

**I. Scientific Investigation**

**A. Parts of Experimental Design:** Match the key words to the correct descriptions

Constants Experiment	Variables Dependent Variable	Qualitative data Independent variable	Quantitative data Hypothesis	Control Mean
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1. \_\_\_\_\_ - is the type of data gathered using the 5 senses.
2. \_\_\_\_\_ - is the type of data gathered using actual measured numbers.
3. \_\_\_\_\_ - is an educated guess/prediction; usually in "IF...THEN" form.
4. \_\_\_\_\_ - any factors that can be changed in an experiment.
5. \_\_\_\_\_ - is the variable that you purposely change...variable "I" change.
6. \_\_\_\_\_ - is the variable that changes as a result of changing the IV.
7. \_\_\_\_\_ - is the standard against which the experimental results are compared.
8. \_\_\_\_\_ - the thing(s) that are purposely kept the same in the experiment.
9. \_\_\_\_\_ - is a structured way to test a hypothesis
10. \_\_\_\_\_ - the average of the data collected in an experiment

**C. Research Sources:** Match the three research sources below with their descriptions

Encyclopedias	State/local agencies	Scientific journals
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- a. \_\_\_\_\_ are the best place to locate *current* findings on the newest technologies
- b. \_\_\_\_\_ are a good place to find information on extinct species or historical theories
- c. \_\_\_\_\_ can help research the effects of pesticides on the squirrel population

**D. Hypothesis, Theory and Law :** Match the three scientific ideas below with their descriptions.

Hypothesis	Theory	Law
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- 1 \_\_\_\_\_ - A phenomenon that is directly observable and demonstrated to be universal
- 2 \_\_\_\_\_ - A prediction or explanation based on observations that has yet to be supported by much data
- 3 \_\_\_\_\_ - An explanation of many scientific observations (i.e. a key or central idea) that is supported by A LOT of scientific data

**E. Scientific Method :** *Read the paragraph and fill in the blanks that follow*

After studying about recycling, members of John's biology class investigated the effect of various recycled products on plant growth. John's lab group compared the effect of different aged grass compost on bean plants. Because decomposition is necessary to release the nutrients, the group hypothesized that older grass compost would produce taller bean plants. Three flats of bean plants (25 plants/ flat) were grown for 5 days. The plants were fertilized as follows: (a) Flat A: 450 g of three-month-old compost, (b) Flat B: 450 g of six-month-old compost, and (c) Flat C: 0 g compost. The plants received the same amount of sunlight and water each day. At the end of the 30 days the group recorded the height of the plants (cm).

**Hypothesis:** \_\_\_\_\_

**IV:** \_\_\_\_\_

**DV:** \_\_\_\_\_

**control:** \_\_\_\_\_

**constants:** \_\_\_\_\_

For each, identify the hypothesis, IV, DV, the control and experimental group.

**1. The addition of the chemical calcium chloride (CaCl) to water will increase its temperature.**

Hypothesis: If \_\_\_\_\_, then \_\_\_\_\_.

Independent Variable: \_\_\_\_\_ Dependent Variable: \_\_\_\_\_

Control Group: \_\_\_\_\_ Experimental Group: \_\_\_\_\_

**2. Watering a plant with salt water will kill the plant.**

Hypothesis: If \_\_\_\_\_, then \_\_\_\_\_.

Independent Variable: \_\_\_\_\_ Dependent Variable: \_\_\_\_\_

Control Group: \_\_\_\_\_ Experimental Group: \_\_\_\_\_

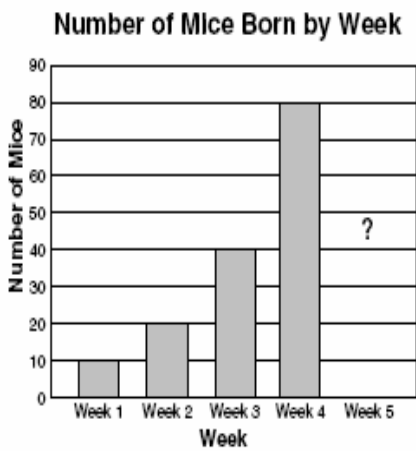
**3. A person that takes a vitamin supplement has better memory retention.**

Hypothesis: If \_\_\_\_\_, then \_\_\_\_\_.

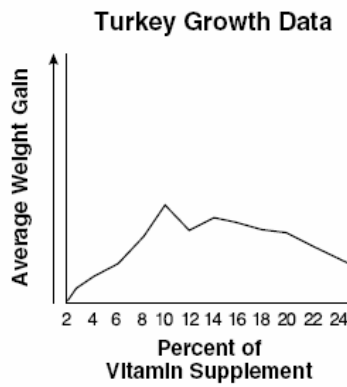
Independent Variable: \_\_\_\_\_ Dependent Variable: \_\_\_\_\_

Control Group: \_\_\_\_\_ Experimental Group: \_\_\_\_\_

**F. Graphs:** Look at the Graphs below and answer the questions that follow.

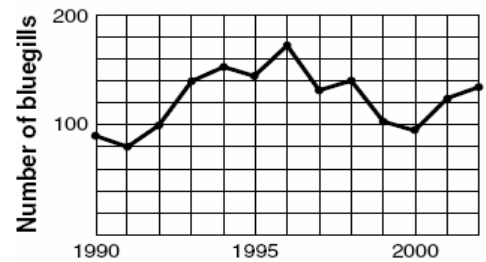


According to the graph, how many mice will be born in week 5 if the trend continues?



A study on a poultry farm was conducted to determine the percentage of vitamin supplement necessary to add to the feed of turkeys in order to maximize their growth. According to this data, what percentage of vitamin supplement should be added to the turkeys' diet?

**Bluegill Population in Farm Pond 1990-2002**



In which year was there likely an abundance of bluegill food?

In which year was there likely an increase in bluegill predators?

**G. Microscopes:**

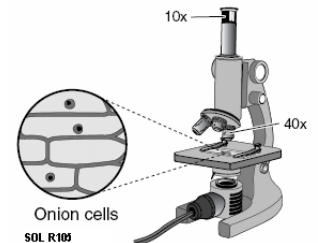
1. What is the total magnification used to view these onion cells through this setup?

2. \_\_\_\_\_ Which of the following came first in the scientific study of living things?

- a. light microscopes
- b. electron microscope
- c. cell theory
- d. model of DNA

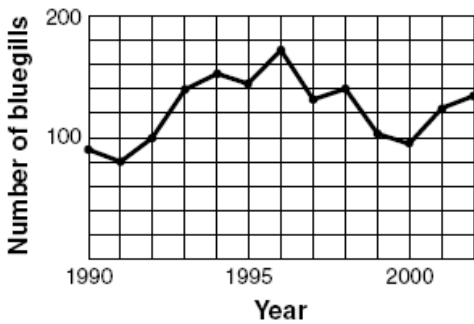
3. \_\_\_\_\_ - Which 4 of the following are needed to make a wet-mount?

- a. coverslip
- b. slide
- c. specimen
- d. clay
- e. water
- f. glue



**H. Interpreting Graphs**

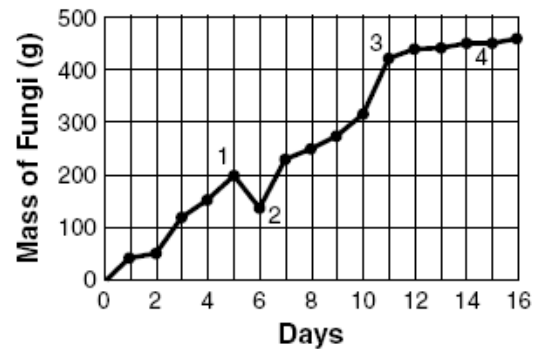
**Bluegill Population in Farm Pond  
1990–2002**



What is on the x-axis? \_\_\_\_\_  
 What is on the y-axis? \_\_\_\_\_  
 What is the dependent variable? \_\_\_\_\_  
 What is the independent variable? \_\_\_\_\_  
 What was the bluegill population in 1991? \_\_\_\_\_  
 What happened to the population from 1996 to 2000? \_\_\_\_\_

What is on the x-axis? \_\_\_\_\_  
 What is on the y-axis? \_\_\_\_\_  
 What is the dependent variable? \_\_\_\_\_  
 What is the independent variable? \_\_\_\_\_  
 Which data point (1-4) is probably invalid? \_\_\_\_\_  
 How many days did it take for the fungi to reach 200 g? \_\_\_\_\_

**Mass of Fungi Grown in  
Forest Leaf Litter**



**I. Characteristics of Life**

autotroph	cells	DNA	energy	evolution	heterotroph
homeostasis	reproduce	response	stimulus		

- Organisms are made of one (uni-) or many (multi-) \_\_\_\_\_.
- Organisms must \_\_\_\_\_ to ensure long-term species survival. Can be asexual or sexual.
- Organisms are based on a universal biological code, stored in the molecule known as \_\_\_\_\_.
- Organisms have a particular pattern of growth and development throughout life.
- Organisms obtain and use materials and \_\_\_\_\_
  - Organisms that make their own organic chemical energy – \_\_\_\_\_
  - Organisms that obtain their organic chemical energy by eating or absorbing it – \_\_\_\_\_
- A change in an organism’s environment is called a \_\_\_\_\_; its reaction is called a \_\_\_\_\_.
- Organisms must maintain a stable internal environment; called \_\_\_\_\_.
- Populations of organisms experience genetic change over time; called \_\_\_\_\_.

**J. Scientists**

- \_\_\_\_\_ Redi
- \_\_\_\_\_ Pasteur
- \_\_\_\_\_ Schleiden
- \_\_\_\_\_ Schwann
- \_\_\_\_\_ Virchow
- \_\_\_\_\_ Hooke
- \_\_\_\_\_ Leeuwenhoek

- |  |
|--|
| <ol style="list-style-type: none"> <li>all animals made of cells</li> <li>all plants made of cells</li> <li>all cells come from pre-existing cells</li> <li>observed cork; named cells</li> <li>invented microscope; observed “animalcules”</li> <li>maggot/meat experiment to disprove spontaneous generation</li> <li>disproved spontaneous generation once and for all</li> </ol> |
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## II. Cytology – Study of cell structure and function

### A. Cell Theory – 3 Main Points

- 1) All organisms are composed of 1 or more \_\_\_\_\_.
- 2) The cell is the basic unit of \_\_\_\_\_.
- 3) All cells come from \_\_\_\_\_ cells.

**B. Cell Types:** For each characteristic, indicate **yes** or **no** for Prokaryotes and Eukaryotes

Characteristic	Prokaryote	Eukaryote
Nucleus?		
Membrane-bound organelles?		
Genetic material?		
Complex?		
Multicellular?		
Bacteria?		
Mitosis?		
Ribosomes?		
Plants and Animals?		

**C. Differences between plant and animals cells** (complete the table by identifying *ONLY* the differences)

Differences	Plant	Animal
Metabolic Function (Photosynthesis, Respiration, or Both)		
Different organelles present		
Shape due to cell wall		

**D. Cell Transport:** In the boxes below, indicate what direction the water moves and what will happen to the cell.

#### Hypertonic Solution

Direction water moves (into cell, out of cell, or both directions equally):

A cell in a hypertonic solution will...

#### Hypotonic Solution

Direction water moves (into cell, out of cell, or both directions equally):

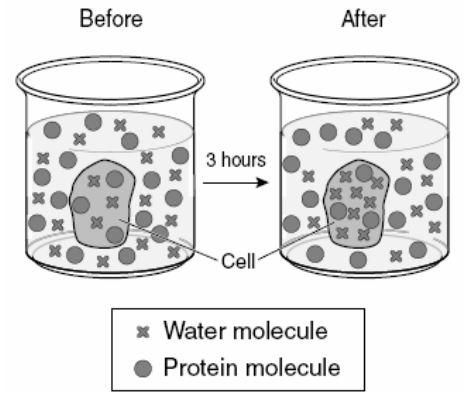
A cell in a hypertonic solution will...

#### Isotonic Solution

Direction water moves (into cell, out of cell, or both directions equally):

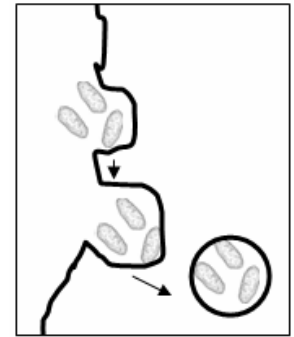
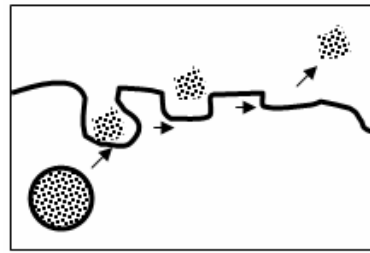
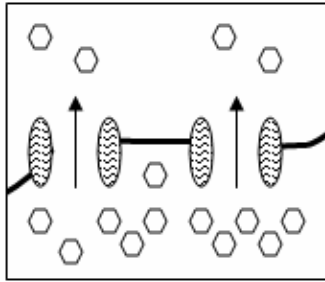
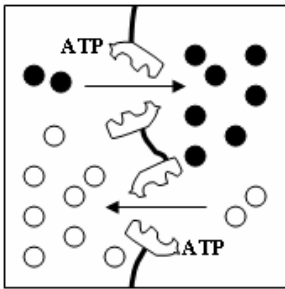
A cell in a hypertonic solution will...

- a. In the picture to the right, are the water molecules moving into or out of the cell?
- b. What type of solution is the cell in (hypotonic, hypertonic or isotonic)?
- c. What will eventually happen to the cell?



Match the types of transport to the correct picture:

Exocytosis    endocytosis    facilitated diffusion    active transport



\_\_\_\_\_

**E. The Fluid Mosaic Model and Movement through the Cell Membrane**

**Word Bank:** Diffusion, proteins, cell membrane, active transport, phospholipids, energy, low, high, osmosis

The cell membrane is composed of \_\_\_\_\_ and \_\_\_\_\_. The Fluid Mosaic Model describes the \_\_\_\_\_.

Passive transport is also called \_\_\_\_\_ and it doesn't require \_\_\_\_\_.

Passive transport moves molecules from areas of \_\_\_\_\_ to \_\_\_\_\_ concentration. \_\_\_\_\_ is a type of diffusion involving only the movement of water molecules.

A nonspecific type of movement that requires energy is \_\_\_\_\_ which moves molecules from low to high concentration.

What is a **selectively permeable membrane**?

What is a **concentration gradient**?

### III. Biochemistry

**A. Water:** Use the following word bank to fill in the blanks that follow

hydrogen    floats    acids    temperature    capillary action    water    polar    7    4    14    0  
adhesion    cohesion    solvent    bases    high heat of vaporization    homeostasis    surface tension

- a. Water molecules have a slightly negative charge at one end and a slightly positive charge at the other end. This means that the molecule is \_\_\_\_\_.
- b. \_\_\_\_\_ is the attraction between the positive end of one water molecule and the negative end of another water molecule (water sticking to water).
- c. Many of the 5 unique properties of water are caused by \_\_\_\_\_ bonding
- ~ \_\_\_\_\_ is the movement of water up thin plant tubes, caused by \_\_\_\_\_ which means that water molecules 'stick' to other things.
  - ~ The property that helps bugs stand on water is \_\_\_\_\_.
  - ~ Water expands when it freezes which makes ice \_\_\_\_\_.
  - ~ Water has a \_\_\_\_\_, so it takes a lot of energy to change from a liquid to a gas. This helps organisms maintain the amount of water they have in their bodies.
  - ~ Water resists temperature change so organisms maintain \_\_\_\_\_ and keep a constant \_\_\_\_\_.
- d. Because water is a polar molecule, it can dissolve many substances and is sometimes called "The \_\_\_\_\_".
- e. Cells are mostly made of \_\_\_\_\_, therefore 95% of your entire body is made of water.

### **B. Water chemistry**

Draw two water molecules – label the \*atom names, \*relative charges, and show \*where a hydrogen bond would form.

**Fill in the Blank Using the Following Words: dissolve, heat, freezing, sweat**

- \*Solid form floats, preventing lakes and oceans from \_\_\_\_\_ solid.
- \* Water can absorb huge amounts of \_\_\_\_\_, which helps stabilize air temperatures around the globe.
- \*Water absorbs heat when it evaporates, allowing organisms to \_\_\_\_\_ to release excess heat.
- \*Water is able to \_\_\_\_\_ many substances (it is a good solvent) so the water inside and outside of cells is able to carry nutrients (solutes) into and around cells, and wastes (also solutes) away from cells.

\*What is the strongest acid listed in Figure 2–2?

\_\_\_\_\_

\*What is the pH of the weakest acid listed in Figure 2-2?

\_\_\_\_\_

\*What is the pH of the strongest base listed in Figure 2-2?

\_\_\_\_\_

*Figure 2-2*

pH Values of Some Common Substances	
Substance	pH
Hydrochloric acid	1.0
Sulfuric acid	1.2
Tomatoes	4.2
Rainwater	6.2
Pure water	7.0
Sea water	8.5
Ammonium chloride	11.1
Sodium hydroxide	13.0

**C. Organic Molecules:** Place the following characteristics and diagrams into one of the four categories of organic compounds.

**Monomer: nucleotide**

**Monomer: monosaccharide**

**DNA & RNA**

**Made at the ribosome of the cell**

**Lots are found in muscle cells**

**Monomer: fatty acid**

**Glucose, fructose & sucrose**

**Enzymes, hemoglobin, & actin**

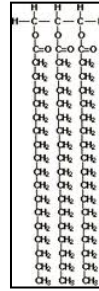
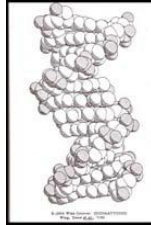
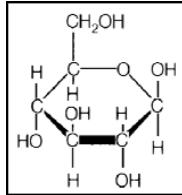
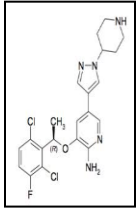
**Sugars**

**Monomer: amino acid**

**Waxes & phospholipids**

**Found in the nucleus of cells**

**Fats**



Carbohydrates

Nucleic Acid

Protein

Lipid

**D. Enzymes**

**Fill in the Blank Using the Following Words:**

substrate, active site, denature, protein, -ase, catalyzes, activation

\*Special kind of \_\_\_\_\_ (macromolecule) that \_\_\_\_\_ (speeds up) chemical reactions.

\* \_\_\_\_\_ - when the shape of the enzyme is changed, making it unable to function properly.

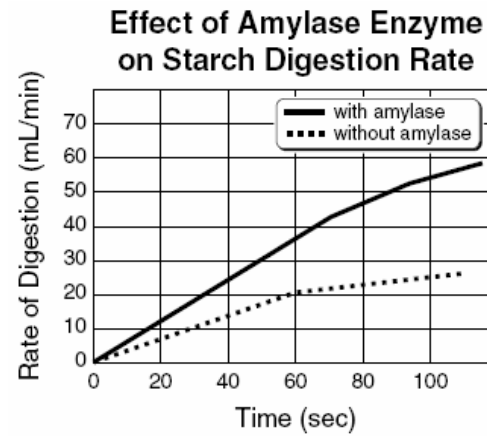
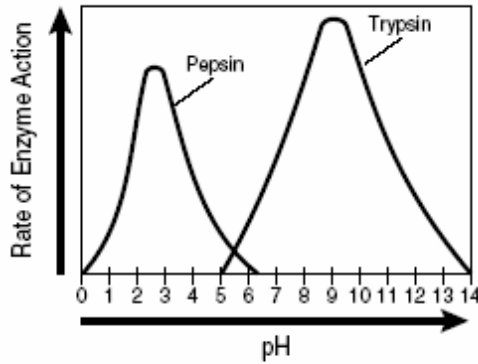
\* Enzyme names usually end in \_\_\_\_\_.

\* \_\_\_\_\_ - the substance on which an enzyme acts

\* \_\_\_\_\_ - the specific site on the enzyme that binds to the substrate (the "business" end)

\* Enzymes lower the \_\_\_\_\_ energy of a reaction, meaning they lower the amount of energy needed for a reaction to progress.

**E. Enzyme Activity graphs:** Use the graphs below to answer the following questions



**pH vs Rate of Enzyme Action**

Which enzyme above works well in acidic conditions?

Which enzyme above works well in basic conditions?

What is optimal pH for pepsin?

What is the optimal pH for trypsin?

**Effect of Amylase Enzyme on Starch Digestion Rate**

What is the substrate of amylase?

What is the product of amylase?

What does the graph indicate about adding amylase to a starch solution?

**IV. Energy: Photosynthesis/Respiration**

**A. Photosynthesis & Respiration and food chains & webs**

What is the equation for photosynthesis? \_\_\_\_\_

What are the reactants? \_\_\_\_\_ What are the products? \_\_\_\_\_

What form of energy is produced by photosynthesis? \_\_\_\_\_

In which cell organelle does photosynthesis occur? \_\_\_\_\_

What is the equation for respiration? \_\_\_\_\_

What are the reactants? \_\_\_\_\_ What are the products? \_\_\_\_\_

What form of energy is produced by respiration? \_\_\_\_\_

Where in the cell does respiration take place? \_\_\_\_\_

**B. The Carbon Dioxide/Oxygen Cycle**

Fill in the Blanks Using the Following words:

heterotrophs, (4) CO<sub>2</sub>, (4) O<sub>2</sub>, glucose, chloroplasts, mitochondria, photosynthesis, chemical, respiration, autotrophs, solar, (2) light, (2) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, glucose, (2) water

a. \_\_\_\_\_ use organelles called \_\_\_\_\_ in their leaves to collect \_\_\_\_\_ energy.

b. \_\_\_\_\_ occurs so plants can make \_\_\_\_\_ to use for energy.



c. Photosynthesis converts \_\_\_\_\_ energy into \_\_\_\_\_ energy.

d. Photosynthesis uses \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ energy to form \_\_\_\_\_ & \_\_\_\_\_.

e. Animals that can't make their own food are called \_\_\_\_\_.

f. Animals, plants, and fungi all use organelles called \_\_\_\_\_ to perform a process called \_\_\_\_\_ which breaks down food molecules to produce ATP for energy.

g. Respiration uses \_\_\_\_\_ and \_\_\_\_\_ to produce \_\_\_\_\_ and \_\_\_\_\_.

h. The gas released by respiration is \_\_\_\_\_; the gas taken in by photosynthesis is \_\_\_\_\_.

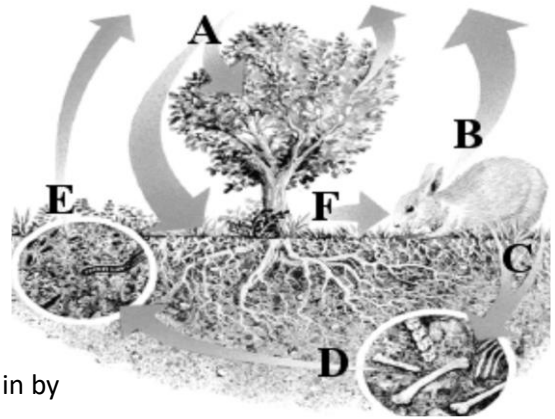
i. The gas taken in by respiration is \_\_\_\_\_; the gas released by photosynthesis is \_\_\_\_\_.

j. The letter \_\_\_\_\_ represents the rabbit dying and replacing nutrients in the soil.

k. The letter \_\_\_\_\_ represents carbon dioxide being taken in to perform photosynthesis.

l. The letters \_\_\_\_\_ and \_\_\_\_\_ show CO<sub>2</sub> being released into the atmosphere by respiration.

m. The letters \_\_\_\_\_ and \_\_\_\_\_ show carbon compounds being ingested for metabolic purposes.



**C. Cellular Respiration** – converts \_\_\_\_\_ energy stored in glucose into \_\_\_\_\_.

\*General equation:

**E.** \_\_\_\_\_ uses oxygen to break down \_\_\_\_\_ which results in \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

**F.** \_\_\_\_\_ does not use \_\_\_\_\_. It is used by unicellular organisms that need less energy. Two types:

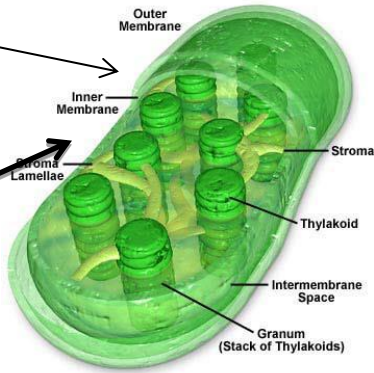
1) \_\_\_\_\_ fermentation – occurs in fatigued muscle cells; used when producing cheese and yogurt; lactic acid is a waste product.

2) \_\_\_\_\_ fermentation – occurs in some yeast cells; used to produce beer, wine and \_Alcohol\_. Alcohol is produced as a waste product.

**D. Fill in the cycle below.**

1. \_\_\_\_\_  
(energy to photosynthesis)

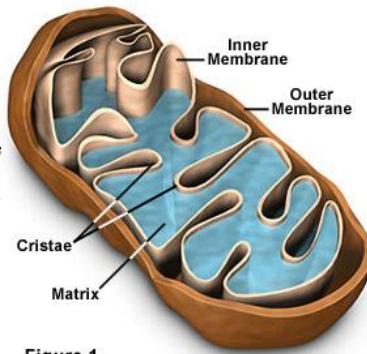
2. \_\_\_\_\_  
(what is this organelle?)



3. \_\_\_\_\_ and \_\_\_\_\_  
(products of respiration)

4. \_\_\_\_\_ and \_\_\_\_\_  
(products of photosynthesis)

**Mitochondria Structural Features**



**Figure 1**

5. \_\_\_\_\_  
(energy made from respiration)

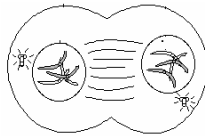
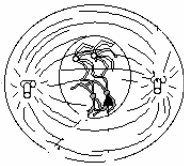
6. \_\_\_\_\_  
(what is this organelle?)

**V. Cell Division: Cell cycle, mitosis, meiosis, DNA, protein synthesis**

**A. Cell Cycle**

Identify the following stages of mitosis and indicate the correct order.

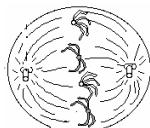
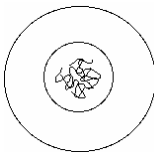
**Word Bank: Anaphase, Interphase, Metaphase, Prophase, Telophase**



A. \_\_\_\_\_

B. \_\_\_\_\_

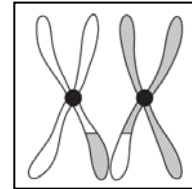
C. \_\_\_\_\_



D. \_\_\_\_\_

E. \_\_\_\_\_

1. What order should the phase above be in? \_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_  
→ \_\_\_\_\_ → \_\_\_\_\_
2. The Cell cycle is made of three stages: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_  
\_\_\_\_\_. Interphase consists of 3 phases: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_  
\_\_\_\_\_. During the \_\_\_\_\_ phase DNA is copied.
3. Look at the picture to the right. What is the term for this process? \_\_\_\_\_  
b. In what phase of meiosis does the following occur? \_\_\_\_\_  
c. What does this process cause in the gametes? \_\_\_\_\_
4. If a gamete of an organism has 6 chromosomes, how many will its body cell have?
5. If a liver cell of an organism has 32 chromosomes, how many will its gametes have?

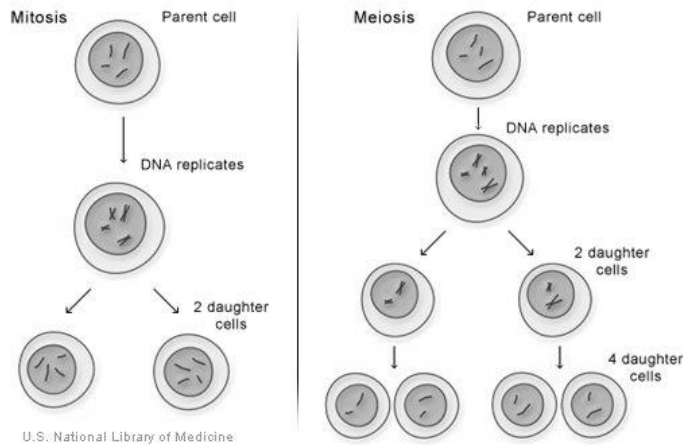


## **B. Mitosis**

Fill in the Blanks Using the Following Words:

**replicated, interphase, prophase, metaphase, anaphase, telophase, cytokinesis, sister chromatid, chromatin, centrioles, spindle fibers, plate, furrow, centromere, cytokinesis, prophase, telophase**

1. A chromosome is made of two identical parts called \_\_\_\_\_.
2. The parts of a chromosome are held together by a \_\_\_\_\_.
3. Only animal cells have \_\_\_\_\_ to help with chromosome movement.
4. During \_\_\_\_\_ sister chromatids are separated at the centromere and are pulled to opposite ends of the cell.
5. DNA is \_\_\_\_\_ during \_\_\_\_\_ so each cell will have the same information.
6. Chromosomes line up along the equator of the cell in \_\_\_\_\_.
7. Loose or uncoiled chromosomes are actually DNA in the form of \_\_\_\_\_.
8. During \_\_\_\_\_ spindle fibers shorten which pulls chromosomes to the poles.
9. After the nucleus divides, \_\_\_\_\_, or division of the cytoplasm, occurs.
10. In plant cells only, a cell \_\_\_\_\_ forms during \_\_\_\_\_.
11. In animal cells only, a cell \_\_\_\_\_ forms during \_\_\_\_\_.
12. \_\_\_\_\_ are attached to chromosomes at the centromere
13. \_\_\_\_\_ - chromatin condenses and becomes visible chromosomes
14. \_\_\_\_\_ - nuclear membrane begins to disappear
15. \_\_\_\_\_ - two daughter cells are formed
16. \_\_\_\_\_ - nuclear membrane begins to form around each set of chromosomes



**D. Meiosis**

Fill in the Blanks Using the Following Words:

gametes, 1, the same, 46, 23, eggs, sperm, homologous, diploid, half, 2, haploid, prophase, zygote, fertilization

1. Meiosis is a type of cell division that makes sex cells or \_\_\_\_\_.
2. The two types of sex cells are \_\_\_\_\_ and \_\_\_\_\_.
3. Mitosis consists of \_\_\_\_\_ division(s), while meiosis consists of \_\_\_\_\_ division(s).
4. Mitosis makes cells with \_\_\_\_\_ number of chromosomes as the parent cell, but meiosis produces cells with \_\_\_\_\_ the number of chromosomes as the parent cell.
5. A human's body cells have \_\_\_\_\_ chromosomes; sex cells or gametes have \_\_\_\_\_.
6. For every chromosome your mother gave you, there is a \_\_\_\_\_ chromosome from your father with information regarding the same trait(s).
7. When a cell has a full complement of homologs from each parent, the cell is said to be \_\_\_\_\_ (2n).
8. Sex cells have only ONE set of chromosomes, they are called \_\_\_\_\_ (1n).
9. When egg and sperm combine during \_\_\_\_\_, the \_\_\_\_\_ that is formed has the normal 2n number of chromosomes.

**E. Mitosis vs. Meiosis**

Complete the chart below by checking off which cell division has which characteristics

Description	Mitosis	Meiosis	Neither
Cell division in body cells			
Cell division in gametes			
Eukaryotic Cells			
Produces haploid cells			
Produces diploid cells			
Produces 2 cells			
Produces 4 cells			
Used by bacteria to divide			

## VI. DNA

### A. DNA & Protein Synthesis – the central dogma (DNA → mRNA → protein)

Fill in the Blanks Using the Following Words:

anticodon, nucleus, attaches, mRNA, unzips, single, protein, ribosome, mRNA, nucleus, tRNA, ribosome, codons, nucleotides, double, S, Cytosine, Thymine, two, one, one, cytoplasm

### B. Structure of DNA and RNA

DNA and RNA are made of \_\_\_\_\_. Each nucleotide consists of three parts:

- 1) 5-carbon sugar (DNA = deoxyribose; RNA = ribose)
- 2) Phosphate (PO<sub>4</sub>)
- 3) Nitrogenous Base (DNA = ATGC, RNA = AUGC)

DNA is \_\_\_\_\_-stranded and in the shape of a double-helix while RNA is \_\_\_\_\_-stranded.

### C. DNA replication

Before a cell enters mitosis, the DNA replicates itself so that each daughter cell receives a copy of the DNA.

This occurs during the \_\_\_\_\_ phase of the cell cycle.

- 1) An enzyme \_\_\_\_\_ the strand by breaking the hydrogen bonds between nitrogenous bases.
- 2) Another enzyme \_\_\_\_\_ free nucleotides to the exposed templates.

Base-pairing rules – Adenine bonds with \_\_\_\_\_ and Guanine with \_\_\_\_\_.

Replication results in \_\_\_\_\_ new molecules of DNA, each made of \_\_\_\_\_ strand of old and \_\_\_\_\_ strand of new DNA.

### D. Protein synthesis – Two major steps

1) **Transcription** – production of \_\_\_\_\_ from the DNA template. Happens in the \_\_\_\_\_ of eukaryotic cells.

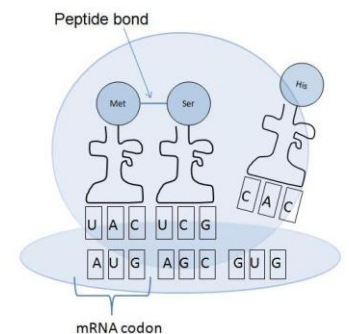
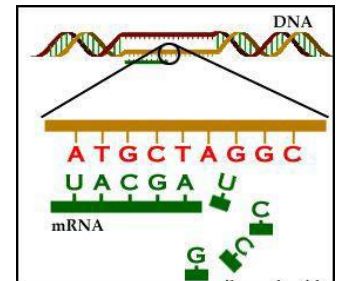
a) An enzyme temporarily unzips a gene to be read. At the same time, it builds a strand of \_\_\_\_\_ that is complementary to the DNA.

b) When RNA polymerase finishes, the mRNA is released and travels to the \_\_\_\_\_. It exits the \_\_\_\_\_.

2) **Translation** – production of a \_\_\_\_\_ from the mRNA template. Happens in the \_\_\_\_\_ and is accomplished by structures called \_\_\_\_\_.

a) Ribosomes read the mRNA in 3-base segments called \_\_\_\_\_. A codon chart can be used to determine which amino acid will be brought to the ribosome when this codon is encountered.

b) A different type of RNA called \_\_\_\_\_ carries individual amino acids to the ribosome. Each tRNA has a 3-base region that is complementary to a codon – this is called an \_\_\_\_\_.



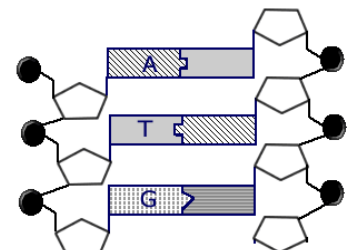
### E. Scientists

\_\_\_\_\_ Hershey & Chase  
\_\_\_\_\_ Franklin  
\_\_\_\_\_ Edwin Chargaff  
\_\_\_\_\_ Watson & Crick

- a. Discovered A-T and G-C base-pairing rules
- b. Built first 3-d model of DNA
- c. Discovered DNA is the genetic material
- d. X-ray photo of DNA which gave clues to DNA's helical structure

### F. Identify the following parts of the DNA molecule

Adenine, Guanine, Thymine, Cytosine, Phosphate, Deoxyribose, Hydrogen Bond



**G. Circle the answer that best completes the sentence.**

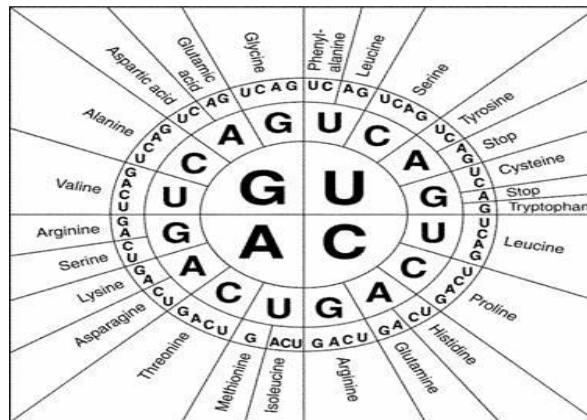
1. Protein Synthesis occurs on structures called ribosomes/nuclei
2. mRNA is made in the nucleus/cytoplasm.
3. DNA Replication occurs in the nucleus/cytoplasm
4. tRNA and Amino Acids are floating around in the nucleus/cytoplasm.
5. DNA is double/single stranded.
6. DNA contains thymine/uracil.
7. RNA contains the sugar deoxyribose/ribose.
8. Transcription produces mRNA/tRNA.
9. Translation produces mRNA/tRNA.
10. Replication produces DNA/RNA.

**H. Complete the following table**

Template DNA	A	T	G	G	T	A	C	C	A
Complement DNA									
mRNA									
tRNA									

**I. Transcription and Translation:**

Use the codon chart below to transcribe and translate the following DNA sequence.



DNA STRAND – TAC GGC CAT TTC GAT TTG AGC ATC

1. mRNA \_\_\_\_\_
2. amino acids: \_\_\_\_\_  
\_\_\_\_\_
3. This protein is made of \_\_\_\_\_ amino acids. (give the number of amino acids)

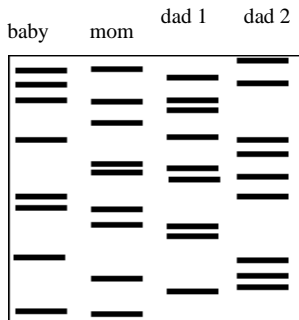
## J. DNA Technology

Fill in the blanks using the following words:

**DNA sequence, genes, fingerprinting, identical, fraternal, collaborative, same**

1. DNA \_\_\_\_\_ is used to identify crime suspects (such as murder and rape).
2. Using electrophoresis, scientists can determine an individual's DNA fingerprint.  
No 2 people have the \_\_\_\_\_ profile, except for \_\_\_\_\_ twins.
3. Human Genome Project was a \_\_\_\_\_ effort because 13 countries worked on it.
4. The objective of the Human Genome Project was to understand \_\_\_\_\_.
5. Scientists wanted to determine the sequence of bases to find the \_\_\_\_\_ responsible for diseases.
6. Look at the electrophoresis sample below. Who is the father of the child? \_\_\_\_\_

## VI. Genetics



## A. Vocabulary Word Bank:

**phenotype, gene, heredity, genetics, genome, recessive, dominant, Gregor Mendel, trait, genotype, alleles, homozygous, heterozygous**

1. \_\_\_\_\_ - two **different** alleles, a hybrid (Tt)
2. \_\_\_\_\_ - is the passing of characteristics from parent to offspring
3. \_\_\_\_\_ - is the **type of genes** or alleles present in an organism's genome
4. \_\_\_\_\_ - form of gene that always shows even in the presence of recessive allele.
5. \_\_\_\_\_ - all of the genes in an organism
6. \_\_\_\_\_ - are different forms of the same gene (ex: tall vs. short)
7. \_\_\_\_\_ - two alleles of the **same** form that make up a genotype, pure breed (TT or tt)
8. \_\_\_\_\_ is the Father of Modern Genetics
9. \_\_\_\_\_ - form of a gene **only** expressed in a homozygous state
10. \_\_\_\_\_ - is an inherited characteristic
11. \_\_\_\_\_ - is an organism's **physical** appearance
12. \_\_\_\_\_ - is the study of heredity
13. \_\_\_\_\_ - is a segment of DNA located on a chromosome

**B. Mendel's Experiments:**

**Independent Assortment, Segregation, Dominance**

Mendel developed three principles based on his mathematical analysis of his experiments with pea plants:

1. The principle of \_\_\_\_\_ states that some alleles are dominant and some are recessive.
2. The principle of \_\_\_\_\_ states that during gamete formation, alleles for a particular trait will separate (or segregate) during meiosis.
3. The principle of \_\_\_\_\_ states that genes for different traits do not influence each other's inheritance.

**C. Punnett Squares** – shows possible outcomes of a mating and predicts what proportion of the offspring will have a given genotype

**\*Monohybrid** crosses – deals with only \_\_\_\_\_ trait at a time.  
(ex: red x white flowers) **Fill in the square to the right.**

**Complete the following Punnett squares.**

1. a. Fill-in the Punnett Square: Tt X TT

- b. How many offspring will be tall? \_\_\_\_\_
- c. What percentage will be short? \_\_\_\_\_



2. A heterozygous brown bear (B) was crossed with a black bear (b).

- a. Fill-in the Punnett Square.
- b. What are the possible genotypes of the offspring?
- c. What are the possible phenotypes of the offspring?



3. A homozygous brown bear is crossed with a homozygous brown bear.

- a. Fill-in the Punnett Square.
- b. What are the possible genotypes of the offspring?
- c. What are the possible phenotypes of the offspring?



**F. Genetic Disorders**

Word Bank:

**21<sup>st</sup>, Down Syndrome, karyotype, trisomy, chromosomal**

1. Only a \_\_\_\_\_ detects a \_\_\_\_\_ mutation caused by nondisjunction.
2. Down Syndrome is \_\_\_\_\_ on the \_\_\_\_\_ chromosome pair.
3. Identify the disorder of the following karyotype: \_\_\_\_\_
4. Identify the gender of the following karyotype: \_\_\_\_\_





**G. Applied Genetics**

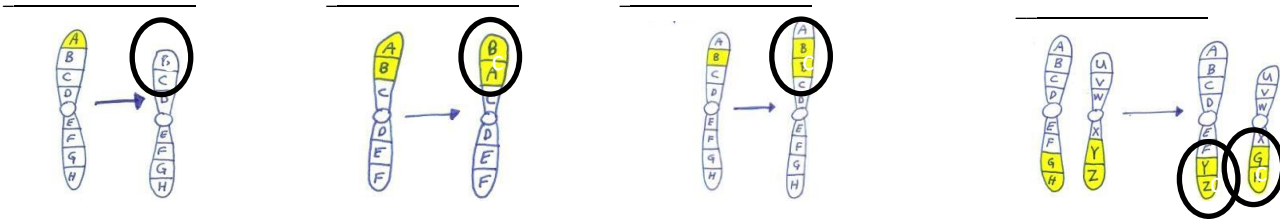
Word Bank:

<b>DNA</b>	<b>Inversion</b>	<b>substitution</b>	<b>helpful</b>	<b>2</b>	<b>Translocation</b>	<b>frameshift</b>
<b>neutral</b>	<b>deletion</b>	<b>harmful</b>	<b>sex cells</b>		<b>Duplication</b>	

Genetic variation – variation is caused by mutations to genes, which are shuffled and recombined during meiosis and fertilization

Mutations – changes to genetic material; must occur in \_\_\_\_\_ to be passed on to offspring - mutations may be \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_ depending on what is changed.

1) Chromosomal mutations – changes to entire chromosomes or pieces of them; Name the 4 types shown below



2) Point (gene) mutations – changes to one or a few nucleotides in a particular gene

- a) \_\_\_\_\_ – one base is changed to another (ex: A instead of a T)
- b) \_\_\_\_\_ - results from an insertion or deletion of one nucleotide; shifts reading frame

Genetic Engineering – the use of special biochemical techniques to manipulate \_\_\_\_\_.

Recombinant DNA – a piece of DNA containing genes from \_\_\_\_\_ organism