



**BAKER COLLEGE**  
**STUDENT LEARNING OUTCOMES**  
EDU2510 & EDU2510L Science Foundations I  
3 Semester Hours

**Student Learning Outcomes and Enabling Objectives**

1. Apply the scientific method to an investigation of natural phenomenon.
  - a. Demonstrate the steps of scientific investigation
  - b. Properly interpret data and evidence.
  - c. Identify aspects of the nature of science, including:
    - i. Science is tentative.
    - ii. Science is subjective.
    - iii. Science is social.
    - iv. Science is empirical.
    - v. Science involves observation and inference.
2. Summarize the chemical, physical, and structural properties of an atom based on its location in the periodic table.
  - a. Identify possible interactions between atoms according to the periodic table and the octet rule.
  - b. Explain atomic structure and periodic properties.
  - c. Define atom, element, nucleus, and orbital.
  - d. Explain the modern theory of atomic structure.
  - e. Describe the physical properties of the subatomic particles, including neutrons, protons, and electrons.
  - f. Define matter, ion, period, and group.
  - g. Describe physical properties of metals.
  - h. Illustrate how to determine the atomic number and mass of an element from the periodic table.
  - i. Identify the location of metals, nonmetals, semiconductors, alkali metals, alkaline metals, halogens, noble gases, representative elements, and transition elements on the periodic table.
  - j. Demonstrate how to determining the number of outer shell electrons for representative elements on the periodic table.
  - k. Explain how to write Lewis dot structures for individual atoms.
3. Apply the mole concept.
  - a. Explain the relationship between the mole and mass and its role in chemistry.
  - b. Demonstrate how to calculate Molar mass from molecular formulas
4. Categorize molecules and compounds.

- a. Explain what valence electrons are, and what they have to do with the formation of ionic bonds and covalent bonds.
  - b. Explain how polar covalent bonds form.
  - c. Explain the octet rule and how it applies to ionic and covalent compounds.
  - d. Describe the physical and chemical properties of ionic compounds.
  - e. Describe the physical and chemical properties of covalent compounds.
  - f. Explain how to write formulas for ionic and covalent compounds.
  - g. Explain how to name ionic and covalent compounds.
  - h. Write Lewis dot structures for binomial compounds.
5. Categorize chemical reactions and balance chemical equations
- a. Recognize the following types of reactions:
    - i. Acids and bases
    - ii. Redox reactions
    - iii. Combustion
    - iv. Decomposition
    - v. Synthesis
    - vi. Single and double displacement
    - vii. Precipitation
    - viii. Gas evolution
  - b. Explain how to write balanced chemical equations.
  - c. Discuss nuclear reactions how it is studied and its potential dangers.
6. Evaluate water and solution chemistry.
- a. Discuss the unique properties of water and its importance in both living and non-living systems.
  - b. Describe the following properties of water and their implications:
    - i. Boiling point.
    - ii. Freezing point.
    - iii. Polarity.
  - c. Distinguish between acids and basis.
  - d. Describe the formation of salts and the release of electrolytes in water.
7. Relate principles of chemistry to life.
- a. Discuss the basic structure and function of the following organic compounds:
    - i. Carbohydrates
    - ii. Proteins
    - iii. nucleic acids
    - iv. Lipids
  - b. Describe the structure and functions of the cell membrane. Including:
    - i. phospholipid bilayer
    - ii. globular proteins
    - iii. Cholesterol
  - c. Explain the principles of diffusion and osmosis

8. Describe the tenants of cell theory.
  - a. Identify the properties of life.
  - b. Identify the cell as the unit of life.
  
9. Compare the structure of prokaryotic and eukaryotic cells.
  - a. Describe the structure and function of the major structures of prokaryotic cells, including:
    - i. capsule
    - ii. cell wall
    - iii. Flagella and motility
    - iv. pili
    - v. circular chromosome
    - vi. Plasmids
  - b. Describe the structure and function of the major organelles of eukaryotic cells including:
    - i. endoplasmic reticulum and protein and lipid synthesis
    - ii. Golgi apparatus and vesicle formation
    - iii. lysosomes and hydrolytic enzymes
    - iv. nucleus and DNA transcription
    - v. mitochondria and respiration
    - vi. chloroplasts and photosynthesis
    - vii. ribosomes and mRNA translation
    - viii. cilia and motility
    - ix. flagella and motility
  - c. Discuss metabolic pathways used by autotrophs and heterotrophs including:
    - i. aerobic respiration
    - ii. anaerobic respiration
    - iii. photosynthesis
  
10. Distinguish between mitosis and meiosis.
  - a. Identify the stages of mitosis
  - b. Identify the stages of meiosis
  
11. Evaluate the mechanisms and basic patterns of inheritance and protein expression.
  - a. Define the terms used to describe genetic processes, including:
    - i. Alleles
    - ii. Carrier
    - iii. Chromosome
    - iv. Crossing Over
    - v. dominant allele
    - vi. Gene
    - vii. Genotype
    - viii. Heterozygous
    - ix. Homozygous

- x. Mutation
  - xi. Phenotype
  - xii. recessive allele
  - xiii. X-linked gene
- b. Explain the process of DNA replication.
  - c. Describe point and chromosomal mutations.
  - d. Discuss patterns of inheritance observed by Mendel
  - e. Discuss the role of sexual reproduction and crossing over in maintaining diversity.
  - f. Explain transcription and translation.

12. Express evolutionary change as the integration of natural selection and genetic processes and its foundational role in understanding biology.

- a. Describe the distribution of population characteristics as normal curves.
- b. Discuss theories of the origins of life on earth.
- c. Interpret major events in the early evolution of life.
- d. Illustrate the influence of the environment in evolution.
- e. Identify the three major domains of life.
- f. Explain the theory of natural selection and the concept of selecting agents.
- g. Define the concept of species.

13. Analyze the hierarchical system of taxonomy.

- a. Review modern strategies used by taxonomists to organize information about species, including:
  - i. Phylogenetics.
  - ii. cladistics.
- b. Review the organization and evolution of the Eubacteria.
- c. Review the organization and evolution of the Archaea.
- d. Review the organization and evolution of the Eukarya. Specifically address these kingdoms:
  - i. Protista
  - ii. Fungi
  - iii. plantae
  - iv. Animalia

14. Explain the systems of the body and how these systems contribute to maintaining homeostasis.

- a. Define anatomy, physiology, and homeostasis
- b. Describe the basic organization and functions of the major body systems including:
  - i. cardiovascular system
  - ii. respiratory system
  - iii. digestive system
  - iv. endocrine system
  - v. integumentary system
  - vi. nervous system, including both general and special senses

- vii. skeletal system
  - viii. muscular system
  - ix. Lymphatic system and immunity
  - x. Urinary system and excretion
  - xi. Reproductive System
- c. Summarize how these systems contribute to maintaining homeostasis.
- d. Discuss human reproduction and reproductive health including:
- i. Male and female sexual development and anatomy.
  - ii. Spermatogenesis
  - iii. Oogenesis
  - iv. Contraception
  - v. Pregnancy and Fetal development
15. Classify ecosystems as a dynamic integration of biotic and abiotic components
- a. Distinguish the different trophic levels of the food chain
  - b. Describe the transfer of energy from one trophic level to another.
  - c. Identify that most energy originates from the sun.
  - d. Define and give examples of the following ecosystem components:
    - i. Carnivore
    - ii. Commensalism
    - iii. Community
    - iv. Competition
    - v. Consumer
    - vi. Environment
    - vii. Food chain
    - viii. Habitat
    - ix. Herbivore
    - x. Mutualism
    - xi. Niche
    - xii. Omnivore
    - xiii. Parasite
    - xiv. Predation
    - xv. Producer
    - xvi. Symbiosis
    - xvii. Trophic level
  - e. Explain the relationships between organisms, populations, communities, and ecosystems.
  - f. Describe terrestrial and aquatic biomes.
  - g. Describe the cycling of materials in ecosystems
  - h. Recognize that ecosystems change over time.
  - i. Define invasive species.

### **Laboratory Student Learning Outcomes and Enabling Objectives**

16. Conduct experimental laboratories applying concepts from lecture:
  - a. Collect experimental data by observing lab safety and proper procedures.
  - b. Analyze data, perform calculations, and interpret the results of the experiments.
  - c. Create well-formatted and -labelled graphs and diagrams.
  
17. Apply principles of safety to chemical and physical investigations, including:
  - a. Basic precautions for working with chemicals
  - b. How to store potentially hazardous chemicals
  - c. Classroom laboratory safety measures
  
18. Examine the treatment and appropriate use of animals in the classroom.
  - a. Recognize the importance of researching and understanding the proper husbandry of an animal prior to purchasing one for the classroom.
  - b. Recognize that the animal must be properly taken care of for the full duration its natural lifespan.
  - c. Review how to safely work with small animals and potential risks to students and the instructor.

These SLOs are not approved for experiential credit.

**Effective: Fall 2017**