Honors Biology Exam Study Guide Name _____

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.
SCSh3. Students will identify and investigate problems scientifically.
SCSh7. Students analyze how scientific knowledge is developed.
SCSh8. Students will understand important features of the process of scientific inquiry.

- Independent/dependent variables
- Quantitative/qualitative data/inferences

Ecology Unit Objectives

SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.

a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes.
b. Explain the flow of matter and energy through ecosystems by

- Arranging components of a food chain according to energy flow.
- Comparing the quantity of energy in the steps of an energy pyramid.
- Explaining the need for cycling of major nutrients (C, O, H, N, P).

c. Relate environmental conditions to successional changes in ecosystems.
d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.
e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.
f. Relate animal adaptations, including behaviors, to the ability to survive stressful environmental conditions.

Ecology: Chapters 13-16

1. Compare and contrast the following terms:

A) exponential growth/logistic growth

B) density-dependent factors/density-independent factors

C) abiotic/biotic factors.

D) population/community

E) autotrophs/heterotrophs

F) photosynthesis/chemosynthesis

G) primary/secondary succession

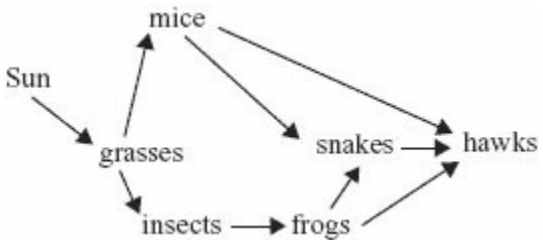
H) fundamental niche/realized niche

2. Know the stages of the water and carbon cycle. Describe the importance of the nitrogen and phosphorus cycles.

3. Giraffes are very tall animals and can therefore see predators from a large distance. The giraffes spot a predator and begin to leave. A group of wildebeests, sensing the giraffes' agitation, also get nervous and leave with them, thus avoiding a predator they never saw. What type of interaction is occurring between the giraffes and the wildebeests?

4. Explain the energy pyramid.

5. Identify organisms in the food web by trophic level. For the consumers, state whether they are primary, secondary, etc.



Cells Unit Objectives

SB1. Students will analyze the nature of the relationships between structures and functions in living cells.

a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining **homeostasis** and cell reproduction.
b. Explain how enzymes function as catalysts.
c. Identify the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids).
d. Explain the impact of water on life processes (i.e., osmosis, diffusion).

Chemistry & Biochemistry: Chapter 2

1. Compare and contrast the following groups of terms:
    A) solvent/solute
    B) covalent bond/ionic bond/hydrogen bond/peptide bond
    C) polar/nonpolar
    D) monomer/polymer
    E) carbohydrate/lipid/protein/nucleic acid
    F) saturated fat/unsaturated fat
    G) starch/cellulose
    H) energy-releasing reaction/energy-absorbing reaction

2. List and explain three unique features of water and why these are important for life.

3. What property of carbon allows it to form such a variety of different molecules?

4. Explain how enzymes help chemical reactions to occur. What is meant by the "lock-key" model?

5. The enzyme catalase catalyzes the following reaction:

$H_2O_2 \rightarrow H_2O + O_2$
A) Identify the substrate(s) of this reaction
B) Identify the product(s) of this reaction

Cells and Transport: Chapter 3

- Describe the major features of the cell theory.
- Explain how the surface area to volume ratio limits cell size.
- Describe the structure and explain the function of the major parts of a cell.
- Compare and contrast plant cells and animal cells.
- Compare and contrast eukaryotic cells and prokaryotic cells.
- Describe the structure and function of the cell membrane.
- Compare and contrast diffusion, osmosis, facilitated diffusion, active transport, endocytosis, and exocytosis.
- Describe the differences between isotonic, hypotonic, and hypertonic solutions.

1. A unicellular organism is discovered. It has DNA and ribosomes, but neither a mitochondria nor endoplasmic reticulum. Is the cell a prokaryote or a eukaryote? Explain how you know.

2. List several differences between plant and animal cells.

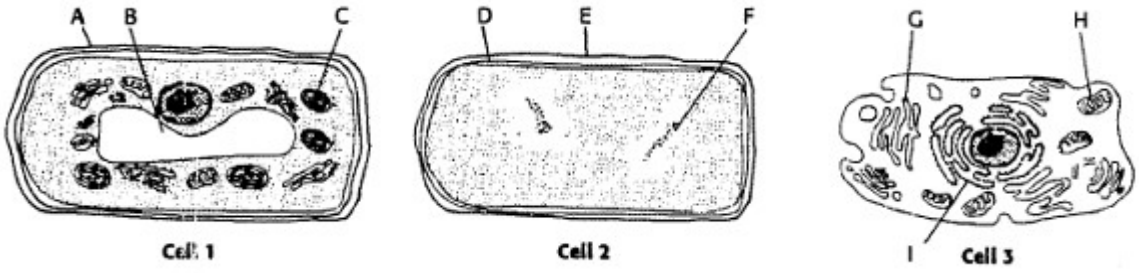
3. A certain cell is specialized in producing a protein hormone and releasing it.
    A) What organelles do you think would be especially numerous in this cell?
    B) Outline the steps that would occur to produce and release that hormone across the cell membrane.

4. A white blood cell engulfs a bacterium by endocytosis. It then digests it.
   A) What cell organelle is responsible for digesting materials?
   B) What organelles were probably involved in producing the proteins used for digestion?

5. How are active transport and facilitated diffusion similar? How are they different?

6. During exercise, muscle cells produce lots of carbon dioxide (CO_2). This carbon dioxide then leaves the muscle cells and enters the bloodstream, which has little carbon dioxide. What transport process is responsible for CO_2 leaving muscle cells? Explain.

7. Answer the following questions with regard to the cells below.



   A) Identify the labeled structures in each cell.
   B) Using your answer to part A, identify each type of cell as either a plant cell, animal cell, or bacterial cell.
   C) Which cell(s) are prokaryotic? Which cell(s) are eukaryotic?
   D) What characteristics do cells 1 and 3 have in common? How do cells 1 and 3 differ?
   E) What characteristics does cell 2 have in common with cells 1 and 3? How does cell 2 differ from cells 1 and 3?

8. Describe the composition of the cell membrane.

9. Compare and contrast diffusion, osmosis, and facilitated diffusion. How are they similar? How are they different?

10. A single celled alga living in the ocean is found to contain ten times as many iodine ions as present in an equal volume of sea water. The cell continues to take in even more iodine. What process must the cell be using to take in these ions? Explain.

11. What happens to a cell in a hypotonic solution? What happens to a cell in a hypertonic solution?

SB3. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.
a. Explain the cycling of energy through the processes of photosynthesis and respiration.

Energy in Cells: Chapter 4 Practice Questions

1. What are the starting materials and products for aerobic cellular respiration? How many ATP molecules can be produced from 1 glucose?

2 Explain why ATP is an energy-rich molecule.

3 Where in the cell do each of the following occur?
(A) Glycolysis (B) Fermentation (C) Light-dependent reactions of photosynthesis (D) Calvin Cycle

4. Suppose two cells are producing energy by breaking down glucose- one by glycolysis and fermentation, the other by aerobic cellular respiration.
   A) Which cell requires oxygen?
   B) Which cell is producing the most ATP?

5. The process of photosynthesis can be summarized with the following chemical equation:

$$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$$

Explain where in the process of photosynthesis each reactant is used and each product is produced.

6. True or False. Plants carry out cellular respiration.

SB2. Students will analyze how biological traits are passed on to successive generations.
c. Using Mendel's laws, explain the role of meiosis in reproductive variability.
e. Compare the advantages of sexual reproduction and asexual reproduction in different situations.

The Cell Cycle and Meiosis: Chapters 5 and 6

- Describe the structure of the nucleus of a cell and how the DNA is packaged within the nucleus.
- Describe the structure of a chromosome.
- Define karyotype, explain the difference between sex chromosomes and autosomes, and predict the sex of an individual based on a karyotype.
- Describe binary fission.
- List and describe the key events of the cell cycle.
- Explain how problems in the cell cycle can result in cancer and describe how cancer spreads through the body during metastasis.
- List and describe the key events of meiosis.
- Explain the process of crossing-over and how it contributes to genetic diversity.
- List errors that can occur during meiosis and the consequences of those errors for an individual.
- Compare and contrast the processes of mitosis and meiosis.

Practice Questions

1. Compare and contrast the following pairs of terms.
   A) Homologous chromosomes vs. Sister chromatids
   B) Diploid vs. Haploid
   C) Sex chromosomes vs. Autosomes
   D) Somatic cells vs. Gametes

2. Compare and contrast the G_1 phase and S phase of the cell cycle.

3. What are the main differences between mitosis and cytokinesis in plants and animals?

4. During which stage of meiosis is the diploid number of chromosomes reduced to a haploid number of chromosomes?

5. A parent cell has a total of 12 chromosomes. How many chromosomes will each of its daughter cells contain after mitosis? After meiosis?

6. Explain the role of crossing-over in ensuring genetic variation.

7. How would the cell cycle be affected if DNA were prevented from replicating during interphase?

8. What is cancer? How does it relate to mitosis? Why is a tumor more dangerous after it has undergone metastasis?

9. What is Down Syndrome? Why does it occur? How is it related to meiosis?

10. Compare and contrast the processes of mitosis and meiosis in terms of the following:
    A) Function
    B) Number of divisions
    C) Number of chromosomes in daughter cells
    D) Which type of cells perform each process

Fundamentals of Genetics: Chapter 6

Describe the methods, results, and conclusions of Mendel's experiments with garden peas.
Define and apply the vocabulary terms: allele, genotype, phenotype, dominant, recessive, homozygous, and heterozygous
Use a Punnett square to solve genetics problems involving a monohybrid cross.
Use simple probability to solve genetics problems.
Draw and interpret pedigrees to track traits through several generations.

Practice Problems

1. Contrast the following terms
    A) Genotype/Phenotype
    B) Dominant/Recessive
    C) Homozygous/Heterozygous
    D) F_2 generation/P generation
    E) Self-pollination/Cross-pollination

2. What is a test cross?

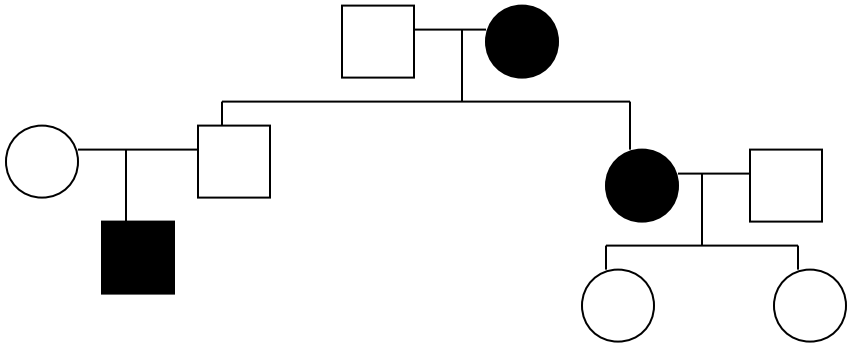
3. Be able to explain Mendel's two laws. (segregation and independent assortment)

3. Explain how two black mice, when mated, can produce some offspring that are white.

4. One parent is homozygous recessive for a certain trait, and the other is heterozygous. What fraction of their offspring would you expect to be heterozygous?

5. Two long-winged fruit flies produced 49 short-winged and 148 long-winged offspring.
    A) Which trait do you assume is dominant? Why?
    B) What are the probable genotypes of the parents?
    C) About how many of the long-winged offspring would you expect to be heterozygous?

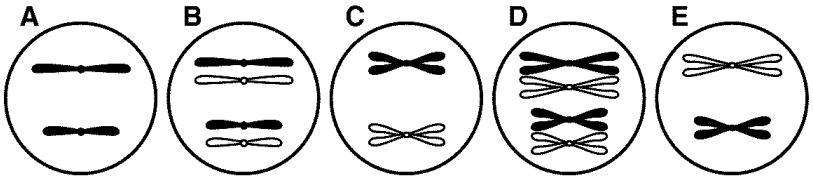
6. The pedigree below traces the inheritance of alkoptonuria, a biochemical disorder. Affected individuals, indicated here by the filled in circles and squares, are unable to break down a substance called alkapton, which colors the urine and stains body tissues.



    A) Does alkoptonuria appear to be caused by a dominant or recessive trait?
    B) Fill in the genotypes of all of the individuals.

7. In a particular type of cattle, horned cattle are dominant over hornless cattle. One farmer wants to establish a herd of horned cattle, and another farmer wants a herd of hornless cattle. They both go to the cattle market, and each buys 5 male and 5 female cattle of their preferred horn variety horned or hornless).
Which farmer will have an easier time establishing a pure-breeding herd? Explain.

Using the information you have learned about cell reproduction, infer answers to the questions below about a cell with a diploid number of 4 chromosomes. Select from among the diagrams below, labeled A, B, C, D, and E, to answer the questions below.



8. Which of the diagrams above depicts a cell at the beginning of mitosis?
(a) A (b) B (c) C (d) D (e) E

9. Which of the diagrams above depicts a cell at the end of mitosis?
(a) A (b) B (c) C (d) D (e) E

10. Which of the diagrams above depicts a cell at the end of meiosis I?
(a) A (b) B (c) C (d) D (e) E

11. Which of the diagrams above depicts a cell at the end of meiosis II?
(a) A (b) B (c) C (d) D (e) E

12. Which cells are haploid?
(a) A only (b) C and E (c) B and D (d) A, C, and E (e) none of them

13. In cats, long hair is recessive to short hair. A true-breeding (homozygous) short-haired male is mated to a long-haired female. What will their kittens look like?

14. Two cats are mated. One of the parent cats is long-haired (recessive allele). The litter which results contains two short-haired and three long-haired kittens. What does the second parent look like, and what is its genotype?

15. Mrs. And Mr. Smith both have widow's peaks (dominant). Their first child also has a widow's peak, but their second child doesn't. Mr. Smith accuses Mrs. Smith of being unfaithful to him. Is he necessarily justified? Why or why not? Work the genetics problem predicting the frequencies of the versions of this trait among their prospective children.

16. Mr. and Mrs. Jones have six children. Three of them have attached earlobes (recessive) like their father, and the other three have free earlobes like their mother. What are the genotypes of Mr. and Mrs. Jones and of their numerous offspring?