

Name: _____ Period: _____ Date: _____

BIOLOGY SOL REVIEW SHEET

I. Scientific Investigation

A. Scientific Method

1. Steps of the scientific Method

- a) Make observations
- b) Conduct research
- c) Make a hypothesis
- d) Collect data (qualitative and quantitative)
- e) form a conclusion
- f) repeat experiment

2. data collection- act of gathering information about a system or environment using one or more of the five senses.
3. Inference- a conclusion based on prior knowledge or information.
4. Hypothesis - “educated guess” or predicted solution to a problem
5. Variables- factors that change and can be measured in the experiment.
6. Independent (manipulated) - the variable that you change on purpose.
7. Dependent - The variable that changes as a result of changing the I.V.
8. Control- A standard against which experimental results can be measured.
9. Constants- Things that are kept the same in the experiment.

B. Graphing

1. Each graph consists of a vertical axis that intersects a horizontal axis at the origin.
2. The independent variable is recorded on the horizontal or x-axis.
3. The dependent variable is recorded on the vertical or y-axis.

There are four types of relationships in a line graph

- a) Direct relationship- as the I.V. increases the D.V. increases.
- b) Inverse Relationship – as the IV increases the dependent variable decreases.
- c) Constant Relationship – as the IV increases, the dependent variable stays the same.
- d) Cyclical Relationship- as the IV increases, the DV increases up to a certain point, after which the dependent variable decreases.

II. Life at the Molecular Level

A. Water

1. Made up of 2 hydrogen atoms covalently bonded (bonds that share electrons) to 1 oxygen atom.
2. The water molecule has a slightly negative charge and a slightly positive charge, which creates a Polar structure.
3. Cohesion-the attraction between the positive end of one water molecule and the negative end of another water molecule.
4. Water has a high specific heat which means that it takes a lot of energy to increase its temperature.(Helps keep temp. in oceans stable and helps humans keep a normal constant body temp.)
5. Called the universal solvent because it can dissolve substances to be more easily transported throughout an organism.
6. Water molecules stick together. This property is called capillary action. (this help water move up a stem)
7. Water molecules also stick to other substances. This is called adhesion.

B. Macromolecules

1. Carbohydrates:

- a) Carbohydrates are organic (contain the element carbon)
- b) Carbohydrates produce and store energy throughout the body.
- c) monosaccharide- one sugar (Glucose)
- d) disaccharide- two sugars (sucrose, maltose, lactose)
- e) polysaccharide-many sugars (cellulose, starch, glycogen)

2. Lipids:

- a) Lipids are a large group of organic macromolecules that are insoluble (ex. Fats, oils, waxes)
- b) Lipids are made up of three fatty acids and one glycerol molecule.
- c) Most common types of fats are triglycerides, saturated fats, and unsaturated fats.

3. Proteins:

- a) Proteins are the key structural elements in living things such as cell membranes, skin, muscle, blood, feather, fins, and fur.
- b) Special proteins called enzymes help speed up chemical reactions.
- c) Made up of amino acids joined together by peptide bonds.
- d) dipeptide - 2 amino acids
- e) polypeptide- 3 or more amino acids

4. Nucleic Acids

- a) Nucleic Acids are made up of repeating units called nucleotides.
- b) A nucleotide consists of a 5-carbon sugar , phosphate group, and nitrogen base.
- c) Two types of nucleic acids are DNA and RNA.
 - (1) DNA - stores genetic information(hold the code)
 - (2) RNA - essential for protein synthesis.(carries the code)

5. Enzymes (a special group of protein)

- a) Enzymes DO
 - (1) increase the rate of reaction by lowering the reaction's activation energy
 - (2) form temporary enzyme substrate complexes (Active Site!)
 - (3) remain unaffected by the reaction
- b) Enzymes DON'T
 - (1) change in the reaction
 - (2) make reactions occur that would otherwise not occur at all
- c) What controls enzyme activity
 - (1) concentration of the enzyme
 - (2) temperature of the enzyme
 - (3) acidity of the cell

C. pH scale 0-14

- 1. 7 is neutral (most reactions occur at neutral)
- 2. below 7 is acid
- 3. above 7 is basic (or a base)

III. Photosynthesis and Cellular Respiration

A. Photosynthesis

SUN

1. What is the equation? $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
2. Chloroplasts are the sites for photosynthesis.
3. Variables that affect the rate of photosynthesis are
 - a) Light intensity
 - b) Carbon dioxide concentration
 - c) Temperature

B. Cellular respiration

1. What is the equation? $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{ATP}!!!$
2. Mitochondrion is the organelle, which is the site for cellular respiration.

IV. The Cell

A. Parts of the Cell theory

1. All Living Things are Composed of Cells
2. Cells are the Basic Units of Structure and Function
3. New Cells Are produced from existing cells

B. Development of the cell theory

1. Hooke- observed 1st cells from cork. Coined the term "cell"
2. Leuwenhoek- observed microscopic cells from pond water "animacules"
3. Schleiden- studied plant cells
4. Schwann- studied animal cells
5. Virchow- concluded that cells come from pre-existing cells.

C. Prokaryotic Cells – Lack a true nucleus and membrane bound organelles (ex. Bacteria) "Prokaryotes" (Kingdom Monera/Bacteria)

D. Eukaryotic cells – have a true nucleus and organelles (all other kingdoms)

E. Cellular Organelles

1. Nucleus -command center of the cell; DNA located here
2. Nucleolus- small organelle located inside the nucleus; helps make ribosomes
3. Ribosomes- small organelles in the cytoplasm; makes protein
4. Endoplasmic Reticulum- transportation system of the cell.
5. Golgi Apparatus- packaging and shipping center of the cell
6. Lysosomes- contains digestive enzymes to break down old cell parts and debris
7. Vacuole- storage tank of the cell
8. Mitochondria- power center of the cell
9. Chloroplast- organelle for photosynthesis; contains chlorophyll
10. Centrioles- assists in cell division (in animal cells)
11. Cytoplasm- medium inside cell which organelles are suspended.
12. Plasma or Cell Membrane- layer (membrane) that surrounds the cell.
13. Cell Wall- composed of cellulose in plants and chitin in fungi.

F. Plant vs. Animal Cells (how are they different?)

1. Plants have Cell Walls
2. Plants have chloroplasts (and a large vacuole)
3. Animal cells have centrioles

G. Cell Membrane (fluid-Mosaic Model)

1. Draw what the cell membrane looks like and label the parts.



H. Transport (about maintaining homeostasis!)

1. Passive Transport (does NOT require energy)

- a) it is also known as diffusion
- b) substances move from an area of high concentration to low concentration.
- c) facilitated diffusion is a unique type of passive transport in which a membrane (carrier) protein is used to shuttle ions and molecules across the membrane.
- d) Osmosis is the special term applied to the movement of water molecules across the cell membrane (as a result of diffusion), hypertonic (high), hypotonic (low), isotonic (equal)

2. Active Transport (requires energy)

- a) substances move from an area of low concentration to high concentration.
- b) Pinocytosis (cell drinking) In this process, vacuoles form at the surface of the cell membrane. They then suck in substances on the cell surface and transport them into the cell to be digested.
- c) Phagocytosis(cell eating) a process in which large food particles are engulfed by the cell and brought into the cell for intracellular digestion.

V. Cell Reproduction and Genetics

- A. **Cell Cycle/Mitosis** is a process in which somatic (body) cells make identical copies of themselves. Interphase (G_1 S G_2), Mitosis
- B. During this process two things occur
1. **Nucleus Divides (Mitosis/PMAT)**
 2. **Division of Cytoplasm (Cytokinesis)**
- C. Stages of mitosis
1. **Prophase** - chromosomes condense and become visible; nuclear membrane disappears; centrioles begin to move away from each other.
 2. **Metaphase**- chromosomes meet in the center of the cell
 3. **Anaphase** - sister chromatids of each chromosome separate at the centromere and slowly move to opposite poles.
 4. **Telophase** - nuclear membrane begins to form around each new set of chromosomes; cell tears in half forming two daughter cells.
- D. Types of Mitosis
1. **Binary Fission** - just like mitosis; bacteria replicate their chromosomes and divide into two identical daughter cells.
 2. **Budding** - process in which little buds sprout from the parent and eventually develop into a fully formed offspring. (ex. Yeast, hydra)
 3. **Sporulation** - organism produces spores that are released from the parent organism into the air.
- E. Meiosis:
1. **Meiosis** is a process by which sexually reproducing organisms maintain the same number of chromosomes from generation to generation.
 2. Chromosomes exist in pairs called **homologues**
 3. When a cell has a full complement of homologues, or homologous chromosomes, it is said to be **diploid**.
 4. Some cells possess only ONE set of chromosomes and they are called **haploid**.
 5. Almost all of the cells in the human body (somatic)are diploid with the exception of sex cells, or **gametes** which are haploid.

6. Meiosis is limited to sex cells in special sex organs called gonads. The gonads in males are the testes, and in females, they are the ovaries
7. Meiosis involves two rounds of cell division.
8. Since meiosis results in the formation of gametes, it is also known as gametogenesis.
9. When meiosis takes place in the male gonads, it results in the production of sperm cells. This is called spermatogenesis in which four sperm cells are produced from each parent cell.
10. In a female, an egg cell (ovum) is produced as the result of meiosis. This process is called oogenesis. This differs from meiosis in males in that only ONE ovum is produced. The other three cells, called polar bodies, will eventually disintegrate.

F. Mitosis vs. Meiosis

Different	Alike	Different

G. Genetics is the study of heredity.

1. **Mendel** is the father of genetics; studied offspring of pea plants.

2. **Genetics Vocabulary**

a) Each trait – an expressed characteristic – is produced by a pair of hereditary factors known as **genes**.

b) **Loci**- location of genes on a chromosome

c) A gene usually consists of a pair of hereditary factors called **alleles**.

d) An allele can be **dominant** or **recessive**.

e) The recessive trait is masked by the dominant trait

f) Symbols for alleles : ex. T or t

g) **Genotype** - genetic makeup

h) **Phenotype**- appearance

i) **homozygous**- same (pure) TT or tt

j) **heterozygous**- different (Tt) hybrid

k) The 1st generation is always called the **Parent** generation. The offspring of the P1 is called the filial or **F1** generation. Offspring of F1 is **F2**.

3. **Mendelian Genetics**

a) a **Monohybrid** cross constitutes a study of only one trait

b) a **Punnett Square** is nothing more than a table using letters to represent possible genotypes. (know how to do them!)

c) Law of **Independent Assortment** - says that each gene is inherited separately from others.

d) A **dihybrid** cross constitutes a study of two traits at the same time.

4. **Beyond Mendelian Genetics**

a) **Incomplete Dominance** - blending (red and white flowers produce pink flowers)

b) **Codominance**- see both traits (ex. AB blood type)

H. DNA Structure

1. DNA molecule is called a double helix or twisted ladder.
2. Watson and Crick first determined the double helix structure of DNA.
3. Each strand of DNA is made up of repeating subunits called nucleotides.
4. Each nucleotide consists of a 5-carbon sugar, phosphate group and nitrogen base.
5. The name of the five carbon sugar in DNA is deoxyribose.
6. A nucleotide in DNA can be attached to one of four bases: thymine, adenine, cytosine, or guanine.
 - a) Adenine binds with thymine “Apple Trees”
 - b) Guanine binds with cytosine “Go Carts”
 - c) This is called base pairing known as Chargoff’s base pairing rule.

I. DNA replication

1. DNA molecule unzips and joins with free nucleotides to make two DNA molecules

J. Proteins and the Genetic Code

1. DNA does not directly manufacture proteins, this job falls to an intermediate known as RNA. DNA holds the code, RNA carries the code
2. DNA to RNA to PROTEINS

K. Differences between DNA and RNA

1. sugar-deoxyribose in DNA, ribose in RNA
2. double helix to single helix
3. Uracil replaces thymine (U pairs with A)

L. Types of RNA

1. messenger RNA-mRNA
2. transfer RNA-tRNA
3. ribosomal RNA-rRNA

M. Transcription: Synthesis of mRNA

1. One strand of DNA acts as a template
2. mRNA is made in the nucleus of the cell then peels away from the DNA template
3. mRNA then moves to the ribosomes in the cytoplasm.

N. Translation: Protein Synthesis

1. mRNA carries the message of DNA in the form of codons which are groups of three bases.
2. mRNA finds a ribosome. This is where tRNA comes in. One end of the tRNA binds to an amino acid. The other end, called an anticodons has three nitrogenous bases that pair up with the bases contained in the codon.
3. Each amino acid is linked by a peptide bond to create your polypeptide (protein)

O. Mutation - a change in one or more of nucleotide bases (can occur from radiation or chemical agents)

1. may cause a change in base or may add/delete a base
2. Chromosomal mutation – change in number or structure of chromosomes.
3. Nondisjunction - chromosomes don't separate (ex Down's Syndrome extra chromosome in pair 21)
4. Translocation - chromosome pieces moved
5. Inverse - segment of chromosome inserted in reverse orientation.
6. deletion - segment of chromosome lost

P. How to Look for Genetic Defects

1. Chorionic villi sampling - look at chemical in blood / urine
2. Amniocentesis - amniotic fluid taken from womb to look at fetal cells.
3. Karyotyping- paired chromosomes arranged based on shape and size.

Q. Genetic Disorders

1. PKU - body unable to metabolize phenylalanine
2. Sickle Cell Anemia - red blood cells abnormally shaped. (malaria resistance)
3. Tay Sachs - nervous system malfunctions due to accumulation of fat in brain.

R. Genetic Engineering - building recombinant DNA (DNA constructed from the DNA of different organisms , DNA Fingerprinting and Electrophoresis

VI. Taxonomy / Ecology

A. Seven Levels of Classification

1. Kingdom most diverse
2. Phylum
3. Class
4. Order
5. Family
6. Genus
7. species most specific

B. In order to accurately classify organisms, biologists must be able to look at homologous/ structures (ex. Wing of bat, arm or human, flippers of whale)

C. Monera (Archaeobacteria/Eubacteria) - Prokaryotic, single celled, both A and H

D. Protista - Eukaryotic (protozoa, algae, slime molds) most unicellular some multi. Both A and H

E. Fungi- eukaryotic, heterotrophic, cell wall of chitin

F. Plantae - ALL multicellular, autotrophic, cell wall of cellulose

G. Animalia - ALL multicellular, heterotrophic, lack cell wall

H. Classification of Invertebrates (Give the Correct Phylum)

1. **Porifera** two layers of cells with pores (sponge)
2. **Cnidaria (Coelenterates)** two layers of cells, hollow digestive cavity with tentacles (jellyfish, hydra)
3. **Platyhelminthes** three layers of cells; flat; bilateral symmetry (tapeworm, planaria, fluke)
4. **Nematoda** digestive system with mouth and anus; round (hookworm)
5. **Annelida** long, segmented body, digestive system, closed circulatory system (earthworm)
6. **Molluska** soft body, hard shell (clam, snail) Squid
7. **Arthropoda** segmented body; jointed legs; exoskeleton
8. **Echinoderms** spiny skinned; complete digestive system (starfish, sea urchin)

I. Classification of Arthropods (Name the 5 Classes)

1. **Crustacean** gills, jointed legs (crab, lobster)
2. **Insecta** 3 body parts, one pair antennae, 6 legs, spiracles
3. **Arachnida** 2 body parts; 8 legs
4. **Chilopoda** one pair of legs per segment/**Centipedes**
5. **Diplopoda** two pairs of legs per segment

J. Classification of Vertebrates (Give the Correct Class)

1. **Agnatha** jawless fishes
2. **Chondrichthyes** fishes with skeleton of cartilage (Sharks)
3. **Osteichthyes** fishes with skeleton of bone
4. **Amphibians** Breath through gills, lungs, moist skin, 3 chambered heart.
5. **Reptilia** cold-blooded, scales, 3 chambered heart
6. **Aves/Birds** warm-blooded, wings, 4 chambered heart
7. **Mammalia** warm-blooded, hair, milk to feed young.

K. Classification of Plants

1. Bryophytes no true roots, stems, and leaves
2. Tracheophytes true roots, stems, and leaves. (contain vascular system)

a) **Gymnosperms (naked seeds),**

b) **Angiosperms (flowering/Fruits)**

Naming Organisms:

3. Always use the genus species (Binomial nomenclature)
4. Example: humans are called Homo sapiens
 - a) Capitalized- genus (look for this to be the same in related species)
 - b) Lower case- species

- L. Fossil Evidence provide the most direct evidence that evolution has occurred (ex. Bones, shells, footprints)

VII. Evolution

- A. Gradualism - Darwin model which suggests that evolution is a slow, gradual and continuous process.
- B. Punctuated Equilibrium - long periods of no physical change followed by short periods of abrupt change.
- C. Speciation - process by which genetically distinct species arise as a result of accumulation of adaptations over time.
- D. Species - population of organisms that can interbreed and have fertile offspring
- E. Evidence for Evolution
 1. Fossils
 2. Geographic Distribution
 3. Embryology (early development)
 4. Homologous Structures
 5. Molecular Similarities
 - A. DNA
 - B. Proteins
- F. Darwin's Ideas
 1. Variation exists in living things
 2. Organisms produce more offspring than can survive

3. **Competition “Struggle for Existence”**
4. **Survival of the Fittest (best adapted survive and reproduce)**
5. **Descent with Modification**
6. **Common descent**

G. Ecology

1. **Ecology** - the study of organisms and their interactions with the environment.
2. **Ecology Vocabulary**
 - a) **Population** - group of organisms of the same species that live together in a particular location.
 - b) **Community** - all of the populations living together in a specific location
 - c) **Ecosystem**- the community of organisms in an area, as well as the nonliving factors of the environment.
 - d) **Biosphere** - all the living and non-living portions of the earth that sustain life.
 - e) **Abiotic** - non-living factors
 - f) **Biotic**- living factors
 - g) **Autotrophs (producers)** - produce own food (photosynthesis)
 - h) **Heterotrophs (consumers)** - get food from other organisms
 - (1) **Herbivores** - plant eaters
 - (2) **Carnivores** - meat eaters
 - (3) **Predators** - hunt for food

 - (4) ***Scavengers*** - eat animals that are already dead
 - (5) **Omnivores** - eat both plants and animals
 - i) **Symbiosis** - two organisms living together with close nutritional relationship
 - (1) **Commensalism** - one organism benefits, one unaffected (shark/remora)
 - (2) **Mutualism**- both organisms benefit (lichen)
 - (3) **Parasitism** - one organism benefits one is harmed (flea/cat)

VIII. Human Body (organs- function) (in book on pages 892-893)

A. Skeletal

B. Muscular

C. Integumentary

D. Digestive

E. Circulatory

F. Endocrine

G. Nervous

H. Immune

I. Urinary

J. Respiratory

IX. Major Scientists

A. Pasteur

B. Leeuwenhoek

C. Redi

D. Hooke

E. Virchow

F. Schleiden

G. Schwann

H. Hershey & Chase

I. Waston & Crick

J. Griffith

K. Chargraff

L. Darwin

M. Linnaeus

N. Lamarck

O. Mendel

X. Suffix Prefix Terms

Di-

Tri-

Poly-

Cyto-

-Saccaride

Bi-

Mono-

Hyper-

Epi-

phyta

Syn-

-plasm

Exo-

Photo-

-ase

Chloro-

-ology

Hemo-

Homo-

Hetero-

Pro-

Eu-

Bio-

Hypo-

Auto-

Anti-

Iso-

Endo-

Mycota-

Archae-

Phage-

Gastro