**Final Exam Study Guide**

**Scientific Method**

1. List the steps of the scientific method in order and explain each
2. What is a controlled experiment and why should you only test one variable at a time?
3. What is a theory and why must it be testable?
4. Describe how a theory is developed. Compare and contrast a theory and hypothesis.

**Macromolecules**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Macromolecule | Monomer | Polymer | Picture | Example |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

2. What is the function of an enzyme? What role does it play in chemical reactions?

**Cell Division**

1. What is the purpose of mitosis? Draw a basic picture of the process.
2. When mutations or errors occur during mitosis what type of issues/disorders/diseases can it cause? Which cells would the mutations not affect?
3. What’s the purpose of meiosis? Create a diagram to show meiosis in a cell that starts with 4 chromosomes. Why does meiosis have 2 cell divisions when mitosis only divides once?
4. When errors in meiosis occur what type of issues/disorders can it create? What specifically causes them?
5. Draw a diagram of fertilization and label each cell as haploid or diploid.

**Cells, Photosynthesis & Cellular Respiration**

1. The diagram below represents specialized cells in the surface of the leaf of a green plant.



The main function of these cells is to

(a) change the size of the stomate to regulate water loss

(b) close the stomate to keep dust and dirt out of the leaf

(c) directly provide leaf cells with the water involved in photosynthesis

(d) allow newly formed glucose to be released from the leaf

2. Which cell structures are correctly paired with their functions?

(a) The mitochondria produce enzymes, and ribosomes transport them.

(b) The ribosomes make proteins, and the nucleus stores genetic information.

(c) The cell membrane makes enzymes, and cytoplasm transports them.

(d) The vacuole stores genetic information, and chloroplasts make proteins.

3. The diagram below represents a cell and several molecules. The number of molecules shown represents the relative concentration of the molecules inside and outside of the cell.



Molecule B could enter the cell as a direct result of

(a) digestion (b) diffusion (c) active transport (d) enzyme production

4. The diagram below represents a series of events that occur in living cells.



Which molecule is indicated by X?

(a) glucose (b) carbon dioxide (c) ATP (d) protein

5. Base your answers to questions a and b on the word equations below and on your knowledge of biology. The equations represent two biochemical processes that occur in living organisms. The letter X represents a molecule produced from process

Process 1: oxygen + glucose → carbon dioxide + water + X

Process 2: carbon dioxide + water → oxygen + glucose

1. Identify the molecule represented by letter X in process 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Which process occurs in the cells of a green plant leaf?

(a) process 1, only (b) neither process 1 nor process 2

(c) process 2, only (d) both process 1 and process 2

6. Fill in the chart below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Organelle** | **Reactants** | **Products** | **Animal, Plant or Both** |
| Photosynthesis |  |  |  |  |
| Cellular Respiration |  |  |  |  |

7. Label the below diagrams with the different products and reactants for photosynthesis when they enter and leave the different organelles involved in both photosynthesis and respiration.



**Ecology**

1. What is the difference between a producer and a consumer?
2. Identify and describe all types of heterotrophs.
3. What is the difference between a food chain and a food web?
	1. What do the arrows in a food chain or food web represent?
4. In an energy pyramid, how much energy is passed on to each trophic level? What happens to the energy that is not passed on?
	1. Draw an energy pyramid with four levels. Show the amount of energy for each level if starting with 5,000 units of energy.
5. List and define the types of symbiosis.
6. What causes a population to grow? What causes it to shrink?
7. Draw and name the two types of growth that can be seen in a population.
8. What is carrying capacity?
9. Define ecological succession.
10. Identify similarities and differences between primary and secondary succession.
11. What type of disturbances cause each type of succession?
12. What is biodiversity and why is it important?
13. What are the main ways that human activity can reduce biodiversity?
14. Identify and define the processes in the carbon cycle.
15. What processes add carbon to the atmosphere? What process removes it?

**For Questions 16-19 Use the diagram to the right.**

1. In the food web at right, which of the following is a secondary consumer?
	1. Fox
	2. Mice
	3. Plants
	4. Seed-eating birds
2. According to the food web shown, the fox receives energy from all of the following **except**:
	1. Squirrels
	2. Mice
	3. Toads
	4. Rabbits
3. According to the food web, rabbits, squirrels, mice, seed-eating birds, and herbivorous insects are all \_\_\_\_\_\_\_\_\_\_\_\_\_ consumers.
	1. Quaternary
	2. Tertiary
	3. Secondary
	4. Primary
4. According to the food web above, hawks and owls eat all of the following **except**:
	1. Mice
	2. Seed-eating birds
	3. Spiders
	4. Squirrels
5. According to the energy pyramid at right, which number represents the level where producers are located?
	1. 1
	2. 2
	3. 3
	4. 4
6. In the graph shown at right, the density of a population of Daphnia (sea flies) over time is shown. What type of growth is this?
	1. Exponential growth
	2. Logistic growth
	3. Carrying capacity
	4. Finite growth
7. What is the approximate carrying capacity for this population of Daphnia per 50 mL?
	1. 195
	2. 180
	3. 100
	4. 130

**Genetics**

**DNA and Protein Synthesis**

1. DNA is a set of instructions to make and maintain a living thing. It contains a secret code that is really instructions for assembling \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. The unit to the right which connects together to other similar units

to make DNA is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 ***3. Label its three parts.***

4. Name the 4 bases found in DNA?

 1. \_\_\_\_\_\_\_\_\_\_\_\_\_ 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3. \_\_\_\_\_\_\_\_\_\_\_\_\_ 4. \_\_\_\_\_\_\_\_\_\_\_\_\_

5. What types of bonds hold together DNA?

6. DNA replication results in two DNA molecules

a. each with two new strands c. one with two new strands and the other with two original strands

b. each with two original strands d. each with one new strand and one original strand

7. What is the point of DNA replication? When does DNA replication occur?

8. Complete the following chart on DNA and RNA:

|  |  |  |
| --- | --- | --- |
|  | DNA | RNA |
| Type of Sugar |  |  |
| Bases |  |  |
| Number or Strands |  |  |
| In what part of the cell is it found? |  |  |
|  |  |  |

9. Protein synthesis can be summarized as \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

10 Fill in the blanks with the correct organelles:

Protein synthesis starts in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then moves into the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and ends on a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

11. In protein synthesis DNA mRNA is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

It takes place in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. Reading the codons in the mRNA to put together amino acids to make a protein is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 It takes place on a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. Write the matching DNA strand ACCATAGATACT

14. a. Transcribe this DNA: GGACTAGAATCCATC

b. How many codons are there? \_\_\_\_\_\_

15. Translate this mRNA: AUGCAGAUCACCGGAUAGUAA

16. Make the protein this DNA codes for: TACCCATGATAGGACCAGATT

17. What are the 3 main types of point mutations that can occur during replication or protein synthesis? Give an example of each type of mutation.

18. Not all mutations change the protein. Why?

**Mendelian Genetics**

1. What does heterozygous mean?

 What does homozygous mean?

2. In flowers, blue flower petals are dominant to red flower petals.

What are the possible phenotypes for the following flowers with these genotypes?

BB \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Bb \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_bb \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What is the phenotype of a heterozygous person if F is freckles and f is no freckles?

4. In humans, big ears are dominant to small ears. B=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What are the genotypes for a person with big ears? \_\_\_\_\_,\_\_\_\_\_

What is the genotype for a person with small ears? \_\_\_\_\_\_

5. In dogs, short hair (H) is dominant to long hair (h). If a heterozygous short hair dog is crossed with a long hair dog, what percentage of the offspring will have long hair? (Hint: Create a Punnett Square)

**Human Heredity**

1. What percent of your DNA comes from each parent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
|  |  |
|  |  |

5. In humans, the Cystic Fibrosis allele (a) is recessive to the normal non-Cystic

Fibrosis allele (A) . Cross a heterozygous female with a heterozygous male.

 What are the chances their first child is born with Cystic Fibrosis?

6. A child is born heterozygous for Black hair (Bb). Black hair allele (B) is dominant to the blonde hair allele (b). List three possible genotype combinations his parents may have. Mom Dad

7. a. What makes an X-linked disorder different from other types of disorders?

 b. Name 3 X-linked disorders: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Determine if the following couple will have sons and daughters who have Hemophilia.

H=Normal h=hemopilia \*\*\*\*\*\*\*Be carful with this one\*\*\*\*\*\*\*

|  |  |
| --- | --- |
|  |  |
|  |  |

 a. Parent genotypes: XHXh x XhY

 Parent phenotypes: \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_

 How many daughters have the disorder? \_\_\_\_\_

 How many daughters are carriers? \_\_\_\_\_

 How many sons have the disorder? \_\_\_\_\_

9. a. In order to have a son, a man must give a sperm containing 22 autosomes and a \_\_\_\_ chromosome=23 total

 b. What are the chances of having a boy or girl. **Explain**.

**Genetic Engineering**

1. If a bioluminescent gene is inserted into a bacteria cell, how will the protein production of the bacteria change?
2. In gene therapy, viruses are used to replace defective genes. What cells are best suited for this treatment?

**Evolution**

1. Describe a “fit” organism?
2. What is an adaptation?
3. Define evolution.
4. What are fossils and how do they support evolution?
5. Define and give examples of homologous structures?

1. What are vestigial organs? How do they provide evidence for evolution?
2. How are artificial and natural selection similar? How are they different?
3. Describe the four factors that must be present for natural selection to occur?

**Distractor Rationales**  [[-hide](https://oars.net/corona/_assessments/_inspect/index.php?mode=show&test_id=2947##)]

**A**. Student(s) may have mistakenly thought that a mutation is usually removed by a chance reverse mutation at the same nucleotide.
**B**. Student(s) may have known that random mating increases genetic variation, but mistakenly thought that it also removes mutations.
**C**. Student(s) may have known that mutations increase genetic variation, but mistakenly thought that the same variation also removes mutations.
**D**. Correct answer

**444449. Mutations are \_\_\_\_\_\_\_\_\_\_ changes of DNA within a gene pool.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   circle**A.** | deliberate |      |   circle**B.** | random |      |   circle**C.** | only mild |      |   circle**D.** | intense |

**10. A species has a better chance of surviving as the environment changes if it \_\_\_\_\_\_\_\_\_\_.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   circle**A.** | lives a long time |      |   circle**C.** | produces few offspring |
|   circle**B.** | has many different places to live |      |   circle**D.** | has many genetic variations |

**11. Biological evolution can best be defined as**

|  |  |
| --- | --- |
|   circle**A.** | Change in the genes of individuals over time  |
|   circle**B.** | Change in the genes of a population over time.  |
|   circle**C.** | Any change that occurs in the lifetime of individuals over time.  |
|   circle | D. Changes in individuals to form new species.  |

**12. What terms describes when humans breed organisms for favorable traits, such as faster horses**

|  |  |
| --- | --- |
|   circle**A.** | Artificial Selection  |
|   circle**B.** | Natural Selection |
|   circle**C.** | Fitness  |
|   circle**D.** | Adaptation  |

**13. Which of the following is a human vestigial structure**

|  |  |
| --- | --- |
|   circle**A.** | lungs  |
|   circle**B.** | Kidneys  |
|   circle**C.** | Appendix  |
|   circle**D.** | Jaw Bone  |

**Use the chart below to answer the following question(s).**


Top of Form

**14. The graph above shows the total number of species among vertebrates (animals with a backbone).  Why do bony fish have a good chance of at least some species surviving a major environmental change?**

|  |  |
| --- | --- |
|   circle**A.** | the ocean environment is the most resistant to environmental change  |
|   circle**B.** | bony fish have the greatest diversity of species  |
|   circle**C.** | all of the bony fish species are restricted to same environment  |
|   circle**D.** | bony fish are the most genetically complex species of vertebrates |

**15. The front legs of a dog and the wings of a bat are \_\_\_\_\_\_\_\_\_\_.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   circle**A.** | Vestigial structures |      |   circle**C.** | homologous structures |
|   circle**B.** | similar characteristics |      |   circle**D.** | genetic traits |

**Distractor Rationales**  [[-hide](https://oars.net/corona/_assessments/_inspect/index.php?mode=show&test_id=2947##)]

**A**. Student(s) may have confused fossil structures with homologous structures, both of which are evidence that species have changed over time.
**B**. Student(s) may not have understood that the front legs of a dog and the wings of a bat are not similar characteristics but instead are examples of homologous structures.
**C**. Correct answer
**D**. Student(s) may not have understood that the front legs of a dog and the wings of a bat are not genetic traits but instead are examples of homologous structures.

Top of Form



16. Organisms that are best fit and adapted go on to reproduce more, this is called

A. Artificial Selection

B. Genetic Drift

C. Natural Selection

D. Fitness

17. Although organisms of the same species are similar, there are important differences that increase or decrease fitness, these differences among the same species is called

A. genetic drift

B. fitness

C. variation

D. competition

18. \_\_\_\_\_\_\_\_\_ refers to individuals having more offspring that can survive?

A. Adaptations

B. Over-Production

C. Competition

D. Gene Flow

19. Fitness is the ability to

A. camouflage

B. survive and reproduce

C. be the biggest and strongest

D. survive

20. The process in which organisms with traits well suited to an environment are more likely to survive and to produce offspring is

a. Natural selection. c. Genetic principles.

b. Origin of species. d. Trait mechanism.

21. Which of the following is a factor in natural selection?

a. Individuals of species compete with one another to survive.

b. All species are genetically diverse.

c. Individuals better able to adapt to changes leave more offspring.

d. All of the above.

22. Individuals that are better able to cope with the challenges of their environment tend to

a. Decrease in population over time.

b. Leave more offspring than those less suited to the environment.

c. Leave fewer offspring than those less suited to the environment.

d. Both (a) and (c)

23. Structures that share a common ancestry or are similar because they are modified versions of structures from a common ancestor that contain the same basic bone structure are

a. Not related. c. Homologous.

b. Not homologous. d. Young in origin.

The illustrations below show vestigial pelvic bones of a baleen whale and vestigial hind limb bones of an extinct whale.

24. The presence of these bones in the baleen whale and extinct whale provides evidence of which of the following?

a. Whales can travel on land when necessary.

b. Whales are developing into animals with four functioning limbs.

c. Whales have functional legs that are hidden by fat and skin.

d. hales evolved from four-legged animals

**Homeostasis**

1. Homeostasis is primarily regulated by what feedback mechanism? Describe how the mechanism works, and provide an example.

2. Name 3 organs of the body that are involved in homeostasis and briefly explain what they do.

3. The immune system of humans may respond to chemicals on the surface of an invading organism by

a. Releasing hormones that break down these chemicals

b. Synthesizing antibodies that mark these organisms to be destroyed

c. Secreting antibodies that attach to these organisms

d. Altering a DNA sequence in these organism

4. Put the following items in order from smallest to largest: cells, tissues, organs, organ systems.