# **Biology Final Exam REVIEW ANSWERS** 2015

**Biology Final Review:** Use this as a guide to assist you in preparing for the final. This is just an outline, and questions on the final reflect these concepts but are NOT limited to just this material. Review your notes, classwork, and quizzes/tests from throughout the year. If you need help studying, I will be staying after Monday-Friday. Please sign up on the whiteboard.

# 1. Scientific Method and Tools

- a. List and understand the steps of the scientific method
- b. Identify each of the scientific method steps given a scenario
- c. Know the difference between an experimental and control group
- d. Know the difference between the dependent and independent variables
- e. Know the difference between a hypothesis and theory
- f. Know the difference between qualitative and quantitative data
- g. Convert between metric system units of measure
- Explain the controls and variables (dependent and independent) in scientific experimentation.
  - Why must you have a control? to compare the experimental results against
  - What is meant by the dependent Variable? the variable that is measured as the result of changing the independent variable
    - On which axis would you graph the dependent variable? y-axis
  - What is meant by the independent Variable? the variable being tested/ changed
    - On which axis would you graph the independent variable? x-axis
  - If you were measuring the growth rate of plants under full sunlight for 8 hours a day versus plants that only have 4 hours of full sunlight per day, what would be the dependent and what would be the independent variable?

Dependent variable amount of sunlight (hours per day) Independent variable growth rate

# 2. Characteristic of living organisms

- a. Describe the characteristics of life
- b. Define homeostasis and suggest examples of how the body maintains this (i.e. temperature, sugar levels, fluid concentrations)
- c. Identify the smallest unit of life
- Biology is the study of \_\_\_\_\_.
  - a. minerals
  - b. weather
  - <mark>c. life</mark>
  - d. energy transformations
- Define homeostasis: regulating/responding to changes so that internal conditions remain constant (ex: sweating or panting when hot to cool down)
  - If you are sick and have fever, how will your body respond to maintain homeostasis?

Sweating to cool down

## 3. Chemistry

- a. Identify the particles that make up an atom (charges, location)
- b. Summarize the role of electron (gain/loss to form ions) in bonding
- c. Compare and contrast ionic vs. covalent compounds
- d. Explain why carbon is such an important element for living things
- e. Define organic chemistry
- f. Compare and contrast the role, properties, and monomers of carbohydrates, lipids, proteins, and nucleic acids
- g. Describe enzymes (function, structure)
- Atomic number is determined by the number of \_\_\_\_\_ in an atom.
  - a. electrons
  - b. neutrons
  - <mark>c. protons</mark>
  - d. both A and C
- Which subatomic particles are located in the nucleus?
  - a. protons, electrons
  - b. protons, neutrons
  - c. neutrons, electrons
  - d. only electrons
- A negative ion results when an atom \_\_\_\_\_.
  - a. gains protons
  - b. loses protons
  - c. gains electrons
  - d. loses electrons
- Organic compounds all contain which element?
  - a. carbon
  - b. hydrogen
  - c. oxygen
  - d. nitrogen
- Which of the following is <u>NOT</u> an organic macromolecule?
  - a. carbohydrate
  - b. lipid
  - c. ribosome
  - d. nucleic acid
- The subunits of proteins are \_\_\_\_\_; and \_\_\_\_\_ are the subunits of fats.
  - a. amino acids, fatty acids
  - b. amino acids, monosaccharide
  - c. nucleic acids, monosaccharide
  - d. nucleic acids, fatty acids
- The monomers of nucleic acid molecules are \_\_\_\_\_.
  - a. amino acids
  - b. DNA and RNA molecules
  - c. nucleotides
  - d. polysaccharides

- Enzymes act as biological \_
  - a. active sites
  - <mark>b. catalysts</mark>
  - c. inhibitors
  - d. substrates
- The part of the enzyme molecule into which the substrate fits is called the
  - a. active site
  - b. coenzyme
  - c. polypeptide
  - d. protease
- Describe the structure and function of the major organic molecules found in living organisms:

	Function	Monomer	Examples
Carbohydrates	To store energy     Brovide structurel support	simple sugars/	bread,
		monosacchande	pasta, sugar
Proteins	<ul> <li>To transport substances</li> <li>To speed up reactions (enzymes)</li> <li>To provide structure support</li> <li>To produce hormones</li> </ul>	amino acids	hemoglobin, enzymes
Lipids	<ul> <li>To store energy</li> <li>To provide structural barriers (cell membrane)</li> </ul>	fatty acids	fats, waxes, oils
Nucleic Acids	<ul> <li>To store and communicate genetic information</li> </ul>	nucleotides	DNA, RNA

- Describe the relationship between an ENZYME and its substrate molecule(s)
  - Define substrate and describe the structure of the enzyme and substrate.

The substrate is the reactant that an enzyme binds to

- An enzyme is what type of organic molecule? Protein
- Describe DENATURATION. Above certain pH and temperature, an enzyme becomes inactive and no longer functions
- Identify 3 factors that can denature enzymes temperature, pH, salinity
- Draw an ENZYME and SUBSTRATE. Label the ENZYME, ACTIVE SITE, & SUBSTRATE.
   The enzyme and substrate bind in a "lock and key" model



# 4. Cell Structure and Functions

- a. Be familiar with cell theory
- b. Compare and contrast prokaryotes and eukaryotes
- c. Compare and contrast animal and plant cells
- d. Know the basic functions and structure of each of the cell organelles (golgi apparatus, endoplasmic reticulum, nuclear envelope, nucleus, mitochondria, chloroplasts, lysosomes, ribosomes)
- Which organelle in a cell produces digestive enzymes?
  - a. mitochondria
  - b. endoplasmic reticulum
  - c. golgi apparatus
  - <mark>d. lysosome</mark>
- Which organelle is involved in the synthesis of proteins within the cell?
  - a. golgi apparatus
  - <mark>b. ribosomes</mark>
  - c. rough Endoplasmic Reticulum
  - d. vacuoles
- Which organelles in plant cells have green pigment and convert energy?
  - a. chloroplasts
  - b. plastids
  - c. mitochondria
  - d. central vacuole
- The organelle is responsible for exporting materials from the cell is \_\_\_\_\_\_.
  - a. endoplasmic reticulum
  - b. lysosomes
  - c. golgi apparatus
  - d. nucleolus
- The smallest units of life in all living things are \_\_\_\_\_.
  - <mark>a. cells</mark>
  - b. cytoplasm
  - c. tissues
  - d. golgi apparatus.
- Cell theory states all of the following, except \_\_\_\_\_.
  - a. all organisms are composed of one or more cells
    - b. the basic unit of life is the cell
    - c. all cells arise from pre-existing cells
    - d. cells can neither be created or destroyed
- A cell that consumes large amounts of energy may contain many \_\_\_\_\_\_.
  - a. chromosomes
  - b. mitochondria
  - c. vacuoles
  - d. cell walls

- Compare and contrast prokaryotes and eukaryotes.
  - Define prokaryote and give an example. A cell that lacks membrane bound organelles. Example: bacteria
  - Define eukaryotes and give an example. A cell that contains membrane bound organelles. Example: animals, plants, fungi.
- Compare and contrast the structures of an animal cell to a plant cell.
  - Describe the shape of animal cells. Animal cells are rounded and plant cells are typically more square- shaped
  - What organelles are present in animal cells but not plant cells? Lysosomes, centrioles, cilia
  - Describe the shape of plant cells. square
  - What organelles are present in plant cells but not animal cells? chloroplasts, a large central vacuole
- Compare and contrast the functions of *autotrophs* and *heterotrophs*.
  - Define autotrophs and list an example. Organisms that produce their own food directly from sunlight. example: plants
  - Define heterotrophs and list an example. Organisms that must consume other organisms (food) for energy. example: animals

## 5. Cell Transport

- a. Describe the types of passive diffusion and describe concentration gradients and energy.
- b. Describe osmosis
- c. Determine the direction of particles/water may move in different environments (hypo/hyper/isotonic solutions)
- d. Compare and contrast passive and active transport
- e. Describe the hydrophobic/hydrophilic structure of the cell membrane
- Phospholipids in the cell membrane are central to determining what enters the cell because...
  - a. they have hydrophilic regions.
  - b. they have hydrophic regions.
  - c. they are triglycerides.
  - d. both A and B.
- When placed in a hypotonic solution, a cell will
  - a. diffuse.
  - b. shrink.
  - c. <mark>swell</mark>.
  - d. stay the same.

- Relate the function of the plasma (cell) membrane to its structure.
  - Describe the structure of the plasma membrane. The cell membrane is composed primarily of phospholipids. They are arranged by hydrophobic tails (facing inward) and hydrophilic heads (facing outward). The heads are hydrophilic and the tails are hydrophobic. Hydrophobic means water fearing and hydrophilic means water loving.
  - Sketch and label a section of the cell membrane.



- Describe 3 functions of the plasma membrane.
  - Selective permeability controls movement in/out of the cell
  - Cell communication
  - Cell recognition
- Compare and contrast active transport and passive transport mechanisms:
   Define diffusion. Is it active or passive transport?

DIFFUSION – a form of active transport where molecules diffuse directly through the cell membrane. Molecules move high to low concentration (down the concentration gradient) and does not require energy.

Passive transport: moves molecules across the cell membrane from HIGH to LOW concentration and doesn't require energy

- Define osmosis. Is it active or passive transport?
   OSMOSIS the diffusion of WATER
- Define facilitated diffusion. Is it active or passive transport? Simple diffusion does NOT need a carrier protein, and facilitated diffusion does need a carrier protein. Both types of diffusion are still Passive Transport (high to low concentration and do NOT require Energy).
- Define endocytosis. Is it active or passive transport? Endocytosis- Transporting particles INTO the cell.
- Define exocytosis. Is it active or passive transport? Exocytosis- Transporting particles OUT (exit) of the cell
- Define phagocytosis. Is it active or passive transport? it's a form of endocytosis meaning "cell eating"
- Define pinocytosis. Is it active or passive transport? it's a form of endocytosis meaning "cell drinking"

# 6. Cellular Reproduction

- a. Compare and contrast mitosis and meiosis. Understand the process and sequence of the phases in both cell cycles.
- b. Identify the end products of mitosis and meiosis
- c. Describe diploid vs. haploid numbers in the cell
- Meiosis results in
  - a. 2 haploid daughter cells
  - b. 2 diploid daughter cells
  - c. 4 haploid daughter cells
  - d. 4 diploid daughter cells
- A cell with 10 chromosomes undergoes mitosis. How many daughter cells are created? \_\_\_\_\_ Each daughter cell has \_\_\_\_ chromosomes.
  - a. 2, 10
  - b. 10, 2
  - c. 1, 10
  - d. 2, 20
- The typical human cell contains 46 chromosomes, after mitosis and cytokinesis, each of the two new cells formed from the original cell:
  - a. Has 23 chromosomes
  - b. Grows new chromosomes from existing DNA
  - c. Has a complete set of 46 chromosomes
  - d. None of the choices are correct
- Mitosis is a process by which
  - a. DNA is replicated
  - b. cells grow in size
  - c. a cell's nucleus divides
  - d. Cytokinesis occurs
- Which of the following cells undergo meiosis?
  - a. sperm cells
  - b. liver cells
  - c. unicellular organisms
  - d. all of the above
- If 2n=8, what is the number of chromosomes in the egg cell after meiosis?
  - a. 2
  - <mark>b. 4</mark>
  - c. 8
  - d. 16
- Meiosis is a type of cell division that produces \_\_\_\_\_.
  - a. zygotes
  - b. chromosomes
  - c. DNA
  - d. Gametes

- Describe the main events in the cell cycle:
   What happens to a cell during interphase? Cell growth and DNA replicates
  - Define mitosis. division of the nucleus to form two new identical cells
  - Define Cytokinesis. division of the cytoplasm
- List in order and describe the stages of *mitosis:* Describe what happens during Prophase.
   chromosomes condense; nuclear membrane disintergrates

Describe what happens during Metaphase.
 chromosomes move by spindle fibers and line up at the middle (equator) of the cell

Describe what happens during Anaphase.
 chromosomes separate to opposite poles of the cell

Describe what happens during Telophase.
 chromosomes reach poles of the cell and nuclear envelope reforms

- Analyze the meiotic maintenance of a constant *chromosome* number from one generation to the next by identifying the number of chromosomes: haploid or diploid
  - Parent chromosome number? diploid
  - Gamete (egg & sperm) chromosome number? haploid
  - Offspring chromosome number? egg + sperm combining = diploid
  - What process --- mitosis or meiosis --- reduces the chromosome number?

#### **7. DNA**

- a. Recognize the structure of DNA (sugar, nitrogen base, phosphate group)
- b. Identify complementary base pairings
- c. Explain transcription and translation
- d. Compare and contrast DNA and RNA
- Which of the following is NOT a component of nucleotides?
  - <mark>a. amino acid</mark>
  - b. nitrogenous base
  - c. phosphate
  - d. sugar

- DNA bases always pairs with a complementary base:
  - a. Adenine: Cytosine, Guanine: Thymine
  - b. Adenine: Thymine, Cytosine: Guanine
  - c. Adenine: Uracil, Cytosine: Guanine
  - d. Adenine: Guanine, Cytosine: Thymine
- Model the components of a DNA nucleotide and an RNA nucleotide.
  - SKETCH and LABEL a DNA nucleotide.



- What 3 components make up an RNA nucleotide?
   Ribose sugar, phosphate group, nitrogenous base
- Describe the Watson-Crick *double helix model* of *DNA*, using the *base-pairing rule* (adenine-thymine, cytosine-guanine).
  - What 2 components form the sides of the DNA structure? Sugar and phosphate
  - Name the type bonds that join the DNA bases. Weak hydrogen bonds

• Compare and contrast the structure and function of DNA and RNA.

	DNA	RNA
SHAPE?	Double helix	Single stranded
BASES?	A, T, G, C	A, U, G, C
SUGAR?	Deoxyribose	Ribose
LOCATED WHERE IN CELL?	Nucleus	Nucleus →
		cytoplasm/ ribosomes
FUNCTION?	Codes for proteins	Codes for proteins

#### • Describe and model the processes of replication, *transcription*, and *translation*.

	REPLICATION	TRANSCRIPTION	TRANSLATION
PURPOSE	To make a complementary copy of the DNA strands	To copy DNA into mRNA	To decode mRNA into a protein
	DNA	DNA	RNA
LOCATION WHERE PROCESS OCCURS?	Nucleuc	Nucleus	Cytoplasm/ ribosomes

## 8. Genetics

- a. Recognize who is the "father of modern genetics"
- b. Predict the probabilities of offspring using a Punnett square for monohybrid crosses
- c. Recognize genetic vocabulary: homozygous, heterozygous, phenotype, genotype
- d. Identify recessive versus dominant genes
- e. Explain genetic mutations

An individual with two of the same allele is said to be \_\_\_\_\_\_.

- a. heterozygous
- <mark>b. homozygous</mark>
- c. homologous
- d. dizygous
- Two alleles for a trait are tall (S) and short (s). Tall is dominant. How would the genotype of a heterozygous individual be written?
  - a. ss
  - b. SS
  - <mark>c. Ss</mark>
  - d. tall
- Phenotype refers to \_\_\_\_\_.
  - a. genetic makeup
  - b. genetic mutations
  - c. physical appearance
  - d. recessive alleles
- Two alleles of a trait are broad and narrow. Broad is dominant. How would the phenotype of a homozygous dominant individual be expressed?
  - <mark>a. BB</mark>
  - b. Bb
  - c. broad
  - d. narrow
- In pea plants, height is determined by a single gene, with tall being dominant. If two heterozygous plants are cross, what proportion of the offspring will be homozygous dominant?
  - a. 1/4
  - b. 1/2
  - c. 3/4
  - d. none
- When a homozygous recessive organism is crossed with a heterozygous dominant organism, what percent of the progeny will be heterozygous?
  - a. 25%
  - b. 50%
  - c. 75%
  - <mark>d. 100%</mark>

- Summarize the outcomes of Gregor Mendel's experimental procedures.
   Who is Gregor Mendel? Father of genetics. He studied pea plants.
- Differentiate among the laws and principles of inheritance:
  - State the Law of Dominance. The dominant allele will be physically expressed
  - State the law of Segregation. two alleles for each trait separate during meiosis
  - State the Law of independent assortment. Genes on separate chromosomes sort independently during gamete formation so there is a random distribution of alleles
- Apply the *laws* of probability and *Punnett squares* to predict *genotypic* and *phenotypic ratios*. *Predict the genotypic and phenotypic ratios for the following crosses:* PEA COLOR --- GREEN is dominant and YELLOW is recessive.
  - homozygous dominant x homozygous recessive

<mark>GG x gg</mark> Genotype: 100% Gg Phenotype:100% Green

heterozygous x heterozygous

Gg x Gg Genotype: 25% GG, 50% Gg, 25%gg Phenotype: 75% Green, 25% yellow

homozygous dominant x heterozygous

<mark>GG x Gg</mark> Genotype: 50% GG, 50% Gg Phenotype: 100% green

#### 9. Evolution

- a. Explain how Darwin's journey lead him to his theory of natural selection
- b. List and explain the evidence for evolution
- c. Identify examples of adaptations in response to the environment
- d. Genetic variations within a population
- Darwin's theory of evolution was that:
  - a. species changed over a period of time and never competed with each other
  - b. animals changes but plants remained the same
  - c. giraffes and peppered moth changed constantly
  - d. species changed over time by natural selection

- According to Darwin, evolution occurs by:
  - a. chance
  - b. rapidly
  - c. natural selection
  - d. half-life periods
- Evidence for evolution included all of the following except:
  - a. punctuated sedimentation
  - b. similarities and differences in protein and DNA sequence between organisms
  - c. the fossil record
  - d. homologous structures
- Natural selection could not happen without:
  - a. genetic differences in species
  - b. changes in the environment
  - c. the formation of fossil
  - d. changes in the occurrence of certain trait in a species population
- Compare and contrast Lamarck's explanation of *evolution* with Darwin's *theory* of *evolution* by *natural selection* 
  - According to Lamarck, why do giraffes have long necks? Change occurred during the giraffes' lifetime to reach higher branches
  - Was Lamarck's theory correct? He realized that organisms responded/adapted to their environemtn; but he was incorrect that this change occurred only in a lifetime
  - Explain Darwin's Theory of Evolution by Natural Selection. Darwin realized that species adapt to their environments through natural selection over many generation
  - According to Darwin, why do giraffes have long necks? The taller giraffes are more "fit" to their environment in competing for food, so this species has greater reproductive success, and eventually (after a very long time) the majority of giraffes have taller necks because the short neck giraffe are less fit and would be less likely to survive and reproduce
- Evaluate the evidence that supports the theory of *evolution*:
  - How does the fossil record help us determine the evolution of organisms?
     Provides anatomical evidence to compare living and nonliving species in analyzing similarities and evolutionary changes in bone structure
  - Today, scientists use DNA analysis or molecular biology in studying evolution. Explain how this is evidence of evolution. All organisms contain the same elements and the same genetic coding, indicating a very early common ancestor
  - How can comparative anatomy show that organisms are related? In analyzing homologous and vestigial structures that show how two different species have similar bone structures based on a common ancestor
  - How can embryology (early development) show that organisms are related?
     Embryos of different species look similar because they develop very similarly

## 10. Bacteria & Viruses

- a. Compare and contrast the main difference between bacteria and viruses
- b. Explain the causes and concerns of antibiotic resistant bacteria
- c. Describe how antibiotic resistance bacteria are an example of natural selection
- Compare and contrast the structures and characteristics of *viruses* with non-living and living things. A virus is nonliving and needs a host to live and the virus takes over the host's DNA.
- Evaluate the medical importance of viruses. Viruses can cause diseases (ex: STDs, flu).
- Classify bacteria according to their characteristics and adaptations. Bacteria are living and can live independent of a host.
- Evaluate the benefits and harms if *bacteria*.
  - benefits of bacteria? Bacteria exist in normal levels in the body; food (cheese, yogurt), and medicines
  - harms of bacteria? Bacteria can lead to disease
- How does the use of antibiotics and pesticides cause resistance in insects and bacteria? Overuse of antibiotics can lead to antibiotic resistance via "survival of the fittest." Bacteria that are naturally resistant to antibiotics are "fittest" and therefore survive and continually reproduce. The quick reproduction cycles of bacteria lead to resistance.

### 11. Classification

- a. Identify the order of taxonomy in classifying organisms: KPCOFGS
- b. Identify binomial nomenclatures for scientific naming
- c. Identify between an individual, population, and species
- d. Compare and contrast characteristics of the kingdoms
- All members of which of the following group has the most characteristics in common?
  - a. Class
  - b. Order
  - c. Family
  - <mark>d. Genus</mark>
  - e. Phylum

- Differentiate among the different domains:
  - Describe the domain Bacteria? Prokaryotic, single celled, can be autotrophic or heterotrophic; typically asexual reproduction
    - Are they prokaryotes or eukaryotes?
  - Describe the domain Archaea. Prokaryotes that live in extreme environments
    - Name 3 types of organisms in the domain Archaea. Methanogens, halophiles, thermophiles
    - Are they prokaryotes or eukaryotes?
  - Describe the domain Eukarya.
    - List the 4 kingdoms in the domain Eukarya. Plantae, animalia, fungi, protista
    - Describe 3 examples of the domain Eukarya. cat, rabbit, dog, apple tree, mushroom, algae
    - Are they prokaryotes or eukaryotes?
- Identify the seven major taxonomic categories. (list them in order from broadest to most specific.)

KINGDOM	PHYLUM	CLASS	ORDER	FAMILY	GENUS	SPECIES
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• Differentiate the characteristics of the six kingdoms:

	Kingdom	General characteristics	Cell wall	Representative organisms
the second	1. Eubacteria	<ul> <li>simple organisms lacking nuclei (prokaryotic)</li> <li>either heterotrophs or autotrophs</li> <li>all can reproduce asexually</li> <li>live nearly everywhere</li> </ul>	often present (contains peptidoglycan)	bacteria, cyan <sub>0</sub> bacteria
** <sup>*</sup> *:	2. Archaebacteria	<ul> <li>prokaryotic</li> <li>heterotrophs</li> <li>live in salt lakes, hot springs, animal guts</li> </ul>	present (does not contain peptidoglycan)	methanogens, extreme thermophiles, extreme halophiles
	3. Protista	<ul> <li>most are single celled; some are multicellular organisms; some are eukaryotic</li> <li>some are autotrophs, some heterotrophs, some both</li> <li>reproduce sexually and asexually</li> <li>live in aquatic or moist habitats</li> </ul>	absent	algae, protozoa
	4. Fungi	<ul> <li>most are multicellular</li> <li>all are heterotrophs</li> <li>reproduce sexually and asexually</li> <li>most are terrestrial</li> </ul>	present	mushrooms, yeasts, bread moulds
	5. Plantae	<ul> <li>all are multicellular</li> <li>all are autotrophs</li> <li>reproduce sexually and asexually</li> <li>most are terrestrial</li> </ul>	present	mosses, fems, conifers, flowering plants
	6. Animalia	<ul> <li>all are multicellular</li> <li>all are heterotrophs</li> <li>most reproduce sexually</li> <li>live in terrestrial and aquatic habitats</li> </ul>	absent	sponges, worms, lobsters, starfish, humans

Table 2: A Six-Kingdom System of Classification