Hanover Central High School

Biology

***Final Exam Topic List—1st Semester***

***General Information:*** The final exam will be given on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It will consist

of 100+ multiple choice or matching questions, on topics from Chapters 1-5, 13-16. \* Note that this review packet does not contain questions/topics for Chapters 5. You have just tested on this material and can use your recent study guides for this section. Questions will require students to ***know and apply*** ***information*** about the topics listed below. Some questions may require students to interpret a diagram or graph and relate it to specific topics that have been studied in order to select the best answer. Additional questions may require students to interpret given laboratory data. Students are also expected to ***know the vocabulary from each chapter***, as these terms will be used within questions.

***Directions:*** Take notes for each topic in the space provided below…this may include a written description or a labeled picture. Pretend that the topics listed are questions. For example, the first topic listed is really asking you…what is the study of biology?

***Chapter 1 (pg 3-27)***

The study of Biology: the science of life, living matter in all its forms and phenomena w/ reference to origin, growth, reproduction, structure, behavior, and health

Properties of Life

Cellular structure and function: all living things are composed of 1 or more cells which are the basic unit of life

Reproduction: all living things reproduce

Metabolism: all the chemical reactions carried out by an organism

Homeostasis: maintaining internal conditions suitable for life despite living in dynamic environments

Heredity: the passing on of traits from parents to offspring (the gene is the basic unit of heredity)

Evolution: changes in inherited characteristics over time in populations

Interdependence: (ecology) all living things depend on other living things for survival

Growth & development: all living things grow and develop

Response to stimulus/ changing environments

The relationship between the following terms:

 species & reproduction

a species is a population or group of populations whose members have the potential to interbreed in nature and produce viable fertile offspring, but do not produce viable fertile offspring with members of different species

growth & development

growth refers to a change in size, development refers to a change in structure. Development often relies on growth with new cells having/ forming different structures

stimulus & response: a stimulus causes a response. All living things must be able to respond to both their internal and external environments to maintain homeostasis

adaptation & evolution

an adaptation is an inherited characteristic of an organism that increases its chances of survival and reproduction in a specific environment. Adaptations can be behavioral or structural. Organisms with better adaptations will survive longer making them more likely to reproduce successfully. Organisms less well adapted are less likely to reproduce successfully. Over time, the population will evolve (change) to have more members with the better adaptations.

Major differences between the evolutionary theories of Darwin and Lamarck

Lamark: believed that traits were acquired during your life time and then passed down to offspring

Darwin: came up with the idea of “natural selection” or “survival of the fittest” He believed that favorable traits were selected for over time and passed on to future generations

Current Uses and Applications of Biology

Medicine, agriculture, genetically modified organisms for food, vaccinations

The general order of Scientific Processes/Methods

Making observations 🡪 asking a question 🡪 stating a hypothesis 🡪 testing a hypothesis (experimentation) 🡪 analyzing data 🡪 making conclusions

Parts of a well designed, controlled experiment:

Hypothesis: an educated guess or prediction about why/ how something happens, that can be tested

Control group: a group in an experiment that receives no experimental treatment and is used to compare experimental groups to

Experimental group: designed to be the same as the control group except for one variable that will be changed

Independent variable: the factor that is changed in the experiment

Dependent variable: the thing that is measured in the experiment

The relationship between a hypothesis, theory, and scientific law

A hypothesis is an educated guess/ **prediction** based on facts that must be tested

A theory is a set of related hypothesis that have been tested and confirmed many times by many scientists

A Scientific Law unifies and explains a broad range of observations. It makes statements about what happens but not why…

Qualitative and Quantitative Data

Quantative data: something that can be counted and is usually expressed as a number or in a graph

Qualitative data: categorical data that describes some property of something

Functions of parts of a light microscope (use the diagram on page R8 in your text to help you review the microscope parts you have used in class)

Nosepiece, stage & stage clips, diaphragm, light source, eye piece, body, arm, fine & course adjustment knobs, base, and the objective lenses

Differences between low and high power objectives in relation to… (pg R10)

 Strength of magnification

 Scanning lens magnifies 4X

 Low- power objective lens magnifies 10X

 High - power objective lens magnifies 40X

Area viewed

Scanning lens gives the greatest area viewed

 High - power objective lens smallest area viewed

 Depth viewed

Scanning lens gives the least depth

 high- power objective lens most depth

 Relative speed of an organism

Scanning lens organisms appear slower

 high- power objective lens organisms appear faster

Computation of the total magnification of the eye piece and an objective lens.

Magnification of eye piece X magnification of objective lens

Types of microscopes:

 Light microscope: uses light and a lens to magnify (not much magnifying power)

Compound light microscope: uses light and a several lenses to magnify (more magnifying power)

Electron microscopes (transmission and scanning): use electrons to magnify objects, have very high magnification but can only view dead things

 Scanning electron microscopes allows you to view surface structures

 Transmission electron microscopes allow you to view internal structures

Scanning tunneling microscope: uses electrons to magnify, has the greatest magnification, and can view living things

***Chapter 2: Chemistry of Life (pg 36-56)***

Basic structure of an atom—nucleus (protons & neutrons) and electron cloud (electrons in energy

levels)

the nucleus is the center of the atom containing protons (+) and neutrons (neutral)

electrons (-) are found orbiting the nucleus in electron clouds

Atomic number vs. atomic mass

Atomic number: the number of protons in an atom

atomic mass: the number of protons + neutrons in an atom

Valence electrons – know how to determine the number of valence electrons for groups 1A – 8A on the periodic table

Valence electrons are the electrons found in the outer most energy level of an atom and are responsible for how the atom will react chemically

1A= 1 valence electron

2A = 2 valence electrons

3A = 3 valence electrons

4A = 4 valence electrons

5A = 5 valence electrons

6A = 6 valence electrons

7A = 7 valence electrons

8A = 8 valence electrons

Elements and compounds

Elements: a pure substance of only 1 kind of atom

Compound: substances made of different elements joined together

Mixtures and solutions

Mixture: 2 or more substances NOT chemically combined, can be separated

Solution: homogenous mixture of 2 or more substances: can NOT be separated

Acids and bases – their definitions and relation to the pH scale

Acids: substances that form H+ ions when dissolved in water, have a pH below 7

Base: substances that remove H+ ions, or produce OH- ions when dissolved in water. Have a pH above 7

pH Scale

 Acid Neutral Base

0—1—2—3—4—5—6—7—8—9—10—11—12—13—14

Types of Bonds…how they are formed and examples of each kind

Ionic bond: ions are formed when atoms gain or lose electrons leaving them electrically charged. Ions with opposite charges are attracted to each other and so stick together forming an ionic bond

 Covalent bond : form when 2 atoms share electrons. May be:

 Nonpolar covalent: when the atoms share the electrons equally

Polar covalent: when atoms don’t share electrons equally leaving the molecule with partial opposite charges at each end

Hydrogen bond: a weak chemical attraction between oppositely charged regions of two

polar molecules

The difference between ions and isotopes

ions are formed when atoms gain or lose electrons leaving them electrically charged

 cations: ions that lose an electron carry a positive charge

anions: ions that gain an electron carry a negative charge

isotopes: atoms that have the same atomic number (number of protons) but different number of neutrons (and so different atomic masses)

what is a polar molecule

a Polar molecule is a molecule whose atoms don’t share electrons equally leaving the molecule with opposite charges at each end

Water:

why it is a polar molecule

water is a polar molecule due to the unequal sharing of electrons between the oxygen and hydrogen atoms. Electrons are pulled closer to the oxygen atom giving it a partial negative charge, and leaving the hydrogen atoms with partial positive charges

O-

 +H H+

The unique properties of water

* + Water is a polar molecule
	+ High specific heat capacity
	+ High heat of vaporization
	+ Adhesion
	+ Cohesion
	+ Exists in 3 states of matter naturally
	+ Kinetic energy differences
	+ Repels hydrophobic materials

why it is so important to living systems

* Water is a good medium for metabolic processes due to its solvent properties
	+ Water can dissolve other polar molecules and ionic compounds (salt)
	+ Osmosis
	+ Diffusion
* Water can moderate temperature
	+ Ice as an insulator
	+ Evaporative cooling: when an area or body becomes cooler as water evaporates off of it 🡪 Sweating/ perspiring
	+ Moderation of coastal climates
* Capillary Action (in plants & is due to cohesion & adhesion)
* Surface tension: A “skin” that forms across the top of water
	+ Organisms lay eggs on water
	+ Organisms walk on water
* Transpiration

Structure of a carbon atom, its ability to form bonds and organic compounds

Carbon has 6 protons, 6 neutrons, and 6 electrons, 4 of which are valence electrons

Because of its 4 valence electrons, carbon can make 4 covalent bonds with other atoms, forming all of the shapes and structures necessary for life

The relationship between the following terms – polymer, dehydration synthesis, hydrolysis

A polymer is any large structure composed of monomers (individual units) linked together. There are 4 classes of organic polymers; carbohydrates, lipids, proteins, and nucleic acids

Polymers are created through the process of dehydration synthesis, in which a molecule of water is removed to link to adjoining monomers together

Polymers are broken down through the process of hydrolysis, in which a molecule of water is used to split the polymer apart

The subunits (monomers) of the following biomolecules:

|  |  |  |  |
| --- | --- | --- | --- |
| Organic Molecule | Monomer | Examples of each polymer | What they do/ Functions |
| Carbohydrate | MonosaccharidesSuch as:GlucoseFructoseGalactose  | StarchCelluloseGlycogenChitin | A polymer of glucose used by plants to store energy, typically found in stems and rootsA polymer of glucose used by plants to make their cell wallsA polymer of glucose used by animals to store energyA polymer of glucose used by fungi to make their cell walls |
| Lipid | Fatty acids&Glycerol | PhospholipidsSteroidsTriglycerides  | Make up cell membranesCholesterol, Testosterone, & Estrogenare used for energy storage & include Fats & oils which can beSaturated or unsaturated |
| **Protein**A biologically functional molecule consisting of 1 or more polypeptides coiled & folded into a unique 3D shape | Amino acids(there are 20) | EnzymesMarker proteinsReceptor proteinsTransport proteins | Speed up chemical reactions by lowering activation energyIdentify cell typeAid in cell communicationLets things into and out of the cell, or carry them around the body |
| **Nucleic Acid**A polymer of nucleotides that serves as the blueprint for proteins, & through the actions of proteins controls all cellular activities | **Nucleotides**(There are 5) Each has a -sugar-phosphate group-nitrogen base (A,T,C,G, & U) | Deoxyribonucleic Acid (DNA)Ribonucleic Acid(RNA) | A double stranded molecule that stores the information needed to make proteins, and is inherited from parents. Composed of the sugar deoxyribose and the nitrogen bases A,T,C,&GA single stranded molecule used in the making of proteins. Composed of the sugar ribose and the nitrogen bases A,U,C,&G |

 The structure of an amino acid (carboxyl group, amino group, R group/variable group)



The relationship between the type and sequence of amino acids and the formation of different proteins

There are 20 amino acids to choose from and it’s the type & # of amino acids that makes each protein different

Activation Energy

The energy needed to start a chemical reaction

The function of enzymes/catalysts

Enzymes speed up chemical reactions by lowering the activation energy so that you need less energy to make the reaction happen. Reactions with enzymes occur more quickly and at lower temperatures and this helps organisms maintain their metabolism and homeostasis. All enzyme assisted reactions are reversible.



Time

The two writing methods for including catalysts in chemical equations

You can either write the enzyme above the arrow OR on BOTH sides of the equation

 enzymes

6CO2 + 6H2O C6H12O6 + 6O2 OR enzymes +6CO2 + 6H2O 🡪 enzymes +C6H12O6 + 6O2

Factors that affect enzyme activity

Temperature, pH, ionic (salt) concentration

The lock and key nature of enzyme-substrate complexes



**Chapter 3: Cell Structure (pg 70-91)**

Contributions of van Leewenhoek, Hooke, Schleiden, Schwann and Virchow to understanding the basic nature of cells

Van Leewenhoek: saw the 1st single celled organism under a microscope

Hooke: looked at cork and coined the term “cell”

Schleiden: said all plants are made of cells

Schwann: said all animals are made of cells

Virchow: said cells only come from other cells

The SI system (pg R5)

SI is a decimal system, so all relationships between SI units are based on powers of 10

Km hm dam **m** dm cm mm μm nm pm

103 102 101 **100**10-1 10-2 10-3 10-6 10-9 10-12

kilo hecta deca **meter** deci centi milli micro nano pic

Basic metric units for length, volume, mass, time and temperature

Length 🡪 meters, volume 🡪 Liters, mass 🡪 gram, time 🡪 seconds, temperature 🡪 degrees Celsius

Parts of the Cell Theory

All living things are made of 1 or more cells

Cells are the basic units of structure and function for life

All cells come from preexisting cells

Limitations to cell size

Because volume increase faster than surface area, cells can’t grow too large because they won’t be able to get enough food in or waste out, causing them to starve or be poisoned

Differences between prokaryotic and eukaryotic cells

|  |  |
| --- | --- |
| Prokaryotes | eukaryotes |
| All are single celled (unicellular)DNA floats freely in the cytoplasm in a region called the nucleoidDo not have membrane bound organelles | Some are unicellular but most are multicellularDNA is enclosed in the nucleusHave membrane bound organelles to carry out specific functions  |

Selective permeability of the plasma membrane

The plasma membrane is said to be selectively permeable because it determines what enters and leaves the cell, letting some things in but not others. This is due to the interactions between the substances and the phospholipid bilayer. Substances can move across the membrane via the following processes:

 Passive Transport Active Transport

 Diffusion carrier proteins

 Osmosis endocytosis

 Facilitated Diffusion exocytosis

 Molecular Pumps

Functions of the four types of membrane proteins

Enzymes: Speed up chemical reactions by lowering activation energy

Marker Proteins: Identify cell type

Receptor Proteins: Aid in cell communication by binding signal molecules that relay messages to the cell

Transport Proteins: Lets things into and out of the cell, for example carrier proteins and molecular pumps

Structure of and major parts of the plasma membrane, including phospholipids, cholesterol, membrane proteins, and hydrophilic/hydrophobic areas (pages 81/84 of text)

Marker Protein

Channel Protein: always open

Receptor Protein



Enzymes

Transport Protein

Cholesterol

Hydrophilic/ Polar heads

Hydrophobic/nonpolar Tails

Gated Ion Channel: closed

The function and structure of the following cell structures…be able to identify them on a diagram:

Cell wall: a protective layer on the outside of the plasma membrane in prokaryotes, plants, fungi, and some protists. Polysaccharides such as cellulose (in plants and some protists), chitin (in fungi), and peptidoglycan (in prokaryotes) are important structural components of cell walls

Centrioles: a structure in the centrosome of an animal cell composed of microtubules and probably involved in mitosis

Chloroplast: organelle found in plants that absorbs sunlight and uses it to drive the synthesis of glucose from carbon dioxide and water. They have 2 membranes, an outer membrane with stacks of thylakoid membranes inside. Each stack of thylakoids is called a grana, while the surrounding space is called the stroma.

Chromatin: a complex of DNA and proteins that makes up eukaryotic chromosomes. When a cell is not dividing chromatin exists as a very long stringy mess of fibers

Endoplasmic reticulum: a highly folded membranous network in eukaryotic cells just outside the nucleus. It has a rough portion studded with ribosomes that makes proteins that will be eventually secreted from the cell. The part that doesn’t have ribosomes is called the smooth ER and is involved in making lipids and detoxifying drugs/toxins

Golgi apparatus/complex: an organelle in eukaryotic cells composed of stacks of flat membranous sacs that modify, store, and rout (send/ship) products of the ER like proteins and lipids

Mitochondrion: an organelle in eukaryotic cells that serves as the site of cellular respiration. It has a smooth outer membrane with a highly folded inner membrane. The mitochondrion uses oxygen too break down glucose and make ATP

Nucleus: the organelle of a eukaryotic cell that stores the cells genetic material (DNA) in the form of chromosomes made up of chromatin

Nucleolus: a specialized structure in the nucleus that produces ribosomes

Nuclear membrane/envelope: in a eukaryotic cell the double membrane that surrounds the nucleus, perforated with pores that allow things in and out of the nucleus. The outer membrane is continuous with the beginning of the ER

Plasma membrane: the membrane at the boundary of every cell, acts as a selective barrier regulating a cells chemical composition. Consists of a phospholipid bilayer studded with various proteins and carbohydrates, and cholesterol

Ribosome: a complex of RNA found in the cytoplasm that functions as the site of protein production for all living things

Vacuole: a membrane bound vesicle whose function is usually storage. In plants, the central vacuole takes up most of the volume of the cell and is involved in storing food, water, & ions

Cytoplasm: the contents of the cell bound by the plasma membrane; in eukaryotes, everything except the nucleus

Cytoskeleton: a network of microtubules, microfilaments, and intermediate fibers that extend throughout the cytoplasm and determine cell shape, help transport materials throughout the cell, and aid in cell locomotion

Lysosome: a membrane enclosed sac containing hydrolytic enzymes found in the cytoplasm of animal cells

Cilia: a short appendage containing microtubules in eukaryotic cells that helps them move (look like hairs)

Flagella: a long cellular appendage made of microtubules and specialized for locomotion (look like tails)

Differences between plant and animal cells

Plant Animal

Chloroplast lysosomes

Cell wall centrioles

Central vacuole

Advantage of folded membranes within cellular organelles

They increase surface are for chemical reactions without taking up extra space. They also form compartments within cells to separate chemical reactions making cells more efficient

*Passive Transport: any transport across cell membranes that moves substances down their concentration gradients and does NOT require energy*

Diffusion: the spontaneous movement of a substance down its concentration or electrochemical gradient, from a region where it is more concentrated to a region where its less concentrated

(it’s the simplest form of passive transport)

Concentration gradients: a region along which the density of a chemical or substance increases or decreases

Relationship between diffusion and osmosis

Osmosis is the diffusion of water across a selectively permeable membrane

How a concentration gradient determines the direction of osmosis:

Things diffuse from where they are more concentrated to a region where they’re less concentrated

Isotonic solution: referring to a solution that when surrounding a cell causes no net movement of water into or out of the cell

39% salt solution, 61% Water

39% salt in cell

Hypertonic solution: referring to a solution that when surrounding a cell causes the cell to lose water

70% salt solution, 30%water 🡪 Will cause a cell to shrivel, and can cause plasmolysis of plant cells

39% salt in cell 🡪 water moves out of cell.

Hypotonic solution: referring to a solution that when surrounding a cell causes water to move into the cell

30% salt solution, 70% water

80% salt, 20% water in cell, water moves into the cell. May cause a cell to burst, in plant cells it causes turgor pressure

Differences between the following types of water: tap water, distilled water, and salt water

Tap contains impurities, distilled has most impurities removed, salt water has large amounts of salt in it

Facilitated diffusion (ion channels)

The passage of molecules or ions down their concentration gradient or electrochemical gradient across a biological membrane **with the assistance of transport protein channels** embedded in the membrane**, requiring no energy**.

*Active Transport: the movement of a substance across a cell membrane against its concentration or electrochemical gradient, mediated by specific transport proteins and requiring an expenditure of energy (usually in the form of ATP)*

Carrier proteins (membrane pumps)

Transport proteins in cell membranes that use energy (usually ATP) to carry substances across the membrane against their concentration gradients. For example, the sodium potassium pump

Endocytosis (pinocytosis and phagocytosis): when a cell takes substances in from the outside by forming a vesicle around it as it moves through the plasma membrane

 Pinocytosis: when the cell takes in a liquid through endocytosis

 Phagocytosis: when a cell takes in solids through endocytosis

Exocystosis: when cells secrete molecules by the fusion of vesicles that contain them with the plasma membrane

Signal Molecules: molecules that bind to receptor proteins and so convey a message to the cell leading to a cellular response. Cells may respond to signal molecules by:

1. Changing their permeability to certain molecules by opening or closing ion channels
2. They may activate a 2nd messenger to relay the signal
3. They may activate an enzyme and so speed up chemical reactions

Chapter 13-16 (pg 396-505)

1. What is biodiversity?

The type and number of different species living in a given area. The more biodiverse an ecosystem is, the more stable and healthy it will be

1. What is succession?

Succession is the observed process of change in the species structure of an ecological community over time to reach a climax community

Primary succession: the type of succession that occurs where no community has ever been, and where there is no soil. Primary succession is always started by a pioneer species, and takes longer to reach a climax community than secondary because you have to make soil.

Secondary Succession: the type of succession that occurs where an existing community has been cleared by some disturbance but has left the soil intact

1. What are some examples of pioneer species?

Moss & lichen

1. What is the difference between a food chain and a food web?

A food chain shows the pathway along which energy is passed from one producer through a line of consumers usually going

producer 🡪 herbivore (primary consumer) 🡪 carnivore (secondary consumer) 🡪 scavenger or larger carnivore (tertiary consumer)

A food web shows all of the possible feeding relationships with interconnected food chains in an area

5. What are 1st order consumers, 2nd order consumers, and 3rd order consumers?

1st order consumer 🡪 herbivores

2nd order consumer 🡪 carnivores

3rd order consumer 🡪 larger carnivores or scavengers

6. To what trophic level do producers belong? Herbivores?

producers 🡪 1st trophic level

Herbivores 🡪 2nd trophic level

7. How much energy is passed along to higher trophic levels?

10% is passed on, 90% is lost as heat

8. What is an energy pyramid?

A pyramid depicting how much energy is available at each trophic level. For example

0.1%

1%

10%

100%

9. What is biomass?

The total mass of organic matter made up of a group of organisms in a given habitat

Biomass is greatest at the producer level and decreases as you move up through the trophic levels

10. What is the relationship between the amount of food required to support an organism compared to the mass of the organism?

As mass of an organism increases, it must eat more food

11. What are the important processes in the carbon cycle?

Photosynthesis: the conversion of carbon dioxide and water into glucose and oxygen

Cellular respiration: the break down of glucose using oxygen back into carbon dioxide and water

Combustion

Decomposition

1. What processes are important in the water cycle?

Transpiration: the evaporation of water out of plants

Precipitation

Evaporation

Condensation

1. In what type of plant is nitrogen fixing bacteria found directly on their roots?

Legumes (beans)

1. What kinds of organisms are decomposers…what do they do?

Bacteria & fungi break down dead organic matter. They are found at every trophic level because everything can die

1. Place the following levels of organization in order from smallest to largest…

ecosystem, biosphere, organism, community, population

organism 🡪 population🡪 community 🡪 ecosystem🡪 biosphere

1. What is a habitat?

The natural environment in which an organism lives

17. What is an ecological niche?

The sum of a species use of biotic and abiotic resources in its environment including its:

 Habitat

 Food preferences

 Temperature ranges

 Mating behaviors and much more

\*According to the competitive exclusion principle No 2 organisms can occupy the same niche in the same place at the same time

1. Identify and explain the three types of symbiosis.

Symbiosis: any close relationship between 2 different species

* 1. Mutualism: both species benefit
	2. Commensalism: one species benefits while the other is neither helped nor harmed
	3. Parasitism: one species, the parasite, benefits by living on or in another, the host, causing it harm

19. What is a biome?

Any of the worlds major ecosystem types, classified according to the predominant vegetation for terrestrial biomes and the physical environment for aquatic biomes. Also characterized by physical adaptations of organisms to that particular environment

20. What factors affect the formation of the terrestrial biomes?

Temperature, precipitation, wind, sunlight, proximity to water, altitude, latitude

21. What are some examples of aquatic biomes?

Fresh water biomes 🡪 lakes, ponds, swamps, marshes, streams, rivers

Salt water biomes 🡪 oceans, seas

Estuaries 🡪 biomes in which a fresh water stream runs into a salt water biome creating a biome of mixed salinity

21. Where are toxic materials most concentrated in a food chain?

In the uppermost trophic levels containing top consumers

* 1. What is this phenomenon called?

Biomagnification

22. What is the greenhouse effect? What gases contribute to this?

The greenhouse effect slows the release of heat energy from Earth’s atmosphere

* + sunlight penetrates Earth’s atmosphere
	+ energy is absorbed and reradiated as heat
	+ Greenhouse gasses include carbon dioxide, water, and methane

23. How is acid rain formed?

Acid rain is caused by fossil fuel emissions.

* + produced when pollutants in the water cycle cause rain pH to drop
	+ can lower the pH of a lake or stream
	+ can harm trees

24. What is destroying the ozone layer?
Chlorofluorocarbons (CFCs) are used as propellants in aerosol sprays and as coolants in refrigerators. When they’re released, the get broken down into Chlorine atoms which react with the ozone (O3) in the ozone layer breaking it down