Name: _____

Start Date: _____

Test Date: _____

Cellular Processes

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Biology Edition

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Vocabulary

Homeostasis	The process within living organisms of maintaining a stable internal environment
Passive Transport	The movement of materials into or out of a cell with the concentration gradient (no energy use)
Active Transport	The movement of materials into or out of a cell against the concentration gradient (energy is required)
Diffusion	A form of passive transport that moves particles from areas of high concentration of that particle to areas of low concentration
Osmosis	A form of passive transport that moves WATER across a selectively permeable membrane
Interphase	Period in the cell cycle in which most time is spent; includes G1, S (DNA replication) and G2
Mitosis	Process of nuclear division while making new body cells (2 identical cells from one parent cell): prophase, metaphase, anaphase, telophase
Cytokinesis	Division of the cytoplasm upon the completion of mitosis; ultimately produces two new daughter cells
Daughter Cells	The cells that are formed as a result of a parent cell dividing to make new cells (mitosis = 2 daughter cells)
Chemotaxis	Movement of an organism toward or away from a chemical stimulus (positive = toward, negative = away from)
Phototaxis	Movement of an organism toward or away from the presence of light (positive = toward, negative = away from)
Pseudopods	Temporary extensions of the cell membrane of a microorganism for movement or feeding purposes
Contractile Vacuole	Organelle that takes on fluid then contracts to get rid of excess fluid in the cell in order to maintain osmotic equilibrium
ATP	Adenosine Triphosphate - Form of chemical energy for all cells
Aerobic Cellular Respiration	Producing ATP with oxygen by breaking down glucose (36 - 38 ATP); occurs in the mitochondria
Anaerobic Respiration	Producing ATP without oxygen by breaking down glucose. Also known as fermentation (alcoholic or lactic acid - 2 ATP); occurs in the cytoplasm (NOT in the mitochondria)
Alcoholic Fermentation	Form of anaerobic respiration (often carried out by yeast) that produces alcohol as a byproduct
Lactic Acid Fermentation	Form of anaerobic respiration (often carried out in muscle cells) that produces lactic acid, which causes muscle fatigue
Cellular Respiration Equation	$6O_2 + C_6H_{12}O_6 \Rightarrow 6CO_2 + 6H_2O + \text{Energy (ATP)}$
Photosynthesis Equation	$6CO_2 + 6H_2O + \text{Energy (light)} \Rightarrow 6O_2 + C_6H_{12}O_6$

Unit Organizer

Pre-Check

Score /12

1. _____	4. _____	7. _____	10. _____
2. _____	5. _____	8. _____	11. _____
3. _____	6. _____	9. _____	12. _____

Post-Check

Score /12

1. _____	4. _____	7. _____	10. _____
2. _____	5. _____	8. _____	11. _____
3. _____	6. _____	9. _____	12. _____

Cellular Processes Bell Ringers

1. Which best describes how _____ is maintained in a cell?
   Answer: _____
   _____
2. Which is an example of _____ transport?
   Answer: _____
   _____
3. Why does _____ occur within cells?
   Answer: _____
   _____
4. Which explains a cellular process that involves the input of _____?
   Answer: _____
   _____
5. In which _____ will the _____ flow according to the diagram?
   Answer: _____
   _____
6. If a cell is placed into a _____ solution, which of the following _____ the environment?
   Answer: _____
   _____
7. A cell is in an environment in which the salt _____ is lower than _____ the cell. What will most likely happen?
   Answer: _____
   _____
8. Which organelle is _____ for the _____ of _____?
   Answer: _____
   _____
9. A cell is placed in a _____ solution. Which _____ will most likely happen?
   Answer: _____
   _____
10. Which most accurately describes the _____ contained within _____?
    Answer: _____
    _____

11. What is the correct _____ for _____?
    Answer: _____
    _____
12. Which best describes the _____ result of _____ cell division?
    Answer: _____
    _____
13. Which is most likely an _____ that benefits a _____-celled organism?
    Answer: _____
    _____
14. How does the process of _____ ensure that both _____ cells are _____?
    Answer: _____
    _____
15. Which best describes _____?
    Answer: _____
    _____
16. In which situation would a _____ most likely undergo _____?
    Answer: _____
    _____
17. Which best describes _____?
    Answer: _____
    _____
18. _____ cells are responsible for producing a high amount of _____. Which process most likely occurs if _____ is limited?
    Answer: _____
    _____
19. What is the formula for _____?
    Answer: _____
    _____
20. Which best describes the important processes of _____ and _____?
    Answer: _____
    _____

Homeostasis
in a cell

-Cells are only able to function because of their _____ ability to let materials _____ and _____ a cell.
-_____
-In what way do substances move across membranes?
-There are 2 classifications of _____:
1. _____ - does NOT require energy
-Molecules travel from areas of _____ concentration to areas of _____ concentration
-_____ the concentration gradient
2. _____ - requires energy
-Molecules travel from areas of _____ concentration to areas of _____ concentration
-_____ the concentration gradient

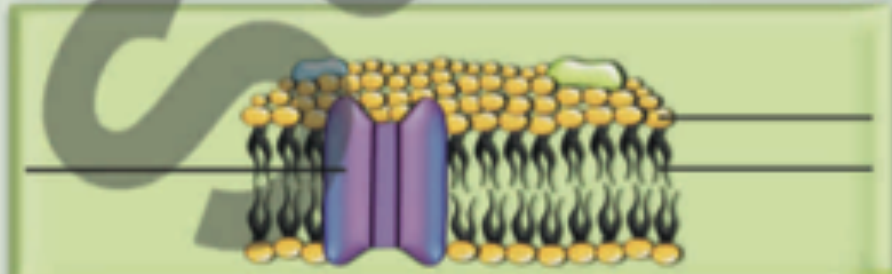
1. Passive Transport:
-Diffusion: _____ pass easily through the phospholipid bilayer
-No _____
-Examples: _____
-Osmosis: Refers to _____ ONLY!
-Pass easily through the phospholipid bilayer
-Basically a special form of simple diffusions referring only to water molecules
-No _____
-Examples: _____
-Facilitated Diffusion: _____ pass through a _____ embedded in the phospholipid bilayer
-No _____
-Examples: _____

2. Active Transport:
-Sodium-Potassium Pump: Animal cells pump _____ out of a cell and replace them with _____
-Against the _____; requires _____
-Endocytosis: _____
-Examples: _____ (solid particles)
_____ (liquid particles)
-Exocytosis: _____

-The cell membrane: _____
-Plays an extremely important role in _____
-Regulates what _____ and _____ the cell
-Selective permeability: _____
-Also may be called: _____
-Structure of the cell membrane:
-Composed of many _____
-Heads: _____
-Tails: _____
-Creates a bi-layer (see diagram below)
-The phospholipid bi-layer is embedded with _____
-Allow materials to _____ and _____
-"Fluid mosaic model"
-Fluid: _____
-Mosaic: _____

-May also be found in the membrane:
_____
_____
_____
_____

- The cell membrane is one of the most valuable tools for living organisms to maintain homeostasis by:
-Examples:
-_____
-_____
-_____
-_____



Now that you have learned why the cell membrane is so important, you should be able to figure out how it maintains homeostasis.

-Regulating Homeostasis:
- -pH: measure of the __________ within a cell
- -Cells may use __________ to regulate internal ______
- -__________ is a protein used to regulate __________ levels
- -Organisms __________ to cool off

-Movement across cell membranes maintains ______________________
-What determines how materials move?
- -Cells function in the bodies of ____________________ based on the role they need to carry out.
  - -Depends on __________ needed for cellular processes
  - -Depends on the __________ in which the cell exists

-Examining Solutions: See the three osmotic solutions at the top of the page
-Review: Solute = __________ Solvent = __________
- -Example: In salt water, what is the solute? __________
- In salt water, what is the solvent? __________

-When identifying a __________, we refer to the __________ in which the cell is located (outside the cell!)

Membrane Transport

-Hypotonic solutions: ______________________

- -Concentration of the solute is __________
- -Concentration of the water is __________
- -"Hypo" means: __________
  - -Think: hypothermia = _____ body heat
- -WATER moves __________
- -Cell will __________

-Hypertonic solutions: ______________________

- -Concentration of the solute is __________
- -Concentration of the water is __________
- -"Hyper" means: __________
  - -Think: hyperactive = _____ activity
- -WATER moves __________
- -Cell will __________

-Isotonic solutions: ______________________

- -Concentration of the solute is __________
- -Concentration of the water is __________
- -"Iso" means: __________
  - -Think: Isosceles triangle = 2 _____ sides
- -WATER moves __________
- -Cell will __________

Notes:

Membrane Lab

You will be using your knowledge of osmosis to determine what will happen to 3 different grapes in 3 different solutions (water, grape juice, and super-saturated sugar water). Will they expand, shrivel up or stay the same size?

MATERIALS:

3 grapes, string, balance, ruler, 50 ml graduated cylinder, 3 small cups, sucrose (sugar) solution, grape juice, water

PROCEDURE:

1. Select 3 grapes (try to find 3 that are close in size).
2. Separate the grapes and label them grape A, grape B, and grape C. You will be conducting measurements for each grape.
3. Measure the mass of each grape to the nearest tenth of a gram on the balance and record. Record in Table 1 under Day 1 for mass.
4. Measure the volume of each grape:
   a) Pour 20 ml tap water into the graduated cylinder (measure from the meniscus).
   b) Place a grape in the graduated cylinder.
   c) Read the meniscus and note the new height of the water.
   d) The difference between the two water levels represents the volume of the grape in milliliters. Record in Table 1 under Day 1 for volume.
5. Measure the circumference of each grape to the nearest millimeter. You will need to wrap the string around the middle of the grape and measure that distance with the ruler. Record in Table 1 under Day 1 for circumference.
6. After completing all measurements for each grape, place each one into a different cup and label according to the grape identification.
7. Pour water into cup 1. Fill until the grape is covered. What will happen? _____
8. Pour grape juice into cup 2. Fill until the grape is covered. What will happen? _____
9. Pour sugar solution into cup 3. Fill until the grape is covered. What will happen? _____
10. Set all the grapes aside where directed.

DAY 2 - Remove the grapes from the cups and repeat procedures 3, 4, and 5 to determine new mass, volume or circumference. Record the results in Table 1 under Day 2 for each grape. Calculate any changes (include + or -) and record under Gain or Loss for each grape.

	Grape 1			Grape 2			Grape 3		
	Day 1	Day 2	Gain/ Loss?	Day 1	Day 2	Gain/ Loss?	Day 1	Day 2	Gain/ Loss?
Mass (g)									
Volume (ml)									
Circum-ference (mm)									

Which grape is in a hypertonic solution? _____ Hypotonic? _____ Isotonic? _____
Where is osmosis observed? _____ What is osmosis? _____

Membrane Activity:

What do you call the ability to allow certain materials to enter or exit a cell?

_____

Materials:

-Dialysis tubing -Starch solution -Small beaker
-Yarn -Iodine -Water

1. Run the dialysis tubing under water until it opens up
2. Twist and fold over one end. Tie tightly with string
3. Add 5 mL of the starch solution
4. Squeeze out the air and twist and tie the other end
5. Place in beaker and fill with water, just so the "cell" is covered
6. Add 10 drops of iodine to the surrounding water

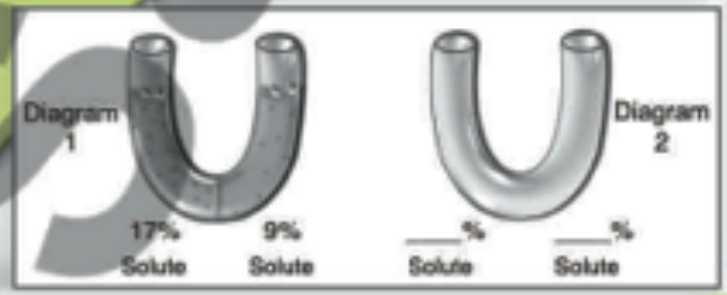
Day 1: Color of water _____
Color of cell _____

Day 2: Color of water _____
Color of cell _____

1. What process does this represent?
   _____
2. Why did both the water and the cell change color?
   _____
3. Why did iodine react with the material in the cell?
   _____
   _____

What process is occurring?
_____
In which direction will the water flow?
_____

Fill in Diagram 2 based on what will happen to the water in Diagram 1. A semi-permeable membrane separates the two sides.



The Cell Cycle

-Another important process within cells is _____

-Must occur to replace _____ cells or make new cells for _____

-The cell cycle includes: _____ - growth and preparation

_____ - division of the nucleus

_____ - final division of the cytoplasm

-Interphase:

-Essential for _____ of the cell

-_____ phase of the cell cycle

-The cell spends _____% of the cell cycle in this phase

-Interphase includes _____ major stages:

1. _____ - 1st Gap Phase

-The cell _____ in size

2. _____ - Synthesis phase:

-DNA _____ (synthesizes new DNA)

-Chromosomes _____ for division so all DNA is packed

3. _____ - 2nd Gap Phase:

-Final preparations, structures needed for _____ are assembled begin development (centrioles, spindles, centromeres)

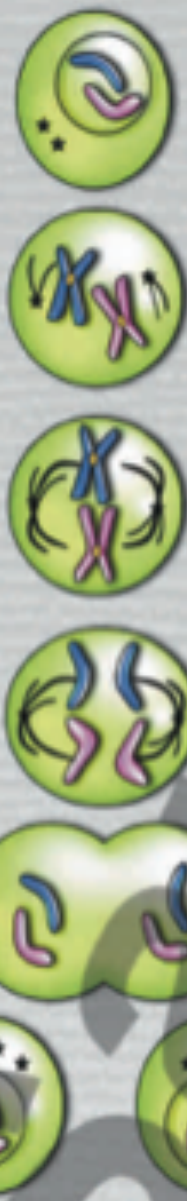
Mitosis (M Phase):

-After interphase occurs, the _____ must divide before the cell can complete the cycle

-Mitosis includes _____ distinct phases: _____

_____

-Mitosis is followed by _____, which finalizes the _____ and redistributes cytoplasm and organelles



This diagram represents the events of the production of body cells throughout the cell cycle and Mitosis.

-Important terms:

-Diploid: _____

_____

-Haploid: _____

_____

-Diploid # of this example: _____

-Haploid # of this example: _____

-Begins with _____ cell

-Ends with _____ cells

- Genetically _____

- _____ (2 homologous chromosomes per pair)

- _____ (somatic) cells

Phases of the cell cycle:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Mitosis

Understanding Mitosis

-Prophase (___ phase of mitosis)
- _____ condenses to form visible _____
- _____ chromosome = _____ sister chromatids
-(packaged _____ of DNA from S-phase of interphase)
-Nuclear _____ disappears
-Important structures for completion of the cell cycle appear:
-Centrioles: _____
-Spindle Fibers: _____
-Centromeres: _____

-Metaphase ("M" is for Middle)
-Chromosomes move to the _____ of the cell
-Still paired as _____
-Attached in center with a _____ (also to spindles)

-Anaphase ("A" is for Apart)
-Centromeres _____ and sister chromatids pull _____
-Spindle fibers shorten and _____chromatids (now each is an individual _____) toward opposite _____ of cell

-Telophase
-Begins when _____ reach opposite poles of cell
-Chromosomes _____ to less visible _____ and _____ and _____ reappear
-Cell begins to pull apart and prepares for _____

-Cytokinesis
Animal cells - _____
- _____ pinches in to divide cells
Plant cells - _____
-Forms a new portion of the _____

-Cell Cycle Regulation
-Uncontrolled cell division results in _____
- _____ monitor each phase of the cycle
-Reasons why cells may _____ uncontrollably:
_____
_____

Fill in the following phases of the cell cycle and mitosis based on a diploid number of 4. Describe at least two events that happen in each phase.

Interphase
_____
_____
_____

Prophase
_____
_____
_____

Metaphase
_____
_____
_____

Anaphase
_____
_____
_____

Telophase
_____
_____
_____

Cytokinesis
_____
_____
_____

Photosynthesis

All cells need to acquire _____ to carry out their functions

- _____ is the ability to _____
- Form of cellular energy: _____

-Different types of organisms have different ways of acquiring _____

-Ecology Review:

- -Producers: _____
  - -Also called _____
  - -_____
- -Consumers: _____
  - -Also called _____
  - -_____

-Photosynthesis: _____

- -Carried out by _____, _____ and _____
- -Takes place in _____ (highest number in the _____)
  - -Contain the pigment _____
    - -Allows for _____
    - -Pigments _____ and _____ light waves
    - -_____ is green because of the light wavelength

-2 phases of photosynthesis:

- -Light Reactions: _____
- -Dark Reactions: _____

_____ + _____ + _____ ⇨ _____ + _____

_____ _____ _____ _____ _____

You have learned that photosynthesis is a chemical process that takes place in the chloroplasts of plant cells, using light energy to produce sugars for fuel necessary to grow.

Materials:

-elodea sample	-ruler and tape	-timer	-baking soda
-150 watt lamp	-test tube	-razor blade	-400mL beaker

Procedure:

1. In this experiment, you will be observing photosynthesis carried out by a water plant called elodea.
2. Gather your materials. Remove a few of the leaves at the base of the stem, slice the end of the stem at an angle and crush the tip.
3. Place the elodea in the test tube with the cut stem end up. Fill the test tube with water so that it completely covers the plant.
4. Seal test tube with your thumb and invert. Stand it up in the beaker, submerging it before releasing thumb. Make sure no bubbles are present.
5. Place the lamp 2 inches away from the plant and record in Data Table 1 how many bubbles have been released from the cut end of the stem after 2, 4, 6, 8 and 10 minutes? (If none appear, re-cut and re-crush the stem)
6. Rinse and repeat with the lamp 10 inches away and record in Data Table 2.
7. Place the lamp 2 inches away from the plant again. Add a pinch of baking soda to the test tube. Record in Data Table 3. How many bubbles have been released from the cut end of the stem after 2, 4, 6, 8 and 10 minutes?
8. Prepare a graph of your data on a separate sheet of paper using the variable (time) as the x-axis and the variable (# bubbles) as the y-axis.

Table 1 - Bubbles formed when lamp is 2 inches away

	2 min	4 min	6 min	8 min	10 min
# Bubbles					

Table 2 - Bubbles formed when lamp is 10 inches away

	2 min	4 min	6 min	8 min	10 min
# Bubbles					

Table 3 - Bubbles formed when lamp is 2 inches away with baking soda

	2 min	4 min	6 min	8 min	10 min
# Bubbles					

Inside the Chloroplast

1. How does this experiment show that plants produce oxygen through photosynthesis?

2. How does the distance of the lamp from the plant affect the rate of photosynthesis?

3. How does baking soda change the rate of photosynthesis?

Cellular Respiration

-Cellular respiration: _____

_____

-Where does the energy come from? When glucose breaks down, the _____ break and make _____

-_____ cellular respiration: Needs _____

-Occurs in the _____

-Has inner folds called _____ to increase _____

-Allows for more _____ production!

-Produces _____

-_____ breaks down completely to _____ and _____ by several reactions that require _____

_____ + _____ ⇨ _____ + _____ + _____

_____ _____ _____ _____ _____

-Which gas affects aerobic respiration the most? _____

-What else may affect aerobic respiration? _____

-Which gas affect photosynthesis the most? _____

-What else may affect photosynthesis? _____

-_____ Cellular Respiration (Fermentation):

-Does NOT need _____

-Occurs in the _____

-_____ is not broken down completely to _____ and _____

-ATP production is not as _____

-Produces _____

-2 types of _____:

-_____

-Alcoholic Fermentation:

-Yeast-use fermentation to convert _____ to _____

-_____ -_____

-Lactic Acid Fermentation:

-Bacteria-use fermentation to convert _____ to _____

-_____ -_____

-Muscle cells change from _____ respiration to _____ when _____ levels are low

-_____ breaks down to _____

-Have you ever had a muscle cramp?

The "mighty mitochondrion" is known as the power house of the cell because it produces 36-38 molecules of ATP from one molecule of glucose. Only aerobic respiration occurs in the mitochondrion, which is why it is more efficient than fermentation.

Fermentation Lab

Materials:

_____

_____

What we did:

_____

_____

Why we did it:

_____

_____

What happened:

_____

_____

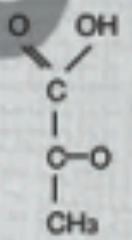
Why it happened:

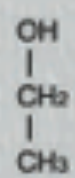
_____

_____

_____

_____





GLUCOSE + YEAST ⇨ 2 PYRUVATE ⇨ 2 ETHANOL + $2CO_2$

Compare and contrast the processes of photosynthesis and cellular respiration in the space below:

Photosynthesis

Respiration

Think outside the box

Unit Review

1. DNA replicates during the _____ phase of interphase.
2. Mitosis results in the formation of _____ genetically _____ cells.
3. Mitosis is a form of _____ reproduction.
4. A plant cell creates a _____ during telophase.
5. In mitosis, what anchors the spindle fibers? _____
6. What are the phases of mitosis? _____
7. What happens during anaphase? _____
8. If a human cell has 46 chromosomes, how many chromosomes will be in each daughter cell after mitosis? _____
9. During which phase of mitosis do the chromatids line up in the middle? _____
10. A membrane's ability to let certain substances pass through is called _____
11. How do active and passive transport differ? _____
12. Will a cell placed in a hypertonic solution gain or lose water? _____
13. Will a cell placed in a hypotonic solution gain or lose water? _____
14. Osmosis specifically refers to _____
15. Cell membranes are composed of _____ and _____
16. Diffusion occurs because molecules are constantly _____
17. Give an example of active transport _____
18. Give an example of passive transport _____
19. What are the two types of endocytosis? _____
20. The green pigment that traps light energy is called _____
21. What are the phases involved in photosynthesis? _____
22. Which organelle is responsible for photosynthesis? _____
23. Which organelle is responsible for aerobic respiration? _____
24. Which organelle is responsible for anaerobic respiration? _____
25. Aerobic respiration produces _____ ATP and anaerobic produces _____ ATP.

Written Assignment:

Discuss the phases of mitosis related to the entire cell cycle. Make sure to include major events of the cell cycle that may occur before, during or after mitosis. Use information covered in this unit to support the importance of a clear understanding of cellular division.

Adenosine Triphosphate (form of chemical energy for all cells)	Process of producing body cells (division of the nucleus into 2 identical daughter cells)	Preceeds mitosis; occurs in 3 phases (G1, S-DNA replication, G2)
The movement of water from highly concentrated areas of water (low solute) to low concentrated areas of water (high solute)	The movement of molecules from high to low concentration	2 end products of fermentation
Equal amounts of solute inside and outside cell	46	Composition of the cell membrane
Containing both copies of each set of chromosomes - one from each parent (all body cells)	The concentration of solutes is lower outside cell (cell swells)	The concentration of solutes is higher outside cell (cell shrinks)
2 resulting cells from mitosis (genetically identical)	Monomer of nucleic acids, made of a 5-carbon sugar, phosphate and nitrogen base	Produce PROTEINS!
O_2 and $C_6H_{12}O_6$ (same as reactants of cellular respiration)	Site of photosynthesis in plant cells	Manufacture cellular energy through aerobic respiration
Effect of lactic acid buildup in muscle cells	Total number of ATP produced from anaerobic respiration	Total number of ATP produced from aerobic respiration

Interphase	Mitosis	ATP
Alcohol and Lactic Acid	Diffusion	Osmosis
Lipids and Proteins	# of human chromosomes in a body cell	Isotonic Solution
Hypertonic Solution	Hypotonic Solution	Diploid
Ribosomes	Nucleotide	Daughter cells
Mitochondria	Chloroplasts	Products of Photosynthesis
36-38 ATP	2 ATP	Muscle Fatigue