

Review Facts for the Biology SOL



Science Department

**A review and study guide for the
Virginia End of Course Standards of
Learning Assessment for Biology**

Biology Test
Blueprint Summary Table
Reporting Categories Number of Items Biology SOL

Reporting Categories	Number of Items	Biology SOL
Scientific Investigation	11	BIO.1a-m BIO.2e BIO.7e
Life at the Molecular and Cellular Level	14	BIO.2a, d BIO.3a-d BIO.4a-d BIO.5f BIO.6a-c, e-g, I BIO.7d
Life at the Systems and Organisms Level	14	BIO.2b BIO.5a-d BIO.6d BIO.7a, c
Interaction of Life Forms	11	BIO.2c BIO.8a-e BIO.9a-e BIO.7b
SOL excluded from this test		BIO.5e BIO.6h
Total Number of Operational Items	50	
Field-Test Items*	10	
Total Number of Items	60	

The passing score for the Virginia Biology SOL is 400-499 (proficient) and 500-600 (advanced). The number of questions vary from 25-28 correct responses to pass the SOL.

Review Facts for the Biology SOL

Scientific Investigation

- A hypothesis can be supported, modified, or rejected based on collected data. Hypotheses are tentative explanations that account for a set of facts and can be tested by further investigation.
- A theory is an explanation of a large body of information, experimental and inferential, and serves as an overarching framework for numerous concepts. It is subject to change as new evidence becomes available.

Variables are the things that change in an experiment. There are two variables.

- The **independent variable** is changed by the experimenter.
- The **dependent variable** responds to the changes in the independent variable.

On a graph of plotted experiment data...

- the independent variable is plotted on the x-axis (horizontal)
- the dependent variable is plotted on the y-axis (vertical).

The **constants** (controlled variables) are the things that you keep the same.

The difference between tables and graphs...

- A table is what you use to record data.
- The data gets plotted on to a chart or graph.

Key Vocabulary: constant, control, dependent variable, graph, independent variable, table

Measurement

The International System of Units (**SI unit**) is the measuring system used by most people around the world. It is the modern version of the **metric system**.

- **Mass** is a measure of the amount of matter in an object. The SI unit of mass is the gram (g).
- **Volume** is the measure of how much an object can hold. The SI unit for volume is the liter (L).
- **Length** is the measure of how long something is. The SI unit for length is the meter (m).
- **Gravity** is a pull which all matter exerts on all other matter, the more mass, the stronger the pull.
- **Weight** is a measure of the pull of the earth's gravity on an object.

There are 3 main states of matter: solid, liquid, gas

Life at the Molecular/Cellular Level

- Water molecules are both cohesive and adhesive due to the nature of bonding (polar covalent and hydrogen bonding).
- Water is able to absorb large amounts of heat. As a result, lakes and oceans stabilize air and land temperatures.
- Water absorbs heat when it evaporates, allowing organisms to get rid of excess heat.
- In the solid form, ice floats, preventing lakes and oceans from freezing solid.
- Water is able to dissolve many substances so the water inside and outside of cells can carry nutrients into and around cells, and wastes away from cells.
- The pH scale goes from 0 to 14. The pH of pure water is 7. Substances added to water can lower or raise the pH. A solution with a pH below 7 is acidic. A solution with a pH above 7 is basic.
- Organisms can only tolerate small changes in pH because every cell has a particular pH at which it functions best. For example, changes in pH cause changes in enzyme conformation, resulting in a change in activity.

- Carbon atoms can easily bond to several other carbon atoms in chains and rings to form large complex molecules. 2
- Cells can make a variety of macromolecules from a relatively small set of monomers.
- The primary functions of carbohydrate macromolecules are to provide and store energy. The primary functions of lipid macromolecules are to insulate, store energy, and make up cell membranes.
- Nucleic acids (DNA and RNA) control cell activities by directing protein synthesis.
- Some proteins are structural (hair, nails). Others function in transport (hemoglobin), movement (muscle fibers and cytoskeletal elements), defense (antibodies), and regulation of cell functions (hormones and enzymes).
- Proteins are polymers made by linking together amino acid monomers.
- A protein's structure depends on its specific conformation. The sequence of amino acids and the shape of the chain are a consequence of attractions between the chain's parts.
- Each enzyme has a definite three-dimensional shape that allows it to recognize and bind with its substrate. In living cells, enzymes control the rate of metabolic reaction by acting as catalysts.
- Most cells function best within a narrow range of temperature and pH. At very low temperatures, reaction rates are too slow. High temperatures or extremes of pH can irreversibly change the structure of proteins and alter their function.
- Photosynthesis and cell respiration are complementary processes for cycling carbon dioxide and oxygen in ecosystems.
- During photosynthesis, cells trap energy from sunlight with chlorophyll, and use the energy, carbon dioxide and water to produce energy-rich organic molecules (*glucose*) and oxygen.
- During cell respiration, eukaryotic cells “burn” organic molecules with oxygen to produce energy, carbon dioxide, and water.
- Photosynthesis and cell respiration are complementary processes for energy transfer in ecosystems.
- Light is the initial source of energy for most communities.
- Photosynthesis involves an energy conversion in which light energy is converted to chemical energy in specialized cells. These cells are found in autotrophs such as plants and some protists.
- Cells release the chemical energy stored in the products of photosynthesis. This energy is transported within the cell in the form of ATP.
- When cells need energy to do work, certain enzymes release the energy stored in the chemical bonds in ATP.
- The development and refinement of magnifying lenses and light microscopes made the observation and description of microscopic organisms and living cells possible.
- The fluid mosaic model of a membrane emphasizes the arrangement and function of a bilayer of phospholipids, transport proteins, and cholesterol.
- Diffusion occurs in cells when substances (oxygen, carbon dioxide, salts, sugars, amino acids) which are dissolved in water move from an area of higher concentration to an area of lower concentration.
- Osmosis refers to the movement of water molecules through a semi-permeable from an area of greater water concentration or pressure to an area of lesser water concentration or pressure.
- Active transport refers to the movement of solid and liquid particles into and out of a cell by endocytosis and exocytosis.
- The development of cell theory was accelerated by the ability to make observations on a microscopic level.
- The cell theory states that all living things are composed of cells and cells come from other cells by cell reproduction.
- Continued advances in microscopy allowed observation of cell organelles and ultrastructure. Current technology allows the observation of cellular processes underlying both cell structure

and function.

- Scientists have developed hypotheses about conditions on early Earth that could have led to the formation of the first organic molecules, early self-replicating molecules, the source of free oxygen in Earth's atmosphere, and appearance of prokaryotic and later eukaryotic cells.
- Science depends on experimental and observational confirmation and is subject to change as new evidence becomes available.
- Earth's first cells were prokaryotes.
- Prokaryotic cells exist in two major forms, eubacteria and archaeobacteria.
- For the body to use food for energy, the food must first be digested into molecules that are absorbed and transported to cells, where the food is used for energy, and for repair and growth.
- To burn food for the release of energy, oxygen must be supplied to cells and carbon dioxide removed.
- Prokaryotes are the Earth's most abundant inhabitants. They can survive in a wide range of environments and obtain energy in a variety of ways.
- Eukaryotes arose from prokaryotes and developed into larger more complex organisms from single-celled Protista to multi-cellular fungi, plants and animals.
- Several differences between eukaryotes and prokaryotes include size, genetic material surrounded by a nuclear membrane, and the addition of mitochondria and chloroplasts.
- Essential cell structures and their function include
 - the nucleus (contains DNA, site where RNA is made)
 - ribosomes (site of protein synthesis)
 - mitochondria (site of cell respiration)
 - chloroplast (site of photosynthesis)
 - endoplasmic reticulum (transports materials through the cell)
 - Golgi (cell products are packaged for export)
 - lysosomes (contain digestive enzymes)
 - cell membrane (controls what enters and leaves the cell)
 - cell wall (provides support).
- Some organisms exist as a single cell while others are composed of many cells, each specialized to perform distinct metabolic functions.
- The basic processes necessary for living things to survive are the same for a single cell as they are for a more complex organism.
- A single-celled organism has to conduct all life processes by itself. A multicellular organism has groups of cells that specialize to perform specific functions.
- Cell specialization occurs during the development of a multicellular organism. The genetic information necessary for all cellular functions remains in each cell but may not be used.

Principles of Genetics

- Mendel's laws of heredity are based on his mathematical analysis of observations of patterns of inheritance of traits.
- The laws of probability govern simple genetic recombinations.
- Genotype describes the genetic make-up of an organism and phenotype describes the organism's appearance based on its genes.
- Homozygous individuals have two identical alleles for a particular trait, while heterozygous individuals have contrasting alleles.
- When one allele masks the effect of another, that allele is called dominant, and the other recessive. When an intermediate phenotype occurs and no allele dominates, incomplete dominance results.
- Mitosis produces two genetically identical cells.
- Meiosis occurs in sexual reproduction when a diploid germ cell produces four haploid

daughter cells that can mature to become gametes (sperm or egg).

- A typical cell goes through a process of growth, development, and reproduction called the cell cycle.
- Mitosis and meiosis refer to division of the nuclear material. Cytokinesis is the division of the cytoplasm and organelles.
- Mitosis is referred to in the following stages: prophase, metaphase, anaphase, and telophase.
- All living cells come from other living cells. During mitosis the nucleus of the cell divides, forming two nuclei with identical genetic information.
- Many organisms are capable of combining genetic information from two parents to produce offspring. Sex cells are produced through meiosis. This allows sexually reproducing organisms to produce genetically differing offspring.
- The many body cells of an individual organism can be specialized to perform different functions, even though they are all descended from a single cell and contain essentially the same genetic information.
- The sorting and recombination of genes in sexual reproduction results in a great variety of gene combinations in the offspring of any two parents.
- Recombination and mutation provide for genetic diversity.
- Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it, causing an altered phenotype.
- An altered phenotype may be beneficial or detrimental.
- Sometimes entire chromosomes can be added or deleted, resulting in a genetic disorder such as Trisomy 21 (Down syndrome).
- The genetic code is a sequence of DNA nucleotides in the nucleus of eukaryotic cells.
- DNA is a polymer of nucleotides. A DNA nucleotide is identified by the base it contains: adenine (A), guanine (G), and cytosine (C) or thymine (T).
- DNA is a double-stranded molecule. The strands are connected by complementary nucleotide pairs (A-T and C-G) like rungs on a ladder. The ladder twists to form a double helix.
- The genetic code is the sequence of DNA nucleotides.
- In order for cells to make proteins, the DNA code must be transcribed (copied) to messenger RNA (mRNA).
- The mRNA carries the code from the nucleus to the ribosomes in the cytoplasm.
- RNA is a single-stranded polymer of four nucleotide monomers. A RNA nucleotide is identified by the base it contains: adenine (A), guanine (G), and cytosine (C) or uracil (U).
- At the ribosome, amino acids are linked together to form specific proteins. The amino acid sequence is directed by the mRNA molecule.
- Cells pass on their genetic code by replicating (copying) their DNA.
- DNA stores the information for directing the construction of proteins within a cell. These proteins determine the phenotype of an organism.
- The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. The code is virtually the same for all life forms.
- Before a cell divides, the instructions are duplicated so that each of the two new cells gets all the necessary information for carrying on life functions.
- During DNA replication, enzymes unwind and unzip the double helix and each strand serves as a template for building a new DNA molecule. Free nucleotides bond to the template (A-T and C-G) forming a complementary strand. The final product of replication is two identical DNA molecules.
- Forensic identification is an example of the application of DNA technology.
- There is great potential for the development of useful products through genetic engineering (e.g., human growth hormone, insulin, and resistant fruits and vegetables).
- Eugenics, a pseudo-science of selective procreation, was a movement throughout the twentieth century, worldwide as well as in Virginia, that demonstrated a misuse of the principles of heredity.

- The Human Genome Project is a collaborative effort to map the entire gene sequence of organisms. This information will be useful in detection, prevention, and treatment of many genetic diseases.
- The potential for identifying and altering genomes raises practical and ethical questions.
- Cloning is the production of genetically identical cells and/or organisms.

Classification and Evolution

- Binomial nomenclature is a standard way of identifying a species with a scientific two-word name. The first word is the genus name and the second the species name.
- A species is defined as a group of organisms that has the ability to interbreed and produce fertile offspring.
- Biological classifications are based on how organisms are related.
- Organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their relationships over a period of time.
- Species is the basic unit of classification.
- Information about relationships among present organisms and those that inhabited Earth in the past is gained by comparing developmental stages of organisms and by examining and interpreting the fossil record. This information is continually being gathered and used to modify and clarify existing classification systems.
- Similarities among organisms on the structural and metabolic levels are reflected in the large degree of similarity in proteins and nucleic acids of different organisms. Diversity is the product of variations in these molecules.
- A fossil is any evidence of an organism that lived long ago.
- Scientists have used the fossil record to construct a history of life on Earth.
- Although there is not a complete record of ancient life from the past 3.5 billion years, a great deal of modern knowledge about the history of life comes from the fossil record.
- Populations are groups of interbreeding individuals that live in the same place at the same time, and compete with each other for food, water, shelter, and mates.
- Populations produce more offspring than the environment can support.
- Organisms with certain genetic variations will be favored to survive and pass their variations on to the next generation.
- The unequal ability of individuals to survive and reproduce leads to the gradual change in a population, generation after generation.
- Through his observations made in the Galapagos Islands, Charles Darwin formulated a theory of how species change over time called natural selection.
- Natural selection is governed by the principles of genetics. The change frequency of a gene in a given population leads to a change in a population and may result in the emergence of a new species.
- Natural selection operates on populations over many generations.
- Natural selection is a process by which organisms with traits well suited to an environment survive and reproduce at a greater rate than organisms less suited to that environment.
- Mutations are important in how populations change over time because they result in genetic changes to the gene pool.
- Genetic mutations and variety produced by sexual reproduction allows for diversity within a given population.
- Many factors can cause a change in the frequency of a gene over time.
- Depending on the rate of adaptation, the rate of reproduction of an organism, and the environmental factors present, structural adaptations may take millions of years to develop.
- Adaptations sometimes arise in response to environmental pressures, for example: the development of antibiotic resistance in bacterial populations, morphological changes in the peppered moth population, pesticide resistance.

- Stephen Jay Gould's idea of *punctuated equilibrium* proposes that organisms may undergo rapid (in geologic time) bursts of speciation followed by long periods of time unchanged. This view is in contrast to the traditional evolutionary view of gradual and continuous change.

Exploring Diversity

- The millions of different organisms that live on Earth today share many structural and metabolic features, including cellular organization, common molecular mechanisms for energy transformation and utilization and maintenance of homeostasis, common genetic code, and mechanisms for the transmission of traits from one generation to the next.
- The diversity that is evident in the natural world can be studied in the local environment in the context of variations on a common theme.
- Scientists have developed hypotheses about conditions on early Earth that could have led to the formation of the first organic molecules, early self-replication molecules, the source of free oxygen in Earth's atmosphere, and appearance of prokaryotic and later eukaryotic cells.
- Throughout history people have created explanations for disease.
- Pasteur and Koch's experimentation and hypotheses led to an understanding of the presence of microorganisms and their relationship to diseases.
- The understanding of the germ theory led to the understanding that many diseases are caused by microorganisms.
- Changes in health practices have resulted from the acceptance of the germ theory of disease.
- The modern approach emphasizes sanitation, the safe handling of food and water, aseptic techniques to keep germs out of the body, and the development of vaccinations and other chemicals and processes to destroy microorganisms.
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- Like other organisms, human beings are composed of groups of cells (tissues, organs, and organ systems) that are specialized to provide the human organism with the basic requirements for life: obtaining food and deriving energy from it, maintaining homeostasis, coordinating body functions, and reproducing.
- Organ systems function to interact to maintain a stable internal environment that can resist disturbance from within or without (homeostasis).
- Understanding normal body functioning assists in understanding situations, both hereditary and environmental, in which functioning is impaired.
- For the body to use food for energy, the food must first be digested into molecules that are absorbed and transported to cells, where the food is used for energy, and for repair and growth.
- To burn food for the release of energy, oxygen must be supplied to cells and carbon dioxide removed. The respiratory system responds to changing demands by increasing or decreasing breathing rate in order to maintain homeostasis.
- The circulatory system, which moves all of these substances to or from cells, responds to changing demands by increasing or decreasing heart rate and blood flow in order to maintain homeostasis.
- The urinary system disposes of dissolved waste molecules, the intestinal tract removes solid wastes, and the skin and lungs rid the body of heat energy.
- Specialized cells of the immune system and the molecules they produce are designed to protect against organisms and substances that enter from outside the body, and against some cancer cells that arise from within.
- Communication between cells is required for coordination of body functions. The nerves

communicate with electrochemical signals, hormones circulate through the blood, and some cells secrete substances that spread only to nearby cells.

- Environmental factors that impact human health include: diet, exercise, sleep, stress, toxic substances that enter the body, viruses, and other living organisms that infect the body.
- Genetic predispositions towards diseases impact human health. Awareness of one's genetic make-up allows individuals to make lifestyle changes that can enhance their quality of life
- Viruses do not share many of the characteristics of living organisms.
- Viruses are not cells. Basic viral structure consists of a nucleic acid core surrounded by a protein coat.
- Viruses can only reproduce inside another living cell, the host cell.
- The viral reproductive process is called the lytic cycle. It includes the following steps:
 - A virus must insert its genetic material into the host cell.
 - The viral genetic material takes control of the host cell and uses it to produce viruses.
 - The newly formed viruses are released from the host cell.

Principles of Ecology

- As any population of organisms grows, it is held in check by interactions among a variety of biotic and abiotic factors.
- A community is a collection of interacting populations.
- Population growth curves exhibit many characteristics such as: initial growth stage, exponential growth, steady state, decline, and extinction.
- Limiting factors are the components of the environment that restrict the growth of populations.
- Carrying capacity is the number of organisms that can be supported by the resources in an ecosystem.
- Abiotic factors are the nonliving elements in an ecosystem such as temperature, moisture, air, salinity, and pH. Biotic factors are all the living organisms that inhabit the environment including predators, food sources, and competitors.
- Symbiosis is a close and permanent relationship between organisms of two different species. Examples include mutualism, commensalism, and parasitism.
- An ecosystem consists of all the interacting species and the abiotic environment in a given geographic area.
- Nutrients cycle through an ecosystem. The most common examples include carbon, oxygen, nitrogen, and water.
- Flow of energy occurs between **trophic** levels in all ecosystems and can be depicted as follows:
 - food chain
 - food web
 - pyramid of energy
 - pyramid of biomass
 - pyramid of numbers
- Ecological succession is a series of changes in a community in which new populations of organisms gradually replace existing ones.
- A climax community occurs when succession slows down and a stable community is established. The climax community is made up of organisms that are successful at competing for resources in a given environment. The climax community in most of Virginia is a deciduous oak-hickory (hardwood) forest.
- Human activities such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming have changed the Earth's land, oceans, and atmosphere.
- Some of these changes have decreased the capacity of the environment to support some life

forms.

- Photosynthesis and cell respiration are complementary processes for cycling carbon dioxide and oxygen in ecosystems.
- During photosynthesis, cells trap energy from sunlight with chlorophyll, and use the energy, carbon dioxide and water to produce energy-rich organic molecules (*glucose*) and oxygen.
- During cell respiration, eukaryotic cells “burn” organic molecules with oxygen to produce energy, carbon dioxide, and water.
- Photosynthesis and cell respiration are complementary processes for energy transfer in ecosystems.
- Light is the initial source of energy for most communities.
- Photosynthesis involves an energy conversion in which light energy is converted to chemical energy in specialized cells. These cells are found in **autotrophs** such as plants and some protists.
- Cells release the chemical energy stored in the products of photosynthesis. This energy is transported within the cell in the form of ATP.
- When cells need energy to do work, certain enzymes release the energy stored in the chemical bonds in ATP.

Structure and Function of Plants

- Photosynthesis and cell respiration are complementary processes for cycling carbon dioxide and oxygen as well as transferring energy in ecosystems.
- During photosynthesis, cells trap energy from sunlight with chlorophyll, and use the energy, carbon dioxide and water to produce energy-rich organic molecules (glucose) and oxygen.
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Invertebrate and Vertebrate Animals

- Understand the differentiation of autotrophs and heterotrophs (producers, consumers, and decomposers) and aquatic and terrestrial organisms.
- Understand behavioral responses to the environment.
- For the body to use food for energy, the food must first be digested into molecules that are absorbed and transported to cells, where the food is used for energy, and for repair and growth.
- To burn food for the release of energy, oxygen must be supplied to cells and carbon dioxide removed. The respiratory system responds to changing demands by increasing or decreasing breathing rate in order to maintain homeostasis.
- The circulatory system, which moves all of these substances to or from cells, responds to changing demands by increasing or decreasing heart rate and blood flow in order to maintain homeostasis.
- The urinary system disposes of dissolved waste molecules; the intestinal tract removes solid wastes; and the skin and lungs rid the body of heat energy.
- Specialized cells of the immune system and the molecules they produce are designed to

protect against organisms and substances that enter from outside the body, and against some cancer cells that arise from within.

- Communication between cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells secrete substances that spread only to nearby cells.
- Environmental factors that impact human health include: diet, exercise, sleep, stress, toxic substances that enter the body, viruses, and other living organisms that infect the body.
- Genetic predispositions towards diseases impact human health. Awareness of genetic predisposition allows individuals to make lifestyle changes that can enhance quality of life.

BIOLOGY SOL REVIEW GUIDE - Scientific Investigation

Differentiate among observations, inferences and predictions.	
What is the difference between a qualitative and a quantitative observation?	
Define independent and dependent variables.	Independent Variable – Dependent Variable –
What are the purposes of control groups and constants (controlled conditions)?	
Write out the procedure for finding: Mean – Median – Mode -	Find the mean, median, and mode for this data: 5,3,2,7,9,6,9
Identify the uses for the following laboratory equipment: Microscopes Graduated cylinders Rulers Slides + cover slips Triple beam balances	
What is a hypothesis?	Write out an example Hypothesis
What is the difference between a theory and a law?	State one theory and one law that has been discussed this year.

PRACTICE QUESTIONS:

<p>#2 6 A biology class wanted to develop a research project to predict the effects of a new highway on wildflower species found in the Piedmont region of Virginia. The class could <i>best</i> conduct such a study by sampling flowers found in the highway construction area —</p> <p>F one year before highway construction begins</p> <p>G both before and after highway construction is completed</p> <p>H immediately after highway construction is finished</p> <p>J during the time highway construction is taking place</p>	<p>41 A student wanted to look at plant growth in five different soil samples. He planted the same type of seeds in identical containers and left them together in full sunlight. He gave each plant the same amount of water and charted the growth of each plant stem. What is the independent variable in this experiment?</p> <p>A Soil</p> <p>B Light</p> <p>C Container</p> <p>D Seeds</p>
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BIOLOGY SOL REVIEW GUIDE - Chemistry

Draw a water molecule.	
What is a hydrogen bond?	
Explain the ability of water to <ul style="list-style-type: none">• prevent lakes and oceans from freezing solid;• stabilize air and land temperature;• allow organisms to get rid of excess heat.	
Why is water important to living things?	
Diagram the pH scale and identify acids, bases, and neutral solutions.	
Differentiate between diffusion and osmosis.	
List the six elements that are the main components of a living cell.	1 2 3 4 5 6
Explain carbon's atomic structure and its role in forming the macromolecules of life and provide examples of compounds.	
What is the monomer, structure and function of the following macromolecules?	
Lipids	
Carbohydrates	
Proteins	
Nucleic Acids	

What is the structure and function of enzymes?	
Diagram an enzyme-substrate reaction.	
Why are pH and temperature important to cell functions? (Include when temperatures/pH get too high and too low.)	

PRACTICE QUESTIONS

#11

38

Before After

Cell

3 hours

Water molecule

Protein molecule

The above diagram shows the process of osmosis. Only the water molecules could enter the cell because water molecules —

F have more energy than the protein molecules

G are smaller than the protein molecules

H are more numerous than the protein molecules

J contain more hydrogen atoms than the protein molecules

33 Which of the following organelles is present in both prokaryotes and eukaryotes?

- A Nucleus
- B Ribosome
- C Golgi body
- D Endoplasmic reticulum

43 Proteins are formed from monomers (subunits) called —

- A amino acids
- B fatty acids
- C nucleic acids
- D nucleotides

20 Ice floats on a lake. This characteristic of water is responsible for —

- F suffocation of aquatic organisms
- G mixing a lake's thermal layers
- H altering migration patterns of fish
- J preventing a lake from freezing solid

BIOLOGY SOL REVIEW GUIDE- Investigating Cells

Summarize the development of early microscopes.													
State the cell theory.													
Distinguish between eukaryotes and prokaryotes based on observations of size, presence of a defined nucleus, and the presence of organelles.	<table style="width: 100%; border: none;"> <tr> <td></td> <td style="text-align: center;"><u>Eukaryotes</u></td> <td style="text-align: center;"><u>Prokaryotes</u></td> </tr> <tr> <td>Size</td> <td></td> <td></td> </tr> <tr> <td>Nucleus</td> <td></td> <td></td> </tr> <tr> <td>Organelles</td> <td></td> <td></td> </tr> </table>		<u>Eukaryotes</u>	<u>Prokaryotes</u>	Size			Nucleus			Organelles		
	<u>Eukaryotes</u>	<u>Prokaryotes</u>											
Size													
Nucleus													
Organelles													
Define photosynthesis and write the equation. Where (in the cell) does photosynthesis occur?													
Define cellular respiration and write the equation for aerobic respiration. Where does respiration occur in eukaryotes? In prokaryotes?													
Diagram and label the fluid mosaic model of the cell membrane.													
Summarize the six important functions of the cell membrane.	<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 												
Name the two prokaryotic kingdoms.													
Why are prokaryotes the most abundant organisms on earth?													

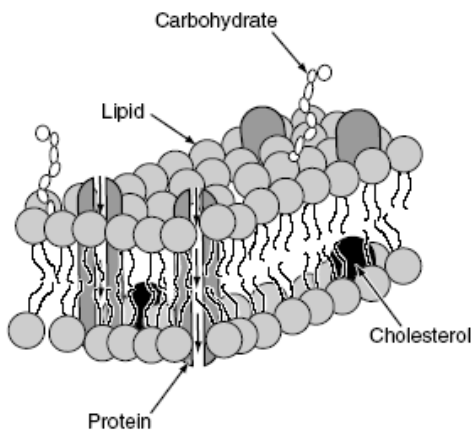
Distinguish between plant and animal cells.	
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Relate the following essential cell structures to their functions:	
nucleus	
ribosomes	
mitochondria	
chloroplast	
endoplasmic reticulum	
Golgi apparatus	
lysosomes	
cell wall	
Name the four eukaryotic kingdoms.	<ol style="list-style-type: none"> 1. 2. 3. 4.
Distinguish between viruses and cells.	
List the steps of the viral reproductive cycle. Name the cycle.	
What type of cells are produced by meiosis?	
How are the daughter cells produced by meiosis different from those produced by mitosis?	

<p>Why is sexual reproduction and meiosis advantageous?</p>	
<p>Diagram the different phases of the cell cycle labeling the parts of the cell that are pertinent.</p>	

PRACTICE QUESTIONS

35



← In the cell membrane model shown above, the molecules which move large molecules into and out of the cell are known as —

- A cholesterol
- B proteins
- C lipids
- D carbohydrates

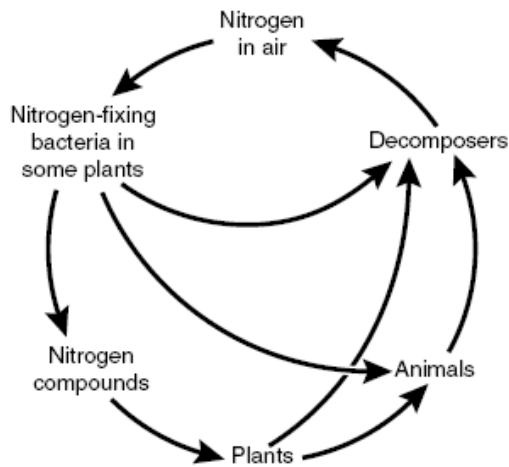
BIOLOGY SOL REVIEW GUIDE - Ecology

Define:	Carrying capacity – Density-dependent limits – Density – independent limits –
Compare and contrast biotic and abiotic factors.	Abiotic – Biotic –
Define symbiosis and using the (+), (-), and (0) symbols, identify the effects on each member for each of the three types of symbiosis.	Symbiosis – 1. 2. 3.
What is a dichotomous key?	
What is ecological succession?	
Differentiate between primary and secondary succession.	
What is the climax community in VA?	
Define:	Producer – Consumer – Decomposer –
What is a biogeochemical cycle? Name 4 cycles that we studied.	
Define and provide an example:	Autotroph – Heterotroph – Multicellular organisms – Unicellular organisms – Motile – Nonmotile –

	Aquatic – Terrestrial –
Using the Chesapeake Bay watershed, identify and describe the ecosystem including: <ul style="list-style-type: none"> • effects of biotic and abiotic conditions • evidence of human influences • energy flow and nutrient cycling • examples of interdependence • ecological succession 	

PRACTICE QUESTIONS:

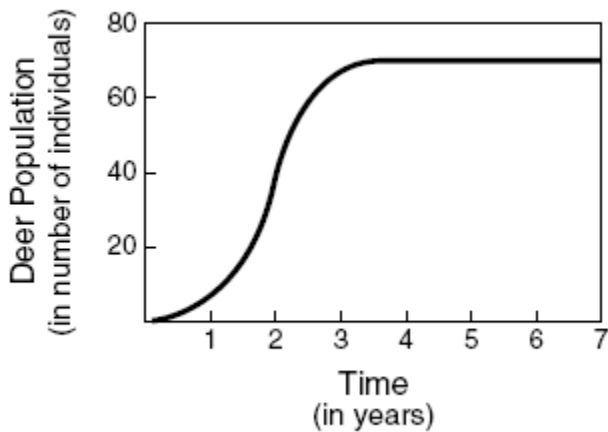
27



Which of these is a decomposer in a Virginia forest?

- A A pine tree
- B A mushroom
- C A dandelion
- D A caterpillar

48



In the graph above, what is the population of deer at the carrying capacity of the environment?

- F 10
- G 30
- H 50
- J 70

BIOLOGY SOL REVIEW GUIDE - GENETICS

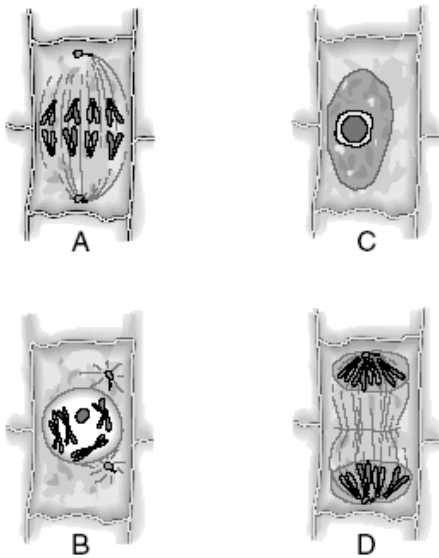
State Chargaff's Rule.	
What did Watson & Crick do?	
What did Franklin and Wilkins do?	
What is the monomer unit of DNA? (Name it and draw its parts.)	
What are the 4 types of bases found in DNA?	
What is the shape of DNA?	
Contrast genotype and phenotype.	Genotype – Phenotype –
What are the steps in DNA replication?	
Name each type of RNA and describe its function (3 types).	1. 2. 3.
Make a complementary mRNA strand to the following DNA sequence:	A T A C G G G C T A A T C C A T T A G A C
What base is found only in RNA? What DNA base does it replace?	
Define each process and identify where in the cell each happens.	Transcription – Translation –
Identify 4 types of DNA technology that we have today.	1. 2. 3. 4.
What are some benefits to genetic engineering?	
What is the Human Genome Project and why is it important?	

Define cloning.	
Identify Mendel's 3 laws of heredity.	<ol style="list-style-type: none"> 1. 2. 3.
Define (and give an example using the letter T).	Homozygous – Heterozygous –
Define and identify the situation in which each would be expressed in the phenotype.	Dominant allele – Recessive allele –
Identify the possible gametes that could be produced by the following parents. (Remember – make ALL combinations!)	AA – Aa – AaBB – AaBb – AABB –
Use a Punnet square to show the results of the following crosses:	Aa x Aa AA x aa AA x AA aa x aa
Why is genetic recombination (as produced by meiosis and sexual reproduction) so important to a species?	
Using the sequence of DNA listed below. Give an example of each type of mutation to that code listed on the right. A B C D E F G H	Insertion – Substitution – Deletion –

	Inversion –
Are mutations always <u>detrimental</u> ?	
When an entire chromosome is added or deleted, it is called a _____ error.	
Identify how each genetic disorder would look on a karyotype (example: extra ___ chromosome or missing the second ___ chromosome).	Turner's Syndrome – Down's Syndrome – Cri du Chat – Kleinfelter's Syndrome –
How does the karyotype for a normal male differ from the karyotype of a normal female?	

PRACTICE QUESTIONS

2



What is the correct sequence for plant cell mitosis?

- F A, B, D, C
- G C, B, A, D
- H B, A, D, C
- J D, C, B, A

42

		Second Base				
		U	C	A	G	
U		Phe	Ser	Tyr	Cys	U
		Phe	Ser	Tyr	Cys	C
		Leu	Ser	stop	stop	A
		Leu	Ser	stop	Trp	G
C		Leu	Pro	His	Arg	U
		Leu	Pro	His	Arg	C
		Leu	Pro	Gin	Arg	A
		Leu	Pro	Gin	Arg	G
A		Ile	Thr	Asn	Ser	U
		Ile	Thr	Asn	Ser	C
		Ile	Thr	Lys	Arg	A
		Met	Thr	Lys	Arg	G
G		Val	Ala	Asp	Gly	U
		Val	Ala	Asp	Gly	C
		Val	Ala	Glu	Gly	A
		Val	Ala	Glu	Gly	G

Genetic Code for Amino Acids

According to this table, a codon AGC is the code for which amino acid?

- F Cysteine (Cys)
- G Leucine (Leu)
- H Serine (Ser)
- J Tyrosine (Tyr)

42 The triplet code of bases for RNA may be represented by all of the following *except* —

- F CGT
- G CGA
- H CGG
- J CGU

7 The jimsonweed *Datura stramonium*, normally has 12 chromosomes in the body cells. How many chromosomes will an egg cell of the weed have?

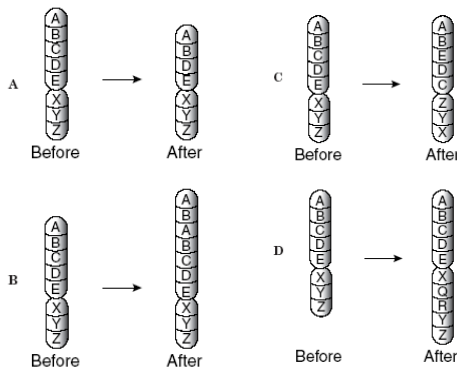
- A 6 chromosomes
- B 12 chromosomes
- C 18 chromosomes
- D 24 chromosomes

9 Which of the following would most likely change the current classification of two closely related flower species to a single species?

- A The discovery of a new, related species
- B An analysis of the DNA sequence of each species
- C An analysis of photosynthesis for each species
- D The collection of seeds from each species

15 The processes of meiosis and fertilization help ensure the survival of the species by providing each generation with the same number of —

- A body cells
- B chromosomes
- C offspring
- D gametes



13 Inversions in chromosomes occur when part of a chromosome breaks out and is reinserted upside down. Which of the diagrams below represents an inversion?

17

Amino-Acid Differences Compared with Human Hemoglobin

Species	Number of amino-acid differences
Lamprey	125
Frog	67
Dog	32
Macaque	8

The table indicates the number of amino acids that differ in the amino-acid sequence of the hemoglobin from selected organisms when compared to human hemoglobin. On the basis of this information, which organism would be classified as *most* closely related to humans?

- A Lamprey
- B Frog
- C Dog
- D Macaque

18 Scientists can use genetic information to identify people because it is unique to each person. Which specific characteristic is unique to an individual?

- F The shape of the DNA molecules in cells
- G The number of chromosomes in each cell
- H The sequence of DNA nucleotides in cells
- J The size of each chromosome in a cell

Biology SOL Review Guide - Life Functions

What process provides a vital connection between the sun and the energy needs of living things?	
Define metabolism.	
How are photosynthesis and cell respiration related?	
What is the initial source of energy for most communities?	
Which plant cell structures perform photosynthesis and cell respiration? (2 organelles)	Photosynthesis- Cell Respiration-
What is the name of the high energy molecule that is used in cells to store energy? (<i>Hint: product of cell respiration</i>)	
Write the equations for photosynthesis and cell respiration and identify the reactants and products for both.	
List at least 6 characteristics of all living things.	
Explain the purpose and functioning of the following human systems:	
• digestive	
• respiratory	
• circulatory	
• excretory	
• immune	
• nervous	
• endocrine	
• skeletal	
• integumentary	
State the germ theory of disease.	

PRACTICE QUESTIONS:

20 What structure is common to all five kingdoms of living organisms?

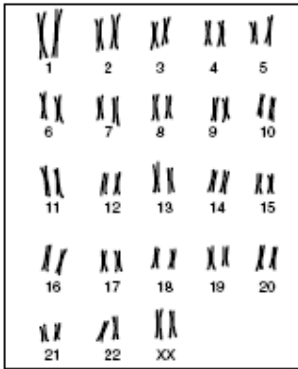
- F DNA
- G Nucleus
- H Cell wall
- J Mitochondria

34 Which is required by all living things?

- F Energy
- G Mobility
- H Oxygen
- J Carbon dioxide

22

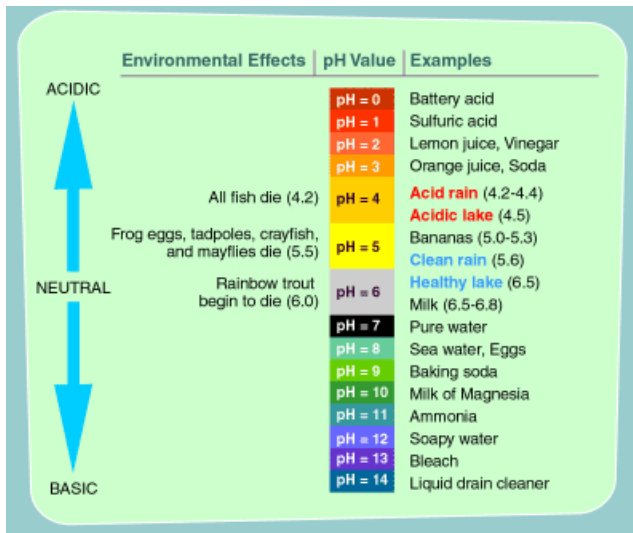
Human Karyotype



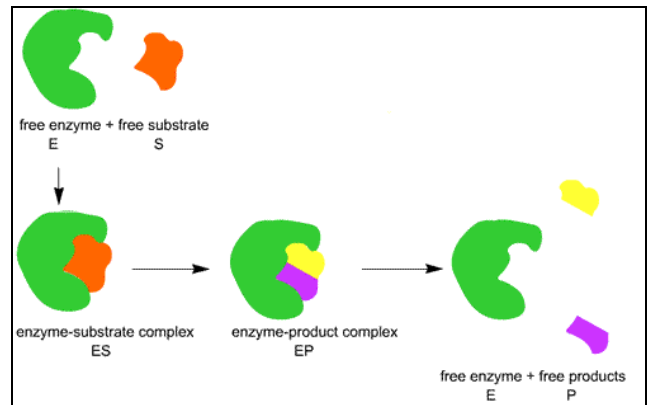
A chart of human chromosome pairs is called a karyotype. What information is revealed in the karyotype above?

- F The sex
- G The age
- H Trisomy
- J Gene dominance

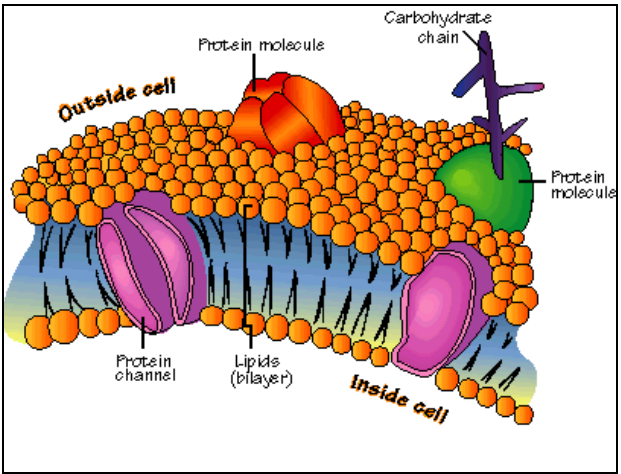
Biology Images and charts



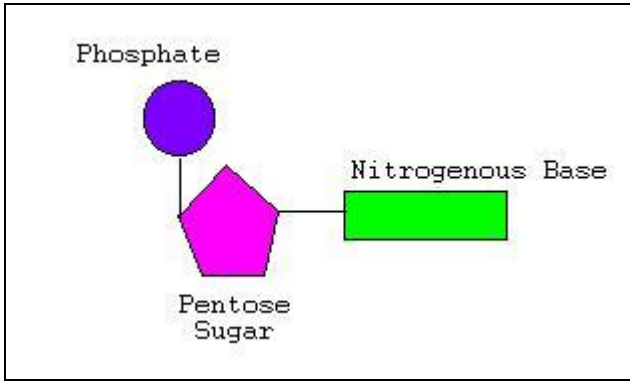
pH scale



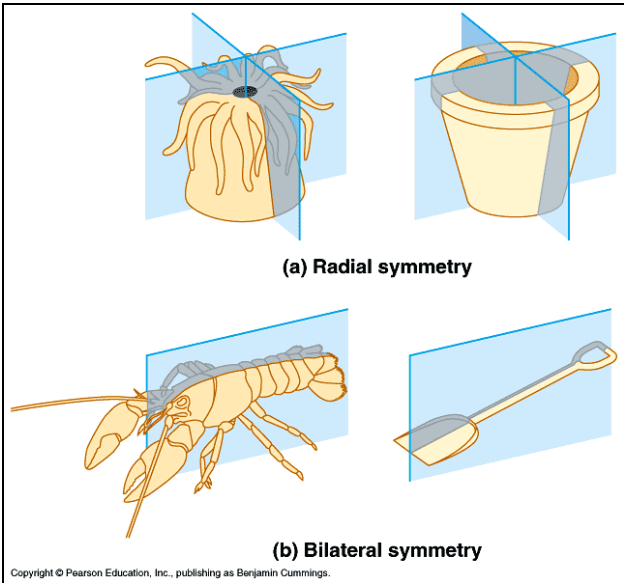
Enzyme-substrate model



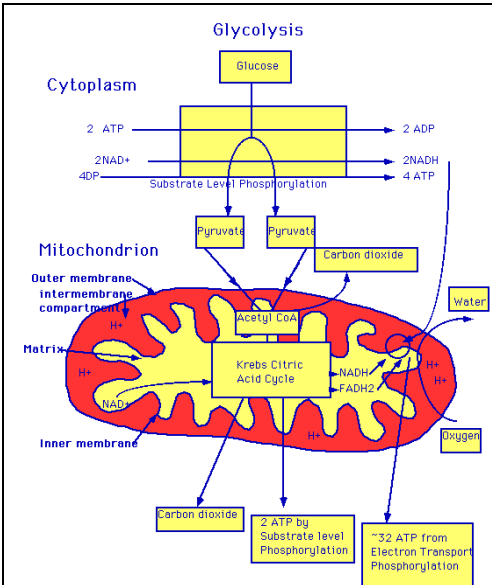
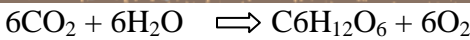
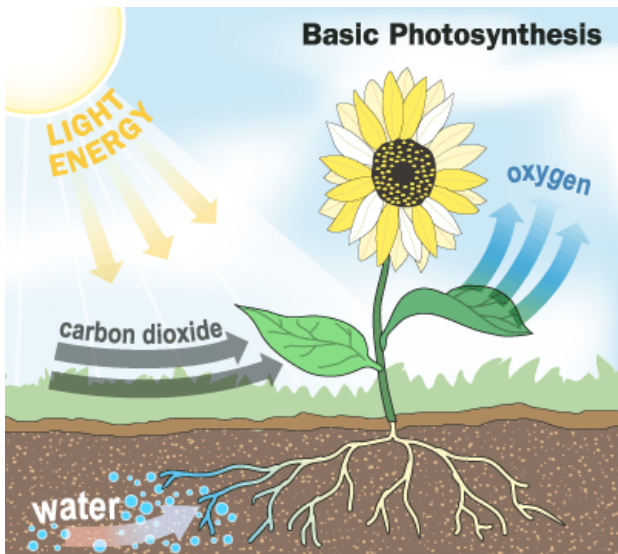
Cell membrane (fluid mosaic model)



nucleotide model



Body symmetry



Cellular Respiration

