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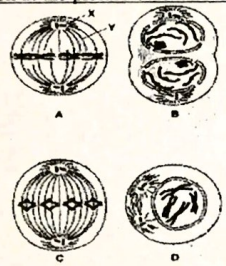
Mitosis and Meiosis

A science student was looking through a microscope at some dividing cells. Please answer the following questions based on her observations.

Observation #1	One cell divided into two cells
Observation #2	The number of chromosomes remained the same in the daughter cells as in the parent cell
Observation #3	The daughter cells were formed by a plate forming between the two new nuclei
Observation #4	The cell appeared to go through 4 stages of chromosome movement before dividing

1. What kind of cell division occurred based on the observations above? _____.
2. What kind of cell was dividing (plant or animal)? How can you tell? _____, _____.
3. Were the resulting cells diploid or haploid? _____.
4. What were the stages of chromosome movement the cell went through before dividing (IN ORDER!)?

Look at the picture below and use it to answer the questions that follow.



5. Name the stages of each picture:
   a.
   b.
   c.
   d.
6. Put them in the correct sequence(use the letters) in which order they should happen.
   _____, _____, _____, _____.
7. Is this picture showing mitosis or meiosis? EXPLAIN YOUR ANSWER!!!
8. Is this picture showing plant or animal cell division? EXPLAIN YOUR ANSWER!!!!

Multiple choice: Choose the letter that best fits the statement.

9. Diploid is to a somatic cell as haploid is to a...
   a. body cell b. Chromosome c. Gamete d. Zygote

10. Which description of mitosis is not correct?
    a. The nuclear membrane breaks down during prophase.
    b. The longest phase is telophase.
    c. Anaphase begins when the chromosome split.
    d. Chromosomes line up across the cells center during metaphase

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11. The spindle and the centriole are composed of
    a. rRNA. B. Chromatin c. Histones. D. Microtubules

12. The structure that holds together the sister chromatids together during mitosis before metaphase.
    a. Nucleus b. Spindle. c. Aster. d. Centromere..

13. Bacteria reproduce through an asexual process called...
    a. meiosis b. cytokinesis c. mitosis d. binary fission

Matching:

a. Diploid	d. prophase	g. cytokinesis	j. nondisjunction
b. Haploid	e. anaphase	h. frameshift	k. crossing-over
c. Mitosis	f. Meiosis	i. Fertilization	l. random assortment of chromosomes

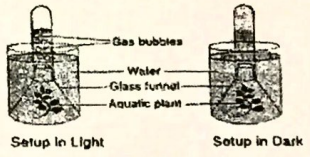
14. _____is the process by which bacteria split asexually into two identical organisms.
15. _____Somatic cells containing two sets of 23 chromosomes.
16. _____The failure of replicated chromosomes to separate.
17. _____The process where a sperm and an egg unite into a zygote.
18. _____Results in 4 different daughter cells produced from 2 divisions.
19. _____Chromosomes coil up and become visible during this phase.
20. _____Chromatids migrate towards poles as spindle fibers shorten during this phases.
21. _____alleles are exchanged between the homolgous chromosomes, to produce new combinations.
22. _____Mutation involving the insertion or deletion of a nucleotide.
23. _____Gametes which contain half the number of chromosomes of the parent cells.
24. _____Genes for different traits can segregate independently into each daughter cell which leads to variations in species.
25. _____Process by which the division of cytoplasm occurs.

26. Fill in the following missing information in the chart for mitosis and meiosis.

Reproductive cell	Somatic cell	Diploid number	Haploid number
46			
	20		
		12	

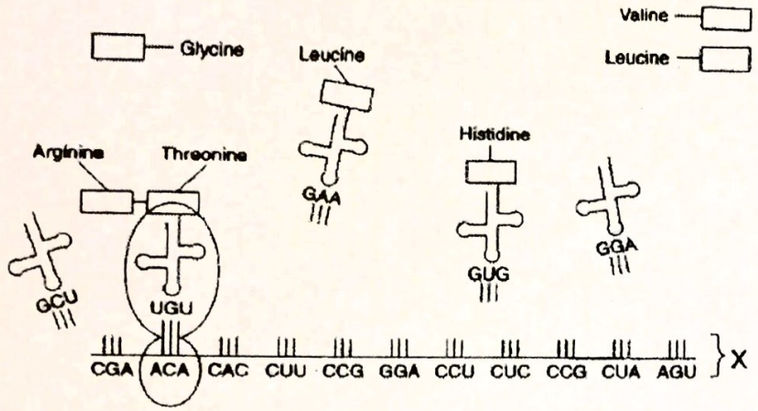
Rewind Your Mind

1. Give four characteristics of enzymes.
   a._____.
   b._____.
   c._____.
   d._____.



2. Describe what is happening in the diagram above and to the right. Be sure to give the scientific formula!

3. Use the following diagram to answer the questions below:



- What is the structure labeled "X"?
- Arginine is what type of molecule?
- Circle and label a tRNA molecule.
- Circle and label an amino acid molecule.

4. An mRNA molecule has the following sequence of nitrogenous bases: CAC ACA CUU. What would be the sequence of amino acids that would form a polypeptide from this mRNA sequence?

mRNA	CAC	ACA	CUU
tRNA	GUG		
amino acid	Histidine		

5. Threonine, histidine and leucine form a polypeptide sequence. What would be the DNA sequence that determined the polypeptide sequence?

Amino acid	Histidine	Leucine	Threonine
mRNA	CAC		
DNA	GTG		

6. Use the term present or absent to indicate which applies.

	Prokaryotic Cell	Eukaryotic Cell
Cell membrane	a.	d.
Nucleus	b.	e.
Nucleus membrane	c.	f.
Complexity	simple	complex

Complete by choosing a = cellular respiration b=photosynthesis.
Determine if these are cellular respiration (CR) or photosynthesis (P) or both (B)

7. _____Energy is given off.)
8. _____Occurs in green plants.

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9. _____Occurs in and animals.
10. _____Produces CO_2 and H_20.
11. _____reactants are Carbon dioxide and water combine.
12. _____Produces 0_2 and simple sugar.
13. _____reactants are sugar and 0_2 combine.

Matching. Choose letter a=carbohydrate, b=lipid, c=protein, d= all above.

14. _____Not normally used as a source of energy.
15. _____Have a ratio of two hydrogen atoms to each oxygen atom.
16. _____Often used as a long-term energy reserve.
17. _____Not soluble in water.
18. _____Organic compounds.
19. _____Number of hydrogen atoms per molecule is much greater than the number of oxygen atoms.
20. _____Often serve as immediate energy sources for life processes.
21. _____Built from amino acids.
22. _____Contain carbon, hydrogen, and oxygen atoms.

Matching. Determine which of the statements in cellular respiration are aerobic and anaerobic. Choose the letter a=aerobic, b= anaerobic, c=both.

23. _____It requires oxygen.
24. _____It does not require oxygen.
25. _____It produces lactic acid
26. _____It can produce alcohol
27. _____It produces a net of 2 ATP.
28. _____It causes pain of muscle fatigue.

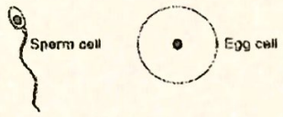
Mitosis and Meiosis

1. Complete the chart below.

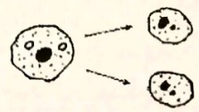
	Sexual Reproduction	**Asexual Reproduction**
advantage		
Disadvantage		
Methods		

2. Look at the pictures below. What forms of reproduction are demonstrated? Label them as sexual or asexual.

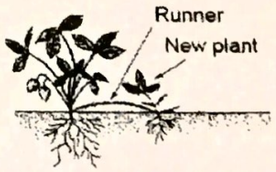
Picture A



Picture B



Picture C



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3. Which form of reproduction gives the greatest genetic variation? Explain your answer.

4. Which form of reproduction gives the least genetic variation? Explain your answer.

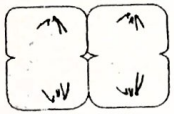
5. Describe three methods of asexual reproduction in plants.

6. Is mitosis a form of sexual or asexual reproduction? Explain your answer.

7. Is meiosis a form a sexual or asexual reproduction? Explain your answer

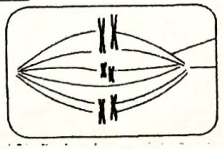
8. Examine the picture below. What phase of mitosis is illustrated?

9. Look at the drawing below. Which phase of meiosis is illustrated?

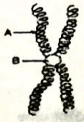


10. Examine the picture below. What phase of mitosis is illustrated?

11. Look at the drawing below. Which phase of meiosis is illustrated?



12. Examine the picture below. Name part A and part B. **What is this a picture of?**



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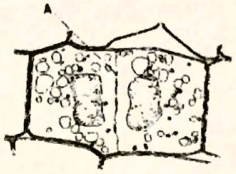
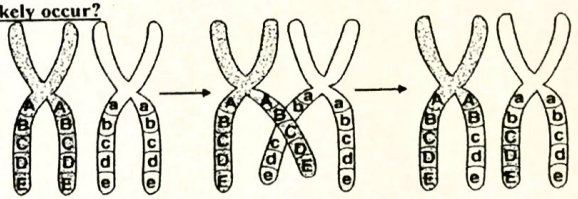
18. Look at the picture to the left. What is letter A pointing to? What will this cell part eventually become?



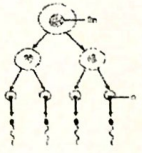
19. Look at the picture below. What process is demonstrated here? **What phase of meiosis would this process most likely occur?**



20. Complete the table below on your own paper.

	Mitosis	Meiosis
Number of cells that result		
Identical or different from the parent cell?		
Diploid or Haploid daughter cells?		
What type of cells?		

21. Look at the picture below. Which process is it illustrating? **How might you explain your answer?**



22. Explain the types of mutations in examples 1-4 below. Would each be a point mutation or a frame-shift mutation? (See Section 12-4)

(1) ABCDEFG → ABCDEF

(2) ABCDEFG → ABCDEFGN

(3) ABCDEFG → ABEDCFG

(4) ABCDEFG → ABCDEFGKMN

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Photosynthesis and Respiration

1. Please write the photosynthesis equation using words and write it using scientific formula.

2. Please write the respiration equation using words and write is using scientific formula.

3. A plant is releasing oxygen. What process is happening in the plant? Explain your answer.

4. A plant is releasing carbon dioxide. What process is happening in the plant? Explain your answer

5. Complete the chart below

	Photosynthesis	Respiration
Function of process		
Equation (scientific formulas)		
Organelle		

6. A plant is placed in a plastic bag. After 2 days, the inside of the plastic bag is covered in droplets of water. Why might this have happened?

7. Please discuss why aerobic cellular respiration is more efficient than anaerobic respiration (fermentation).

8. What is the difference chemically between ATP and ADP? Discuss which has more energy and why.

9. Draw a mitochondria. Why is the mitochondria folded inside?

10. Draw a chloroplast. Why is the chloroplast green?

Rewind Your Mind

1. A student wants to know how much sugar will make bread rise best. She predicts that if 5 grams of sugar are added to one packet of yeast, then the bread will rise best. In her experiment, she mixes her materials as follows:
   Container A= Yeast, Flour, Warm water, 5 grams of Sugar
   Container B= Yeast, Flour, Warm water, 10 grams of Sugar
   Container C= Yeast, Flour, Warm water

   A. What is her hypothesis?

   B. List all the constants in the experiment.

   C. What is the independent variable?

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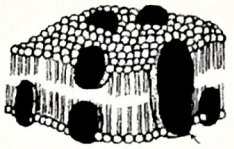
   D. What is the dependent variable?

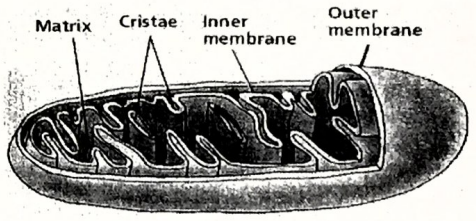
   E. Which of the containers is the control?

   F. Why might she have container B?

2. Identify the structure below in detail. What is the function? Please label the phosphates, lipids and proteins. What types of cells have a cell membrane.



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



   a. Identify the structure to the left.

   b. What process occurs in this cell organelle?

   c. Which life process is it most closely related to.

4. Be able to identify what will happen to a cell that is placed in a **hypertonic** solution, **hypotonic** solution and an **isotonic** solution. An example of a question you should be able to answer is as follows. A blood cell has the same concentration of solutes as seawater. What would happen to the blood cell if it were placed in a container of distilled (pure/100%) water? **Draw a picture and explain in words your drawing.**

5. Draw what happens to a cell placed in a hypertonic solution.

6. Draw what happens to a cell placed in a hypotonic solution.

7. Draw what happens to a cell placed in an isotonic solution.

8. In the bloodstream, the concentration of oxygen is 80%. The concentration of carbon dioxide is 20%. In the cell, the concentration of oxygen is 15%. The concentration of carbon dioxide is 85%.
   a. Draw a picture to show the movement of the molecules.
   b. What might happen to the oxygen molecules and the carbon dioxide molecules? (Hint: what will move out of the cell, and what will move into the cell?)

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Biochemistry:

Compare and contrast the structure and functions of the following organic molecules:

Macromolecules	Function	Subunits
Carbohydrates		
Proteins		
Lipids		
Nucleic Acids		

Specific Molecule	Function	Subunits
Starch		
Cellulose		
Glycogen		
Glucose		
Enzymes		
Fats		
DNA		
RNA		

Describe the following nutrient tests:

Nutrient	Type of Test	Negative Test	Positive Test
Starch			
Lipids			
Monosaccharides			
Protein			

Explain the importance of shape to enzyme function.

Explain what determines the shape of an enzyme.

Explain why enzymes are specific.

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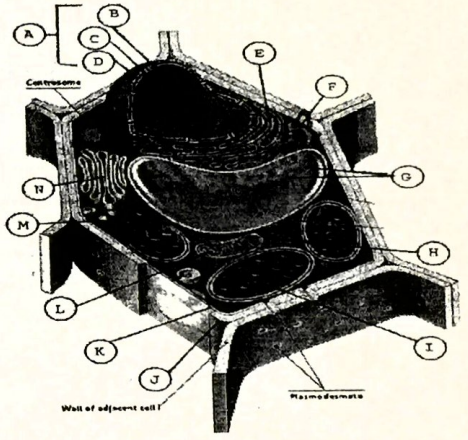
Cells:

Fill in this chart. Also give the letter or number of the part as seen in the diagrams below.

Cell Part and Letter	Structure Description	Function
Nucleus		
Plasma Membrane		
Cell wall		
Mitochondria		
Vacuoles		
Chloroplasts		
Ribosomes		

Which cell is the plant cell (left or right)?
Which structures are found only in the plant cell?



The diagram below shows many proteins and other molecules embedded in a cell membrane.
What are some of the functions of these proteins and other molecules?

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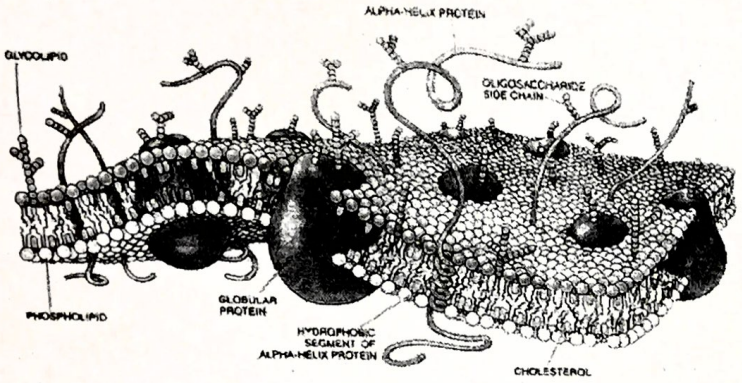
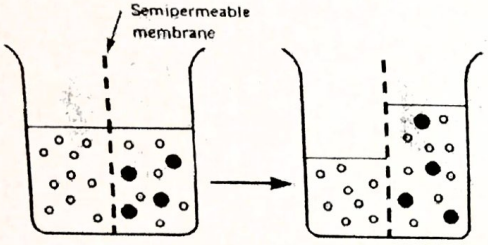


Investigate and analyze the cell as a living system including: maintenance of homeostasis, movement of materials into and out of cells, and energy use and release in biochemical reactions.



Explain what has happened in the diagram to the left.

Why did the large dark molecules NOT move to the left?

How is the semipermeable membrane like a cell membrane?

If the dark molecule is starch, where is the starch concentration greatest (left or right)?

If the white molecule is water, where is the water concentration greatest at first?

In osmosis, water moves from an area of _____ to an area of _____ concentration.

If the dark molecules could move, in what direction would they move? Why?

In diffusion, molecules move from an area of _____ to an area of _____ concentration.

Comparison of active and passive transport

	PASSIVE TRANPORT	ACTIVE TRANSPORT
Requires energy?		
Low to high concentration or high to low concentration?		
Examples		

Energy
Use the following diagram to show where energy is released and where energy is used. Also use arrows on the lines attached to the circles to indicate the direction of the energy.

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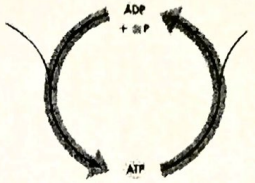


What cellular process produces ATP?

What is ATP energy used for? Give examples.

2.05 Investigate and analyze the bioenergetic reactions: aerobic respiration, anaerobic respiration, and photosynthesis.

Label the following molecules in these equations (water, glucose, oxygen, carbon dioxide, ethyl alcohol)

A) $6H_2O + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6O_2$

B) $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

C) $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

Which of the above reactions is photosynthesis?
Which of the above reactions is fermentation (anaerobic cellular respiration)?
Which of the above reactions is cellular respiration (aerobic)?

Which reaction(s) requires or stores energy?
Which reaction(s) release energy (ATP)?
Which reaction releases the most energy? Why?
Which reaction requires chlorophyll? What is the purpose of the chlorophyll?
Which reaction requires light? What is the light used for?
Which organisms carry out process A?
Which organisms carry out process B?
Which organisms carry out process C?
Which process uses chloroplasts in eukaryotes?
Which process uses mitochondria in eukaryotes?
What factors could speed up (or slow down) process A?

Evolution:
Discuss the steps in Darwin's theory of evolution by natural selection.

1) populations of organisms have many genetic variations. Where do these come from?

2) organisms could reproduce exponentially but they don't. Why not?

3) Genetic variations lead to different adaptations. What are adaptations?

4) Some adaptations have better survival value in certain environments. What does this mean?

5) Those organisms with adaptations that better fit them to an environment will survive, reproduce and pass on their genes. What does it mean to be "fit" to an environment?

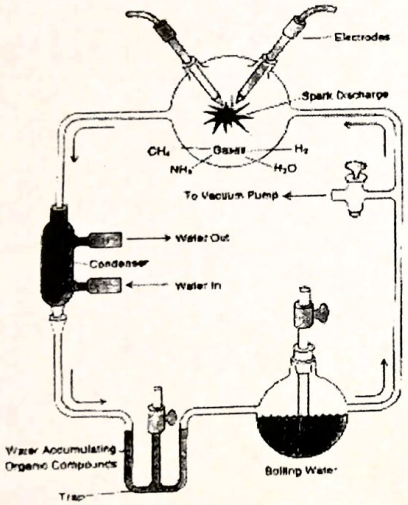
6) The next population will have a high frequency of the genes that have been selected for. Why will the frequency of selected genes increase?

7) When this process continues over millions of years, it can lead to speciation. What is speciation?

Describe how a population of bacteria can become resistant to an antibiotic (or an insect to a pesticide) using the steps listed above.

What are the differences between abiogenesis and biogenesis?

What did Louis Pasteur contribute to our understanding of the origins of life?



Explain Miller and Urey's hypothesis.

Why did Miller and Urey put those particular gases into their experiment?

What type of organic molecules did they find?

What is the significance of their experiments?

Most hypotheses state that prokaryotic anaerobes probably evolved first. Why?

The hypotheses then suggest that prokaryotic autotrophs probably evolved? Why?

What would enter the atmosphere as a result of these autotrophs appearing.

Then prokaryotic aerobic heterotrophs could evolve. What can these cells do that others before them cannot?

What is the hypothesis explaining how eukaryotic cells evolved?

Explain how the organization of the kingdoms and domains have changed over time.

What is the current accepted kingdom-domain system?

What is the current seven-level classification system?

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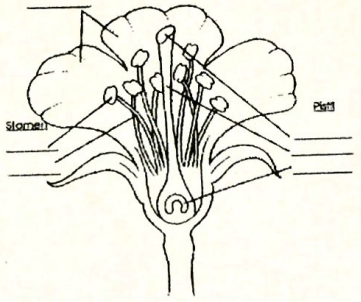
What is binomial nomenclature?

	Non-vascular Plants	Gymnosperms	Angiosperms
Transport of materials			
Excretion			
Respiration			
Regulation			
Nutrition			
Reproduction			
Growth and development			

Compare the following two types of cells.

	Prokaryotic	Eukaryotic
Membrane-bound organelles		
Ribosomes		
Types of chromosomes		
size		



Label the following parts on the flower and give their functions: Stigma, style, ovary, petal, sepal, anther, filament

Fill in the following charts with the information required.

	Reproduction Adaptations	Adaptations to life on Land
Non-vascular plants		
Gymnosperms		
Angiosperms		