 8 **A** ½ n B 1 ½ n **C** 2n D 3n

Examples of polyploid plants: wheat and oats (6n), sugar cane and strawberry (8n). →D

62 **Polyploid chromosomes in wheat plants leads to…**

CH 8 **A** Strength and rigidity **B** Death **C** No effect **D** Weak growth

Examples of polyploid plants: wheat and oats (6n), sugar cane and strawberry (8n). →A

63 **What is the term for the programmed death of cells that are damaged beyond repair or have harmful changes in their DNA?**

CH 8 **A** Apoptosis **B** Carcinogens **C** Cytokinesis **D** Mitosis

Apoptosis: programmed cell death. →A

64 **Which cells are not locked into becoming one particular kind of cell and are capable of developing into specialized tissues?**

CH 8 **A** Apoptotic cells **B** Cancer cells **C** Prokaryotic cells **D** Stem cells

Stem cell: an unspecialized cell that can develop into specialized cells under the right conditions →D

65 **Cancer cells can reproduce rapidly because they**

CH 8 **A** Are smaller than normal cells. **B** By pass interphase. **C** Undergo mitosis faster **D** Spend less time in interphase

Cancer cells spend less time in interphase than do normal cells. →D

66 **What is cancer caused by?**

CH 8 **A** Cell-membrane damage **B** Mutation **C** Metabolic poisoning **D** Immune-system damage

Cancer can have diverse causes, all of which result in mutation in a cell's DNA. →B