

Name key  
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## Biology Keystone Exam Review

### Chapter 1

1. Describe the characteristics of life shared by all prokaryotic & eukaryotic organisms.

List the eight characteristics that all living things share.

**They have cells and DNA**

**They reproduce, grow and develop, respond to stimuli, maintain homeostasis, adapt and evolve**

### Chapter 7

2. Compare cellular structures & their functions in prokaryotic & eukaryotic cells.

Identify three differences between **prokaryotic** and **eukaryotic** cells.

**Have no nuclei**

**Have nuclei**

**Have no membrane-bound  
internal parts**

**Have membrane-bound  
internal parts**

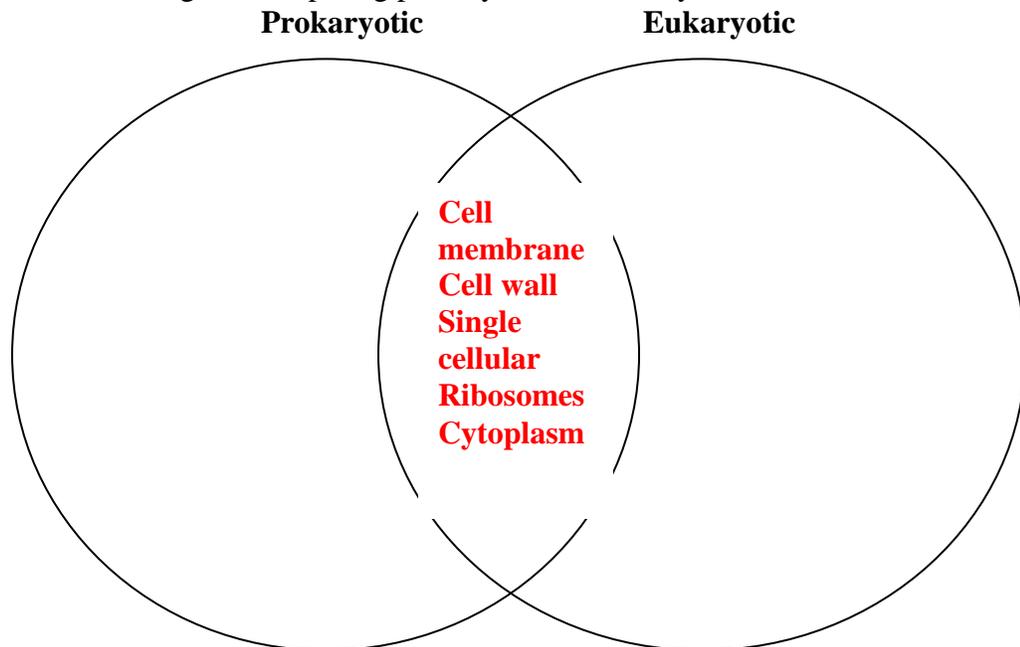
**Generally smaller**

**Generally larger**

**Less complex**

**More complex**

Complete the Venn Diagram comparing prokaryotic and eukaryotic cells.



## Chapter 7

### 3. Describe and interpret the relationships between structure and function at various levels of biological organization.

Place the following terms in order from least complex to most complex:

Organs      cells      organ systems      tissues      organism

**Cells → tissues → organs → organ systems → organism**

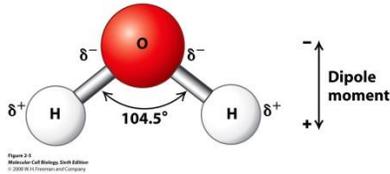
## Chapter 2

### 4. Describe the unique properties of water and how these properties support life on Earth (e.g. freezing point, high specific heat, cohesion)

What makes water polar?

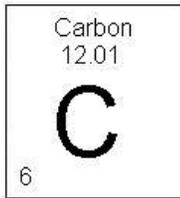
**Water has a partially positive end (pole) and partially negative end (pole)**

Draw a water molecule and show how it is charged on both ends.



### 5. Explain how carbon is uniquely suited to form biological molecules.

What makes **carbon** unique as compared to other elements?



**Carbon has four covalent bonds that allow it to bond to many elements including itself and form long chains**

How many valence electrons does a **carbon** atom have? **4**

What kind of bond(s) do **carbon** atoms readily form? **covalent**

### 6. Describe how biological molecules form from monomers.

Identify the polymers that are made up by the monomers given below:

monomer	polymer
Monosaccharide (simple sugar) + monosaccharide (simple sugar)	<b>Polysaccharide (carbohydrate)</b>
Fatty acids + glycerol	<b>Triglyceride (lipids)</b>
Amino acid + amino acid + amino acid...	<b>Poly peptide (Protein)</b>
Nucleotide + nucleotide...	<b>Polynucleotide (Nucleic Acids)</b>

**7. Compare the structure & function of carbohydrates, lipids, proteins, & nucleic acids in organisms.**

Match each class of organic compounds with their appropriate function.

**Carbohydrates**

**Proteins**

**Lipids**

**Nucleic Acids**

\_\_\_\_\_ **Nucleic Acid** \_\_\_\_\_ Stores and transmits genetic information

\_\_\_\_\_ **Lipids** \_\_\_\_\_ Stores energy

\_\_\_\_\_ **Proteins** \_\_\_\_\_ Help fight disease

\_\_\_\_\_ **Lipids/ Proteins** \_\_\_\_\_ Move substances in and out of cells

\_\_\_\_\_ **Carbohydrates** \_\_\_\_\_ Quick energy

\_\_\_\_\_ **Proteins (enzymes)** \_\_\_\_\_ Control the rate of reactions

**8. Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.**

Define the following terms:

**Enzyme- A biological catalyst**

**Catalyst- A substance that speeds up a chemical reaction**

**Activation energy- The amount of energy needed to start a chemical reaction**

**True** or False: All enzymes are proteins.

True or **False**: All catalysts are enzymes.

**True** or False: Enzymes lower the energy of activation of a reaction by binding the substrate.

**9. Explain how factors such as pH, temperature, & concentration levels can affect enzyme function.**

**They all can alter the shape of the active site on the enzyme, causing it to function improperly**

## Chapters 8 and 9

**10. Describe the fundamental roles of plastids (e.g. chloroplasts) & mitochondria in energy transformation.**

Complete the table.

	<b>Photosynthesis</b>	<b>Cellular Respiration</b>
<b>Function</b>	<b>Store energy</b>	<b>Release energy</b>
<b>Location</b>	<b>chloroplast</b>	<b>Mitochondria and cytoplasm</b>
<b>Reactants</b>	<b>H<sub>2</sub>O and CO<sub>2</sub></b>	<b>O<sub>2</sub> and C<sub>6</sub>H<sub>12</sub>O<sub>6</sub></b>
<b>Products</b>	<b>O<sub>2</sub> and C<sub>6</sub>H<sub>12</sub>O<sub>6</sub></b>	<b>H<sub>2</sub>O, CO<sub>2</sub>, and ATP</b>

Which organelle converts chemical energy stored in food into compounds that are more convenient for the cell to use? **ATP**

**11. Compare the basic transformation of energy during photosynthesis & cellular Respiration.**

Write the balanced equation for **Photosynthesis**:



Write the balanced equation for **Cellular Respiration**:



**12. Describe the role of ATP in biochemical reactions.**

What is the name of the energy currency molecule of the cell? **ATP**

## Chapter 7

**13. Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.**

Identify the function of the cell membrane.

**To control what enters and leaves the cell**

How does facilitated diffusion differ from diffusion?

**Uses proteins to move substances**

**Does not use proteins to move substances**

**14. Compare the mechanisms that transport materials across the plasma membrane (i.e. passive transport- diffusion, osmosis, facilitated diffusion; and active transport- pumps, endocytosis)**

Distinguish between **active** and **passive** transport.  
How is **diffusion** different from **osmosis**?

**Movement of particles from an area of high concentration to a low concentration**

**Movement of water from an area of high concentration to a low concentration**

Define the following terms and describe what would happen if you put a red blood cell in each type of solution.

- a) Hypertonic- **a solution that has more solute outside of the cell than inside it will make a red blood cell shrink**
- b) Hypotonic- **a solution that has more solute inside the cell than outside it will make a red blood cell expand**
- c) Isotonic- **a solution that has equal amounts of solutes inside and outside the cell**

**15. Describe how membrane-bound cellular organelles (e.g. endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.**

Identify the function of the following organelles:

**Endoplasmic Reticulum – rough ER aids in the production of proteins**

**Golgi Apparatus – modifies, sorts and repackages proteins that are transported outside of the cell**

**16. Explain how organisms maintain homeostasis (e.g. thermoregulation, water regulation, oxygen regulation).**

What is meant by the term **homeostasis**?

**Maintaining a stable internal environment**

What is a contractile vacuole and how can it be used to maintain **homeostasis**?

**A contractile vacuole is an organelle in paramecia that pumps out excess water to help the single celled organism maintain homeostasis.**

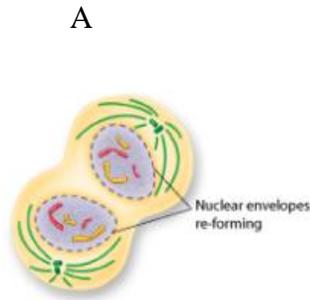
#### **Chapters 10 and 11.4**

**17. Describe the events that occur during the cell cycle: interphase, nuclear division (i.e. mitosis or meiosis), cytokinesis.**

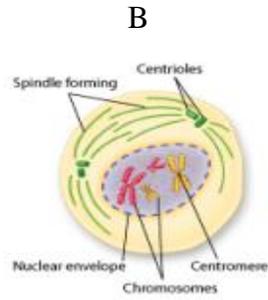
Name and describe the three parts of the cell cycle. **Interphase is the phase of growth, DNA replication, and preparation for cell division. Mitosis is the cell division of single celled**

**organisms and body cell of multicellular organisms. Meiosis is the cell division of sex cells (gametes) in organisms that reproduce sexually.**

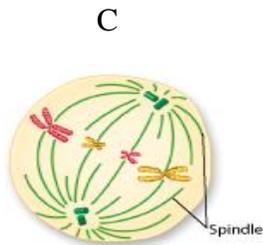
Identify mitotic phases:



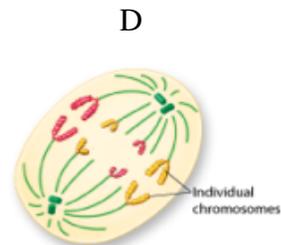
**Telophase**



**Prophase**



**Metaphase**



**Anaphase**

List the above phases of mitosis in order (use letters) **B, C, D, A**

**18. Compare the processes and outcomes of mitotic and meiotic nuclear divisions.**

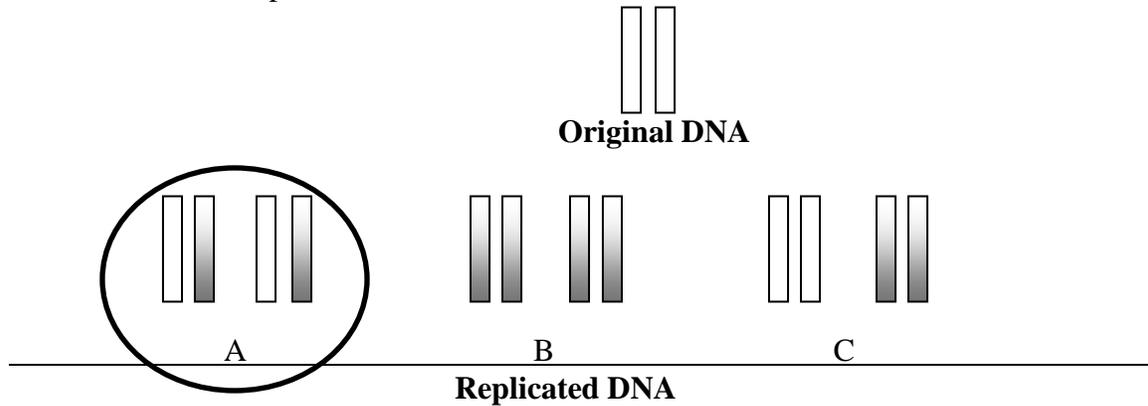
Compare mitosis and meiosis:

	<b>Mitosis</b>	<b>Meiosis</b>
Number of cell divisions	<b>1</b>	<b>2</b>
Number of daughter cells	<b>2</b>	<b>4</b>
Number of chromosomes in daughter cells (2N/N)	<b>2N - diploid</b>	<b>N- haploid</b>
Daughter cells are genetically (identical/different) than parent cell	<b>identical</b>	<b>different</b>
Occurs in what type of cell	<b>Body cells (somatic cells)</b>	<b>Sex cells (gametes)</b>

## Chapter 12

**19. Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.**

Circle the DNA strands below that would represent the new DNA molecules that would result from replication.



**20. Explain the functional relationships between DNA, genes, alleles, & chromosomes and their roles in inheritance.**

Describe the relationship between DNA, gene, allele, chromosome, and nuclei.

**There are two alleles for every gene. A gene is a segment of DNA. DNA makes up chromosomes. Chromosomes are found in nuclei**

## Chapter 11

**21. Describe and/or predict observed patterns of inheritance (i.e. dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).**

Define and give an example of each of the following patterns of inheritance:

Codominance – **an inheritance pattern in which the heterozygous individual has both the forms of a phenotype**

Incomplete Dominance – **an inheritance pattern in which the heterozygous individual has a blend of the two forms of the phenotypes**

Multiple Alleles – **a trait that is controlled by three or more alleles**

Polygenic Traits – **a trait that is controlled by many genes**

Japanese four o'clock flowers come in three varieties: red, pink, and white. Cross two pink Japanese four o'clock flowers. Show a Punnett Square and give the phenotypic ratio of the offspring produced by the cross. **RW x RW P = 1:2:1**

	<b>R</b>	<b>W</b>
<b>R</b>	<b>RR</b>	<b>RW</b>
<b>W</b>	<b>RW</b>	<b>WW</b>

**Chapter 14**

One parent is heterozygous for type A blood and the other is heterozygous for type B blood. What are the possible blood types of their children? Include the parents' genotypes in your answer. **I<sup>A</sup>i x I<sup>B</sup>i possible blood types = A, B, AB, O**

	<b>I<sup>A</sup></b>	<b>i</b>
<b>I<sup>B</sup></b>	<b>I<sup>A</sup>I<sup>B</sup></b>	<b>I<sup>B</sup>i</b>
<b>i</b>	<b>I<sup>A</sup>i</b>	<b>ii</b>

A female carrier does not have the disease. Her genotype is X<sup>H</sup>X<sup>h</sup>, where X indicates the alleles are on the X chromosome. The carrier female mates with a normal male. **X<sup>H</sup>X<sup>h</sup> x X<sup>H</sup>Y**

	<b>X<sup>H</sup></b>	<b>X<sup>h</sup></b>
<b>X<sup>H</sup></b>	<b>X<sup>H</sup>X<sup>H</sup></b>	<b>X<sup>H</sup>X<sup>h</sup></b>
<b>Y</b>	<b>X<sup>H</sup>y</b>	<b>X<sup>h</sup>y</b>

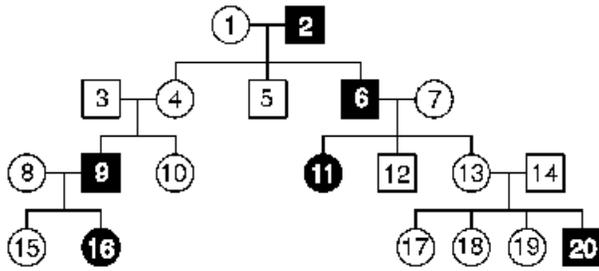
a) What is the probability that a female offspring will be normal? Will be a carrier?

**50%. 50%**

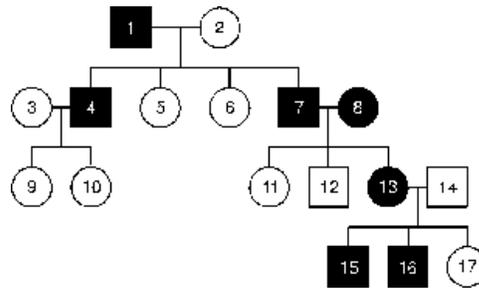
b) What is the probability that a male offspring will inherit hemophilia?

**50%**

Use the pedigrees below to answer the next six questions.



Pedigree A



Pedigree B

What is the pattern of inheritance for the trait in pedigree A?  
(autosomal dominant or **autosomal recessive**)

What is the pattern of inheritance for the trait in pedigree B?  
(**autosomal dominant** or autosomal recessive)

What must be the genotype of individual 20 in pedigree A? **recessive - hh**

What must be the genotype of individual 17 in pedigree B? **recessive - hh**

What must be the genotype of individual 1 in pedigree A? **heterozygous - Hh**

What must be the genotype of individual 1 in pedigree B? **heterozygous - Hh**

**Chapter 11.4, 13, 14.2**

**22. Describe processes that can alter composition or number of chromosomes (i.e. crossing over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).**

What is crossing over, and when does it occur during meiosis?

**Crossing over is the exchange of genetic information from two non-sister chromatids during prophase I of meiosis**

Distinguish between a chromosomal mutation and a gene mutation and give two examples of each type of mutation.

**Chromosomal mutations such as translocations or inversions, are changes in large segments of chromosomes while gene mutations such as substitutions, deletions or insertions, change small segments of DNA on chromosomes.**

**23. Describe how the processes of transcription and translation are similar in all organisms. Transcribe the given DNA sequence into a complementary mRNA:**

**A T G C A A G T C A T T C C A G C T**

**U A C G U U C A G U A A G G U C G A**

## Chapter 7

24. Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of different types of proteins.

Identify the function of each of the following organelles:

Ribosomes – **site of protein synthesis**

Endoplasmic Reticulum – **rough ER assembles proteins**  
**smooth ER assembles lipids**

Golgi Apparatus – **sorts, modifies, and repackages proteins**

Nucleus – **holds genetic information and controls most cell processes**

## Chapter 13

25. Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g. silent, nonsense, frame-shift)

How are frameshift and substitution mutations similar? How are they different?

**Frameshift and substitutions are similar because they alter the DNA sequence. Frameshift mutations are different because they may change multiple amino acids.**

Use the tables below to answer the next two questions.

Amino acid sequence	Protein Produced
Methionine-isoleucine-proline-leucine	Protein A
Methionine-isoleucine-valine-leucine	Protein B
Methionine-isoleucine-proline-alanine	Protein C

codon	Amino acid
AUG	methionine
CUA	leucine
CCG	proline
AUA	isoleucine
CCC	proline

Follow the given sequence of DNA below through transcription and translation resulting in a protein. Fill in the missing information indicated by the question marks.

TACTATGGCGAT → AUGA ? ACC ? CU ? → methionine-isoleucine – ?-- ?

?= **U** ?= **C** ?= **A** ?= **proline** ?= **leucine**

DNA → mRNA → amino acid sequence  
Protein produced above **(A)** B, or C) (circle one)

If the above sequence of DNA had a **substitution** mutation so that the mutated sequence was TACTATGGGGAT, which protein **(A)** B, or C) will be produced?

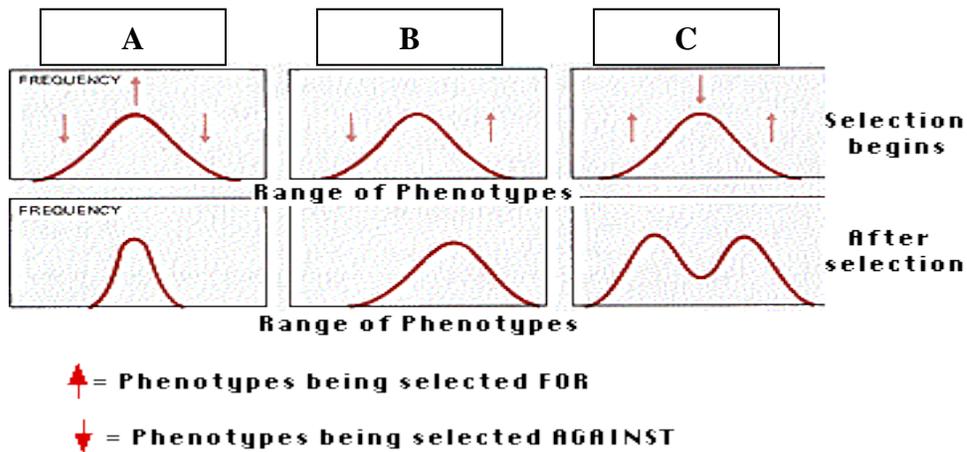
**Chapter 15**

26. Explain how genetic engineering has impacted the field of medicine, forensics, and agriculture (e.g. selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy)

**Chapter 17**

27. Explain how natural selection can impact allele frequency of a population. Distinguish between stabilizing, disruptive, and directional selection.

**Stabilizing selection favors average individuals, while disruptive selections favors individuals of two extremes, and directional selection favors one extreme or the other.**



Identify the type of selection in graph A stabilizing selection

Identify the type of selection in graph B directional selection

Identify the type of selection in graph C directional selection

In a species of snail, dark individuals are better hidden (from bird predators) in the shady forest, while lighter individuals are better hidden in well lit brushy edge areas. There are no areas of intermediate brightness; therefore, \_\_\_\_\_ acts on shell color in these snails.

- a. directional selection
- b. disruptive selection**
- c. stabilizing selection

Small Aristelliger lizards have difficulty defending territories, but large lizards are more likely to be preyed upon by owls. This situation results in \_\_\_\_\_ on adult body size.

- a. directional selection
- b. disruptive selection
- c. stabilizing selection**

Long necks make it easier for giraffes to reach leaves high on trees, while also making them better fighters in "neck wrestling" contests. In both cases, \_\_\_\_\_ appears to have made giraffes the long-necked creatures they are today.

- a. directional selection**
- b. disruptive selection
- c. stabilizing selection

**28. Describe the factors that can contribute to the development of new species (e.g. isolating mechanisms, genetic drift, founder effect, migration)**

*Types of Reproductive Isolation:*

<b>Behavioral Isolation</b>	<b>A reproductive isolation in which two populations develop different mating (courtship) rituals preventing them from breeding together</b>
<b>Geographic Isolation</b>	<b>A reproductive isolation in which two populations are separated by a physical barrier i.e. a body of water, mountain, or river that leads to the formation of a new subspecies</b>
<b>Temporal Isolation</b>	<b>A reproductive isolation in which two populations breed at different times of the year preventing them from mating together</b>

Populations of the same species of seal live on islands too far apart to swim between them for mating.

- a. behavioral isolation
- b. temporal isolation
- c. geographic isolation

Species of birds have elaborate courtship dances, and females select the best dancers as mates.

- a. behavioral isolation
- b. temporal isolation
- c. geographic isolation

Varieties of oak tree produce pollen during different seasons, so they can't pollinate one another.

- a. behavioral isolation
- b. temporal isolation
- c. geographic isolation

Herds of caribou misinterpret each other's mating behavior, so they fight instead of mating

- a. behavioral isolation
- b. temporal isolation
- c. geographic isolation

What is **genetic drift**?

**Random changes in allele frequency, in which alleles become more or less common in a population.**

**29. Explain how genetic mutations may result in genotypic and phenotypic variation within a population.**

**If a mutation changes the amino acid sequence, it could change how the protein functions; thereby, affecting the physical characteristics of an organism within a population. These changes could increase or decrease the chances of seeing the trait in a population.**

## Chapter 16

### **30. Interpret evidence supporting the theory of evolution (i.e. fossil, anatomical, physiological, embryological, biochemical, & universal genetic code)**

Define and give an example of each of the following terms:

<b>Vocabulary</b>	<b>Description</b>	<b>Example(s)</b>
<b>Homologous Structure</b>	<b>Structures with similar anatomical (physical) features, but may or may not have similar functions</b>	<b>Arm of humans Leg of cats Wing of birds Fin of whales</b>
<b>Analogous Structure</b>	<b>Structures with different anatomical (physical) features, but similar functions</b>	<b>Wing of birds Wing of insects</b>
<b>Vestigial Structure</b>	<b>Structure that have no present day use</b>	<b>Appendix of humans Pelvis of sharks</b>

## Chapter 1

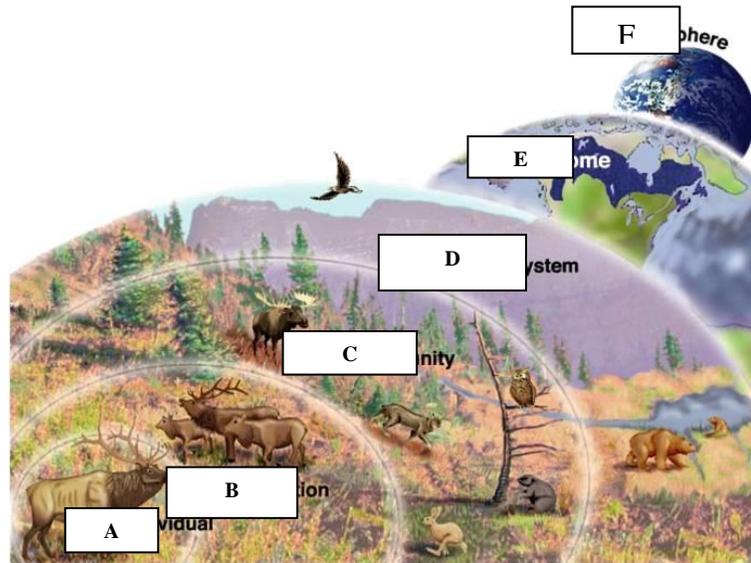
### **31. Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact observation**

Describe the relationship between a hypothesis, an inference and a theory.

**Inferences are logical interpretations based on prior knowledge and may be used to develop a hypothesis, which is a testable explanation for a set of observations. A theory is developed only after a hypothesis has been tested several times and provides the same result each time.**

### Chapter 3

32. Describe the levels of ecological organization.



Use the terms below to identify the six levels of ecological organization in the diagram above. Then define each term.

Community  
Population

Ecosystem  
Species/Organism

Biosphere  
Biome

A – **Species/organism** – a single type of living thing that may breed together and produce fertile offspring

B – **Population** – a group of like organisms living in the same area

C – **Community** – a group of different species living in the same area

D – **Ecosystem** – the interaction of living and non-living things in the same area

E – **Biome** – an area characterized by its climate (average temp. and precipitation in a year) and distinct vegetation

F – **Biosphere** – all of the portions on Earth including the atmosphere and the ocean deep

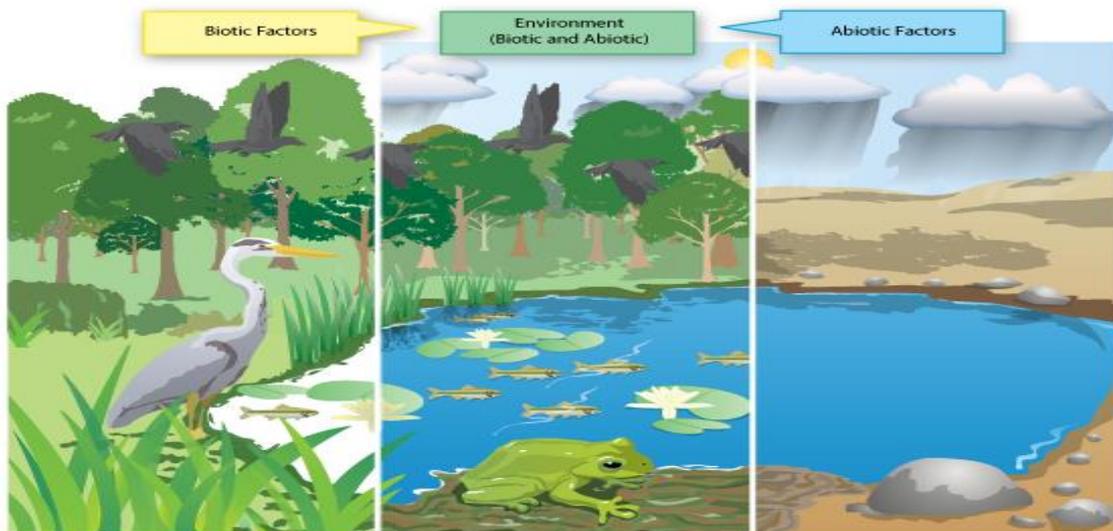
**33. Describe characteristic biotic and abiotic components of an ecosystem.**

Define the following terms:

Biotic Factors – **living material in an area**

Abiotic Factors – **non-living material in an area**

Identify four **biotic** and four **abiotic** components of the aquatic and terrestrial **ecosystems** shown below.



Biotic Factors	<b>Treed, bird, frog, grass</b>
Abiotic Factors	<b>Pond, soil, clouds, sunlight</b>

34. Describe how energy flows through an ecosystem (e.g. food chains, food webs, and energy pyramids)

Use the food chain below to answer the next two questions.



Identify the original source of energy in this food chain.

**The sun**

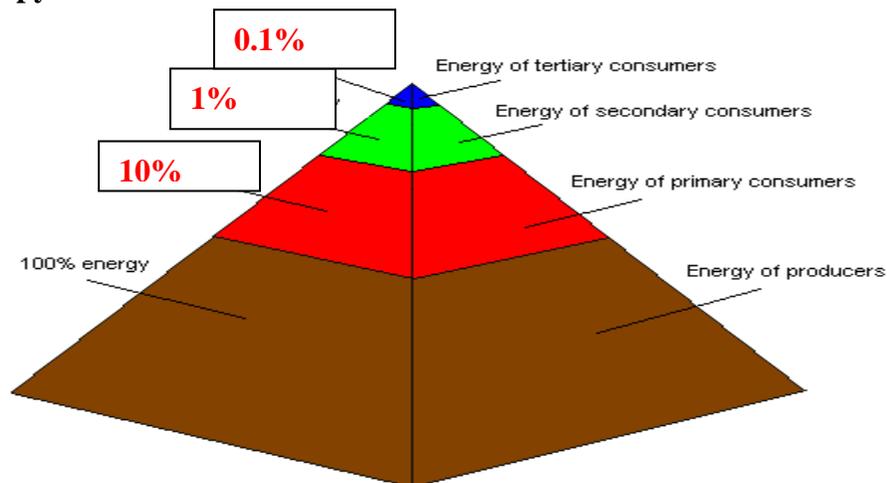
What percent of energy is transferred from the second **trophic level** (deer) to the third **trophic level** (lion)?

**10%**

Energy in an ecosystem (**flows in one direction** / cycles). (circle one)

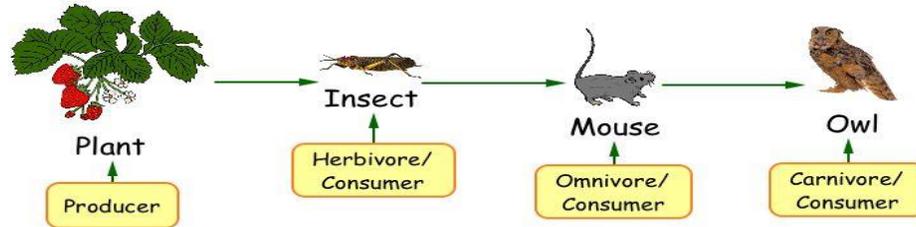
Nutrients in an ecosystem (flow in one direction / **cycles**). (circle one)

Identify the percent of energy available for organisms in each **trophic level** of the **ecological pyramid** below.



35. Describe biotic interactions in an ecosystem (e.g. competition, predation, symbiosis)

Use the **food chain** below to answer the next two questions.



If the size of the insect **population** were to decrease, what effect would that have on the size of the mouse **population**? Explain your answer.

**If the insect population decreased, the mouse population would decrease because the mouse feed on insects.**

If the size of the owl **population** were to decrease, what effect would that have on the size of the mouse **population**? Explain your answer.

**If the owl population decreased, the mouse population would increase because there would be no predators to control the growth rate of the mouse population.**

Use the **food web** below to answer the next question.



If the size of the rabbit **population** were to decrease, which of the following would most likely happen?

- a. The snake population will decrease.
- b. The plant population will decrease.
- c. The wild cat population will increase.
- d. The jackal population will decrease.**

Describe each of the **community** interactions in the table below.

<b>Interaction</b>	<b>Description</b>
Competition	<b>Fighting for resources in an area</b>
Symbiosis	<b>Living together</b>
Predation	<b>Predator – prey relationship</b>
Parasitism	<b>A symbiotic relationship in which one organism is harmed</b>
Mutualism	<b>A symbiotic relationship in which both organisms benefit</b>
Commensalism	<b>A symbiotic relationship in which one organism benefits and the other organism is neither harmed nor benefits</b>

Match each example with the correct type of community interaction.

- a. Competition
- b. Parasitism
- c. Mutualism
- d. Commensalism

\_\_\_ **b** \_\_\_ A leech feeds on the blood of a human.

\_\_\_ **c** \_\_\_ A clownfish lives among the sea anemone's tentacles and protects the sea anemone by chasing away would-be attackers. A sea anemone, in turn, protects the clownfish from predators.

\_\_\_ **a** \_\_\_ A cow and a sheep feed on the same grass.

\_\_\_ **d** \_\_\_ A tree provides nutrients and a sunlit location for the orchid living on it.

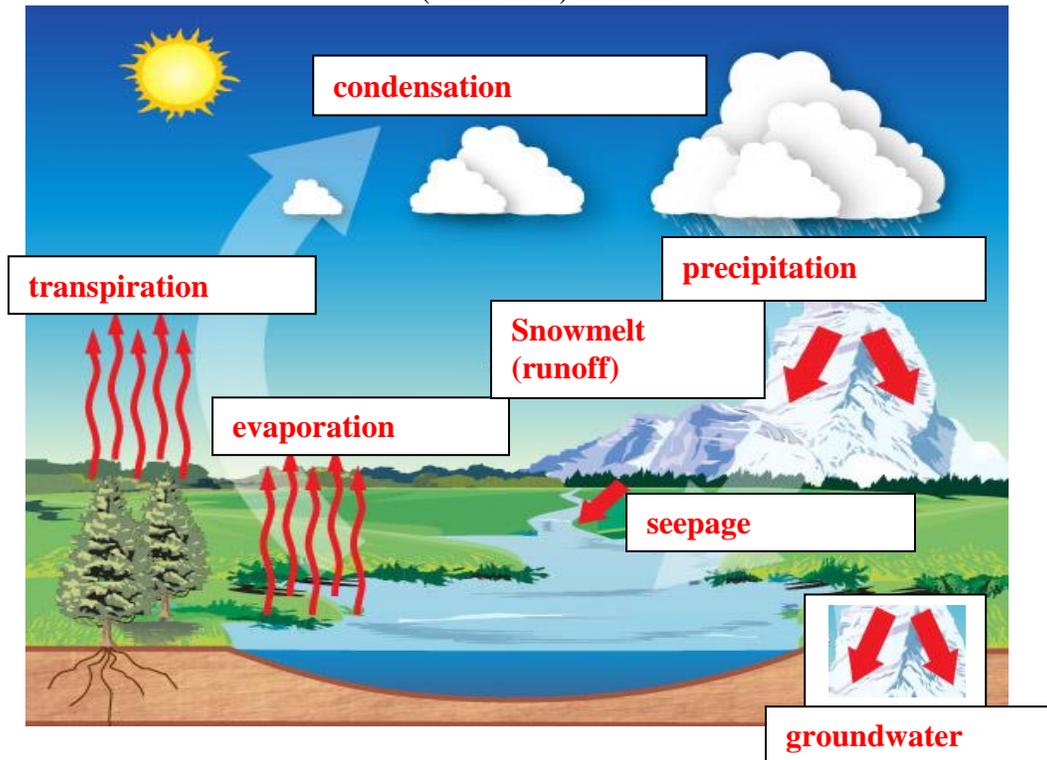
36. Describe how matter recycles through an ecosystem (i.e. water cycle, carbon cycle, oxygen cycle, and nitrogen cycle)

Complete the diagram of the **water cycle** using the words below:

Evaporation  
Transpiration

Precipitation  
Condensation  
(Snowmelt) Runoff

Groundwater  
Seepage



Describe each of the following types of organisms:

Autotroph – **organisms that make their own food (producers)**

Heterotroph – **organisms that consume food (consumers)**

Herbivore – **plant eater**

Carnivore – **meat eater**

Omnivore – **plant/meat eater**

Decomposer – **consumer that breaks down dead organic matter**

Complete the diagram of the **carbon cycle** using the words below:

Fossils and fossil fuels

Animal Respiration

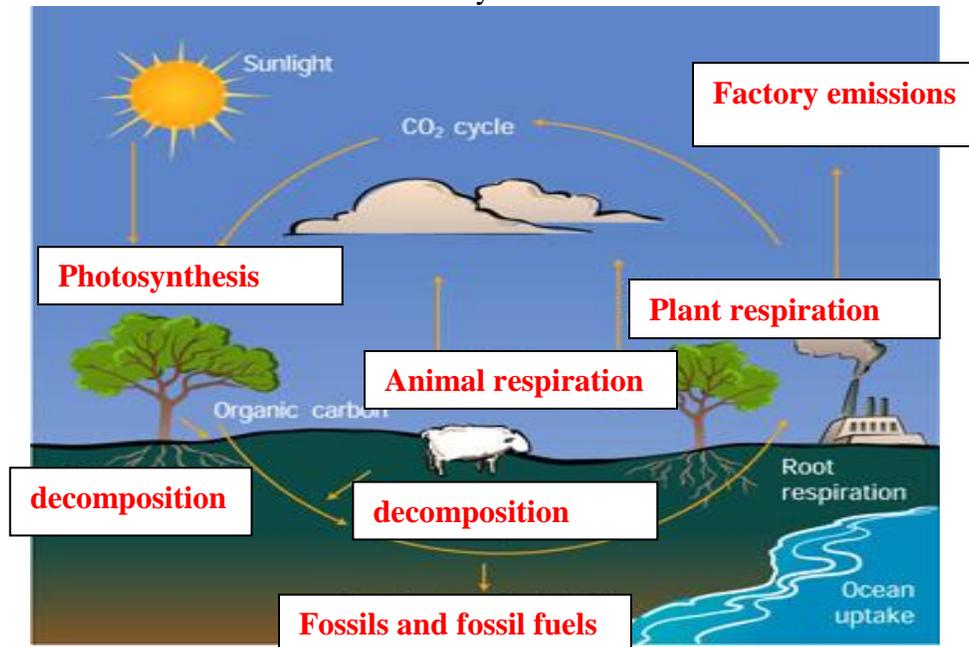
Decomposition

Factory emissions

Plant Respiration

Decomposition

Photosynthesis



#### Chapter 4

37. Describe how ecosystems change in response to natural and human disturbances (e.g. climate change, introduction of nonnative species, pollution, fires).

What is ecological succession?

**The gradual changes that occur in a community from the pioneer species to the climax community.**

Distinguish between primary and secondary succession.

**Primary succession begins with pioneer species on rocky surfaces**

**Secondary succession begins after a natural disaster such as forest fires or after human action such as an abandoned parking lot.**

#### Chapter 6

Identify five ways that humans reduce biodiversity in an ecosystem.

**Hunting, farming, habitat destruction, clear cutting,**

How does the introduction of nonnative species threaten biodiversity?

**Nonnative species or exotic species have no predators when they are introduced into a new area, therefore, they take over the area by excessive reproduction.**

## Chapter 5

**38. Describe the effects of limiting factors on population dynamics and potential species extinction.**

What is a limiting factor?

**A factor that limits the growth of an organism.**

Distinguish between density-dependent and density-independent limiting factors and give two examples of each type of limiting factor.

**Density dependent limiting factors are dependent upon the number of individuals in a population. An example is disease. It can be wide spread if there are many individuals in the population.**

**Density independent limiting factors are not dependent upon the number of individuals in a population. An example is a natural disaster such as a hurricane. It affects every organism in the community the same regardless of how many of them are in the area.**