

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

B. 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

C. 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

D. 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: _____

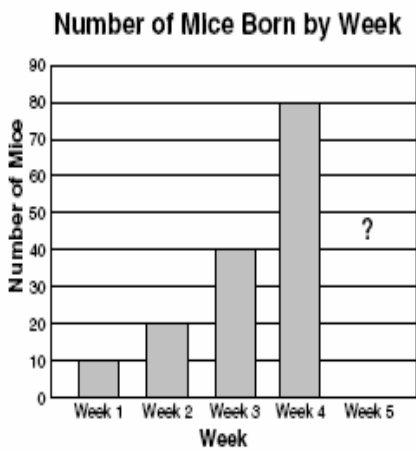
3. A person that takes a vitamin supplement has better memory retention.

Hypothesis: If _____, then _____.

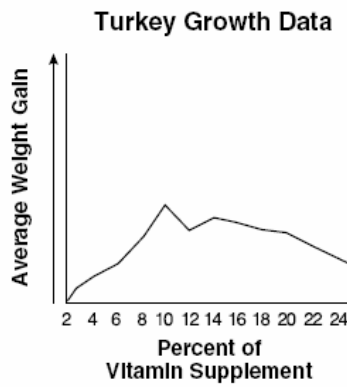
Independent Variable: _____ Dependent Variable: _____

Control Group: _____ Experimental Group: _____

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

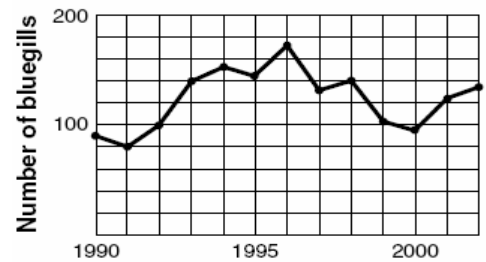


According to the graph, how many mice will be born in week 5 if the trend continues?



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?

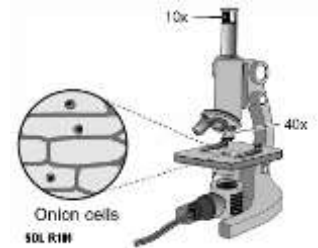
F. Microscopes:

1. _____ 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

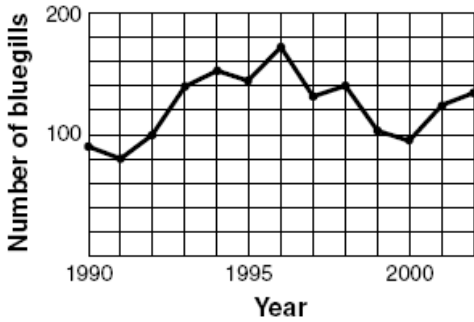
2. _____ - Which 4 of the following are needed to make a wet-mount?

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



G. Interpreting Graphs

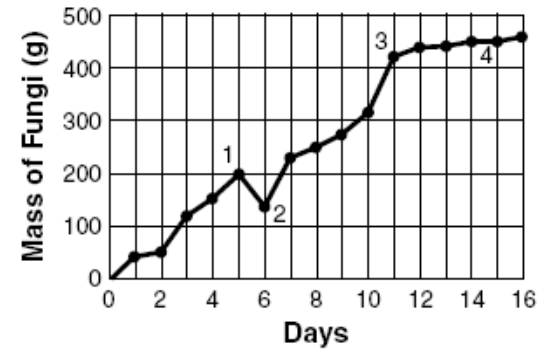
**Bluegill Population in Farm Pond
1990–2002**



- 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**



H. Characteristics of Life

autotroph	cells	DNA	energy	evolution	heterotroph
homeostasis	reproduce	response	stimulus		

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

I. Scientists

- _____ Redi
- _____ Pasteur
- _____ Schleiden
- _____ Schwann
- _____ Virchow
- _____ Hooke
- _____ Leeuwenhoek

- a. all animals made of cells
- b. all plants made of cells
- c. all cells come from pre-existing cells
- d. observed cork; named cells
- e. invented microscope; observed “animalcules”
- f. maggot/meat experiment to disprove spontaneous generation
- g. disproved spontaneous generation once and for all

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 Environment

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

A cell in a hypertonic environment will...

Hypotonic Environment

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

A cell in a hypertonic environment will...

Isotonic Environment

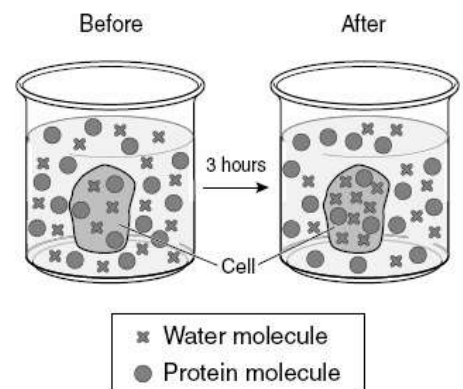
Direction water moves (into cell, out of cell, or both directions equally):

A cell in a hypertonic environment will...

a. In the picture to the right, are the water molecules moving into or out of the cell?

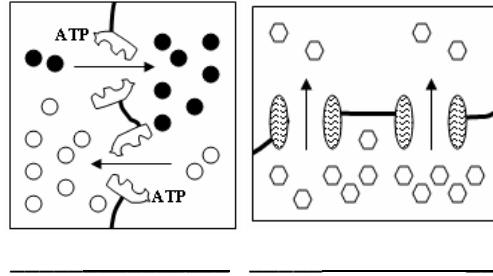
b. What type of environment is the cell in (hypotonic, hypertonic or istic)?

c. What will eventually happen to the cell?



Match the types of transport to the correct picture:

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 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 float acids body temperature capillary action water polar 7 14 0
 adhesion cohesion solvent bases high heat capacity homeostasis surface tension neutral

- 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 cool off when they sweat or stay cool in lakes and ponds.
 - ~ Water resists temperature change so organisms maintain _____ and keep a constant _____.
 - ~ Water can dissolve many substances, so it is called a universal _____.
- d. Because water is a polar molecule, it can dissolve many substances and is sometimes called "The _____".
- e. Cells are mostly made of _____, therefore 65% of your entire body is made of water.
- f. The pH scale ranges from _____ to _____. Substances below 7 are _____. Substances above 7 are _____. Water is _____ because it has a pH of exactly _____.

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.

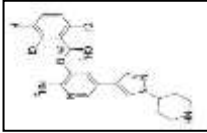
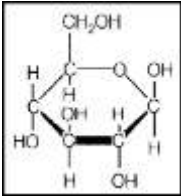
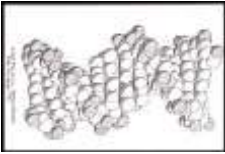
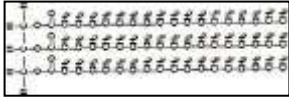
*What is the strongest acid listed in the table?

*What is the pH of the weakest acid listed in the table?

*What is the pH of the strongest base listed in the table?

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.

<p>Monomer: nucleotide Monomer: monosaccharide DNA & RNA Made at the ribosome of the cell Lots are found in muscle cells</p> 	<p>Monomer: fatty acid Glucose, fructose & sucrose Enzymes, hemoglobin, & actin Sugars</p> 	<p>Monomer: amino acid Waxes & phospholipids Found in the nucleus of cells Fats</p>  
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Carbohydrates	Nucleic Acids	Proteins	Lipids

D. Enzymes

Fill in the Blank Using the Following Words:

substrate, active site, speeds up, denature, protein, -ase, catalysts, activation

*Special kind of _____ (macromolecule) that _____ chemical reactions. These molecules are called biological _____.

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

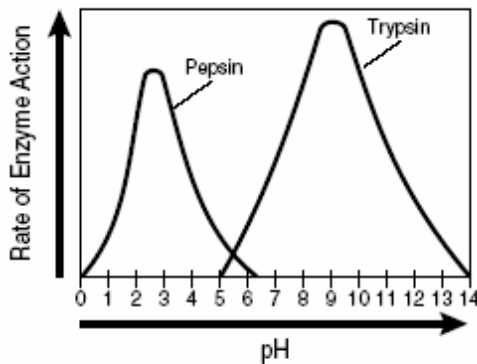
*Enzyme names usually end in _____.

* _____ - 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. This is why reactions speed up.

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

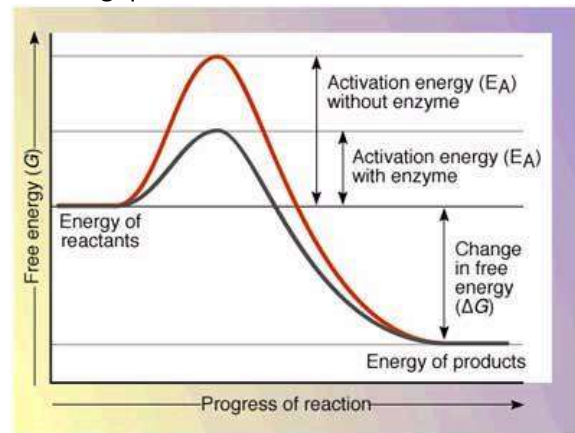


pH vs Rate of Enzyme Action

Which enzyme above works well in acidic conditions?

Which enzyme above works well in basic conditions?

What is optimal pH for pepsin? Trypsin?



Effect of Enzymes on Activation Energy

According to the graph, what happens to the activation energy when an enzyme is added?

According to the graph, what happens to the activation energy when an enzyme is removed?

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? _____

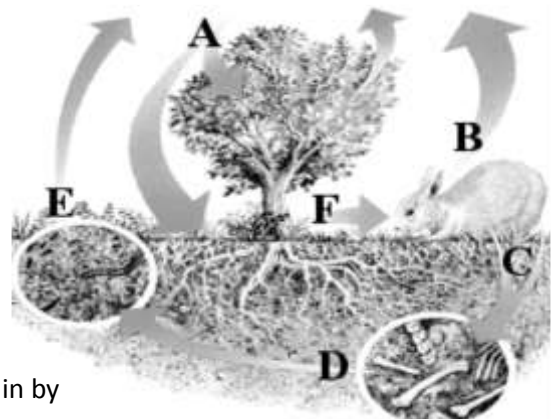
Where in the cell does respiration take place? _____

B. The Carbon Dioxide/Oxygen Cycle

Fill in the Blanks Using the Following words:

heterotrophs, (4) CO₂, (4) O₂, glucose, chloroplasts, mitochondria, photosynthesis, chemical, respiration, autotrophs, solar, (2) light, (2) C₆H₁₂O₆, 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 make _____ & _____.
- 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 CO₂ 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 _____.

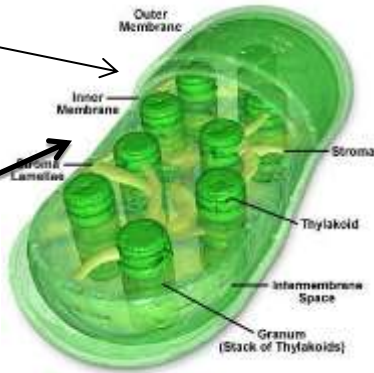
F. _____ does not use _____. It is used by unicellular organisms that need less energy. Two types:

- 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

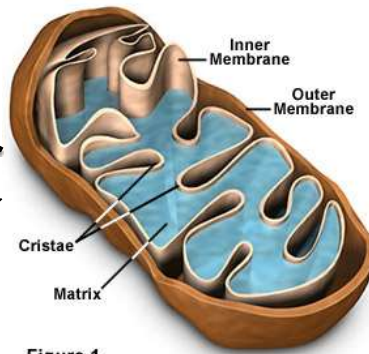


Figure 1

5. _____
(energy made from respiration)

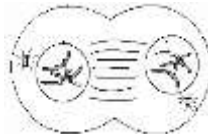
6. _____
(what is this organelle?)

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

A. Cell Cycle

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

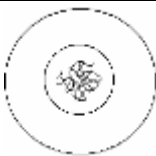
Word Bank: Anaphase, Interphase, Metaphase, Prophase, Telophase



A. _____

B. _____

C. _____



D. _____

E. _____

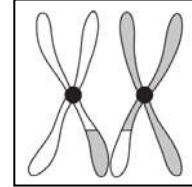
1. What order should the cell cycle phase above be in? _____ → _____ → _____ → _____ → _____

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 (PO₄)
- 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.

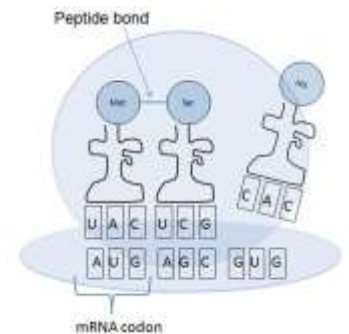
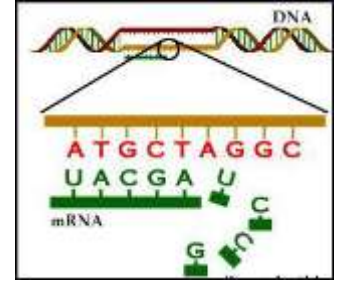
a) An enzyme temporarily unzips a gene to be read. At the same time, it builds a strand of _____ that is complementary to the DNA.

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

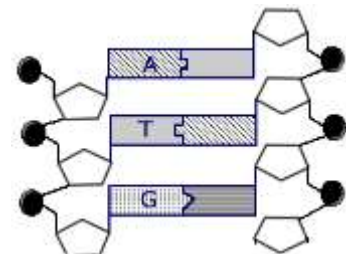
- a. Discovered A-T and G-C base-pairing rules
- b. Built first 3-d model of DNA
- c. Discovered DNA is the genetic material
- d. X-ray photo of DNA which gave clues to DNA's helical structure

F. Identify the following parts of the DNA molecule

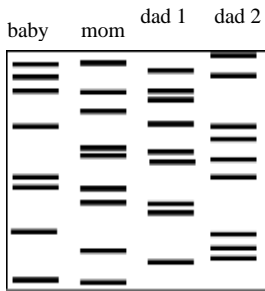
Adenine, Guanine, Thymine, Cytosine, Phosphate, Deoxyribose, Hydrogen Bond

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.



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:

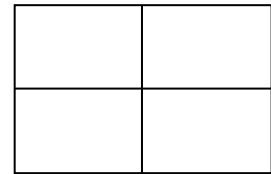
1. The principle of _____ states that some alleles are dominant and some are recessive.
2. The principle of _____ states that during gamete formation, alleles for a particular trait will separate (or segregate) during meiosis.
3. The principle of _____ states that genes for different traits do not influence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

***Mono**hybrid 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?

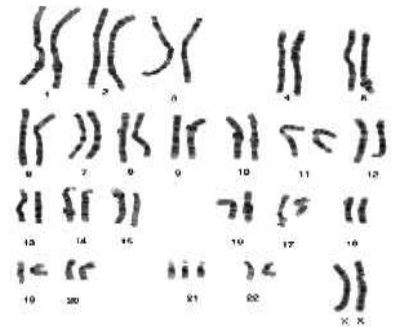


F. Genetic Disorders

Word Bank:

21st, 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: _____



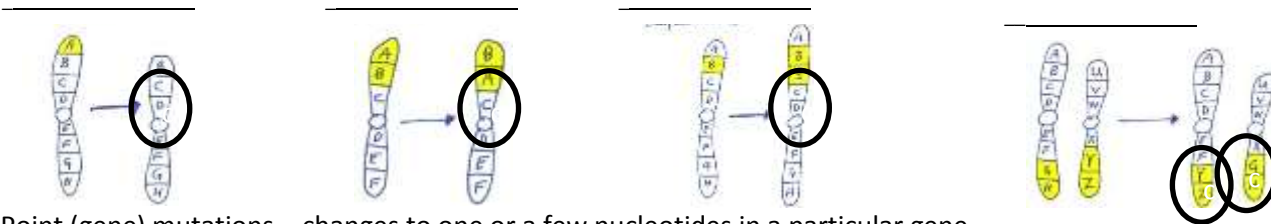
G. Applied Genetics

Word Bank: DNA Inversion substitution helpful 2 Translocation frameshift
neutral deletion harmful sex cells Duplication

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

VIII. Evolution

A. Matching

- _____ A change in genetic material.
 - _____ Accurate fossil age based on amounts of radioactive isotopes like uranium.
 - _____ Formation of a new species by some form of isolation.
 - _____ Species no longer exists on Earth.
 - _____ Evolutionary pattern of stability interrupted by rapid changes.
 - _____ Approximate age of fossil is determined by where it fits in the fossil record.
- A Extinction
B Mutation
C Punctuated equilibrium
D Radioactive dating
E Relative dating
F Speciation

B. Charles Darwin

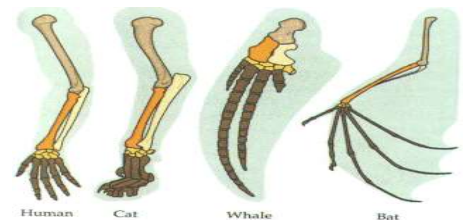
Word Bank:

theory Natural Selection Beagle diversity gradualism Galapagos equilibrium
On the Origin of Species homologous

- British naturalist who sailed on H.M.S. _____ around the world, making many important observations of biological _____.
- Observations of finches, turtles and marine iguanas on the _____ islands were very influential for Darwin.
- Darwin supported _____ - the idea that evolution occurs slowly but steadily over time.
- The opposite idea, proposed by Stephen Jay Gould, hypothesizes that organisms evolve rapidly in bursts, followed by time unchanged (punctuated _____).
- Darwin suggested that random variations take place in living things resulting in some individuals being better able to survive. Those with better traits are more likely to survive until reproduction, during which their beneficial variations are passed on to the next generation. Darwin called this process _____.
- Darwin published his theory in a book called _____.
- Evolution is a _____ because it is supported by a lot of evidence.

Using the diagram to the right, answer the question

- The forelimbs of the organisms are examples of what types of structure?



IX. Classification, Taxonomy & Kingdom

- Hierarchy of classification – created by _____, a Swedish botanist.
- Name the levels in order, from largest (most general) to smallest (most specific):

- Organisms named by *Genus species* (binomial nomenclature). What is the scientific name of a human?

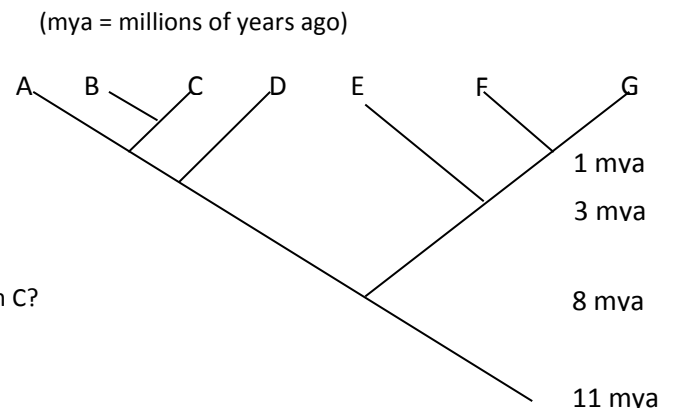
4. Place the following characteristics in the proper Kingdoms. Those that are used more than once have the number of times they will be used in parentheses.

yeast	eukaryotes(4)	prokaryotes	only heterotrophs(2)	moss
mushroom	protozoan	conifer	algae	tree
amphibian	jellyfish	only autotrophs	mold	reptile
chordate	only unicellular	multicellular (3)	multi- & unicellular	fern
flower	bird	fish	mammals	deciduous
decomposer (2)	cellulose	cell walls	insects	E.coli
hetero- & autotroph (2)		gymnosperm	angiosperm	mammal

K. Animalia	K. Plantae	K. Fungi	K. Protista	K. Archaeobacteria & Eubacteria

5. The diagram below is a cladogram which shows evolutionary relationships between organisms.

- Which 2 organisms are the most related?
- How long ago did A & D split?
- Which organism is most related to G?
- Which 2 organisms are the LEAST related?
- Which 2 organisms split ~8 mya?
- Which organisms would be in the same phylum as G?
- If organism B is *Felis domesticus*, what is the most likely genus of organism C?
- Which organism has changed the least in 11 million years?



C. Kingdom Protista (The “everything-else” kingdom)

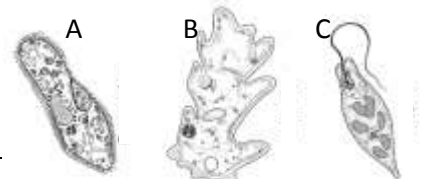
Word Bank: cilia algae flagella pseudopodia protozoa

Classified based on nutrition:

- Plant-like protists – “ _____ ” ; All are mostly autotrophic
- Animal-like protists – “ _____ ” ; All are heterotrophic

How do the following cells move to the right?

A. _____ B. _____ C. _____



D. Kingdom Fungi (Molds, mushrooms, yeast, mildew)

Word Bank: chitin, outside, multicellular, eukaryotic

- Cell type: _____
- # of cells: most _____; yeast is unicellular

3. Cell wall made of: _____
4. Digest food _____ of their bodies (extracellular digestion)

X. Ecology

Ecology - how organisms interact with each other and their environment

Word Bank: Aquatic, Community, Ecosystem, Freshwater, Individual, Marine, Population, Terrestrial

- _____ - one organism
- _____ - a group of one species in one location
- _____ - all the species living together in one location (all biotic factors)
- _____ - all the abiotic and biotic factors interacting in one location

A. Ecosystems – defined by characteristic biotic and abiotic factors

- 1) biotic factors – _____
- 2) abiotic factors – _____
- 3) Niche – _____
- 4) Habitat - _____

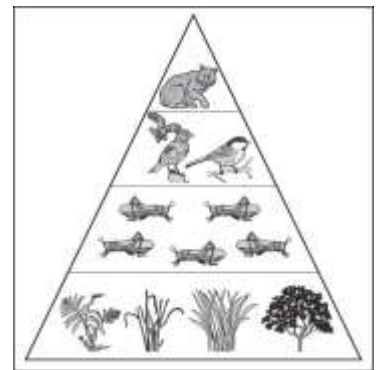
B. Ecosystem dynamics

Word Bank: carnivores, detritivores, growth, herbivores, omnivores, primary consumers, producers, secondary consumers, trophic

_____ levels – feeding levels, often represented as levels on a pyramid

Biomass – total _____ or organic matter at each trophic level

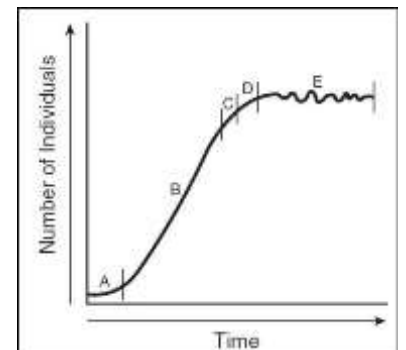
- 1) _____ – autotrophic; highest biomass
- 2) _____ – eat autotrophs; lower biomass
- 3) _____ – eat primary consumers; lower biomass
- _____ - Eat left overs/dead organisms
- _____ - Eat plants
- _____ - Eat animals
- _____ - Eat animals & plants



C. Growth Curve

Word Bank: Carrying capacity, Competition, Density-dependent, Density-independent, Exponential, Initial, Limiting factors

- 1) _____ – factors that limit the size of a population.
- _____ - those factors that limit growth only when a population becomes large (food, water, space)
- _____ - those factors that limit a population no matter how big it is (natural disasters)
- 2) _____ growth – growth rate in each new generation is faster than the previous generation (Letter _____ on the graph)
- 3) _____ – maximum number of organisms that can be supported by environmental resources (Letter _____ on the graph)
- 4) _____ - slow growth that begins a population (Letter _____ on the graph)
- 5) _____ - greatest at or above a population's carrying capacity



D. Symbiotic Relationships

Word Bank: Commensalism, Host, Mutualism, Parasite, Parasitism, Symbiosis

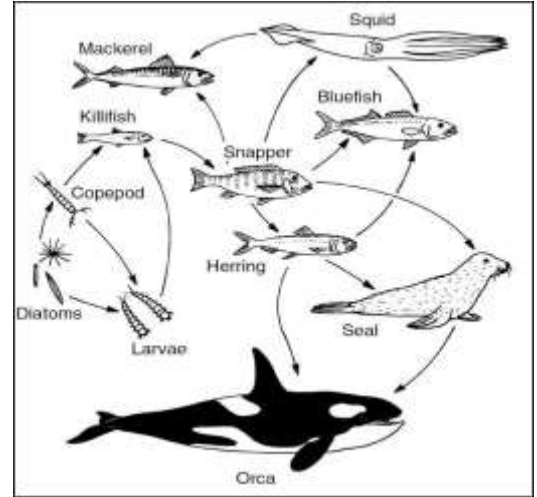
- 1) _____ - very close relationship between two different species;
- a) _____ – _____ benefits while the _____ is harmed. (eg. ticks, fleas, tapeworms)
- b) _____ – both parties benefit (eg. lichens, nitrogen-fixing bacteria in root nodules)
- c) _____ – one benefits, the other is mostly unaffected (eg. orchids, vultures follow hyenas)

E. Food Chains and Webs – graphical displays of energy transfer between and among trophic levels

Food chain – linear (straight line)

Food web – shows all the interconnected food chains in an ecosystem

In chains and webs, **arrows point** in the direction of energy flow (from prey to predator) (producer → herbivore → carnivore)



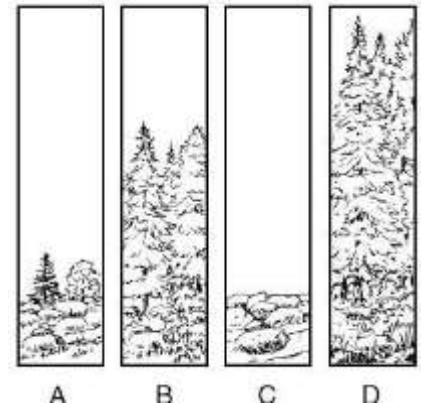
Using the food web at right:

- Where do killifish get their energy? _____
- How many different organisms get energy from snappers? _____
- Do orcas get energy indirectly from diatoms? _____
- Which organism provides nutrients for the largest number of organisms? _____

F. Ecological Succession – community changes in which new populations or organisms gradually replace existing ones

Word Bank: climax, disturbance, pioneer, primary, secondary

- Succession occurs because of natural or human _____
 - _____ - succession that begins from nothing but rock (no soil) (a new island or a receding glacier)
 - _____ - succession that begins with soil and other organic matter (after a fire)
- _____ – species that is first to colonize an area; gradually replaced by members of the climax community
- _____ community – community that has reached relative stability; VA climax community is mostly oak/hickory deciduous forest.
 - Order the steps of succession (A-D) in the diagram at right: _____
 - Order the pictures from least to most diverse: _____
 - Which letter best represents the climax community: _____



G. Nutrient Cycles

Word Bank: bacteria, combustion, condensation, decomposition, DNA, eat, evaporation, nitrogen fixation, photosynthesis, precipitation, protein, respiration, runoff, transpiration

Water cycle (define the terms)

- _____ - Water vapor turns into clouds
- _____ - Water falls from the sky
- _____ – Water leaves the plants
- _____ - Water rises to the sky
- _____ – Water flows down land to rivers and streams

H. Carbon and Oxygen cycles – (Word Bank: burned, H₂O, autotrophs, CO₂, respire, O₂, aerobic, food)

- _____ releases oxygen from and uses up carbon dioxide in plants .
- _____ releases carbon dioxide from food .
- _____ releases carbon dioxide from dead organisms
- _____ releases carbon dioxide by burning wood or fossil fuels.

I. Nitrogen Cycle

- _____ - converting gaseous nitrogen in atmosphere into usable forms.
 - What organisms are the primary fixers of nitrogen? _____
- Animals _____ eat other organisms for nitrogen; nitrogen is used in building _____ and _____

XI. Kingdom Plantae

Plants!

cell type: _____ # of cells: _____

nutrition: _____ cell walls contain: _____

Plant Kingdom Word Bank: Angiosperms, Ferns, Gymnosperms, Mosses

Plant Type	Vascular Tissue?	Seeds?	Reproduction?	Examples
	No	None	Spores	n/a
	Yes	None	Spores	n/a
	Yes	Naked	Cones, pollen	Conifers (Pine)
	Yes	Covered (Fruit)	Flowers, pollen	Flowers, Deciduous trees

XII. Kingdom Animalia

Animals!

Cell type: _____ # of cells: _____

Nutrition: _____

5. Most have tissues and body symmetry

- _____ symmetry – **any** number of imaginary planes passing through the center of the organism from top to bottom will divide it into equal halves (ex: corals and jellyfish)

- _____ symmetry – only one imaginary plane divides the organism into equal halves (ex: humans and insects)

7. Most animal species are _____, meaning they have no backbone.

Major Animal Phyla – (Word Bank: cartilage, chordata, bilateral, spiny, mammary, scaly, feathers, radial, soft, bone, oxygen, sponges, segmented, jointed, moist, exoskeleton, wings)

1) Porifera – simplest, no tissues/organs, filter-feeders (ex: _____)

2) Cnidaria – _____ symmetry, stinging cells, polyp & medusa form (ex: corals, jellyfish, sea anemones)

3) Platyhelminthes – simple tissues, organ systems, _____ symmetry, free-living and parasitic (ex: flatworms)

4) Annelida – _____ bodies, complex organ systems (ex: roundworms, leeches)

5) Mollusca – _____-bodied; some make shells; have muscular “foot”; internal organs (ex: snails, slugs, clams, squid, octopus)

6) Arthropoda – segmented body; tough _____; _____ appendages; complex organ systems (ex: insects, spiders, crabs, lobsters, scorpions, crustaceans)

7) Echinodermata – _____ skin; internal skeleton; suction-cuplike tube feet (ex: starfish, sea urchins, sand dollars)

8) _____ – notochord; backbone in most (exception: tunicates and lancelets)

Major Chordate Classes

a) Chondrichthyes – skeletons made of _____ (ex: sharks, rays, skates)

b) Osteichthyes – skeletons made of _____ (ex: bony fishes such as goldfish, tuna, trout)

c) Amphibia – water & land life stages; breath w/lungs as adult; _____ skin; (ex: frog)

d) Reptilia – dry, _____ skin; lungs; terrestrial egg-layers (ex: lizards, snakes, turtles)

e) Aves – _____ for flight; front limbs modified into _____ (ex: all birds)

f) Mammalia – hair; _____ glands; most _____ (ex: dolphins, cow, humans)