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Keystone Exam Review Sheet Biology
Module 1 – Cells and Cell Processes

Unit 1a: Introduction to Life BIO.A.1

Biology is the study of living things, of life. Any living thing is known as an **organism**.

Two MAIN themes in biology:

A. **MAIN IDEA** (theme): Every structure on or in an organism has a function. (or had a function at one time)
Function (what does it do) = Structure (why it is shaped/built the way it is)

B. **MAIN IDEA** (theme): All organisms share the same basic characteristics of life. The number of characteristics may vary from scientist to scientist, sometimes the characteristics are grouped together, at times they stand alone, but those discussed in the year of your biology class were:

1. **Cellular Organization** - All organisms are made up of one or more cells AND those cells are organized in order to perform the necessary functions of life.
2. **Metabolism** – all organisms use energy to carry on life processes.
3. **Responsiveness** – all organisms respond to their environment.
4. **Homeostasis** – all organisms must maintain balance between their internal conditions and the conditions outside in their environment.
5. **Reproduction** – all organism must reproduce to survive as a species.
6. **Heredity** – during reproduction, organisms pass on their traits to their offspring. The change over time of these traits in response to their environment is called *evolution*.
7. **Growth** – all organisms grow, in volume or number of cells, from the time of their birth. Change in an organism during growth is known as *development*.

Every topic covered in biology class is related to one of the characteristics of life (listed above)

BIO.A.1 Basic biological principles BIO.A.1.1.1 & BIO.A.1.2.2

1. Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.
2. Compare cellular structures and their functions in prokaryotic and eukaryotic cells.

Prokaryotes	shared by both	Eukaryotes
older cells	cytoplasm	younger cells
less complex	DNA	more complex
unicellular only	ribosomes	multicellular or unicellular
no nucleus	cell membrane	nucleus to protect DNA
no organelles		membrane bound organelles
DNA in simple loop		DNA in chromosomes
smaller cell – less inside		larger cell – has organelles

3. Describe and interpret relationships between structures and functions at various levels of biological organization. There are 5 levels of organization.
   - ***Cells* that do the same job form tissues, several *tissues* doing a similar job form an organ, several *organs* working together form an *organ system*, several organ systems form an *organism*.**

Cells → Tissues → Organs → Organ Systems → Organism

   - Smaller structures have more surface area to volume ratio needed for increased nutrient & gas exchange
   - The size and shape of a structure is related to its function.

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Module 1 (continued) – Cells and Cell Processes

Unit 1b: The Chemistry of Life - (Characteristic of Life = #1 Cellular Organization – molecular level) Everything (living and non-living) is made up of *matter*. Matter is made up of *atoms*. Atoms have three main parts: *protons*, *neutrons*, *electrons*. The number of protons (positive charges) in the nucleus will determine the type of atom. Neutrons are located in the nucleus of an atom but have no charge (+ or -). Electrons (negative charge) move around the nucleus of the atom and can be lost or gained to form bonds.

Element = a substance made up of all the same type of atoms.
Compound = a molecule of two or more *different* atoms held together by a bond.
Molecule = the smallest bit of a compound.

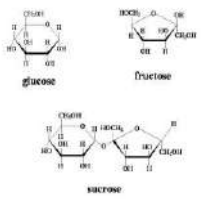
Three types of bonds were discussed:

1. **Covalent bond** = strongest of the bonds, occurs when electrons are shared between atoms.
2. **Ionic bond** = the force of attraction when atoms lose electrons (become a positively charged ion) or gain electrons (become a negatively charged ion).
3. **Hydrogen bonds** = weakest of the bonds, occurs when a positive portion of a polar compound is attracted to a negative potion of a polar compound.

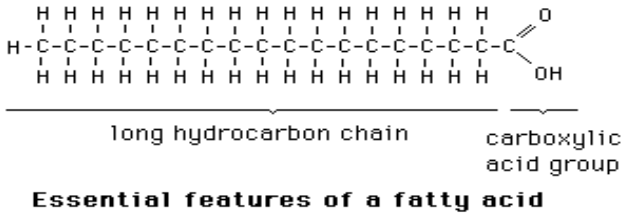
LIVING things are made up of four basic compounds: Carbohydrates, Lipids, Proteins, Nucleic Acids These four types of compounds are known as biological macromolecules and are made up of repeating units. Molecules made up of repeating units are known as Polymers, each individual unit is called a monomer.

The Chemical Basis for Life BIO.A.2.2.1

1. Organic compounds (made with carbon from living things) and inorganic compounds (no carbon, not living)
2. **Organic compounds** – MACROMOLECULES – polymers made up of monomers
   A. **Carbohydrates**- elements carbon, hydrogen and oxygen. Hydrogen to oxygen ratio of 2:1. Function = main source of energy in the body. Monosaccharides (glucose, fructose or galactose) are the monomers of carbohydrate polymer. Chemical structure is a carbon ring: many rings make a polysaccharide.



   B. **Lipids** – elements of Carbon, hydrogen and oxygen.
   Lots of Carbon and hydrogen atoms, very little oxygen atoms. Hydrocarbon tail and carboxyl head. The fatty acid is the monomer of a lipid polymer. Function = control the movement of water and nutrients in the cells. They do not dissolve in water. Main structural unit in cell membranes. Triglycerides – large molecules of lipids
   Oils – triglycerides that are liquids atroom temperature. Found in plants
   Fats – triglycerides that are solid at room temperature. Found in animals
   Wax – waterproof, found in plants and animals
   Steroid – made up of 4 carbon rings. Found in hormones, venoms, and plant poisons

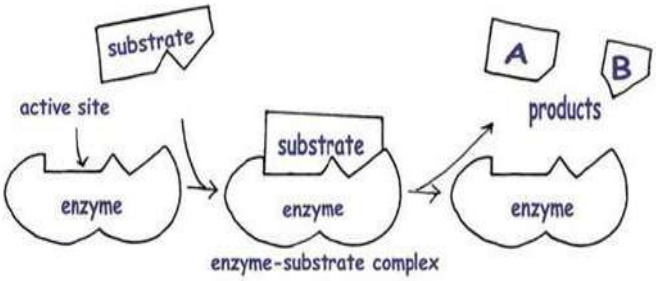


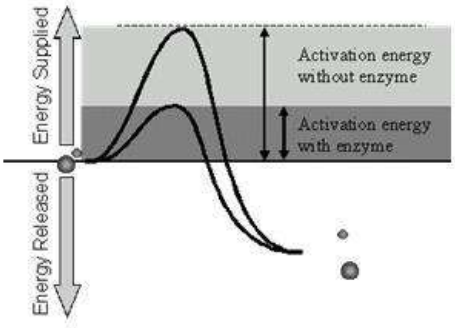
Essential features of a fatty acid

C. **Proteins** – elements of Carbon, hydrogen, oxygen, nitrogen (sometimes sulfur) these elements form amino acids, the monomers of a protein polymer. Amino acids bond with peptide bonds and form sheets that fold over to make specific shapes.

One Function = structural units that make up cells.

Two Function = enzymes that control chemical reactions. Enzymes have a specific shape that "fits" on a substrate at an active site. An enzyme acts as a *catalyst* speeding up a reaction by lowering activation energy needed to run that reaction. Enzymes lose shape in high temperature and will stop working.





1. Enzymes are not destroyed in chemical reactions
2. Enzymes lower activation energy

D. **Nucleic acids** (DNA and RNA) – made up of Carbon, hydrogen, oxygen, nitrogen. These elements form nucleotides, the monomers of the polymer DNA or RNA. Function = DNA stores large amounts of hereditary information in the form of genes. RNA aids in the building of proteins. (see module #2 for more extensive information)

General Similarities

All Organic Molecules (Carbohydrates, Lipids, Proteins, Nucleic Acids) are alike in so far as they ALL contain Carbon atoms. All of these organic compounds contain oxygen and hydrogen molecules (in different amounts) The carbon atoms provide a basic structural backbone for each organic molecule.

Carbohydrates = carbon rings Lipids = long straight chains of carbon atoms

Proteins = branched carbon chains

ONE **inorganic** molecule necessary for Life is: BIO.A.2.1

Water – an inorganic molecule necessary for life. H_2O is the chemical formula. It is polar (unevenly charged) with a positive on the hydrogen end and a negative charge on the oxygen end. Polarity gives it the unique qualities necessary for life. It acts as a universal solvent (dissolves many chemicals)

1. It has the properties of **cohesion** (sticks to itself), **adhesion** (sticks to other things), and **capillarity** (ability to move upward in a small tube). It turns into a solid (freezes) at zero degrees Celsius and boils at 100 degrees Celsius.
2. Ice floats (lakes, rivers and streams freeze from the top down)

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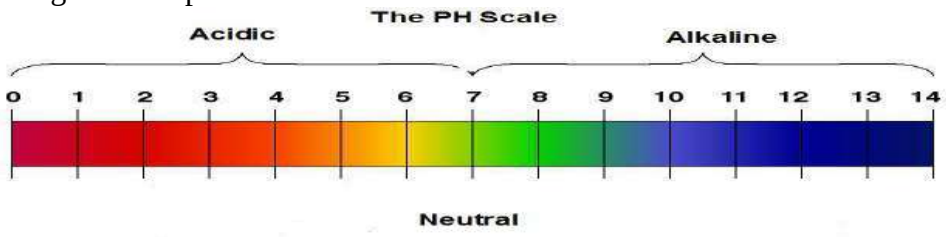
pH scale runs from 1 (very acidic) to 14 (very basic/alkaline). A pH of 7 is neutral – many living things live in a range around pH 7.



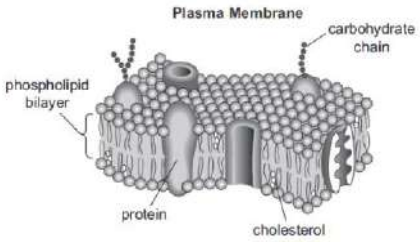
Module 1 (continued) – Cells and Cell Processes
Unit 2: Cell Structure and Function BIO.A.1

	Organelle	Notes	Structure	Function	Location	Cell like a City
common to both Prokaryotes and Eukaryotes	Plasma Membrane	a/k/a Cell Membrane **Semi-Permeable**	**Phospholipid Bilayer** (2 layers) contains embedded proteins	**Barrier** (fence) Controls what comes in or out of the cell	Outer boundary	Barrier around the city (fence)
	Cytoplasm	2/3 of cell weight	Watery-gel	1. holds organelles 2. provides shape 3. provides location for biochemical reactions	inside plasma membrane	Everything inside the City limits
	Ribosome	small (tiny) numberous spherical	rRNA strands	site of protein synthesis (building)	1. free floating in cytoplasm 2. attached to ER	Protein factories
	DNA	Hereditary material - found on chromosomes	nucleotides linked together	contains the code for building proteins	nucleus	City Blueprints
Found only in eukaryotic cells - both plants & animals	Cytoskeleton	1. Microfilaments 2. Microtubules 3. intermediate fibers	network of protein fibers	provide shape and support organelles	cytoplasm	Infrastructure (bridges, sidewalks, power poles)
	Nucleus (Nucleolus)	enclosed in a double membrane	double membrane contains **nuclear pores** for movement in or out	**Nucleus** - protects the DNA **Nucleolus** - builds ribosome parts	cytoplasm	City Hall (control center)
	Endoplasmic Reticulum	2 types: 1. **Rough ER** (ribosomes attached) 2. **Smooth ER** (no ribosomes)	Series of membranes	provide rapid movement through the cytoplasm	all through the cytoplasm	Streets & Highways
	Golgi Apparatus	large, usually only one a cell	Stack of membranes and vesicles (membrane sacs)	repackages proteins for shipment in and out of the cell	cytoplasm	Post Office
	Lysosome	a type of vesicle	vesicle (hollow membrane sac)	breakdown of old parts, food, foreign material	cytoplasm	Recycle Center
	Vesicles & Vacuole	Large central Vacuole in plants Vesicles are smaller then vacuoles (vesicles are typically spherical)	hollow containers made from membranes	1. Store materials 2. transport materials 3. provide chambers for chemical reactions	cytoplasm	Warehouse (storage)
	Mitochondria	1. Contain their own DNA 2. Form the basis of **endosymbiotic theory**	Double membrane: inner membrane is folded into **Cristae** (provide more surface area for reactions)	provides the energy (ATP) needed for cell processes	cytoplasm	Power Plant

plant cells only	***Plastids***	1. Chloroplast 2. Chromoplast 3. Leucoplast	Membrane bound organelles - internal structures vary	capture light energy and convert it into chemical energy	cytoplasm	Food Processing factories
	Cell Wall	*conatins tiny holes for water and nutrient movement*	rigid layer of **lignin** fibers and **pectin** glue: Complex Carbohydrates **(cellulose)**	Provides support and protects cell. Allows plants to remain upright.	outside plasma membrane	Wall around the city (protection)

BIO.A.4 Homeostasis and Transport

1. Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.
   - Cell membrane (plasma membrane) is composed (made up) of two layers of phospholipids. A phospholipid is formed from a water loving (hydrophilic) head and a two water fearing (hydrophobic) tails.
   - Imbedded in the lipid bilayer are proteins: transport proteins, enzymes, cell surface markers and receptor proteins.
   - Transport through a cell membrane (plasma membrane)
     - Passive transport – no energy (ATP) needed – simple diffusion, facilitated diffusion (ion channels, gated channels, transport proteins)
     - Active transport – energy is needed (ATP) because substances are being moved against their concentration gradients (from low to high) – sodium-potassium pump (protein carrier)
     - Active transport – **endocytosis** (building a vesicle) to bring large particles into the cell and **exocytosis** – building a vesicle to move large particles out of the cell (golgi apparatus does this)



2. Explain mechanism that permit organisms to maintain biological balance between their internal and external environments.
   - **Diffusion** – is the movement of a substance from an area of high concentration to an area of low concentration (down a concentration gradient) until equilibrium is reached.
   - **Osmosis** – the movement of water through a plasma membrane (cell membrane) from an area of high free water concentration to an area of lower free water concentration.

BIO.A.3 Bioenergetics

1. Identify and describe the cell structures involved in processing energy.
2. Identify and describe how organisms obtain and transform energy for their life processes.
   - **Photosynthesis** captures the light energy and uses it to convert carbon dioxide and water into a carbohydrate (monosaccharide) and oxygen

     sunlight
   - $\mathbf{6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2}$
   - Photosynthesis takes place in the chloroplast (a plastid structure found only in plant cells)
   - Chloroplasts are made up of thylakoid membranes (where the light reactions take place) and the stroma (where the dark reactions also known as Calvin Cycle also known as carbon fixation takes place)
   - A photon of light excites the pigments molecules (chlorophyll is the main one – green) which passes it to photosystem II and photosystem I – electron transport chains. This is the light reaction.
   - Carbon dioxide cycles through the Calvin Cycle (dark reactions) and produces organic molecules (sugar)

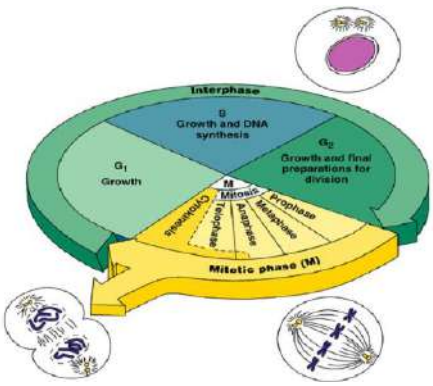
- **Cellular Respiration** takes a monosaccharide (carbohydrate -glucose a sugar) and breaks it down through a series of chemical reactions to produce ATP – the energy molecule (Adenosine Triphosphate)
  $C_6H_{12}O_6$ + $6O_2$ → $6CO_2$ + $6H_2O$ + 38 ATP
- The first process is anaerobic (does not use oxygen) and is known as Glycolysis. This takes place in the cytoplasm of a cell. This is the only way prokaryotic organisms get energy. The cell only gets 2 ATP from Glycolysis.
- Eukaryotic organisms can use oxygen (aerobic respiration) and finish cellular respiration in the organelle known as the mitochondria. Inside the mitochondria matrix the process of the Kreb's Cycle occurs and along with electron transport chains in the cristae (inner mitochondrial membranes) obtain and additional 36 ATP molecules.
- Oxygen molecules are necessary for aerobic respiration to occur and carbon dioxide and water are the end products of cellular respiration.

3. ATP is the only energy molecule cells use to do work. When the third phosphate groups is chemically removed, energy is released to do the work.

Module 2 – Continuity and Unity of Life

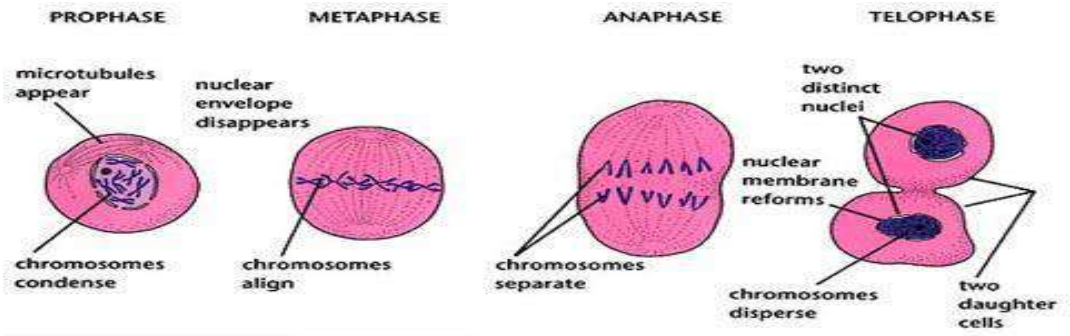
BIO.B.1 Cell Growth and Reproduction

1. Describe the three stages of the Cell Cycle: Interphase, nuclear division (mitosis), cytokinesis
2. Compare the processes and outcomes of mitotic (mitosis) and meiotic (meiosis) divisions.

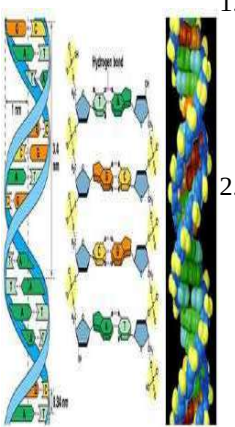


Mitosis	Meiosis
1. Start with a 2n cell (diploid) end with 2 diploid cells (2n cells)	1. Start with a 2n cell (diploid) end with 4 n cells (haploid)
2. Organism growth, repair, and development	2. Makes gametes for sexual reproduction
3. Process is 4 steps: Prophase, Metaphase, Anaphase, Telophase and Telophase	3. Process is 8 steps: Prophase I, Metaphase I, Anaphase I, Telophase I <u>then</u> Prophase II, Metaphase II, Anaphase II, Telophase II

<u>Mitosis-</u>



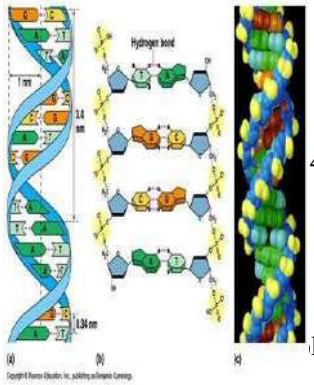
BIO.B.2 Genetics



1. Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance
   - Chromosomes are made up of DNA and histones (proteins the DNA wraps around)
   - A gene is a single piece of DNA that codes for one protein
   - DNA – deoxyribonucleic acid is the biological macromolecule that holds the genetic information that is passed from parent(s) to offspring.
   - An allele is an alternate form of a gene(character is hair line – alleles are 1.**straight** or 2. **widow's peak**)
2. Compare Mendelian and non-mendelian patterns of inheritance. (Chapter 12)

- P1 (result from self- pollination) – F1 are the offspring of a cross pollination of two P1's – F2 is a result of self-pollination of the F1 generation. F1 results (all dominate phenotypes): F2 results 3:1 ratio of dominant to recessive traits.
- Non-Mendelian patterns of inheritance – sex-linked traits (on the X or Y chromosome), co-dominance (both alleles are expressed at the same time – blood type AB), incomplete dominance (dominant alleles are blended together – red x white = pink), multiple alleles (results in 4 different phenotypes – blood type A, B, AB or O)

3. Describe how the process of DNA replication results in transmission and/or conservation of genetic information (Chapter 13)
    - DNA is composed of nucleotides (5 carbon sugar deoxyribose, phosphate group and nitrogen base) Nitrogen bases are purines (Adenine and Guanine) or pyrimidines (Thymine and Cytosine)
    - DNA replication occurs during the S phase in Interphase. Helicase (enzyme) unzips the DNA double helix and then DNA polymerase (enzyme) matches up the open base pairs A-T (adenine to thymine) G-C (guanine to cytosine)



4. Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture. (chapter
    - Genetically engineering food (agriculture) – seedless grapes, seedless watermelon, hybrid corn, antibiotic meats.
    - Forensics – biometrics (your personal DNA for identification); Medicine – gene therapy

lain the process of protein synthesis (transcription, translation, and protein modification) – (chapter 13)

- Transcription is in the nucleus – RNA polymerase binds to a promoter region of DNA and unzips it. RNA polymerase matches nucleotides to one DNA open strand and builds mRNA (transcribes the message)
- mRNA moves from nucleus (through nuclear pore) into the cytoplasm to the ribosome (rRNA) where it is held in place.
- tRNA translates the mRNA codons (3 base sequence code) and brings amino acids which form peptide bonds. Begins coding with a start code (Methionine) and ends with a stop code.

6. Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (silent, nonsense, frame shift) – (Chapter 13)
    - Mutations occur during replication, transcription or translation. They may OR may not affect the protein to be built. Silent mutation (no change); Nonsense (protein built does not work at all); Frameshift (all amino acids after the mutation are incorrect for the protein): Point mutation – may change one Amino Acid or change nothing. Insertion or deletion – will add or delete an Amino Acid if in multiple of 3.

BIO.B.3 Theory of Evolution

1. Explain how natural selection can impact allele frequencies of a population.
    - Natural Selection is a theory where a process in nature in which organisms possess inherited traits are better able to survive and reproduce compared to others of their species. (Charles Darwin pioneered)
        - 1. Variation - individuals among a species are different (have different forms of traits)
        - 2. Overpopulation – a species makes more offspring than can survive in nature)
        - 3. Selection – the environment will select those traits that are better suited for survival
        - 4. Adaptation – over time the favorable traits will increase in the species population
    - Charles Darwin published his theory of Evolution my means of Natural Selection in 1859. He was influenced by Lamarck, Malthus, Lyell, Hutton and Cuvier.
    - Darwin sailed in the ship: HMS Beagle and studied finch beaks and tortoises in the Galapagos Islands
2. Describe the factors that can contribute to the development of new species.
    - Speciation = formation of a new species as a result of evolution
        - Microevolution - study how genes change in populations (mate choice, mutation, migration, genetic drift, natural selection
        - Macroevolution – study of patterns of diversity or speed of change in a species (extinction, gradualism, punctuated equilibrium, convergent evolution, coevolution, adaptive radiation.
3. Explain how genetic mutations may result in genotypic and phenotypic variations within a population.
    - Mutations can lead to altered proteins which may or may not be favorable for survival.
    - Most mutations are NOT good. Rarely they allow an individual to better survive and reproduce, thereby increasing the number of individuals in the population with that mutated trait. Over time the population changes to include that trait that was originally mutated.

4. Interpret evidence supporting the theory of evolution -fossils, biochemical, homologous structures, embryological
   - Fossil records of older species (giant armadillo) giving rise to current species (armadillo)
   - Biochemistry - comparison of DNA or proteins among related species
   - Anatomy – comparison of homologous structures (human arm, bat wing, alligator leg)
   - Embryology – embryos of human, rabbit, frog, fish all look the same early in development become different during development (suspected common ancestor)
5. Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.
   - Scientific Method (basic) – Observe, question, predict (hypothesis), investigate (experiment), evaluate (analyze data looking for patterns), communicate (good and bad results)
     - Hypothesis – an IF –THEN statement (not a question) that is testable. Based on observations
     - Theory – system of ideas that explains may related observations and supported by evidence from scientific investigations
     - Investigation (experiment) – test one factor (variable) at a time. A controlled experiment must have all factors the same and test the:
       - Independent variable – the variable to be tested
       - Dependent variable – the variable to be measured to see if the independent variable has an effect on the investigation.
     - Observations – **quantitative** (has a number in it) OR **qualitative** (no numbers)
       - 37 frogs were in the pond (quantitative)
       - The frogs were green and brown (qualitative)

BIO.B.4 Ecology

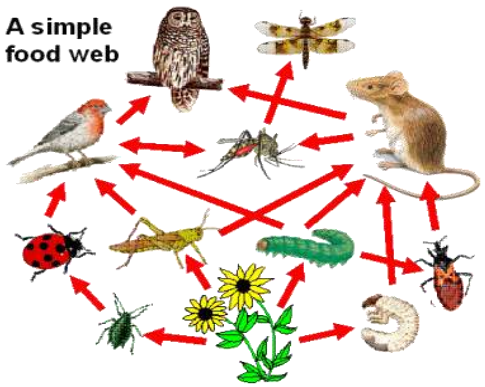
Describe the levels of ecological organization (organism, population, community, ecosystem, biome, biosphere.)

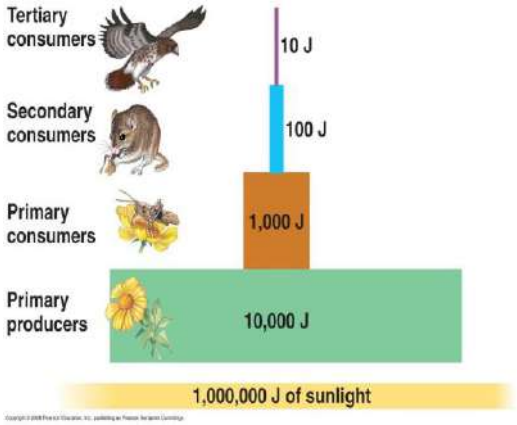
An **organism** is a single living thing.
- Many of the same organisms living and breeding together form a **population**
  - Many populations of different organisms living and interacting together is a **community**.

An **ecosystem** is the living and non-living parts of the environment (Biotic and Abiotic)
- **Biome** is a large geographical area that shares similar weather (sunlight and precipitation) they will have distinct organisms (plants and animals) adapted to that environment.
  - **Biosphere** is the zone on the earth were life exists (total of all ecosystems)

1. Describe characteristics biotic and abiotic components in aquatic and terrestrial ecosystems.
   - Biotic – the living things in an ecosystem. (plants, animals, bacteria, fungi - community)
   - Abiotic – the non-living things in an ecosystem. (water, weather, rocks, sunlight, shade, etc..)
2. Describe how energy flows through an ecosystem (food web, food chain, energy pyramids)

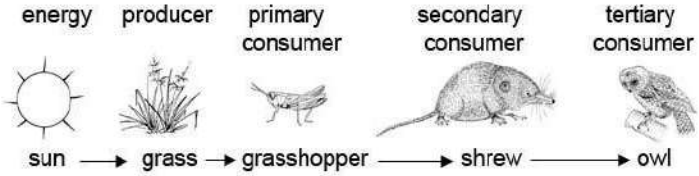
Food Web





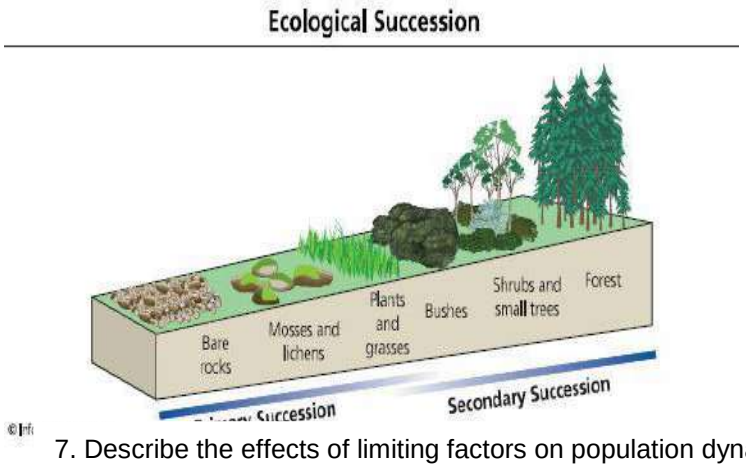
Energy pyramid

Food Chain



3. Describe biotic interactions in an ecosystem. (symbiosis, predation, competition)
   - Symbiosis – when two organisms have a close, long term, relationship to each other as to how they live
     - Mutualism – both organism benefit from the relationship
     - Commensalism – one organism benefits while the other is neither helped or harmed
     - Parasitism – one organism benefits while the other is slightly harmed
4. Describe how matter recycles through an ecosystem (water, carbon, oxygen and nitrogen cycles)

5. Describe how ecosystems change over time in response to natural and human disturbances.



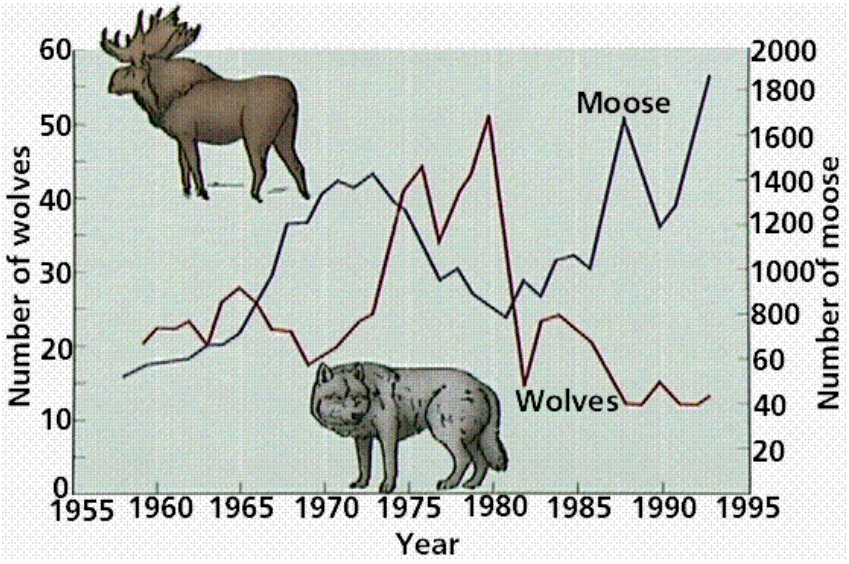
Primary succession – from bare rock to climax community

Secondary succession – when primary ecosystem is damage or destroyed and is then regrown

7. Describe the effects of limiting factors on population dynamics (changes) and potential species extinction.

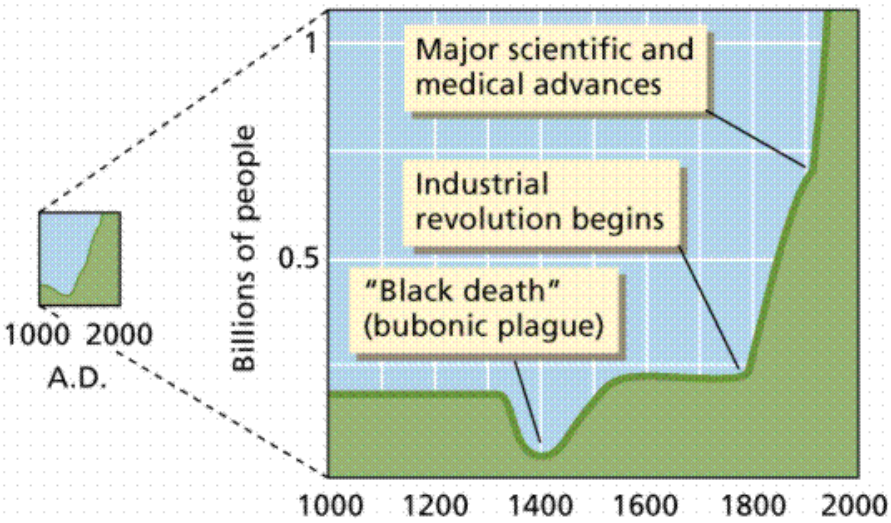
Limiting factors in ecosystems – water, food, shelter, space (4 main ones): also available mates, predators, disease

Predator and prey interactions



Human Population Growth – limiting factors effect growth (food, disease)

(more individuals in a given space = **disease** can have a greater effect, kill more individuals)



PDE Keystone 2015 Sampler Module 1

Multiple choice:

Which characteristic is shared by **all** prokaryotic and eukaryotic organisms?

A. The ability to reproduce asexually
B. The ability to make their own food
C. The need for a source of energy
D. The need for oxygen for respiration

1. Life function are performed at many levels of biological organization. Which level of biological organization is the simplest level at which a structure can support life functions?

   A. Cell
   B. Tissue
   C. Organelle
   D. Organ system

2. The opening of the stomata allows water to evaporate from inside the leaf in a process known as transpiration. As this occurs, water molecules cling to one another and pull water in a continuous stream up the stem of the plant from the roots to the leaves. Which property of water makes the movement possible?

   A. Cohesion
   B. Freezing point
   C. High specific heat
   D. Temperature-dependent density

3. Cells are largely made of organic compounds that contain carbon. Which property of the carbon atom makes it an essential component of organic compounds?
   A. Carbon is a nonmetal
   B. Carbon oxidizes to carbon dioxide
   C. Carbon is solid at room temperature
   D. Carbon can form four covalent bonds
4. Plant cells use sunlight to make their own food. Which structure allows plant cells to perform this function?
   A. Nucleus
   B. Vacuole
   C. Chloroplast
   D. Mitochondrion

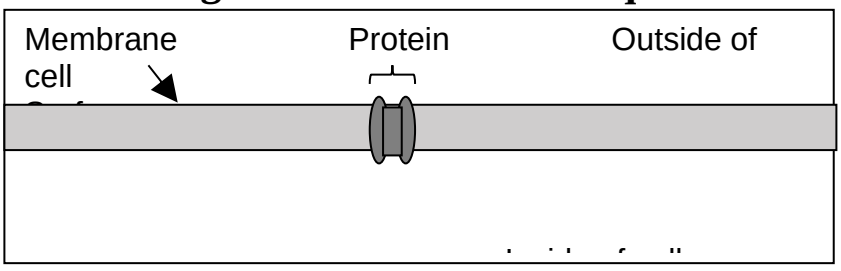
5. Which statement best explains why cellular respiration in plants and other organism is dependent on photosynthesis?
   A. Photosynthesis is one of the final steps in cellular respiration.
   B. Photosynthesis provides the materials that fuel cellular respiration
   C. Photosynthesis absorbs excess energy produced by cellular respiration
   D. Photosynthesis absorbs materials that are catalyzed during cellular respiration

Molecules needed for Protein Synthesis

- **mRNA**
- **tRNA**
- **amino acids**
- **ATP molecules**

6. A plant cell uses the molecules in the list above to synthesize a protein. What role do the ATP molecules play in the protein synthesis process?
   A. They provide energy.
   B. They increase activation energy.
   C. They convert energy into hereditary information.
   D. They absorb excess energy to prevent overheating.

Use the diagram below to answer question 8.



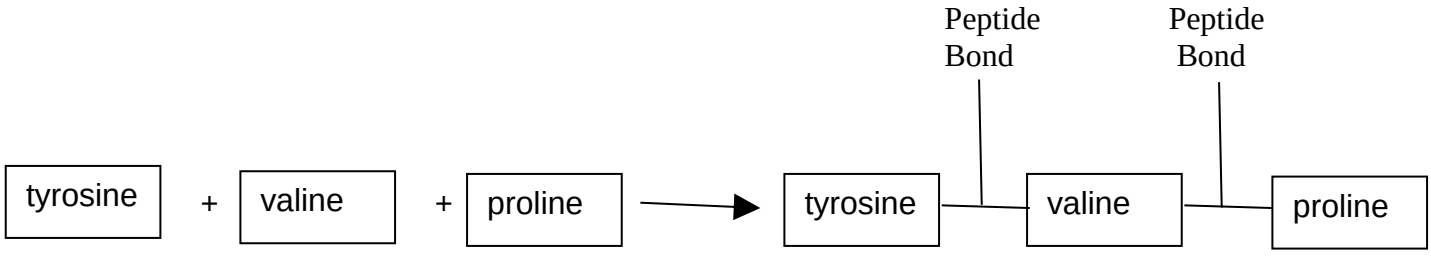
7. The indicated protein is part of a cell membrane. What is the **most likely** purpose of this protein?
   A. It allows passage of particles into and out of the cell.
   B. It manufactures phospholipids to repair membrane damage.
   C. It releases stored chemical energy in membrane carbohydrates.
   D. It attracts unbalanced electrical charges in the cell's environment.

8. Which statement best describes how active transport differs from passive transport?
   A. Only active transport requires ATP.
   B. Only active transport moves small particles.
   C. Only active transport allows substances to leave a cell.
   D. Only active transport relies on a plasma membrane.

9. All living organisms must maintain homeostasis in order to survive. Which statement best describes one way humans maintain homeostasis?
   A. Temperature is regulated by giving off carbon dioxide.
   B. Water content is regulated by giving off carbon dioxide.
   C. Temperature is regulated by sweating.
   D. Water content is regulated by sweating.

Use the diagram below to answer question 11.

Biological Reaction



10. Which statement **best** describes the event shown in the diagram?

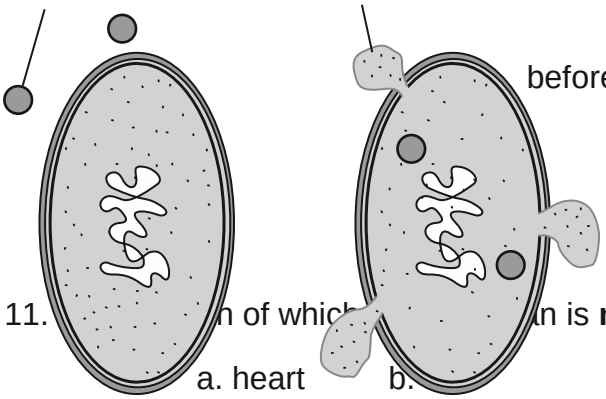
    A. Glucose is being synthesized in the chloroplast using nitrogen from plants.
    B. Amino acid monomers are joining together to form a protein macromolecule.
    C. A polymer in the nucleus is being broken into its individual monomer subunits.
    D. Lipid molecules are forming fatty acid chains in a dehydration synthesis reaction.

information presented on page to answer questions 11 and 12.

Bacteria and Antibiotics

Bacteria are single-celled microorganisms. The cell walls of these microorganisms serve as barriers to chemicals that might affect the processes that occur within a bacterial cell. Antibiotics are a type of substance used to stop bacterial growth. Some antibiotics cause the bacterial cell wall to rupture.

Antibiotic Action on a Bacterium



11. Which of which of the following is **most** like the cell walls of bacteria?

a. heart b. c. pancreas d. skin

12.Which statement **best** describes how antibiotics affect cellular homeostasis?

A. Antibiotics remove chloroplasts from plant cells to cause starvation.

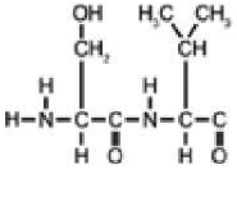
B. Antibiotics interfere with the transport of intracellular and extracellular materials.

C. Antibiotics increase the rate of DNA replication in human cells by forming nucleotides.

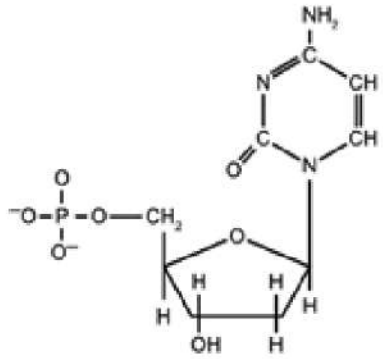
D. Antibiotics decrease the rate of cellular respiration in animal cells by producing oxygen.

Use the illustrations below to answer the question.

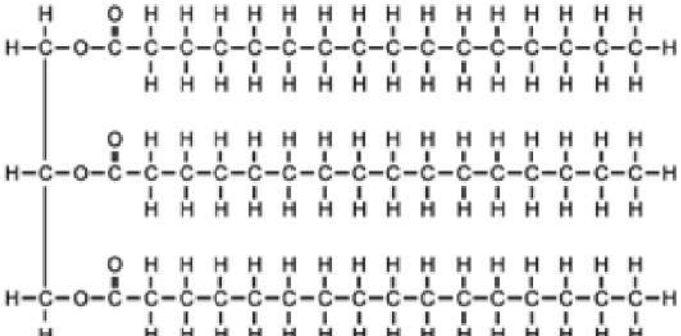
Four Organic Molecules

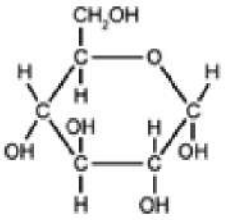


dipeptide



nucleotide





Part A: Describe two similarities in the structure of the organic molecules shown.

Similarity 1:

Similarity 2:

Part B: "Structure determines function" is an important concept to biology. Select one of the organic molecules shown and explain how its structure is related to its function.

PDE Keystone 2015 Sampler Module 2

MULTIPLE-CHOICE ITEMS

1. What must be transmitted to new DNA strands during replication to maintain genetic information?

A. individual atoms from existing DNA strands
B. individual sugars from existing DNA strands
C. the sequence of bases from existing DNA strands
D. the sequence of phosphates from existing DNA strands

2. The genetic material of two different individuals of the same species is analyzed. One individual has brown eyes. The other has blue eyes. Which characteristic for eye color would be the same for both individuals?

A. the allele
B. the DNA sequence
C. the amount of pigment
D. the location of the gene

3. Which effect is **most likely** caused by nondisjunction during meiosis?

A. an increase in nuclei
B. an extra chromosome
C. only two types of nitrogenous bases
D. increased survival benefits from traits

4. A genetic mutation involving a single base causes an error that affects the sequence of the next 500 amino acids in a protein. Which type of mutation could have produced this type of error in the protein?

A. silent
B. nonsense
C. frame-shift
D. substitution

5. New technologies enable oils to be extracted from plants to make renewable biodiesel fuel. Scientists have altered the genome of a specific plant species to increase the amount of oil produced by each plant. Which statement explains why this technology **most likely** benefits farmers?

A. It makes each plant more resistant to disease.
B. It lowers the cost of each acre of plants cultivated.
C. It increases the value of each acre of land cultivated.
D. It eliminates the processing needed to extract plant oils.

6. A population of squirrels was separated during the formation of the Grand Canyon. Over time the squirrels, separated by the canyon walls and the Colorado River, became unique species. Which mechanism **most likely** caused the development of the new species?

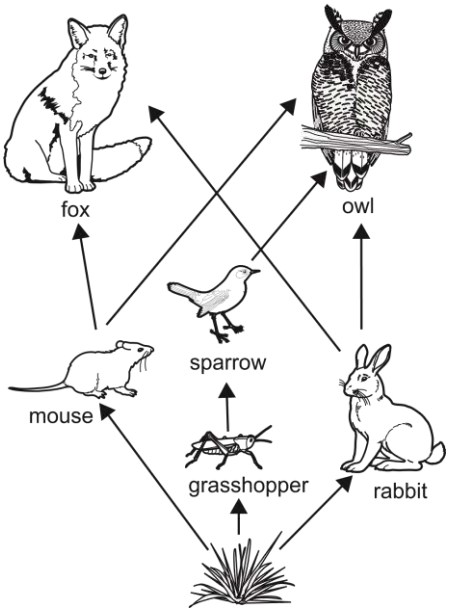
A. habitat preference
B. increased gene flow
C. geographic isolation
D. behavioral isolation

7. A researcher observes two species of frogs in the same area. Both species have a similar diet. One species breeds in fast-moving streams, while the other species breeds in ponds. Both species are similar in appearance and have very similar DNA. Which information provides the **best** evidence that these two species descended from a common ancestor?

A. the species' similar diets
B. the species' shared habitat
C. the species' mating behaviors
D. the species' physical characteristics

8. Which description is the **best** example of a population?

A. all of the red foxes in a forest
B. all of the red foxes in every forest
C. all of the organisms in a forest
D. all of the organisms in every forest



9. Which energy transfer **most likely** occurs between organisms in the food web?

A. from owl to fox
B. from rabbit to fox
C. from sparrow to grass
D. from mouse to grasshopper

10. In Pennsylvania, a nonnative plant called stiltgrass out-competes native plants in many forest ecosystems. Which statement **best** describes how the spread of stiltgrass negatively affects native herbivores?

A. Stiltgrass stops the life cycles of native herbivores.
B. Stiltgrass reduces the size of the native plant populations.
C. Stiltgrass increases the flow of energy through the ecosystem.
D. Stiltgrass attracts other nonnative plants to the forest ecosystem.

Four Locations of Aye-ayes

Madagascar

11. The map indicates four locations of aye-aye populations. Which location would **most likely** have an aye-aye population with the greatest variation in allele frequencies?

A. location 1
B. location 2
C. location 3
D. location 4

12. For the aye-aye species, what is **most likely** the primary value of individuals living alone?

A. decreased space needs for the species
B. increased survival rates with habitat loss
C. reduced competition for natural resources
D. greater genetic variability within the species

Constructed response:

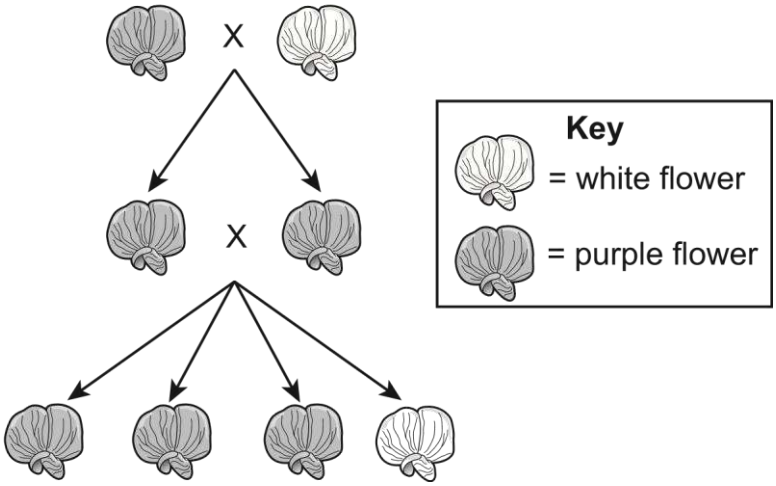
13. White-tailed deer from North America were brought to the islands of New Zealand around the year 1900. This species of deer has survived in several regions in New Zealand.

Part A: Explain why the white-tailed deer population is considered a nonnative species in New Zealand.

Part B: Describe one possible effect that a nonnative species can have on a native ecosystem and explain why this effect might occur.

Use the diagram below to answer question 14.

Pea Flower Color Cross



14. In pea plants, the flowers can be purple or white. The diagram shows three generations of pea plant crosses.

Part A: Using the pea flower color cross, identify the pattern of inheritance shown and explain how the cross shows this pattern.

Part B: Explain how farmers could ensure that they only grow white flowers.