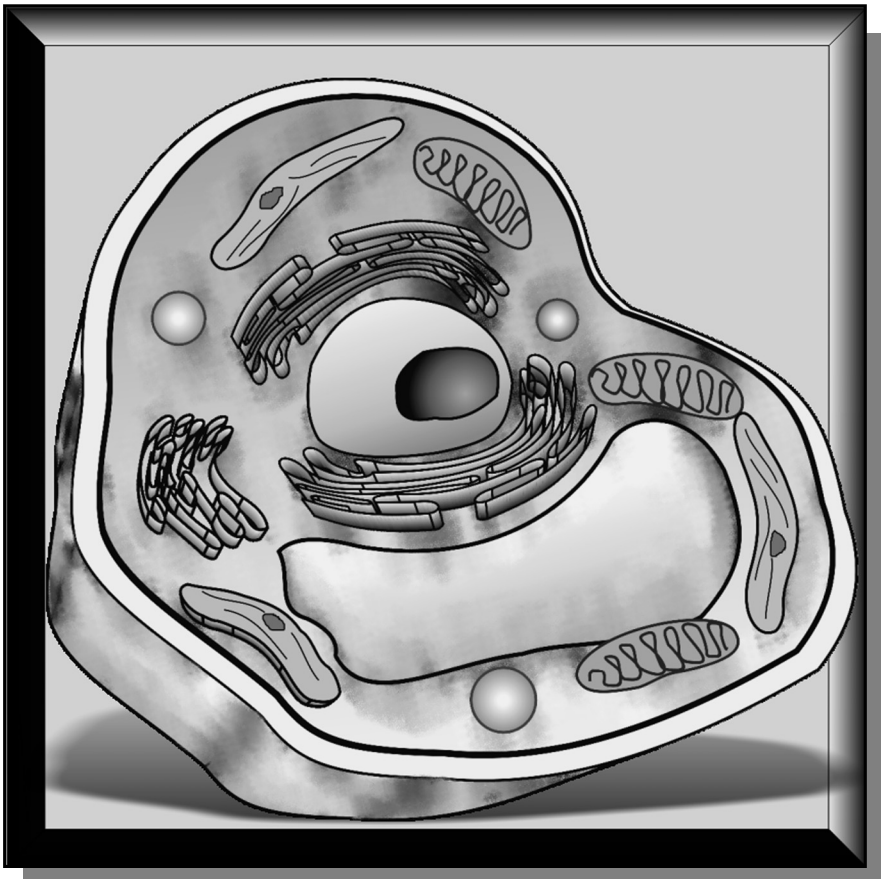
The Principles, Theories & Precepts of Biology

ACTIVITIES



Chapter 2

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The Principles, Theories & Precepts of Biology

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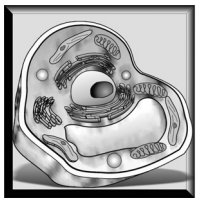
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ACTIVITIES
Lesson 1:

THE CELL—A BRIEF HISTORY

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The smallest working units of living things are called _____.

2. The most important tool used by biologists to study ***cells*** is the _____.

3. A ***microscope*** produces _____ images of a specimen.

4. Anton van Leeuwenhoek's first microscope was:_____
_____.
(a) a highly complex device
(b) a system of several magnifying lenses at proper distances from each other
(c) the most powerful microscope to date
(d) not a functional device

5. What happens to light as it enters the light microscope? _____
_____
(a) It shines straight through the lenses.
(b) It is bent through the lenses.
(c) It is reflected in the lenses.
(d) none of the above

6. Why were Leeuwenhoek's *animacules* significant? _____
_____
(a) They represented the discovery of tiny living things in many liquids.
(b) They demonstrated the power of Leeuwenhoek's light microscope.
(c) They had never before been seen by the human eye.
(d) all of the above

7. Place an "X" in front of all of the following statements that describe Robert Hooke's contributions to biology.
_____ (a) He published *Micrographia*.
_____ (b) He observed microscopial pores.
_____ (c) He coined the term “cell” to describe the tiny rectangular chambers in the woody parts of plants.
_____ (d) He recognized that plants and animals were both made up of cells.

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8. Theodore Schwann and Matthias Schleiden compared their observations and proposed that:_____.
   (a) only plants are composed of cells
   (b) only animals are composed of cells
   (c) plants and animals are composed of cells
   (d) cells are too small to be of any consequence

9. All cells are microscopic in size. _____ (a) True or (b) False

10. Rudolf Virchow proposed that new cells are produced only by the division of cells that already exist. _____ (a) True or (b) False

11. The cell theory states that:
   (a)_____
   _____
   (b)_____
   _____
   (c)_____
   _____
   (d)_____
   _____
   (e)_____
   _____
   (f)_____
   _____

12. Organisms range from a single cell to millions of cells. _____
   (a) True or (b) False

13. Every organism begins with _____ cell(s).

14. Louis Pasteur proved Rudolf Virchow's theory of _____ which states that all living cells arise from pre-existing living cells.

15. Place the following steps of Pasteur's experiment in chronological order.
   _____(a) He boiled broth in flasks to kill microorganisms.
   _____(b) He placed nutrient broth into long-necked flasks.
   _____(c) The microorganisms in the air were trapped in the curves of the flask neck.
   _____(d) He bent the necks of the flasks into curves.

16. What did Pasteur's experiment prove?_____
   _____
   (a) The source of microorganisms that grew in the flasks was the air.
   (b) The microorganisms that grew in the flasks arose spontaneously from the nutrient media.
   (c) The first living cell arose from non-living material.
   (d) The broth was toxic to microorganisms.

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17. Jan Evangelista Purkinje called the jelly-like substance inside the cell_____.

18. ***Protoplasm***, or ***cytoplasm*** is composed of:_____
_____.

(a) liquid only (b) liquid and fibrils only
(c) a large variety of structures (d) smaller cells

19. The type of light microscope used in most biology classrooms or laboratories is the _____.

20. Cells and organisms can be studied while they are still alive with the ***compound light microscope***. _____ (a) True or (b) False

21. Place an "X" in front of all of the following statements that correctly describe the ***electron microscope***.

_____ (a) It uses a beam of protons to examine a sample.
_____ (b) It magnifies up to one million times.
_____ (c) It samples must be kept in a vacuum so that image will not be blurred.
_____ (d) It can be used to study living or non-living organisms.

22. Currently, all microscopes use lenses to produce images. _____
(a) True or (b) False

23. A microscope that traces the surfaces of a sample with a probe to produce an image is known as a(n): _____.

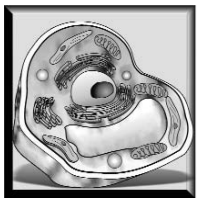
(a) imaging microscope
(b) scanning probe microscope
(c) compound light microscope
(d) electron microscope

24. Write the **Life Principle**:
"_____
_____
_____."

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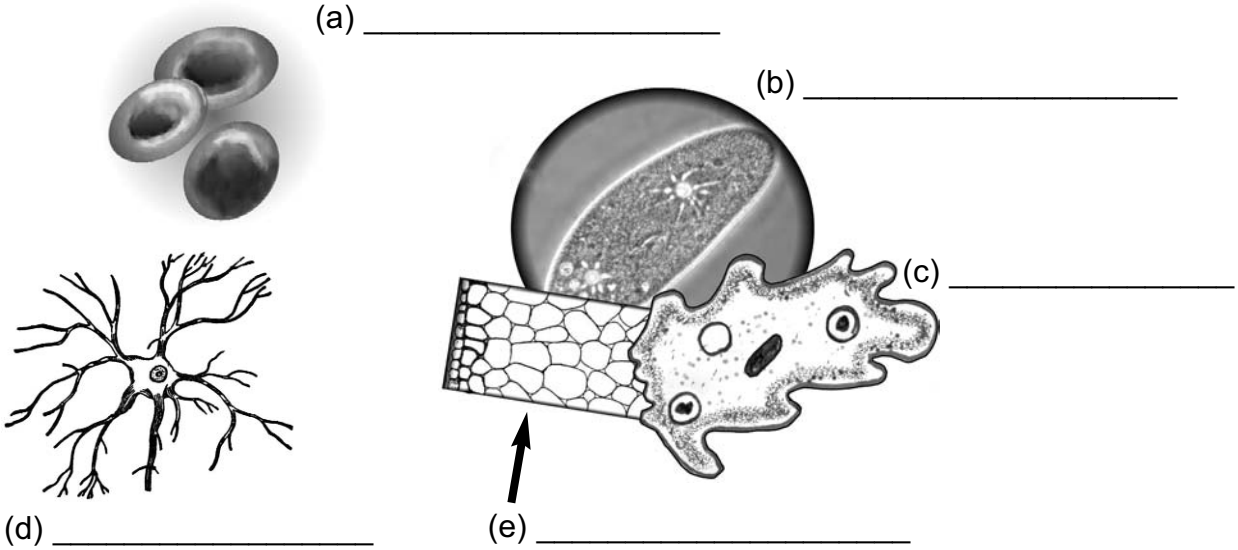




THE CELL—A FUNCTIONAL MIRACLE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. ***Bacteria*** and ***Protozoa*** are _____, meaning they consist of a single cell.
2. The cell is capable of making many products in the same vessel while keeping them distinct and separate. _____ (a) True or (b) False
3. The smallest known cell is a bacterium called a _____.
4. The largest cell is a _____ cell in the neck of a _____ that can be nearly 10 feet long.
5. Plant cell shapes typically resemble: _____.
   (a) rods (b) spirals (c) circles (d) cubes
6. In multicellular organisms, the shape of a cell is due to the cell's:_____.
   (a) organelles (b) age (c) function (d) life-span
7. Label the cells.



8. Cells function independently and as a unit. _____ (a) True or (b) False

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9. Place an "X" in front of all correct descriptions of cell-to-cell activity.
   _____ (a) independence
   _____ (b) communication
   _____ (c) cooperation
   _____ (d) isolation

10. Number the specialized cell groupings in order from simplest to complex.
   _____ organs
   _____ cells
   _____ systems
   _____ tissues

11. The four major building blocks of cell structure are:_____
   _____
   _____.

Matching.

12. _____ ***absorption*** (a) the oxidation of absorbed substances with a release of energy

13. _____ ***digestion*** (b) the breakdown of food molecules to be absorbed and provide nourishment

14. _____ ***respiration*** (c) the transport of dissolved substances into cells

15. When protein digestion occurs, the cell can use the amino acids for immediate energy as in _____, or to build a new protein substance. This cell function is _____.

Matching.

16. _____ ***excretion*** (a) release of biosynthesized substances for use by other cells

17. _____ ***egestion*** (b) removal of non-soluble waste materials from the cell

18. _____ ***secretion*** (c) removal of soluble waste materials from the cell

19. Locomotion of a cell from one point to another or moving things within a cell is known as _____.

20. The ability of a cell to respond to its environment inside and out is known as_____
   _____.

21. ***Homeostasis*** involves:_____.
   (a) creating new cells (c) creating chaos in the cell
   (b) locomotion (d) maintaining order in the cell

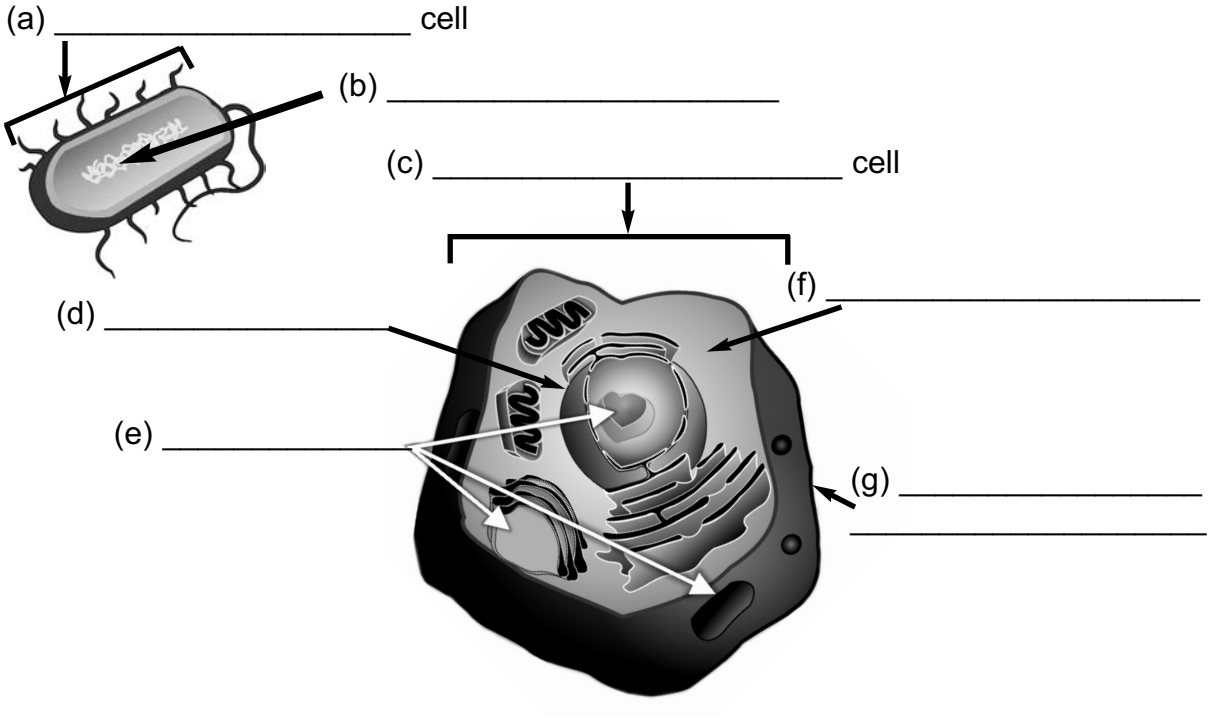
22. The study of cells is known as:_____.
   (a) biology (b) cytology (c) ecology (d) geology

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23. Specify the following characteristics as ***prokaryotic*** or ***eukaryotic*** cells.

_____ (a) no nucleus
_____ (b) cell membrane and membrane-bound organelles
_____ (c) single compartment, protective cell wall
_____ (d) make up plants, animals, and fungi; larger size

24. Label the cells and their components.



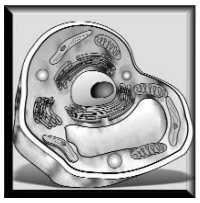
25. Write the **Life Principle**:

"_____
_____
_____."

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CELL WALLS AND CELL MEMBRANES

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

Matching:

1. _____ cytoplasm	(a) structure in cell that contains cell's DNA
2. _____ ***cell membrane***	(b) tough, porous boundary outside of cell membrane in plants and some bacteria, but not animals
3. _____ nucleus	(c) portion of the cell outside the nucleus; contains many organelles
4. _____ ***organelles***	(d) small structures in the cell with specific functions
5. _____ ***cell wall***	(e) part of cell's outer boundary; contains a lipid bilayer

6. The cell membrane's vital role is to_____
_____
_____
_____.

7. The cell membrane must allow certain substances to _____, or pass through it.

8. S.J. Singer and Garth Nicolson proposed the fluid mosaic model which envisions the membrane as a mosaic of individually inserted protein molecules drifting in a fluid bilayer of _____.
(a) proteins (b) starches (c) carbohydrates (d) phospholipids

9. The polar heads of phospholipids group together on the _____ of the lipid bilayer.

10. Some proteins in the lipid bilayer:_____.
(a) protect the membrane
(b) form channels to move material across the membrane
(c) pump material across the membrane
(d) all of the above

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11. Why is the cell membrane called "fluid?" _____
    (a) The membrane evaporates easily.
    (b) Lipids and proteins move freely.
    (c) The membrane is rigid.
    (d) The membrane is made mostly of water.

12. Which of the following would be most likely to pass through a cell membrane?_____
    _____
    (a) lipid soluble substances
    (b) lipid insoluble substances
    (c) water soluble substances
    (d) substances cannot pass through the cell membrane

13. Which of the following organisms' cells do not contain a cell wall?_____
    (a) plants (b) animals (c) algae (d) bacteria

14. Organisms have either a cell wall or cell membrane but not both. _____
    (a) True or (b) False

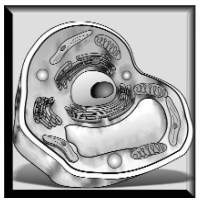
15. The cell wall is selectively permeable. _____ (a) True or (b) False

16. Most cell walls are made of _____ and _____.

17. The main carbohydrate in plant cell walls is _____.

18. Write the **Life Principle**:
    "_____
    _____
    _____."

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THE CELL'S TRAFFIC CONTROL CENTER

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

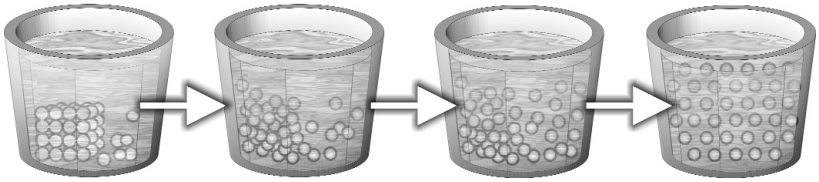
1. The process of maintaining order in the cell and making sure that all substances needed by the cell are available continuously is known as_____.

2. The inside of a cell and its outside environment are very similar in composition.
_____ (a) True or (b) False

3. The _____ determines what substances enter and leave the cell.
(a) cell wall (b) cell membrane (c) environment (d) organelle

4. What is the primary difference between ***active transport*** and ***passive transport***?_____
_____
(a) Active transport moves materials into the cell, and passive transport move materials out of the cell.
(b) Active transport requires energy, and passive transport does not.
(c) In active transport, materials do not cross the membrane.
(d) They are essentially the same.

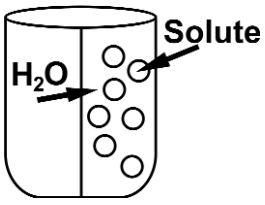
5. The images below illustrate which concept?_____
(a) osmosis (b) diffusion (c) active transport (d) plasmolysis



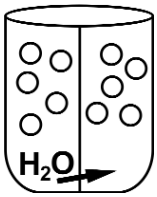
6. The process by which substances spread through a liquid or gas from regions of high concentration to regions of low concentration is known as: _____.
(a) active transport (b) osmosis (c) diffusion (d) locomotion

7. Water movement through a selectively permeable membrane is best depicted by: _____.

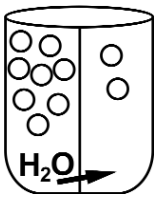
(a)



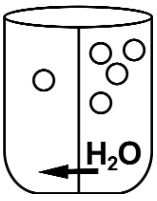
(b)



(c)



(d)



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8. What is ***osmosis***?_____
_____.
   (a) the flow of water from regions of low water concentration to regions of high water concentration
   (b) the active transport of water across a semi-permeable membrane
   (c) the flow of water up and down its concentration gradient
   (d) the diffusion of water through a selectively permeable membrane

9. What is the function of protein ***carrier molecules***?_____
_____.
   (a) transportation of specific substances across the cell membrane
   (b) membrane stability during cell transport
   (c) cell division
   (d) DNA replication

10. If a sugar solution and pure water are separated by a cell membrane, in which direction will the water move?_____
_____.
   (a) from the sugar solution into the pure water
   (b) water concentrations will remain constant
   (c) from the pure water into the sugar solution
   (d) water will move in the direction of highest water concentration

11. What did Alexander Fleming notice about his Staphylococcus culture that led to the discovery of Penicillium?_____
_____
   (a) Specks of mold had fallen on the culture and nourished the bacteria.
   (b) The culture had been left uncovered, destroying the bacteria.
   (c) Specks of mold had fallen on the culture and killed bacteria.
   (d) Bacteria caused the mold culture to grow exponentially.

12. All bacteria cause harm when living in an organism. _____
   (a) True or (b) False

13. How does penicillin kill a bacterium? _____
   (a) It injects toxins into the bacterium.
   (b) It weakens the bacterium's cell wall.
   (c) It disrupts DNA replication in the bacterium.
   (d) all of the above

14. Differences in water concentration in two regions separated by a semi-permeable membrane create a pressure called _____.

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Matching: Choose the correct answers.

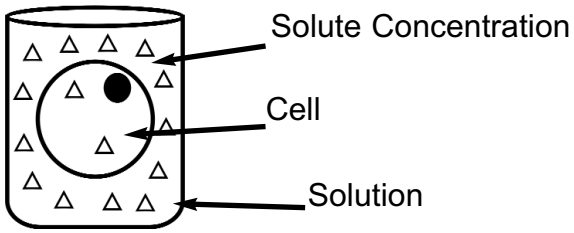
15. _____ ***cytolysis***
16. _____ hypotonic
17. _____ isotonic
18. _____ hypertonic
19. _____ ***plasmolysis***

(a) a collapse of the cell due to water flowing out of the cell
(b) a solution that has a higher solute concentration than that of the cell
(c) rupturing of a cell due to excess internal osmotic pressure
(d) a solution that has a lower solute concentration than that of the cell
(e) cell and solution fluids are of equal amounts

20. A _____ solution causes a high osmotic pressure outside of the cell, creating the danger of cytolysis.

21. The danger of plasmolysis is created by a _____ solution.

22. The Solution in the illustration below is _____ in relation to the cell.
(a) hypertonic (b) hypotonic (c) isotonic (d) none of these



23. If a cell is placed in a solution that contains a low concentration of salt relative to the salt concentration within the cell, the water will: _____.
(a) flow into the cell
(b) flow out of the cell
(c) stay constant
(d) none of the above

24. List the three ways that cells control osmotic pressure.
(a)_____
(b)_____
(c)_____

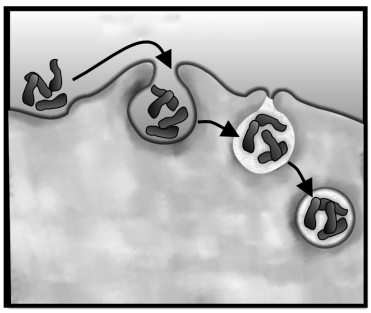
25. Blood is a good buffer for animal cells because:_____
_____.
(a) it creates a high osmotic pressure inside the cell
(b) it is a hypertonic solution
(c) its solute concentration is equal to that of animal cells
(d) it is a hypotonic solution

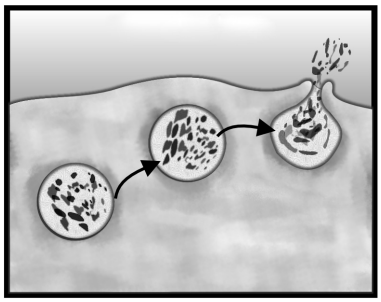
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26. Energy is required to:_____
_____.
(a) move water from regions of high water concentration to regions of low water concentration
(b) move substances from regions of high concentration to regions of low concentration
(c) move substances against a concentration difference
(d) move water with its concentration gradient

27. What cellular mechanisms are so critical to life that a third of human energy is involved in their operation?_____

Label the processes depicted in the following illustrations.





28. _____ 29. _____

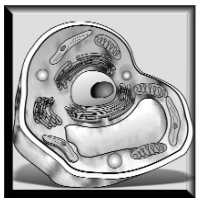
Matching: Choose the correct answers.

30. _____ ***endocytosis***
31. _____ phagocytosis
32. _____ exocytosis

(a) process by which a large particle is absorbed into the cell
(b) process by which cells remove, or eliminate, macromolecules through the plasma membrane
(c) process by which cells take in substances by causing a part of the plasma membrane to surround the substance

33. Write the **Life Principle:** "_____
_____
_____."

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INSIDE THE CELL—A MANUFACTURING WONDER

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Place an "X" in front of all of the following statements that correctly describe the cell nucleus.
   _____ (a) It contains almost all of the cell's DNA.
   _____ (b) It is the least important organelle.
   _____ (c) It is a large, dense structure.
   _____ (d) It is found in all cells.
   _____ (e) It is essential to the life processes of a cell.

Matching: Choose the correct answers.

2. _____ ***chromatin***
3. _____ ***chromosome***
4. _____ ***nucleolus***
5. _____ ***ribosome***
6. _____ nuclear envelope
7. _____ cytoplasm

(a) structure that forms from chromatin when cell divides
(b) double membrane surrounding the nucleus
(c) site of protein assembly
(d) material in the nucleus from which chromosomes are made
(e) site where ribosomes are made
(f) portion of the cell outside of the nucleus

8. Small structures in the cell that perform specialized functions are known as _____.

9. After proteins are made in a cell, they must be used immediately. _____
   (a) True or (b) False

10. Both the endoplasmic reticulum and the Golgi apparatus:_____ _____.
    (a) process proteins
    (b) transport proteins
    (c) process and transport macromolecules
    (d) all of the above

11. The presence of what structure distinguishes the rough ER from the smooth ER?
    _____
    (a) nucleus (b) cytoplasm (c) ribosomes (d) lysosomes

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12. _____ are produced in the smooth ER.

13. After a protein or lipid leaves the ER, it travels into the_____ _____ where it is sorted and stored until needed.

14. The ***Golgi apparatus*** could be described as the _____ of the cell.
(a) control center (c) clean-up crew
(b) mailing service (d) maintenance service

15. The function of the lysosome is to:_____.
(a) package proteins (c) break down substances in the cell
(b) make substances for the cell (d) store energy for the cell

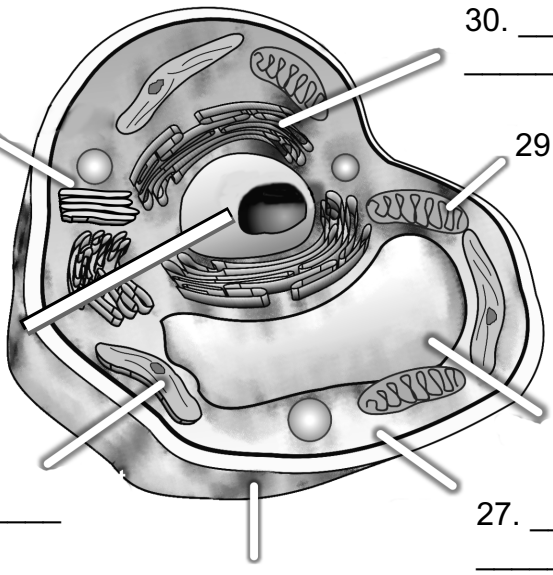
Matching: Choose the correct answers.

16. _____ cytoskeleton
17. _____ microtubules
18. _____ microfilaments
19. _____ ***cilia***
20. _____ ***flagella***
21. _____ spindle

(a) cytoskeleton component that is much thinner than a microtubule
(b) whip-like projections found on some cells
(c) cluster of microtubules built during cell division to move chromosomes
(d) supporting framework of a eukaryotic cell
(e) short, hair-like projections in some cells
(f) a cytoskeleton component; provides a tough, flexible framework of support for a eukaryotic cell.

22. Which of the following structures stores materials in the cell such as proteins, fats, carbohydrates, water, and dissolved salts? _____
(a) vacuole (b) lysosome (c) nucleus (d) microtubule

Label the parts of the Eukaryotic/Plant Cell diagram below for #23-30.



23. _____ _____
24. _____
25. _____
26. _____
27. _____ _____
28. _____
29. _____
30. _____ _____

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31. The pressure that helps to keep a plant rigid is called _____.

32. The mitochondria function as the _____ of the cell.
    (a) network
    (b) clean-up crew
    (c) control center
    (d) power house

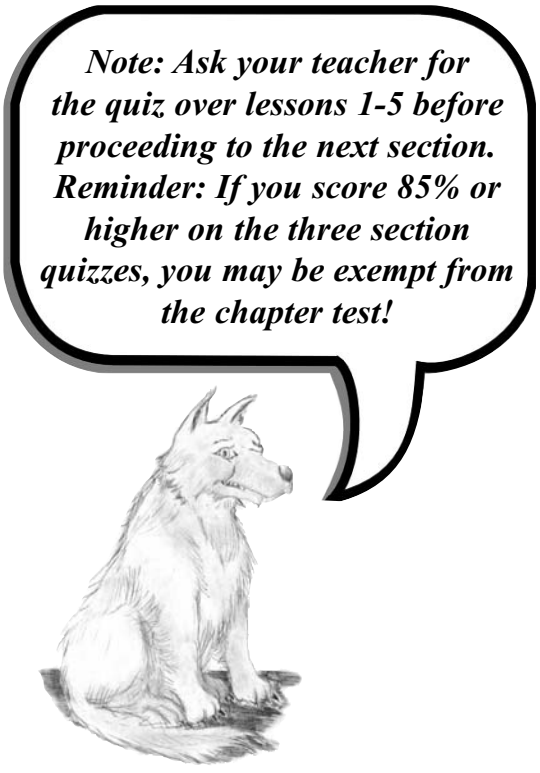
33. Place an "X" in front of all of the following statements that correctly describe ATP.
    _____ (a) synthesized in mitochondria
    _____ (b) serves as energy battery for cellular reactions
    _____ (c) not required in muscle and liver cells

34. _____ are the structures in plants that convert light energy into glucose by the process of photosynthesis.

35. Write the **Life Principle**: "_____
    _____
    _____."

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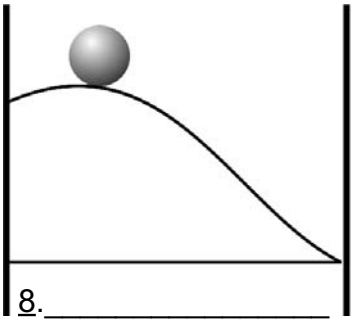
ACTIVITIES
Lesson 6:

THE ENERGY OF LIFE

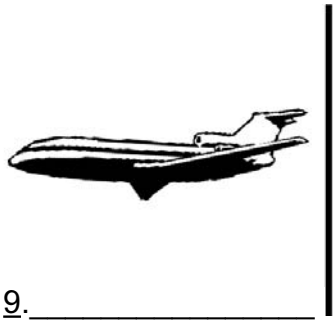
You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The ***Second Law of Thermodynamics*** states that:_____
   _____.
   (a) disorder in the universe must decrease
   (b) free energy in the universe continually increases
   (c) the universe in continually becoming more orderly
   (d) entropy in the universe must increase
2. ***Entropy*** is the measure of _____ in a system.
3. ***Free energy*** decreases as _____ increases.
4. _____ is required for a cell to maintain an orderly chemical composition.
5. A tree uses very little energy for its life processes. _____ (a) True or (b) False
6. The cells in your body get their energy from the food you eat; all of the energy in the food ultimately comes from the _____.
7. List four forms of energy:_____
   _____

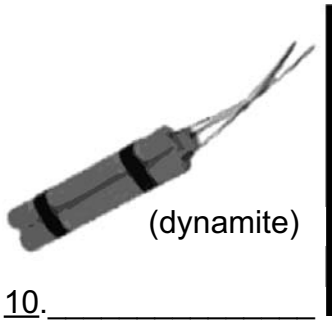
Label the following as kinetic energy or potential energy.



8._____



9._____



10._____

11. Energy is released when chemical bonds:_____.
    (a) break (b) form (c) tighten (d) rotate

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12. The process by which a cell converts a food fuel such as glucose into ***ATP*** in the presence of oxygen is known as _____.

13. The molecule, _____ stores energy in the cell.

14. Through ***cellular respiration***, a phosphate group is added to AMP to make _____ which is then converted to ATP.

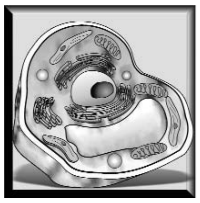
15. The phosphate bonds in ATP, when broken, release:_____ _____.
    (a) the same amount of energy as most chemical bonds
    (b) more energy than most chemical bonds
    (c) less energy than most chemical bonds
    (d) no energy

16. When an enzyme needs energy to complete a chemical reaction:_____ _____.
    (a) a phosphate group is added to ATP
    (b) a phosphate bond breaks
    (c) AMP forms ADP
    (d) none of the above

17. Phosphate groups are added to AMP and ADP molecules in order to _____ energy; phosphate groups are removed from ATP molecules in order to_____ energy.
    (a) store; release (c) release; store
    (b) create; release (d) release; create

18. Write the **Life Principle**:
    "_____ _____ _____."

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CELLULAR RESPIRATION: STAGE I—GLYCOLYSIS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The process of ***cellular respiration*** requires which of the following?_____
   (a) nitrogen (b) hydrogen (c) oxygen (d) phosphorus

2. Place an "X" in front of all of the following descriptions of ***glycolysis***.
   _____ (a) the first part of cellular respiration
   _____ (b) very slow process
   _____ (c) takes place in the cytoplasm of the cell
   _____ (d) one molecule of glucose produces a net gain of four ATP molecules
   _____ (e) requires specific enzymes

3. Which of the following statements correctly describes ***cofactors*** or ***coenzymes***?_____
   _____
   (a) Additional molecules are required for an enzyme to catalyze a reaction.
   (b) They degrade after one reaction.
   (c) They are required in large quantities in the cell.
   (d) They are synthesized from glucose.

Matching: Match the following coenzymes with the vitamins from which each is made.

4. _____ ***NAD^+*** (a) riboflavin
5. _____ ***FAD*** (b) niacin
6. _____ ***CoA*** (c) pantothenic acid

7. In glycolysis, the energy of two ATP molecules converts glucose into:_____
   _____.
   (a) PGAL (b) pyruvic acid
   (c) NAD^+ (d) a six-carbon glucose phosphate

8. The end product molecule of glycolysis is _____.

9. Glycolysis produces two pairs of high-energy electrons that are passed to the coenzyme NAD+ to form _____.

10. Oxygen is a key component of glycolysis. _____ (a) True or (b) False

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11. A condition in which no oxygen is available to a cell is called a(n)_____ _____.

12. Under ***anaerobic*** conditions, the cell:_____ _____.
(a) passes electrons from NADH back to the pyruvic acid molecule from which it came
(b) passes electrons from NADH to the Kreb's cycle
(c) passes electrons from NADH to oxygen
(d) passes electrons from pyruvic acid to the Kreb's cycle

13. The two types of ***fermentation*** are:_____ _____.

14. In most animals, ***pyruvic acid*** that accumulates in anaerobic conditions is converted to _____ when it accepts electrons from NADH.

15. Although aerobic respiration produces much more ATP than does anaerobic respiration, anaerobic respiration is still a necessary process because:_____ _____.
(a) large muscles in the body quickly run out of oxygen during exercise
(b) cells still need ATP even in the absence of adequate oxygen
(c) the body often cannot supply enough oxygen to muscles to meet their needs
(d) all of the above

16. Yeasts produce _____ and _____ from pyruvic acid under anaerobic conditions.

17. Alcohol fermentation causes all of the following, **except**:_____ _____.
(a) bread dough to rise
(b) bubbles in alcoholic beverages
(c) bubbles in soda pop
(d) none of these

18. Louis Pasteur concluded that fermentation occurred only when _____ was/were present.
(a) oxygen (b) alcohol (c) yeast (d) bacteria

19. Place an "X" in front of each description of what happens to wine yeasts in the presence of oxygen.
_____ (a) They will produce alcohol.
_____ (b) They will be overcome by yeasts and bacteria that produce acetic acid.
_____ (c) They will be converted from producing alcohol to producing vingegar.
_____ (d) They will contaminate the wine-making process.

20. Write the **Life Principle**:
"_____ _____ _____."

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CELLULAR RESPIRATION: STAGE II—THE KREBS CYCLE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. After glycolysis, about _____ percent of available energy from glucose is unused.
   (a) 5 (b) 25 (c) 75 (d) 95

2. The _____ membrane of a mitochondrion is permeable to a variety of molecules; the _____ membrane is less permeable.

3. The inner, infolded membrane of a mitochondrion is known as a(n)_____ _____.

4. Enzymes and substrates for the second and third stages of respiration are contained within the:_____.
   (a) mitochondrial matrix (c) outer membrane
   (b) cytoplasm (d) nucleus

5. Cells that are more active and have larger energy requirements than other cells have many more _____.

6. The second stage of respiration is known as the ***Kreb's Cycle,*** or the_____ _____.

7. The four-carbon intermediate compound (which, when combined with acetyl CoA, initiates the Kreb's Cycle) is known as: _____.
   (a) citric acid (b) pyruvic acid (c) carbon dioxide (d) oxaloacetic acid

8. The carbon dioxide produced by the mitochondria throughout your body is released when you _____.

9. The electrons released when the carbon atoms in glucose are broken down and released as CO_2 are passed to which of the following molecules? _____
   (a) NAD^+ (b) FADH (c) ATP (d) NADH

10. The greatest part of the energy derived from the original glucose molecule is found in: _____.
    (a) the ATP produced in the Kreb's Cycle
    (b) oxaloacetic acid
    (c) the five pairs of electrons removed during the Kreb's Cycle
    (d) none of the above

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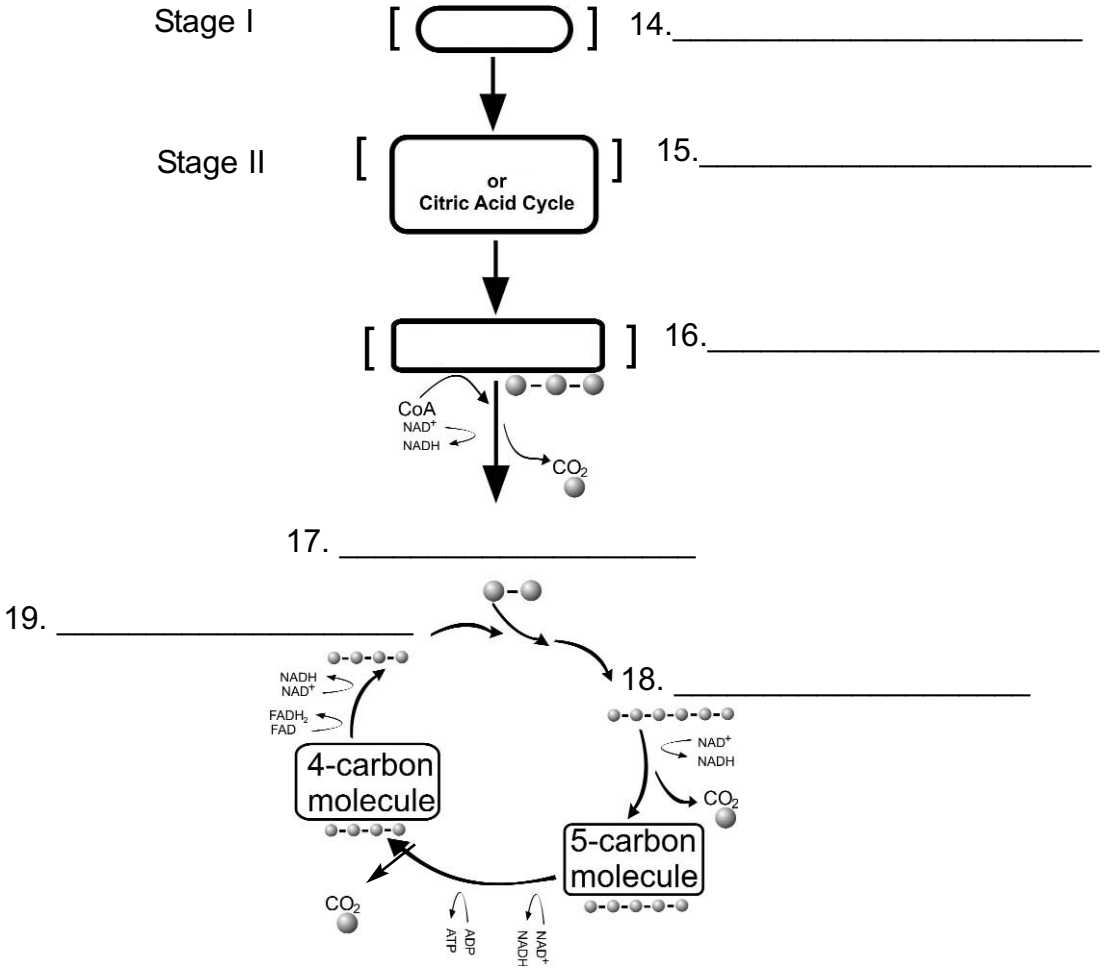
11. _____ molecule(s) of ATP is/are formed during each turn of the Kreb's Cycle.
(a) four (b) two (c) one (d) three

12. _____ molecule(s) of ATP is/are formed for each glucose molecule during the Kreb's Cycle.
(a) four (b) two (c) one (d) three

13. Seven _____ carry out the reactions of the Kreb's Cycle and produce many intermediate compounds.

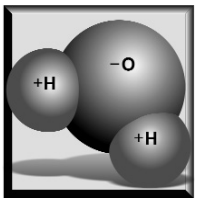
Review Question:

Fill in the missing parts of cellular respiration and the Citric Acid Cycle below using the illustration in your text.



20. Write the **Life Principle**:
"_____
_____
_____."

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CELLULAR RESPIRATION STAGE III — THE ELECTRON TRANSPORT CHAIN

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. How does the cell utilize the energy available in a glucose molecule?_____
_____.
   (a) It burns glucose, releasing CO_2 and H_2O.
   (b) It works in a very slow, controlled manner.
   (c) It works in a short, violent manner.
   (d) The cell does not use glucose for energy.

2. Place an "X" in front of all of the following which require oxygen.
   _____ (a) glycolysis
   _____ (b) Kreb's Cycle
   _____ (c) electron transport chain

3. ***The electron transport chain*** is a series of molecules located in the inner membrane of the mitochondrion that receives _____ from electron carriers.
   (a) low-energy electrons (c) high-energy electrons
   (b) high-energy protons (d) low energy protons

4. Which of the following molecules accepts electrons at the end of the electron transport chain? _____
   (a) NAD^+ (b) FAD^+ (c) oxygen (d) carbon dioxide

5. _____ take the electrons produced during the Kreb's Cycle and transport them to the inner membranes of the mitochondrion to be processed.

6. After electrons are passed to the electron transport chain, electron carriers:_____
_____.
   (a) are destroyed
   (b) return to the Kreb's Cycle
   (c) become part of the electron transport chain
   (d) all of the above

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7. Electrons in the electron transport chain:_____.
   (a) are passed from one molecule to the next
   (b) are combined with hydrogen ions and oxygen to form H_2O
   (c) gradually lose energy to the production of ATP
   (d) all of the above

8. During glycolysis and the Kreb's Cycle, a net total of _____ molecules of ATP are produced; during the electron transport chain, _____ molecules of ATP are produced.

9. The *entire* process of cellular respiration can yield a net total of _____ molecules of ATP.
   (a) 38 (b) 36 (c) 32 (d) 40

10. The cell utilizes 100% of the energy available in a glucose molecule through the process of cellular respiration. _____ (a) True or (b) False

11. The most efficient man-made machine can produce _____ percent of the energy that is available in the fuel that powers the machine.

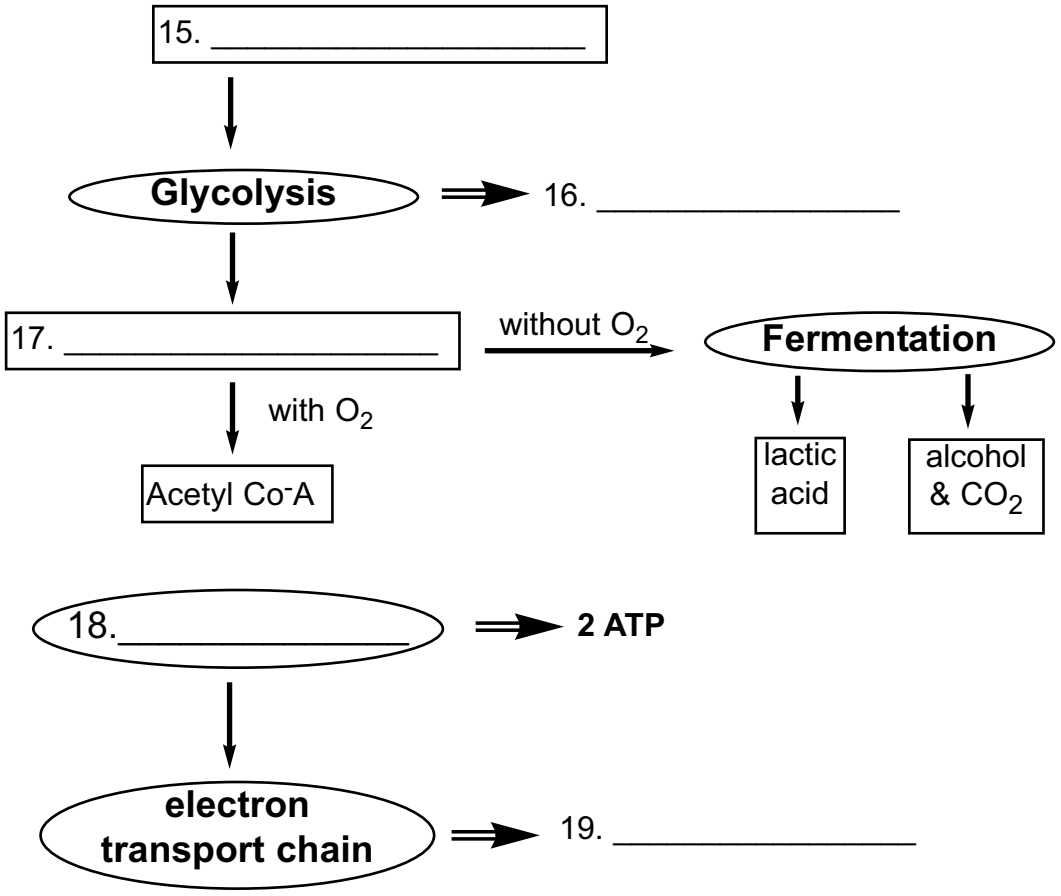
12. All carbohydrates are broken down to either glucose or _____ and are eventually converted to pyruvic acid.

13. Fats and proteins are metabolized without entering glycolysis or the Kreb's Cycle.
    _____ (a) True or (b) False

14. Fat is produced and stored when:_____
    _____.
    (a) fats are ingested
    (b) more food is ingested than is needed to build macromolecules and release energy
    (c) carbohydrates and proteins are used immediately
    (d) fatty acids are converted to acetyl CoA

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Review Question:
Fill in the spaces below using the illustration from your text.



20. Write the **Life Principle**:
"_____
_____
_____."

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PHOTOSYNTHESIS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Whether an animal is a plant-eater or a meat-eater, the animal's source of energy can be traced back to plants. _____ (a) True or (b) False

2. In the process of ***photosynthesis***:_____
_____.
   (a) glucose is converted into carbon dioxide and water
   (b) meat-eaters gain energy from eating plants
   (c) green plants use energy from sunlight to convert carbon dioxide and water into glucose
   (d) energy is lost

3. An extremely important by-product of photosynthesis is _____, on which most organisms depend.

4. Photosynthesis occurs in all of the following, **except**: _____.
   (a) green plant
   (b) algae
   (c) bacteria
   (d) amoebas

5. Plants use the glucose they produce to build leaves, flowers, fruits, and seeds, and to produce _____, the structural material of cell walls.

6. When plants produce more glucose than is needed, the excess glucose is:_____
_____.
   (a) shared with other plants
   (b) destroyed
   (c) stored
   (d) used to make a new plant

7. Humans and animals must rely on the glucose and oxygen produced by plants because they are unable to_____
_____.

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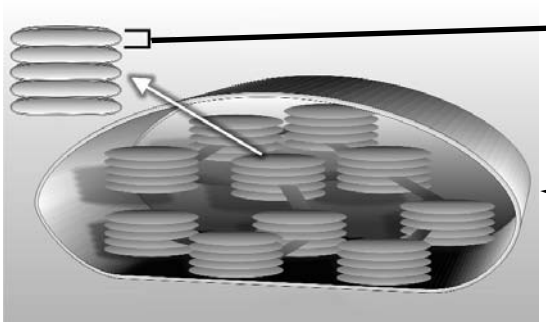
Matching:

8. _____ Joseph Priestly — (a) showed the importance of sunlight for O_2 production
9. _____ Jan Ingen-Housz — (b) showed that H_20 is necessary for photosynthesis
10. _____ Jean Senebin — (c) demonstrated that green plants reverse effects of breathing
11. _____ Nicolas Theodore de Sanssure — (d) showed photosynthesis is dependent on CO_2

12. The organelle in which plant photosynthesis occurs is called a(n)_____ _____.

13. The numerous disk-shaped compartments inside the chloroplast which contain chlorophyll are known as _____.

Label the plant cell structures below using the illustration from your text.



16. The green pigment in plants is called:_____.
(a) chloroplast (b) chloride (c) chlorophyll (d) chlorine

17. Plant pigment absorbs light in the blue and red regions of the visible spectrum, but not in the _____ region of the spectrum.

18. When chlorophyll absorbs light, energy is transferred directly to _____ in the chlorophyll molecule.
(a) protons (b) glucose (c) electrons (d) oxygen

19. The reaction process during photosynthesis that requires the direct involvement of light is known as _____.

20. The passing of electrons down the ***photosynthetic electron transport chain*** results in: _____.
(a) a release in energy from the electrons
(b) a loss of energy to the electrons
(c) a conversion of chemical bond energy into sunlight energy
(d) none of the above

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21. Excited electrons in chlorophyll can be used to form ATP or can be captured by _____ to form _____.
    (a) NAD^+; NADH
    (b) FAD^+; FADH
    (c) NADPH; $NADP^+$
    (d) $NADP^+$; NADPH

22. What is the function of water in photosynthesis?_____
    _____
    (a) to turn high-energy electrons to chlorophyll and release O_2 into the atmosphere
    (b) to initiate the excitation of electrons
    (c) to break chlorophyll apart
    (d) to split enzymes in two

23. ***Light-independent reactions***:_____
    _____.
    (a) require light energy
    (b) convert energy from ATP and $NADP^+$ into sugars
    (c) use sugars to power reaction of ATP and $NADP^+$
    (d) produce sugars that must be used immediately

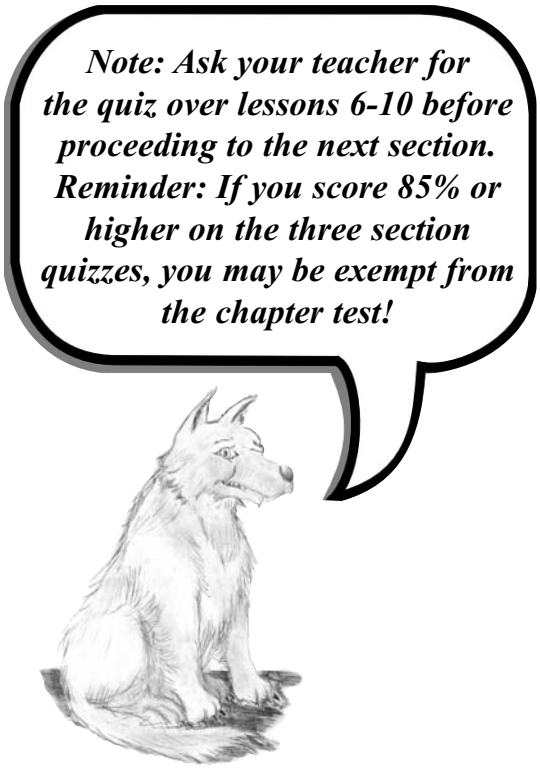
24. During the light-independent reaction, carbon dioxide is collected from the atmosphere and combined to a 5-carbon sugar to produce two Phosphoglyceric Acid, (or_____ _____), molecules.

25. Energy from ATP and $NADP^+$ is converted into sugars in the:_____
    _____.
    (a) Kreb's Cycle
    (b) electron transport chain
    (c) Calvin Cycle
    (d) photosynthetic electron transport chain

26. How many turns of the Calvin Cycle are necessary to produce a 6-carbon sugar molecule?
    _____
    (a) 2 (b) 4 (c) 6 (d) 8

27. Write the **Life Principle**:
    "_____
    _____
    _____."

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CELL GROWTH, DIVISION AND THE CELL CYCLE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. To increase the size of an organism:_____ _____.
   (a) cells grow larger
   (b) fluid fills the spaces around cells
   (c) cells fill with fluid
   (d) cells reproduce

2. The larger a cell's diameter:_____ _____.
   (a) the more material it has available to meet its needs
   (b) the smaller the surface area of the cell
   (c) the more difficult it is to get materials in and out of the cell
   (d) the smaller the cell's internal volume

3. The process by which a cell divides into two independent daughter cells is known as _____.

4. In order to transmit nuclear information to both daughter cells, the information from the parent cell is split in two halves; one for each daughter cell. _____
   (a) True or (b) False

5. For a parental cell to divide and produce two viable cells:_____ _____.
   (a) it must make a complete copy of the genetic information in its nucleus
   (b) it must give half of its genetic material to each daughter cell
   (c) it must mix its genetic material with that of the daughter cells
   (d) none of the above

6. Place an "X" in front of all of the following statements that are true concerning ***binary fission***.
   _____ (a) It occurs in prokaryotic cells.
   _____ (b) A new wall material cuts through the cytoplasm and the nuclear area.
   _____ (c) Each new cell possesses one-half of the parent cell's genetic information.
   _____ (d) Genetic information is replicated.

7. ***Cell division*** in eukaryotic cells was described in detail by_____ _____ of the German University of Prague in the 1800s.

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8. The process of cell division in eukaryotic cells in which each of the daughter cells has identical DNA information as the parent cell is known as:_____.
   (a) binary fission (c) meiosis
   (b) mitosis (d) cytokinesis

9. The division of the cell's cytoplasm is called:_____.
   (a) binary fission (c) meiosis
   (b) mitosis (d) cytokinesis

10. The process that creates the ***gametes*** used for sexual reproduction is known as_____ _____.

11. Gametes that result from a meiotic division contain _____ the number of chromosomes of the parent cell.

12. When two gametes combine, the new cell will have:_____ _____.
   (a) twice the number of chromosomes as one gamete
   (b) one-half the number of chromosomes as one gamete
   (c) three times the number of chromosomes as one gamete
   (d) one third the number of chromosomes as one gamete

13. The period of time from the beginning of one cell division to the beginning of the next is called the _____.

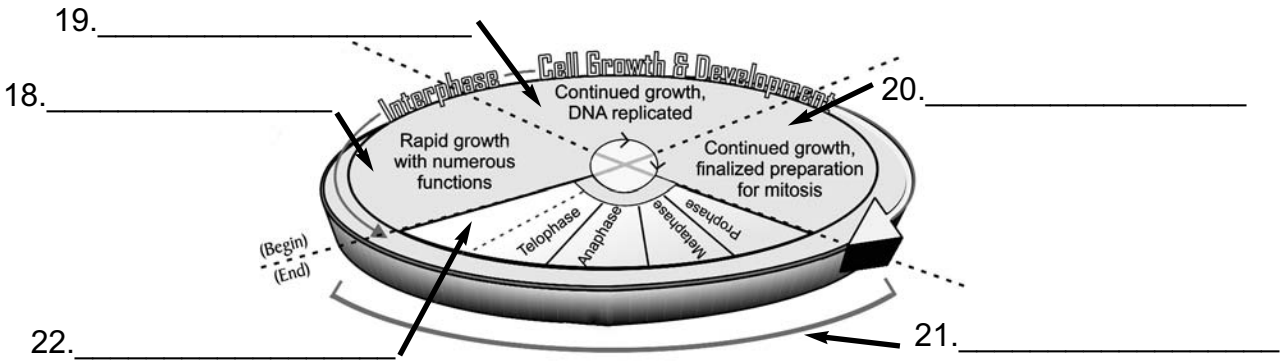
14. The event in cell division in which ***mitosis*** or ***meiosis*** takes place marks the part of the cell cycle called the _____ phase.
   (a) G1 (b) S (c) G2 (d) M

15. Chromosomes are copied during which phase of the cell cycle? _____
   (a) G1 (b) S (c) G2 (d) M

16. Most cell growth and activity takes place in which phase of the cell cycle? _____
   (a) G1 (b) S (c) G2 (d) M

17. The cell makes the final preparations for cell division during the _____ phase.
   (a) G1 (b) S (c) G2 (d) M

Review Question: Label the phases of the cell cycle in the diagram below.



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23. Although it varies, the average length of the cell cycle in a typical human adult cell is about _____ hours.

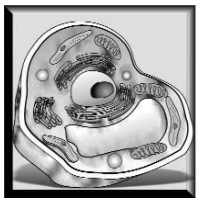
24. Once a cell enters the S phase, it is very likely to continue through the rest of the cell cycle and enter cell division. _____ (a) True or (b) False

25. Write the **Life Principle**:
"_____
_____
_____."

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MITOSIS—THE CONTINUITY OF LIFE



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The process of asexual cell division in eukaryotes in which each of the daughter cells receive the exact genetic makeup of the parent cell is called:_____ _____.
   (a) meiosis (b) cytokinesis (c) mitosis (d) prophase

2. Yeasts, molds, and mushrooms are classified as:_____.
   (a) animals (b) plants (c) protists (d) fungi

3. In a full grown organism, mitosis is a means of _____ the organism.
   (a) developing (c) enlarging
   (b) maintaining (d) all of the above

4. ***Somatic*** cells exclude all **except** which of the following?_____
   (a) sperm cells (c) reproductive cells
   (b) egg cells (d) muscle cells

5. The nuclei of human somatic cells contain _____ ***chromosomes***.
   (a) 46 (b) 8 (c) 16 (d) 48

6. In addition to the G1, G2, S, and M phases, the cell cycle is also divided into three more phases:_____ _____.

7. Interphase includes which phases of the cell cycle? _____
   (a) G1, S, M (c) G1, G2, S
   (b) G1, G2, M (d) G2, S, M

8. A cell in interphase could also be referred to as a resting cell. _____
   (a) True or (b) False

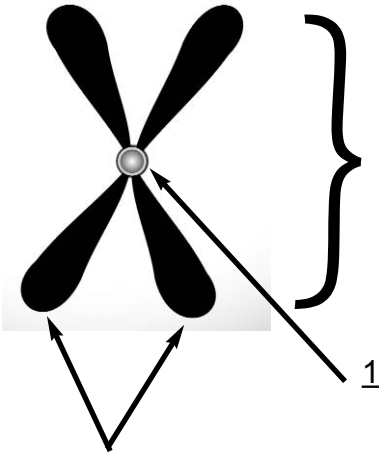
9. Place an "X" in front of all of the following that correctly describe interphase.
   _____ (a) clearly visible nucleus
   _____ (b) clearly visible chromosomes
   _____ (c) most active phase for chromosomes

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10. The process of mitosis actually begins with which of the following?_____
_____
(a) prophase (b) interphase (c) cytokinesis (d) anaphase

11. Which of the following is characteristic of prophase?_____
_____
(a) Chromosomes line up at the center of the cell.
(b) Duplicated chromosomes separate.
(c) Chromosomes organize and each consist of two chromatids.
(d) Two distinct nuclei from within the cell.

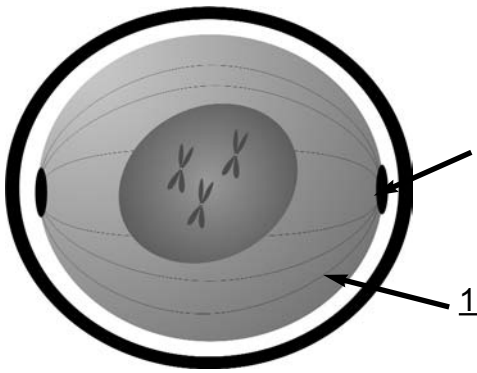
Label the following diagrams, using your text.



12._____

13._____

14._____



15._____

16._____

17. The cytoskeleton component that provides a tough, flexible framework of support for the cell is called a(n) _____.

18. The beginning of metaphase is marked by the final disintegration of the:_____
_____.
(a) spindle (c) nuclear membrane
(b) chromatids (d) cytoplasm

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19. The chromosomes line up across the center of the cell in which mitotic phase?_____ _____
(a) prophase (b) metaphase (c) anaphase (d) telophase

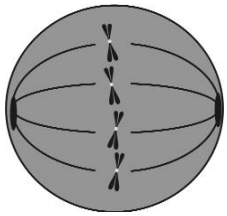
20. During anaphase: _____.
(a) two nuclei form within the cell
(b) the mitotic spindle forms
(c) the chromatids separate
(d) the nuclear membrane reforms

21. Place an "X" in front of all of the following statements that correctly describe telophase.
_____ (a) Mitotic spindles break down.
_____ (b) Chromosomes unwind.
_____ (c) A nuclear membrane reforms around each new chromosome cluster.
_____ (d) One distinct nucleus forms within the cell.

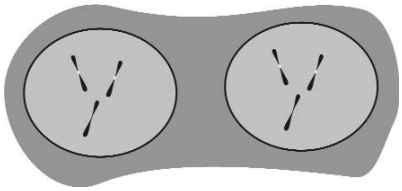
22. The division of the cellular cytoplasm is called _____.

23. When plant cells undergo cytoplasmic division, a structure called the_____ _____ forms midway between the two nuclei.
(a) cytoplasmic groove (c) cell plate
(b) cell furrow (d) ring of filaments

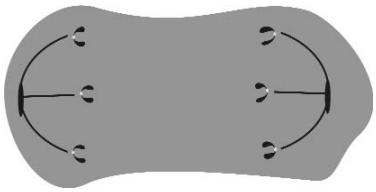
Review Question: Label the following diagrams as prophase, metaphase, anaphase, teleophase, or cytokinesis.



24._____



25._____

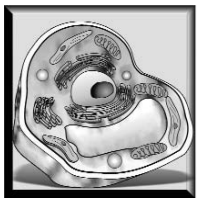


26._____

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27. Write the **Life Principle**: "_____
_____
_____."

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MEIOSIS—THE PROPAGATION OF LIFE



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Chromosome pairs of the same length and centromere position, containing the same kind of information are known as _____.

2. One ***homologue*** is inherited from an organism's _____ and the other from the organism's _____.

3. Why must a gamete contain only one-half the number of chromosomes present in normal body cells?_____
_____

   (a) It must fuse with another gamete to produce a cell with the same number of chromosomes as a normal body cell.
   (b) Because otherwise, with each generation, the number of chromosomes per cell would double.
   (c) Because otherwise, the cell would become too large very quickly.
   (d) all of the above

4. Human cells are _____ because they contain two of each type of chromosome.

5. Human gamete cells are _____ because they contain one of each type of chromosome.

6. When two gametes (reproductive cells) unite, they from a cell that contains:_____
_____.

   (a) the normal diploid number of chromosomes
   (b) double the normal diploid number of chromosomes
   (c) one-half the normal diploid number of chromosomes
   (d) the normal haploid number of chromosomes

7. Place an "X" in front of all of the following statements that correctly describe meiosis.
   _____ (a) Chromosomes in gametes are reduced by half.
   _____ (b) One diploid cell is converted into four haploid cells.
   _____ (c) The process is divided into meiosis I and meiosis II.

8. At the beginning of meiosis, each chromosome consists of:_____
_____.

   (a) four chromatids attached at a centromere
   (b) three chromatids attached at a centromere
   (c) one chromatid
   (d) none of the above

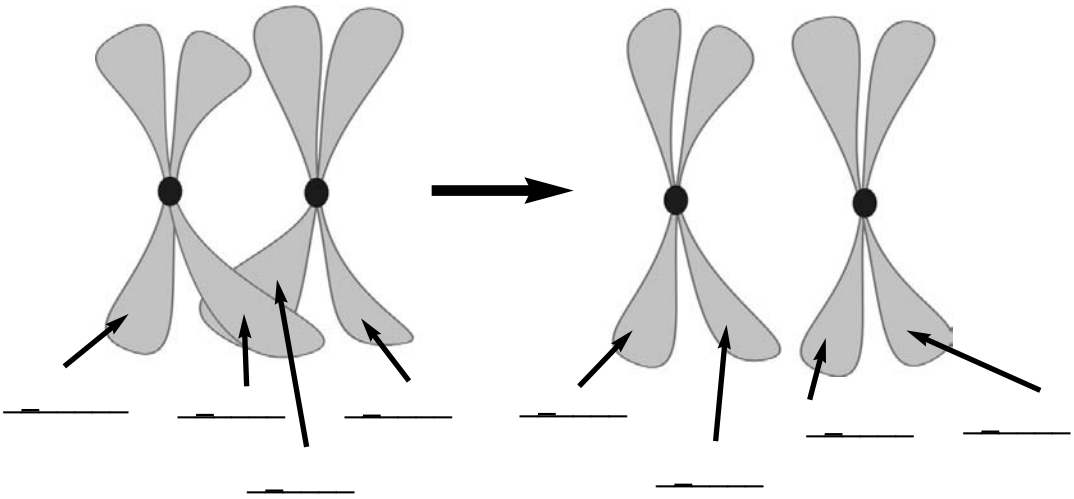
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Matching: Choose the correct answers.

9. _____***homologous chromosomes***
10. _____ tetrad
11. _____ ***synapsis***
12. _____ ***crossing over***

(a) chromosome pairs of the same length and centromere position, containing the same kind of genetic information
(b) the pairing of homologous chromosomes during meiosis I
(c) the exchange of parts of two homologous chromosomes during meiosis
(d) the combination of four chromatids during synapsis

13. Label the chromosomes that will result from this synapse.



14. In _____ of meiosis, the tetrads align on the spindle as in mitosis.

15. In anaphase I, the _____ separate.
(a) chromatids (c) centrioles
(b) homologous chromosomes (d) centromeres

16. In meiosis, the goal is to produce cells that are genetically _____.

17. In telophas I, each of the nuclei formed has _____ the number of chromosomes that were present in the parent cell.
(a) twice (b) one-half (c) one-third (d) three times

18. DNA replication occurs rapidly during meiotic interphase. _____
(a) True or (b) False

19. During meiosis II in humans, forty-six chromatids will separate into two cells, each with _____ single-stranded chromosomes.
(a) 46 (b) 23 (c) 92 (d) 184

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20. During anaphase II, _____ separate to opposite poles of the cell.
    (a) homologous chromosomes
    (b) chromatids
    (c) centromeres
    (d) none of the above

21. The 23 chromosomes in the four cells from human meiosis are not identical. _____
    (a) True or (b) False

22. The development point at which an organism attains sexual maturity is known as _____.

23. A single ***diploid*** cell in a human male yields _____ ***haploid*** sperm cells with 23 chromosomes each.

24. The result of meiosis II in human females is a single egg per cycle containing 23 chromosomes and three _____ which disintegrate.

25. When an egg and a sperm unite, the fertilized egg will contain:_____ _____.
    (a) the haploid number of chromosomes
    (b) 23 single-stranded chromosomes
    (c) 46 single-stranded chromosomes
    (d) 92 single-stranded chromosomes

26. After formation of the zygote, the process of _____ will yield a complete human being.
    (a) meiosis
    (b) mitosis
    (c) cytokinesis
    (d) fertilization

27. Write the **Life Principle**: "_____ _____ _____."

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REGULATING THE CELL CYCLE AND THE AGING PROCESS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Which of the following types of cells divide most rapidly and most often?_____
   _____
   (a) brain cells (c) nerve cells
   (b) skin cells (d) bone cells

2. Why are alcohol, marijuana, and cocaine particularly dangerous to brain cells?_____
   _____
   (a) Brain cells cannot be replaced once destroyed.
   (b) It is difficult for brain cells to divide once they have been weakened by drugs.
   (c) These drugs slow the mitotic process of brain cells.
   (d) These drugs enlarge brain cells, causing the brain to swell.

3. ***Cancer*** is a condition in which:_____.
   (a) the regulation of the cell cycle has become too rigid, preventing cells from dividing
   (b) growth of cells is hindered
   (c) the regulation of the cell cycle is lost, resulting in uncontrolled division of cells
   (d) the cell cycle proceeds in reverse order

4. Proteins that control cell division and regulate the timing of the cell cycle are called _____.

5. The M-phase ***cyclin*** regulates: _____.
   (a) cell entry into mitosis (b) DNA replication
   (c) interphase (d) cytokinesis

6. What determines the length of time required for a cell to move through the cell cycle?
   _____
   (a) the time required to destroy cyclin after mitosis
   (b) the amount of DNA that must be duplicated during the S phase
   (c) the time required to make sufficient cyclin for the cell to enter mitosis
   (d) the number of phases the cell must go through

7. In addition to cell mitosis, the job of some cyclins is to delay or _____ cell divisions.

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8. The sum of changes that accumulate with time, and eventually bring an organism to death, is known as _____.

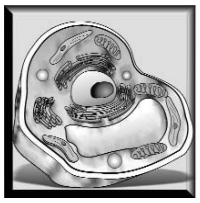
9. Aging begins: _____.
   (a) after complete developement
   (b) after puberty
   (c) after midlife
   (d) before complete development

10. Aging and death seem to be: _____.
    (a) fully understood
    (b) independent of environment
    (c) genetically programmed
    (d) socially determined

11. All living things must eventually die. _____ (a) True or (b) False

12. Write the **Life Principle**:
    "_____
    _____
    _____."

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ACTIVITIES
Lesson 15:

CELL ORDER

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Cells in a multicellular organism seem to be: _____.
   (a) identical (b) simple (c) specialized (d) generalized
2. The liver and kidneys perform much of the _____ work of the body.
3. Muscle cells perform _____ work in the body.
4. _____ and _____ cells control voluntary and involuntary body movements.
5. Red blood cells consist almost entirely of _____ and skin cells consist almost entirely of: _____.
   (a) hemoglobin; keratin
   (b) carbohydrates; hemoglobin
   (c) keratin; hemoglobin
   (d) hemoglobin, carbohydrates
6. An amoeba-like cell that moves through tissue fibers, engulfing bacteria and dead cells is a(n) _____.
7. Specialized granules in the macrophage:_____ _____.
   (a) confuse the bacteria, making it easier for the macrophage to engulf them
   (b) give the bacteria a coloration so macrophages can identify them
   (c) attack the cell wall of bacteria, killing them
   (d) fill the bacteria and turn them into macrophages
8. The process by which a ***macrophage*** engulfs a large substance by surrounding it with part of its plasma membrane, is called _____.
9. A cell that carries an impulse through the nervous system is called a(n)_____ _____.
   (a) macrophage (b) gamete (c) tissue (d) neuron
10. Impulses in nerve cells are controlled by the _____.

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Matching:

11. _____ epithelial tissues (a) contract and relax body parts
12. _____ connective tissues (b) inner and outer body surfaces
13. _____ muscle tissues (c) support and hold together body parts
14. Your kidneys, lungs, heart, and eyes are all: _____.
    (a) tissues (b) cells (c) organs (d) organ systems
15. How many major organ systems operate in the human body? _____
    (a) one (b) eleven (c) twelve (d) twenty
16. Cells of different specialties are completely independent of one another. _____
    (a) True or (b) False
17. List in order of complexity, the four levels of organization within man and other multicellular organisms.
    (a) _____
    (b) _____
    (c) _____
    (d) _____

Matching:

18. _____ tissue (a) a group of tissues that work together to perform a specific function
19. _____ organ (b) a group of organs that perform several closely related functions
20. _____ organ system (c) a group of similar cells that work together to perform a specific function
21. Write the **Life Principle**:
    "_____
    _____
    _____."

Note: Ask your teacher for the quiz over lessons 11-15 before proceeding to the next section. Reminder: If you score 85% or higher on the three section quizzes, you may be exempt from the chapter test!

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