BIOL-8 Final Exam

Comprehensive: All Modules (01-15)

Date: Tuesday, May 12, 2026
Time: 5:30 PM - 8:40 PM
Total Points: 150

Part A: Multiple Choice (75 points)

Choose the best answer for each question. Each question is worth 1.5 points.

Foundations of Life Science (Modules 01-03)

1. The smallest unit of life that can carry out all life functions is the:
2. A) Atom
3. B) Molecule
4. C) Cell
5. D) Organ
6. A controlled experiment requires:
7. A) Multiple hypotheses
8. B) An experimental group and a control group
9. C) At least 100 test subjects
10. D) Expensive equipment
11. Hydrogen bonds are important in water because they:
12. A) Are the strongest type of bond
13. B) Give water its unique properties
14. C) Are covalent bonds

15. D) Make water nonpolar

16. Enzymes are made of which macromolecule?

17. A) Carbohydrates
18. B) Lipids
19. C) Proteins

20. D) Nucleic acids

21. The monomer of nucleic acids is a:

22. A) Nucleotide
23. B) Amino acid
24. C) Fatty acid
25. D) Monosaccharide

Cells and Membranes (Modules 04-05)

1. Which organelle contains the cell's genetic material?
2. A) Mitochondrion
3. B) Ribosome
4. C) Nucleus

5. D) Golgi apparatus

6. Which is NOT a component of the cell membrane?

7. A) Phospholipids
8. B) Cholesterol
9. C) Proteins

10. D) Cellulose

11. Facilitated diffusion is similar to simple diffusion because both:

12. A) Require ATP
13. B) Move molecules against the concentration gradient

14. C) Do not require energy

15. D) Use vesicles

16. A cell in a hypotonic solution will:

17. A) Shrink
18. B) Swell
19. C) Stay the same

20. D) Divide

21. Endocytosis is the process by which cells:

    - A) Release materials
    - B) Take in materials
    - C) Divide
    - D) Produce ATP

Metabolism and Cell Division (Modules 06-08)

1. The product of glycolysis is:

    - A) Glucose
    - B) Pyruvate
    - C) Oxygen
    - D) Carbon dioxide

2. Where does the citric acid cycle occur?

    - A) Cytoplasm
    - B) Mitochondrial matrix
    - C) Inner mitochondrial membrane
    - D) Nucleus

3. In mitosis, sister chromatids separate during:

    - A) Prophase

- B) Metaphase
- C) Anaphase
- D) Telophase

4. The result of meiosis in humans is:

    - A) 4 diploid cells with 46 chromosomes
    - B) 2 haploid cells with 23 chromosomes
    - C) 4 haploid cells with 23 chromosomes
    - D) 2 diploid cells with 46 chromosomes

5. Crossing over results in:

    - A) Identical daughter cells
    - B) Genetic recombination
    - C) Chromosome duplication
    - D) Nondisjunction

Genetics (Module 09)

1. In a dihybrid cross of two heterozygous individuals (AaBb × AaBb), the expected phenotypic ratio is:

    - A) 3:1
    - B) 1:2:1
    - C) 9:3:3:1
    - D) 1:1:1:1

2. A trait that appears more often in males than females is likely:

    - A) Autosomal dominant
    - B) Autosomal recessive
    - C) X-linked
    - D) Y-linked

3. If a red flower (RR) is crossed with a white flower (WW) and all offspring are pink (RW), this demonstrates:

    - A) Complete dominance
    - B) Incomplete dominance
    - C) Codominance
    - D) Multiple alleles

Tissues and Skeletal System (Modules 10-11)

1. Which tissue type lines body surfaces and cavities?

    - A) Connective
    - B) Muscle
    - C) Epithelial
    - D) Nervous

2. Bone-forming cells are called:

    - A) Osteoclasts
    - B) Osteocytes
    - C) Osteoblasts
    - D) Chondrocytes

3. The skull and vertebral column belong to the:

    - A) Appendicular skeleton
    - B) Axial skeleton
    - C) Muscular system
    - D) Integumentary system

4. Long bones grow in length at the:

    - A) Periosteum
    - B) Endosteum
    - C) Epiphyseal plate
    - D) Diaphysis

Muscular System and Pathogens (Modules 12-13)

1. The smallest contractile unit of a muscle fiber is the:
    - A) Myofibril
    - B) Sarcomere
    - C) Muscle cell
    - D) Motor unit
2. Which muscle type is found in blood vessel walls?
    - A) Skeletal muscle
    - B) Cardiac muscle
    - C) Smooth muscle
    - D) Striated muscle
3. Prions cause disease by:
    - A) Injecting genetic material into cells
    - B) Causing normal proteins to misfold
    - C) Releasing toxins
    - D) Digesting cell walls
4. Which pathogen type causes tuberculosis?
    - A) Virus
    - B) Fungus
    - C) Bacterium
    - D) Prion

Cardiovascular and Respiratory Systems (Modules 14-15)

1. Deoxygenated blood from the body enters the heart through the:
    - A) Aorta
    - B) Pulmonary vein
    - C) Superior and inferior vena cavae

◦ D) Pulmonary artery

2. The pulmonary circuit carries blood to and from the:

◦ A) Heart
◦ B) Brain
◦ C) Lungs
◦ D) Body tissues

3. Which chamber of the heart has the thickest wall?

◦ A) Right atrium
◦ B) Left atrium
◦ C) Right ventricle
◦ D) Left ventricle

4. The structure that prevents food from entering the trachea is the:

◦ A) Larynx
◦ B) Epiglottis
◦ C) Bronchus
◦ D) Pharynx

5. The respiratory control center is located in the:

◦ A) Cerebral cortex
◦ B) Medulla oblongata
◦ C) Spinal cord
◦ D) Lungs

6. Oxygen diffuses from alveoli into the blood because:

◦ A) Oxygen is actively transported
◦ B) Blood has lower oxygen concentration
◦ C) Hemoglobin pushes oxygen into blood
◦ D) The lungs contract

Integrative Questions

1. Which macromolecule stores genetic information?
    - A) Carbohydrates
    - B) Lipids
    - C) Proteins
    - D) Nucleic acids
2. ATP is produced in the greatest quantity during:
    - A) Glycolysis
    - B) The citric acid cycle
    - C) The electron transport chain
    - D) Fermentation
3. A cell with 20 chromosomes undergoes meiosis. How many chromosomes are in each daughter cell?
    - A) 5
    - B) 10
    - C) 20
    - D) 40
4. Which hormone is important for bone growth during puberty?
    - A) Insulin
    - B) Growth hormone and sex hormones
    - C) Glucagon
    - D) Melatonin
5. Red blood cells transport oxygen using:
    - A) Myosin
    - B) Hemoglobin
    - C) Actin
    - D) Antibodies

6. The function of surfactant in the lungs is to:

    - A) Trap pathogens
    - B) Reduce surface tension in alveoli
    - C) Increase CO_2 absorption
    - D) Strengthen alveolar walls

7. Muscle fatigue is primarily caused by:

    - A) Lack of calcium
    - B) Accumulation of metabolic waste products
    - C) Dehydration of muscle fibers
    - D) Overproduction of ATP

8. A person's blood pressure reading is 120/80 mmHg. The 120 represents:

    - A) Diastolic pressure
    - B) Systolic pressure
    - C) Mean arterial pressure
    - D) Venous pressure

Additional Integration (41-50)

1. Which process is shared by all living cells?

    - A) Photosynthesis
    - B) Cellular respiration
    - C) Sexual reproduction
    - D) Movement

2. The Golgi apparatus functions to:

    - A) Produce ATP
    - B) Modify and package proteins
    - C) Break down cellular waste
    - D) Store genetic information

3. Osmosis is the diffusion of:

- A) Solutes across a membrane
- B) Water across a membrane
- C) Gases in the lungs
- D) Ions in nerve cells

4. Down syndrome results from:

- A) A mutation in one gene
- B) Nondisjunction during meiosis
- C) Crossing over
- D) A dominant allele

5. Cartilage differs from bone in that it:

- A) Is harder
- B) Has no blood supply
- C) Contains more calcium
- D) Cannot flex

6. The inflammatory response includes all EXCEPT:

- A) Redness
- B) Swelling
- C) Antibody production
- D) Heat

7. The sinoatrial node generates electrical impulses that:

- A) Contract skeletal muscle
- B) Initiate heart contraction
- C) Regulate breathing rate
- D) Control blood pressure

8. Carbon dioxide is primarily transported in blood as:
    - A) Bound to hemoglobin
    - B) Dissolved in plasma
    - C) Bicarbonate ions
    - D) Carbonic acid
9. A motor unit consists of:
    - A) A single muscle fiber
    - B) The neuromuscular junction only
    - C) A motor neuron and all muscle fibers it innervates
    - D) The sarcomere and its proteins
10. The final product of alcoholic fermentation is:
    - A) Lactic acid and ATP
    - B) Ethanol and CO2
    - C) Pyruvate only
    - D) Water and ATP

Part B: Short Answer (45 points)

Answer each question in 2-4 sentences. Each question is worth 5 points.

1. Compare and contrast photosynthesis and cellular respiration in terms of their inputs, outputs, and purposes.
2. Explain how the structure of DNA allows it to store and transmit genetic information.
3. Describe the process of crossing over and explain its significance for genetic variation.
4. Compare the structure and function of arteries, veins, and capillaries.
5. Explain the relationship between the structure of the alveoli and their function in gas exchange.

6. Describe how the skeletal, muscular, and nervous systems work together to produce movement.

7. Explain how vaccines work to prevent infectious disease.

8. Compare the three types of muscle tissue in terms of structure, location, control, and function.

9. Describe the cell cycle and explain why proper regulation is important for preventing cancer.

Part C: Essay Questions (30 points)

Choose TWO of the following essay questions. Write well-organized responses of at least one page each. (15 points each)

Option A: Trace the flow of energy through a biological system, starting with the sun and ending with ATP in a muscle cell. Include photosynthesis, cellular respiration, and the use of ATP in muscle contraction.

Option B: Explain how the body maintains homeostasis during exercise, focusing on the cardiovascular, respiratory, and muscular systems. Describe the changes that occur and how they are regulated.

Option C: Compare and contrast mitosis and meiosis, including their purposes, stages, and outcomes. Explain how errors in each process can lead to different consequences.

Option D: Discuss the relationship between structure and function at multiple levels of organization in biology. Use specific examples from molecules, cells, tissues, and organ systems.

End of Final Exam