Biology
End of Course Test (EOCT)
Study Guide

What are the **properties of life**?

- Made of one or more cells
- Displays organization
- Grows and develops
- Reproduces
- Responds to stimuli
- Requires energy
- Maintains homeostasis
- Adaptations evolve over time

Compare and contrast **independent** and **dependent variables**.

- Independent variable—one factor should only be tested at one time in an experiment (the one that "I" change)

- Dependent variable—the results from the independent variable. The outcome of the experiment.

What are the **levels of organization** in ecology?

- Atom—molecule—organelles—cell (smallest unit of life!)—tissue—organ—organ system—organism—population—community—ecosystem—biome—biosphere

Describe the 3 types of living relationships (**symbiosis**) and give examples.

- Commensalism—when one organism benefits from a relationship, and the other is not helped or harmed. Example—bird living in a tree,
- Mutualism—both organisms benefit from a relationship. Example—bird living on top of a rhino. The bird eats the insects off of the rhino and the rhino protects the bird.
- Parasitism—one organism is helped and the other is harmed. Example—a tapeworm takes all of the host's food.

Distinguish between a **food web** and a **food chain**. Describe the different **trophic levels** used in each

- A food web is a complex series of food chains.
- The bottom of the energy pyramid is the plants/producers which are autotrophs. As you move up the food chain, you have consumers (primary eats the plants and are herbivores, secondary eats plants and animals and are omnivores, and the tertiary consumers are usually carnivores and are known as top predators.)

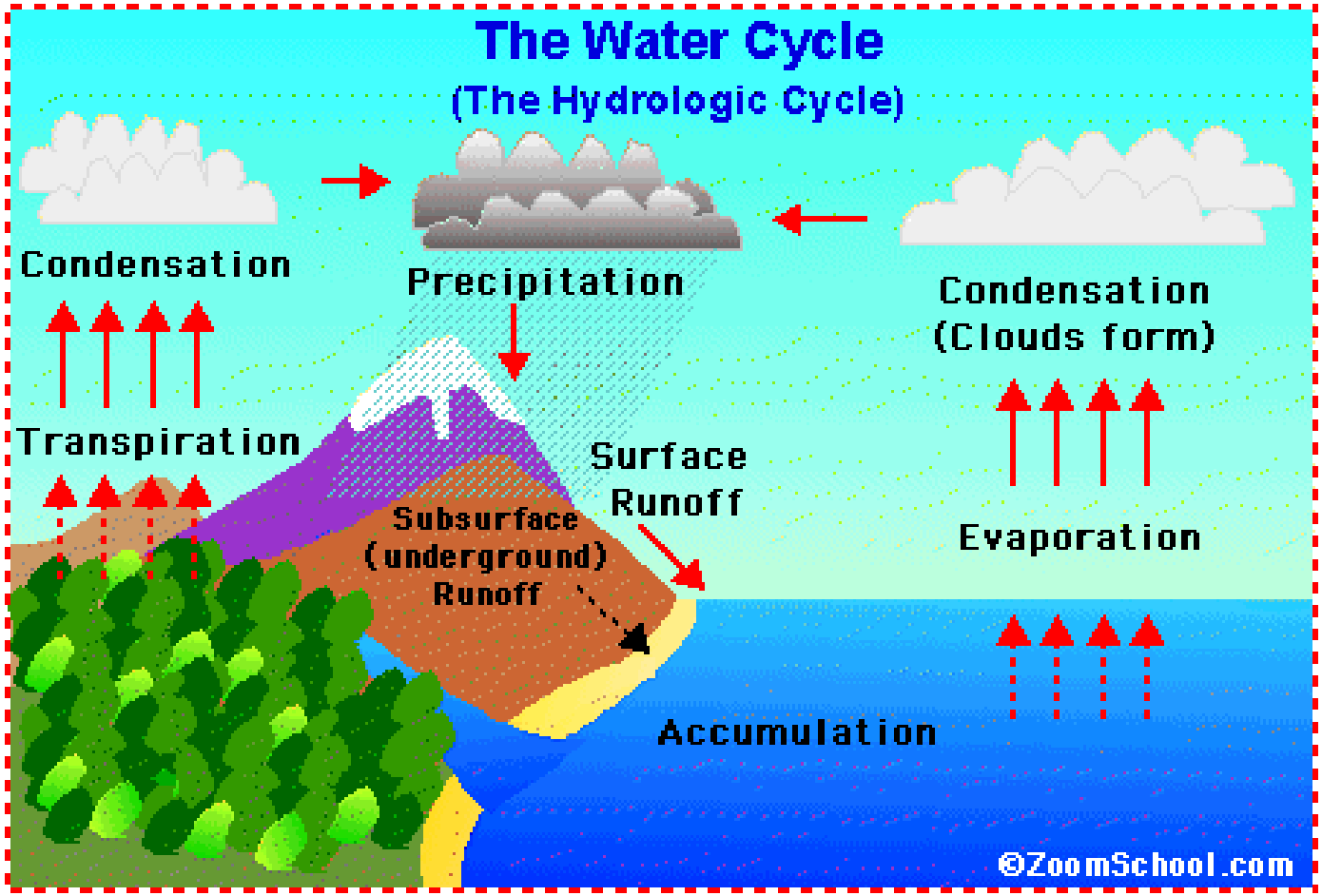
What happens to the energy as you move up the steps of an **energy pyramid**? Explain

- 90% of energy is lost to heat and only 10% of the energy moves up the pyramid. That means that the top predator gets very little energy, but primary consumers that eat the plants get a lot more energy.

Describe the **water**, **carbon**, and **nitrogen cycles**.

- All matter in the universe is neither destroyed nor created. Nutrients on earth are recycled as well.

Water Cycle


The Water Cycle
(The Hydrologic Cycle)
Condensation
Precipitation
Condensation
(Clouds form)
Transpiration
Surface
Runoff
Subsurface
(underground)
Runoff
Evaporation
Accumulation
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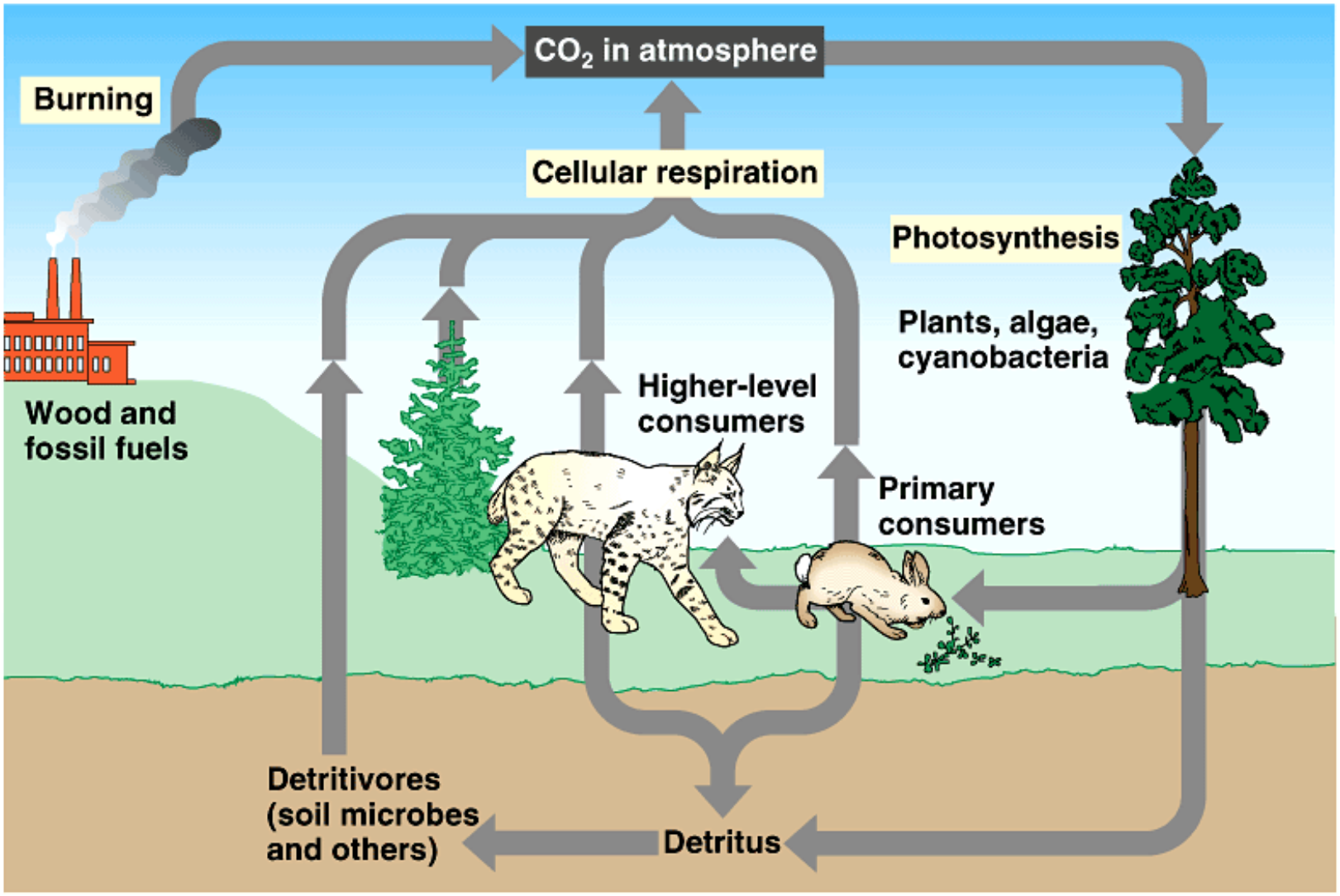
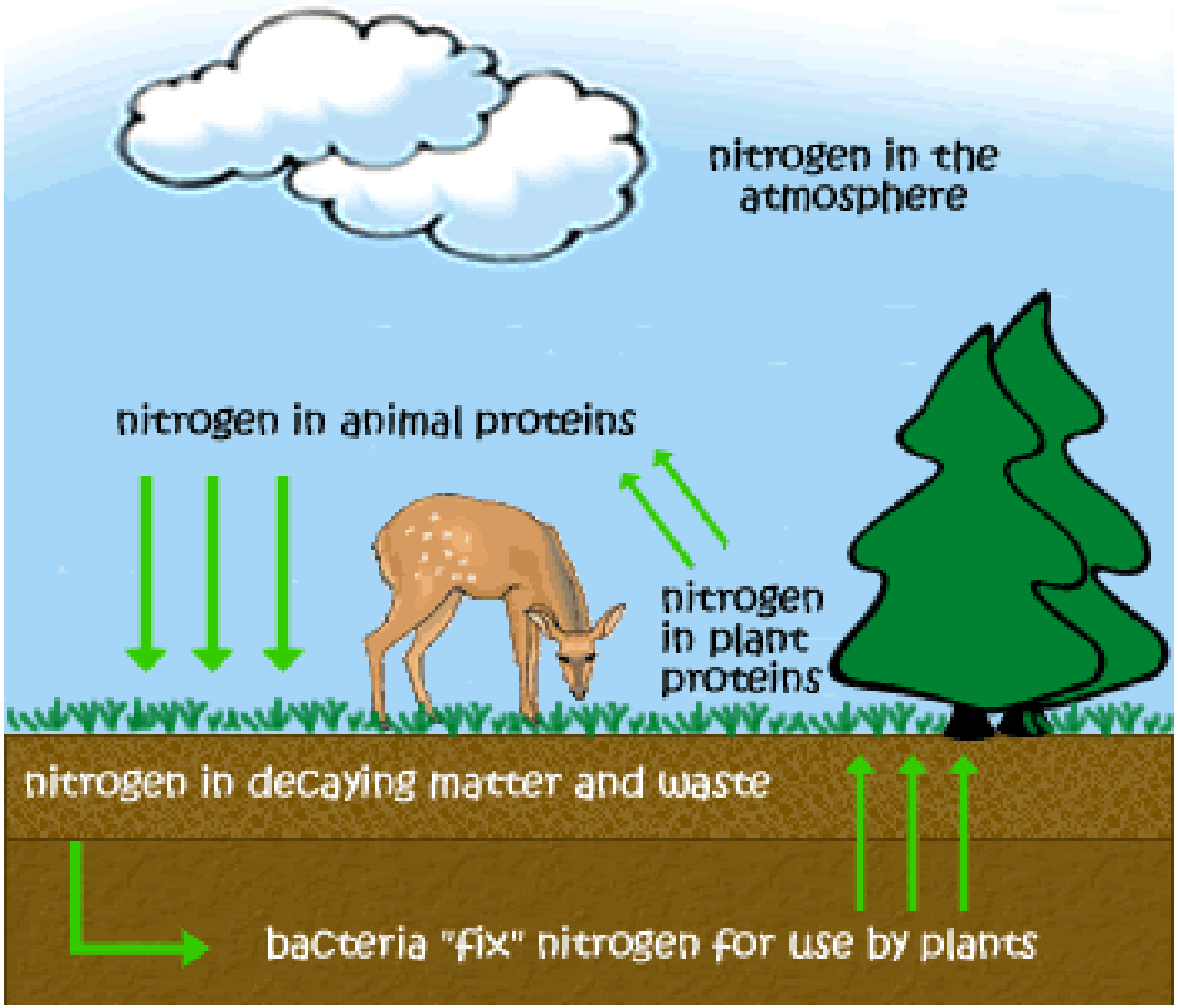
Carbon Cycle



Nitrogen Cycle



Distinguish between **primary** and **secondary succession**.

- Primary succession is when there is just rock, and no soil for the plants to grow on. It is a very slow process. Lichens are an example of one of the first organisms to grow.
- Secondary succession is when there is soil left by a natural disaster. For instance, a tornado or flood does not wash away all soil, giving succession a base for growing plants.

Describe the major characteristics (including locations) of these biomes:

- Marine—salt water biome that covers most of the earth.
- Freshwater—lakes, rivers, and streams
- Tundra—cold, no trees, has a layer of permafrost. Canada, Alaska, Northern Russia
- Taiga—cold, northern forest that has conifers. Also called boreal forest. Canada, Alaska, etc. Animals include reindeer, moose, etc.
- Desert—hot during the day, and cold at night. Very little to no rain. Northern Africa, South Western United States
- Grassland—Midwest United States. Good for farming, very little trees, herbivore and grazing animals are abundant. Moderate rainfall and moderate to cold temperatures.
- Temperate forest—Georgia is an example of temperate forest in the North Georgia Mountains. Deer, fox, raccoons, bobcats. Moderate to cold temperatures and moderate rainfall.
- Tropical rain forest—very rainy. Biomass is in the trees. Poor soil. Abundance of animals and the most diverse species. South America is an example.

How does **carrying capacity** affect the growth of a population?

- The carrying capacity is the maximum number of organism that an environment's resources can sustain. If the population exceeds the carrying capacity, then individuals will die because of lack of resources.

Compare and contrast **density independent** and **density dependent** factors. How does **competition** effect a population?

- Density independent factors are abiotic factors that occur no matter the size of the population. Examples are hurricanes, floods, and other weather factors.

- Density dependent factors are biotic factors that depends on the size of the population. Competition, disease, and predation are examples of these factors.

- Competition can affect population size. The larger the population, the greater the competition will occur. Organisms will compete for space, food, and mates.

What is **demography**? How does birth rate, death rate, immigration, and emigration effect demography?

- Demography is the study of the human population and the above categories.
- Birth rate—increases population
- Death rate—decreases population
- Immigration—organisms coming INTO a population will increase the population size
- Emigration—organisms EXITING a population will decrease the population size

Describe the **structure of an atom**.

- Protons (positive charge) and neutrons (no charge) make up the dense nucleus of the atom. Neutrons and protons have an atomic size of 1. Electrons (negative charge) orbit in the shells around the nucleus. Electrons are very small in comparison to protons and neutrons and have a mass of 0.

List the characteristics and functions of the 4 classes of **macromolecules** and where they're found in the body.

Name	Subunit	Function	Examples
Lipids	Triglycerides	Long term storage of energy Make up membranes	Fats, waxes, oils
Carbohydrates	Monosaccharide	Short term energy	Glucose, sucrose
Proteins	Amino Acids	Muscle building Hormones, enzymes	
Nucleic Acids	Nucleotides	Stores genetic information	DNA, RNA

What are **enzymes**? How do they work? What type of organic macromolecule are they?

- Enzymes are proteins. They are biological catalysts. An enzyme will bind to a substrate to speed up reactions. The enzymes will not be used up in the reaction. It just lowers the activation energy needed to start a reaction.

- HINT! Remember: reactants → products

Compare and contrast **Prokaryotes** and **Eukaryotes**. What types of organisms are typical to each?

- **Prokaryotes** are simple cells with no nucleus. An example would be bacteria.

- **Eukaryotes** have a nucleus and membrane-bound organelles. An example would be plant and animal cells.

What are the functions of the following organelles:

- **Nucleus**—the center of the cell that controls all activities. "The Brain"
- **Ribosome**—site of protein synthesis. On the Rough ER
- **Mitochondria**—converts sugar into ATP for use in the cell. "Powerhouse" of the cell
- **Chloroplast**—converts sunlight into glucose (sugar) for energy "Chlorophyll FILLS the chloroplast" Only in plant cells. Where photosynthesis takes place in the leaves.
- **Cell (Plasma) Membrane**—a semi-permeable structure that regulates what comes in and out of the cell, "Gatekeeper of the Cell"
- **Cell Wall**—Only in plant cells. This is a rigid structure that is outside the cell membrane. It provides structure/shape and protection.
- **Lysosome**—Uses enzymes to clean the cell of worn out parts or waste. "Cleans like Lysol!"
- **Vacuole**—Mainly in plant cells. Stores water, minerals, and food. Usually the largest structure in the plant cell. If the vacuole is filled, then the plant appears normal. If the vacuole is empty, the plant leave appear to be wilted.
- **Cilia**—hairlike structures on the outside of the cell that help the cell move and capture food
- **Flagella**—one long hairlike structure that helps the cell move. Example is sperm cells.
- **Cytoplasm**—a jelly like substance within a cell that fills the space. All reactions in the cell occur here.

Explain the difference between **hypotonic, hypertonic**, and **isotonic** solutions and how this effects movement across cell membranes.

- **Hypotonic solutions**—There is more water (solvent) on the outside of the cell then on the inside. The result is water rushes into the cell making it swell and possibly burst. "You swell up like a hippo in a hypotonic solution.
- **Hypertonic solutions**—There is more water on the inside of the cell than on the outside. The result is that all of the water rushes out making the cell shrink.
- **Isotonic solution**—concentrations in the cell and outside the cell are equally. There is no NET movement of concentration.

Compare and contrast **passive** and **active transport**.

- **Passive transport**—transport across a cell membrane that requires no energy. The molecules move down its concentration gradient from high to low! (like rolling down a hill!)

  Examples of passive transport—

  Osmosis—passive transport of WATER

  Diffusion—passive transport mainly of gases

- **Active transport**—transport across a cell membrane AGAINST a substances concentration gradient. (like pushing a boulder uphill!!)

  Examples of active transport—

  Endocytosis—bringing a substance INTO a cell ENTERING=ENDO"

  Exocytosis—bringing a substance OUT of a cell "EXITING=EXO"

  Phagocytosis—cell eating

  Pinocytosis—cell drinking

List the phases of **mitosis** and describe the processes of each. Drawings might be useful.

- **Prophase**—nucleus breaks down and chromosome appear
- **Metaphase**—chromosomes line up in the center of the cell
- **Anaphase**—sister chromosomes are pulled apart by spindle fibers
- **Telophase/Cytokinesis**—two INDENTICAL daughter cells are made

Compare and contrast **photosynthesis** and **cellular respiration**. What are the chemical equations for each?

- **Photosynthesis** occurs in plant leaves in the chloroplasts. It is a process in which sunlight is converted to sugar

  $CO_2 + H_2O + \text{sunlight} \rightarrow C_6H_{12}O_6\ (\text{sugar}) + O_2$

- **Cellular Respiration** occurs in the mitochondria of a cell. It converts glucose to make ATP

  $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O + 36\ ATP$

List the phases of **meiosis** and describe the processes of each. Drawing might be useful. Describe the differences among chromatin, chromatids, sister chromatids, homologous chromosomes and tetrads and when/where they're used in meiosis.

- Meiosis goes through two phases of PMAT to produce FOUR GENETICALLY DIFFERENT CELLS. The purpose of meiosis is to produce sex cells, or gametes—sperm and eggs.

- Female gametes, or **_OVUM___**, fuse with male gametes, or **_SPERM__,** to create a **_ZYGOTE__**.

Who was **Gregor Mendel**? What were his three **laws of heredity**?

- **Gregor Mendel** was the "father of genetics". He studied pea plants to formulate his laws of heredity.
- **The law of dominance**—the dominant trait will always show up in offspring
- **The law of segregation**—there are two alleles for each trait, but they will separate individually into the offspring.
- **The law of independent assortment**—traits are expressed separately (example—just because of you have brown hair does not mean you have brown eyes!)

Distinguish between **dominant** and **recessive**; **heterozygous** and **homozygous**; **genotype** and **phenotype**.

- **Dominant** traits are usually expressed and cover up the recessive allele.
- **Recessive** traits are usually not expressed and can be covered up by the dominant trait. Only two recessive alleles will show up.
- **Heterozygous** alleles consist of two different alleles (one dominant and one recessive Rr)
- **Homozygous** alleles are two same alleles (rr or RR)
- **Genotype** is the actually gene code (GG, Gg, gg)
- **Phenotype** is the physical expression of the trait (brown hair, long necks, etc)

Compare the advantages of sexual reproduction and asexual reproduction in different situation.

- Asexual reproduction produces the same organism. Sexual reproduction gives a combination of two different genes, with each parent donating half their chromosomes to its offspring. This gives the offspring an advantage of not having disorders and other genetic abnormalities. They have the possibility of getting the strongest traits from both parents.

Describe the structure of a **DNA molecule**. What are the nitrogenous bases for DNA?

- It is a double helix structure made up a sugar, a phosphate and nitrogen bases. The bases are ATGC. Adenine, Guanine, Cytosine, and Thymine. A pairs with T, C pairs with G

Describe the structure of an **RNA molecule**. What are the nitrogenous bases for RNA?

- A single stranded molecule that carrying genetic information. It codes for proteins. The bases are AUGC. Adenine, Guanine, Cytosine and Uracil. A pairs with U and C pairs with G

Describe the process of **DNA replication**. Why is DNA replication necessary? When does it occur?

- DNA replication occurs in the S phase of interphase. It is a semi-conservative process in which dna unwinds. One strand of DNA is saved and one strand of DNA is used to make a copy.

How does DNA code for a protein?

- DNA copies itself. mRNA reads the copied DNA by transcription. tRNA codes this piece of genetic material by translation. This final code is read to make an amino acid.

What are the major types of **mutations**?
How do mutations affect protein synthesis?
List some common **mutagens**.

- **Deletion** where a base is left out.
- **Insertion** in which a base is put into the code.
- **Substitution** in which two bases are swapped.
- In all of this, the bases will be read in a different order and a mutation will occur. A mutation is a permanent change in DNA.
- Common mutagens can be UV light, pollutants, chemicals (drugs, alcohol, etc.)

Distinguish between **incomplete dominance** and **codominance**. Describe **sex-linked inheritance.**

- **Incomplete dominance**—where two traits blend to form an "in-between" trait. Example: a red flower and a white flower could blend to form a pink flower.
- **Codominance**—where two alleles are equally dominant. Therefore the result is both alleles showing up. Example: a black cat and a white cat have black and white striped kittens. Spots or stripes!
- **Sex-Linked Traits**—a trait (usually disorder) that only occurs on the X chromosome. Therefore a female can be a carrier (X^hX) because the second allele will mask the trait. A male cannot be a carrier and will always show the trait X^hY. The Y does not cover it up.

Name and describe the 6 different types of **fossils**?

- **Casts**—external view
- **Mold**—external view
- **Trace fossils**—footprints or other animal tracks that animals leave behind
- **Imprints**—an outline of an organism (usually a plant) that is left in the sediment and hardened
- **Petrified fossils**—best known, like dinosaur bone deposits. The bones are replaced by minerals and are hardened, but leaving scientists a great view of the bone structure.
- **Amber preserved and frozen fossils**—whole specimens and soft tissue is preserved.

How was **spontaneous generation** disproven twice?

- Spontaneous generation is the idea that living things came from nonliving things. Francisco Redi put rotting meat into a closed flask and maggots did not appear. Louis Pasteur created a similar experiment that show that no living organisms would grow in a closed environment.

Describe Darwin's theory of **natural selection** and **survival of the fittest**. How did it differ from Lamarck?

- Lamarck believed in "use and disuse". He believed that if you didn't use a feature, that your offspring would lose it. Darwin created his theories of natural selection. This stated that the best trait or adaptation would be passed to offspring. Survival of the fittest stated that only the healthiest, best adapted organisms would survive and reproduce.

What are the **three types of natural selection** and how do they affect populations over time?

- **Stabilizing Selection**-- The extremes are selected against.

  Example: height; mostly beings tend to the average height- not too many really short ones or really tall ones.
- **Directional selection**-- One extreme value is selected for.

  Example: speed; faster is always better so a population will tend to get faster over time.
- **Disruptive selection**-- The extremes are both selected for.

  This type of selection is not as common as the first two. Example: Prey-type animal with distinctive markings which the predators know will over time move away from the norm in both directions.

What are the different **patterns of evolution** and how do they affect populations over time?

- **Natural selection** says that the best traits or adaptations are going to be passed down to their offspring.

- **Convergent evolution** means unrelated species become more and more similar in appearance as they adapt to the same kind of environment. For example: The two unrelated types of plants in the picture above have adapted to desert environments.

- **Divergent evolution** is the process of two or more related species becoming more and more dissimilar. The red fox and the kit fox provide and example of two species that have undergone divergent evolution. The red fox lives in mixed farmlands and forests, where its red color helps it blend in with surrounding trees. The kit fox lives on the plains and in the deserts, where its sandy color helps conceal it from prey and predators

Is a **virus** living? Why or why not?

- A virus is not living because it cannot survive independent of a host organism. It must use the host organism for reproduction.