| **Required Course Numbers** | | | | | | | | | | | |
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| **Test Content Categories** |  |  |  |  |  |  |  |  |  |  |  |
| I. Nature and Impact of Science   and Engineering (14%) |  |  |  |  |  |  |  |  |  |  |  |
| A. Nature of Science and Engineering |  |  |  |  |  |  |  |  |  |  |  |
| 1. Nature of scientific knowledge |  |  |  |  |  |  |  |  |  |  |  |
| a. Use of a variety of methods |  |  |  |  |  |  |  |  |  |  |  |
| b. Based on empirical evidence |  |  |  |  |  |  |  |  |  |  |  |
| c. Models, laws, and theories explain natural phenomena |  |  |  |  |  |  |  |  |  |  |  |
| d. Major concepts developed over time / Subject to revision in light of new evidence |  |  |  |  |  |  |  |  |  |  |  |
| e. Crosscutting concepts and processes |  |  |  |  |  |  |  |  |  |  |  |
| 2. Engineering Design |  |  |  |  |  |  |  |  |  |  |  |
| a. Define problems and identify criteria and constraints |  |  |  |  |  |  |  |  |  |  |  |
| b. Design, test, and evaluate possible solutions with respect to how well they meet the criteria and constraints |  |  |  |  |  |  |  |  |  |  |  |
| c. Optimize the design solution through a systematic process of modification and testing |  |  |  |  |  |  |  |  |  |  |  |
| 3. Safety, Materials, and Standard Equipment in the Laboratory and Field |  |  |  |  |  |  |  |  |  |  |  |
| a. Understands safety and emergency procedures in the laboratory and field |  |  |  |  |  |  |  |  |  |  |  |
| * Equipment (e.g., eyewash stations, safety showers) |  |  |  |  |  |  |  |  |  |  |  |
| * Appropriate student apparel and behavior (e.g., goggles, clothing) |  |  |  |  |  |  |  |  |  |  |  |
| * Emergency procedures for minor burns and other injuries |  |  |  |  |  |  |  |  |  |  |  |
| * Emergency procedures for mishaps (e.g., fires, chemical spills) |  |  |  |  |  |  |  |  |  |  |  |
| * Awareness of potential hazards (e.g., allergies, asthma, environmental hazards) |  |  |  |  |  |  |  |  |  |  |  |
| b. Is familiar with the procedures for safe  and correct preparation, storage, use, and disposal of materials in the laboratory and field |  |  |  |  |  |  |  |  |  |  |  |
| * Safe storage |  |  |  |  |  |  |  |  |  |  |  |
| * Proper use and safe disposal (e.g., chemicals, biohazards, sharps) |  |  |  |  |  |  |  |  |  |  |  |
| * Proper selection and preparation |  |  |  |  |  |  |  |  |  |  |  |
| * Use of equipment (e.g., fume hoods, safety goggles, waste containers) |  |  |  |  |  |  |  |  |  |  |  |
| c. Is familiar with how to use standard equipment in the laboratory and field |  |  |  |  |  |  |  |  |  |  |  |
| * Appropriate use of equipment (e.g., thermometers, microscopes, barometers, graduated cylinders, Bunsen burners, balances, pH meters, rock hammers) |  |  |  |  |  |  |  |  |  |  |  |
| * Basic care, preparation, and maintenance of equipment |  |  |  |  |  |  |  |  |  |  |  |
| B. Science, Technology, Society, and the Environment |  |  |  |  |  |  |  |  |  |  |  |
| 1. Interdependence of science, engineering, and technology |  |  |  |  |  |  |  |  |  |  |  |
| a. Engineering advances lead to important discoveries in science. |  |  |  |  |  |  |  |  |  |  |  |
| b. Science and technology drive each other forward. |  |  |  |  |  |  |  |  |  |  |  |
| 2. Impact of engineering, science, and technology on the environment and society |  |  |  |  |  |  |  |  |  |  |  |
| a. Air and water pollution |  |  |  |  |  |  |  |  |  |  |  |
| b. Greenhouse gases |  |  |  |  |  |  |  |  |  |  |  |
| c. Global climate and sea level change |  |  |  |  |  |  |  |  |  |  |  |
| d. Waste disposal |  |  |  |  |  |  |  |  |  |  |  |
| e. Acid rain |  |  |  |  |  |  |  |  |  |  |  |
| f. Loss of biodiversity |  |  |  |  |  |  |  |  |  |  |  |
| g. Ozone depletion |  |  |  |  |  |  |  |  |  |  |  |
| h. Urban development and land use |  |  |  |  |  |  |  |  |  |  |  |
| 3. Major issues associated with energy production and the management of natural resources |  |  |  |  |  |  |  |  |  |  |  |
| a. Conservation and recycling |  |  |  |  |  |  |  |  |  |  |  |
| b. Renewable and nonrenewable energy resources |  |  |  |  |  |  |  |  |  |  |  |
| c. Pros and cons of power generation based on sources |  |  |  |  |  |  |  |  |  |  |  |
| d. Distribution, extraction, and use of Earth’s resources |  |  |  |  |  |  |  |  |  |  |  |
| 4. Applications of science and technology in daily life |  |  |  |  |  |  |  |  |  |  |  |
| a. Chemistry (e.g., properties of household products) |  |  |  |  |  |  |  |  |  |  |  |
| b. Physics (e.g., batteries, communications technology) |  |  |  |  |  |  |  |  |  |  |  |
| c. Life science (e.g., public health, selective breeding, genetic modification) |  |  |  |  |  |  |  |  |  |  |  |
| d. Earth and space science (e.g., agricultural practices, space technology) |  |  |  |  |  |  |  |  |  |  |  |
| II. Physical Science (30%) |  |  |  |  |  |  |  |  |  |  |  |
| A. Matter and Its Interactions |  |  |  |  |  |  |  |  |  |  |  |
| 1. Structure and properties of matter |  |  |  |  |  |  |  |  |  |  |  |
| a. Atomic structure, including atomic |  |  |  |  |  |  |  |  |  |  |  |
| b. How the periodic table is organized in groups with similar chemical and physical properties (e.g., metals, nonmetals, noble gases) |  |  |  |  |  |  |  |  |  |  |  |
| c. States of matter (e.g., solids, liquids, gases) |  |  |  |  |  |  |  |  |  |  |  |
| * Use the particle model to describe solids, liquids and gases. |  |  |  |  |  |  |  |  |  |  |  |
| * Describe the effect that changes in temperature/kinetic energy have on  particle motion. |  |  |  |  |  |  |  |  |  |  |  |
| d. Classification of matter: elements, compounds, and mixtures |  |  |  |  |  |  |  |  |  |  |  |
| e. Characteristics of mixtures: heterogeneous and homogenous, saturated and unsaturated solutions, dilute and concentrated solutions, acids and bases (pH), and factors that affect the dissolving process (e.g., temperature, particle size) |  |  |  |  |  |  |  |  |  |  |  |
| f. Elements and simple compounds: formulas and structures, ionic, covalent, and metallic bonding |  |  |  |  |  |  |  |  |  |  |  |
| g. Phase changes and the effect of transfer of thermal energy on matter (e.g., melting, evaporation, freezing, condensation, cooling and heating curves) |  |  |  |  |  |  |  |  |  |  |  |
| 2. Chemical reactions |  |  |  |  |  |  |  |  |  |  |  |
| a. Identifying the difference between chemical and physical changes |  |  |  |  |  |  |  |  |  |  |  |
| b. Conservation of matter in chemical reactions (e.g., balancing simple chemical reactions using visual and mathematical models) |  |  |  |  |  |  |  |  |  |  |  |
| c. Types of chemical reactions (e.g., combustion, acid-base, synthesis, decomposition) |  |  |  |  |  |  |  |  |  |  |  |
| d. Energy in chemical reactions (e.g., exothermic and endothermic) |  |  |  |  |  |  |  |  |  |  |  |
| B. Motion and Stability: Forces and Interactions |  |  |  |  |  |  |  |  |  |  |  |
| 1. Forces and motion |  |  |  |  |  |  |  |  |  |  |  |
| a. Descriptions of motion |  |  |  |  |  |  |  |  |  |  |  |
| * Distance and displacement |  |  |  |  |  |  |  |  |  |  |  |
| * Speed and velocity |  |  |  |  |  |  |  |  |  |  |  |
| * Acceleration |  |  |  |  |  |  |  |  |  |  |  |
| b. Forces |  |  |  |  |  |  |  |  |  |  |  |
| * Newton’s laws of motion and their applications |  |  |  |  |  |  |  |  |  |  |  |
| * Buoyancy (e.g., sink or float, relative density) |  |  |  |  |  |  |  |  |  |  |  |
| * Gravitational forces related to mass and distance (e.g., weight vs. mass on Earth vs. Moon) |  |  |  |  |  |  |  |  |  |  |  |
| * Vector nature of force (e.g., magnitude and direction |  |  |  |  |  |  |  |  |  |  |  |
| 2. Electricity and magnetism |  |  |  |  |  |  |  |  |  |  |  |
| a. Electricity |  |  |  |  |  |  |  |  |  |  |  |
| * Electrostatics (attraction and repulsion between charges) |  |  |  |  |  |  |  |  |  |  |  |
| * Simple circuits (identifying series and parallel circuits) |  |  |  |  |  |  |  |  |  |  |  |
| * Conductors and insulators |  |  |  |  |  |  |  |  |  |  |  |
| b. Magnetism |  |  |  |  |  |  |  |  |  |  |  |
| * Magnets |  |  |  |  |  |  |  |  |  |  |  |
| * Magnetic fields |  |  |  |  |  |  |  |  |  |  |  |
| c. Applications of electricity and magnetism (e.g., electromagnets, generators, electrical motors) |  |  |  |  |  |  |  |  |  |  |  |
| C. Energy and Waves |  |  |  |  |  |  |  |  |  |  |  |
| 1. Energy |  |  |  |  |  |  |  |  |  |  |  |
| a. Types of energy |  |  |  |  |  |  |  |  |  |  |  |
| * Kinetic energy (e.g., its relationship to speed and mass) |  |  |  |  |  |  |  |  |  |  |  |
| * Potential energy |  |  |  |  |  |  |  |  |  |  |  |
| b. Forms of energy (e.g., sound, light, thermal, electrical, chemical) |  |  |  |  |  |  |  |  |  |  |  |
| c. Conservation of energy (e.g. pendulums, springs, roller coasters) |  |  |  |  |  |  |  |  |  |  |  |
| d. Energy transfer between the system and its surroundings |  |  |  |  |  |  |  |  |  |  |  |
| e. Thermal energy transfer (e.g., convection, conduction, radiation) |  |  |  |  |  |  |  |  |  |  |  |
| f. Energy transformations (e.g., chemical to electrical and electrical to mechanical) |  |  |  |  |  |  |  |  |  |  |  |
| III. Life Science (30%) |  |  |  |  |  |  |  |  |  |  |  |
| A. From Molecules to Organisms: Structures   and Processes |  |  |  |  |  |  |  |  |  |  |  |
| 1. Structure and function |  |  |  |  |  |  |  |  |  |  |  |
| a. Cells |  |  |  |  |  |  |  |  |  |  |  |
| * Organelles (e.g., nucleus, mitochondria, chloroplasts) |  |  |  |  |  |  |  |  |  |  |  |
| * Cell membranes and cell walls (e.g., passive and active transport) |  |  |  |  |  |  |  |  |  |  |  |
| b. Cell types |  |  |  |  |  |  |  |  |  |  |  |
| * Prokaryotes/eukaryotes (e.g., bacteria, plants, animals) |  |  |  |  |  |  |  |  |  |  |  |
| * Unicellular/multicellular |  |  |  |  |  |  |  |  |  |  |  |
| c. Characteristics of viruses |  |  |  |  |  |  |  |  |  |  |  |
| d. Levels of organization in multicellular organisms |  |  |  |  |  |  |  |  |  |  |  |
| * Specialized cells and tissues |  |  |  |  |  |  |  |  |  |  |  |
| * Organs and organ systems (circulatory, excretory, digestive, respiratory, muscular, and nervous systems) |  |  |  |  |  |  |  |  |  |  |  |
| * Focus on system and subsystem interactions |  |  |  |  |  |  |  |  |  |  |  |
| * Homeostasis |  |  |  |  |  |  |  |  |  |  |  |
| 2. Growth and development of organisms |  |  |  |  |  |  |  |  |  |  |  |
| a. Cell reproduction |  |  |  |  |  |  |  |  |  |  |  |
| * Role of mitosis |  |  |  |  |  |  |  |  |  |  |  |
| * Role of meiosis |  |  |  |  |  |  |  |  |  |  |  |
| b. Effect of environmental and genetic factors on plant and animal growth |  |  |  |  |  |  |  |  |  |  |  |
| c. Reproduction |  |  |  |  |  |  |  |  |  |  |  |
| * Plant structures and adaptations |  |  |  |  |  |  |  |  |  |  |  |
| * Animal behaviors and adaptations |  |  |  |  |  |  |  |  |  |  |  |
| 3. Matter and energy flow in organisms |  |  |  |  |  |  |  |  |  |  |  |
| a. Important biomolecules (e.g., ATP, sugars) |  |  |  |  |  |  |  |  |  |  |  |
| b. Photosynthesis in plants |  |  |  |  |  |  |  |  |  |  |  |
| c. Cellular respiration in plants and animals |  |  |  |  |  |  |  |  |  |  |  |
| d. Fermentation (e.g., by yeast) |  |  |  |  |  |  |  |  |  |  |  |
| e. Differentiation between matter and energy |  |  |  |  |  |  |  |  |  |  |  |
| 4. Sensory information processing in animals |  |  |  |  |  |  |  |  |  |  |  |
| a. Stimuli (e.g., light, sound, chemical) and sensory receptors (e.g., eyes, ears) |  |  |  |  |  |  |  |  |  |  |  |
| b. Transmission and processing (e.g., nerve, brain) and responses (e.g., behavior or memory) |  |  |  |  |  |  |  |  |  |  |  |
| **B. Ecosystems: Interactions, Energy, and Dynamics** |  |  |  |  |  |  |  |  |  |  |  |
| 1. Interdependent relationships in ecosystems |  |  |  |  |  |  |  |  |  |  |  |
| a. Impact of resources on population growth |  |  |  |  |  |  |  |  |  |  |  |
| b. Relationships and behavior (e.g., competition, mutualism, parasitism, predator-prey) |  |  |  |  |  |  |  |  |  |  |  |
| 2. Cycling of matter and energy transfer in ecosystems |  |  |  |  |  |  |  |  |  |  |  |
| a. Energy flow |  |  |  |  |  |  |  |  |  |  |  |
| * Energy transfer between producers, consumers, and decomposers |  |  |  |  |  |  |  |  |  |  |  |
| * Food webs as models |  |  |  |  |  |  |  |  |  |  |  |
| b. Cycling of atoms (e.g., carbon, nitrogen) between living and nonliving components |  |  |  |  |  |  |  |  |  |  |  |
| 3. Ecosystem dynamics, functioning, and resilience |  |  |  |  |  |  |  |  |  |  |  |
| a. Biotic and abiotic factors |  |  |  |  |  |  |  |  |  |  |  |
| b. Distinguish between biomes and ecosystems |  |  |  |  |  |  |  |  |  |  |  |
| c. Relationships between biodiversity and human resource |  |  |  |  |  |  |  |  |  |  |  |
| d. Stability and change within ecosystems |  |  |  |  |  |  |  |  |  |  |  |
| C. Heredity and Biological Evolution |  |  |  |  |  |  |  |  |  |  |  |
| 1. Heredity: Inheritance and Variation of Traits |  |  |  |  |  |  |  |  |  |  |  |
| a. Inheritance of traits |  |  |  |  |  |  |  |  |  |  |  |
| * Basic structure and function of DNA and RNA |  |  |  |  |  |  |  |  |  |  |  |
| * Conceptual understanding of replication, transcription, and translation |  |  |  |  |  |  |  |  |  |  |  |
| * Relationship between chromosomes, genes, alleles, and proteins |  |  |  |  |  |  |  |  |  |  |  |
| * Sexual and asexual reproduction (advantages and disadvantages) |  |  |  |  |  |  |  |  |  |  |  |
| b. Variation of traits |  |  |  |  |  |  |  |  |  |  |  |
| * Mendelian inheritance (simple Punnett squares) |  |  |  |  |  |  |  |  |  |  |  |
| * Mutations (harmful, beneficial, neutral) |  |  |  |  |  |  |  |  |  |  |  |
| 2. Biological Evolution: Unity and Diversity |  |  |  |  |  |  |  |  |  |  |  |
| a. Evidence of common ancestry and diversity |  |  |  |  |  |  |  |  |  |  |  |
| * Patterns in fossil record found within sedimentary layers (e.g., major extinction events and emergence of  new organisms) |  |  |  |  |  |  |  |  |  |  |  |
| * Anatomical similarities and differences |  |  |  |  |  |  |  |  |  |  |  |
| * Among modern organisms |  |  |  |  |  |  |  |  |  |  |  |
| * Between modern and fossil organisms |  |  |  |  |  |  |  |  |  |  |  |
| * Similarities in embryological development |  |  |  |  |  |  |  |  |  |  |  |
| * Classification of organisms according to shared characteristics |  |  |  |  |  |  |  |  |  |  |  |
| b. Natural selection and adaptation |  |  |  |  |  |  |  |  |  |  |  |
| * Mechanisms of evolution (e.g., mutation, natural selection) |  |  |  |  |  |  |  |  |  |  |  |
| * Distribution of traits in a population can change over time in response to environment. |  |  |  |  |  |  |  |  |  |  |  |
| IV. Earth and Space Science (26%) |  |  |  |  |  |  |  |  |  |  |  |
| A. Earth’s Place in the Universe |  |  |  |  |  |  |  |  |  |  |  |
| a. Basic characteristics and life cycles of stars (e.g., composition, apparent brightness and distance from Earth) |  |  |  |  |  |  |  |  |  |  |  |
| b. Basic types, characteristics, and motion of galaxies |  |  |  |  |  |  |  |  |  |  |  |
| c. Observed motions of stars from Earth |  |  |  |  |  |  |  |  |  |  |  |
| d. Formation and evidence (e.g., big bang theory) |  |  |  |  |  |  |  |  |  |  |  |
| 2. Earth and the solar system |  |  |  |  |  |  |  |  |  |  |  |
| a. Formation of the solar system and the role of gravity |  |  |  |  |  |  |  |  |  |  |  |
| b. Properties of objects in the solar system (e.g., models, scales, structure, composition, surface features) |  |  |  |  |  |  |  |  |  |  |  |
| c. Patterns of movement in the Sun-Earth-Moon system (e.g., Moon phases, eclipses, tides) |  |  |  |  |  |  |  |  |  |  |  |
| d. Effect of Earth’s tilt on seasons and climate |  |  |  |  |  |  |  |  |  |  |  |
| 3. The history of planet Earth |  |  |  |  |  |  |  |  |  |  |  |
| a. Basic principles of historical geology and the geological timescale |  |  |  |  |  |  |  |  |  |  |  |
| * Stratigraphy (e.g., superposition, intrusive relationships, crosscutting relationships, fossil succession) |  |  |  |  |  |  |  |  |  |  |  |
| * Major events (e.g., extinction events, volcanic eruptions, glaciation, asteroid impacts) |  |  |  |  |  |  |  |  |  |  |  |
| b. Relative and absolute dating (e.g., fossil record, radiometric dating) |  |  |  |  |  |  |  |  |  |  |  |
| B. Earth’s Systems |  |  |  |  |  |  |  |  |  |  |  |
| 1. Earth materials and systems |  |  |  |  |  |  |  |  |  |  |  |
| a. Rock types and their formation processes (e.g., energy flow, the rock cycle) |  |  |  |  |  |  |  |  |  |  |  |
| b. Minerals and their properties (e.g., color, streak, hardness, acid test) |  |  |  |  |  |  |  |  |  |  |  |
| c. Weathering, erosion, and deposition |  |  |  |  |  |  |  |  |  |  |  |
| * Chemical, biological, and physical weathering |  |  |  |  |  |  |  |  |  |  |  |
| * Agents of erosion (e.g., water, ice, wind) |  |  |  |  |  |  |  |  |  |  |  |
| * Effect on surface features and the origin of major landforms (e.g., valleys, canyons, coastline topography) |  |  |  |  |  |  |  |  |  |  |  |
| * Prediction of natural hazards (e.g., landslides) and mitigation of their impact on humans (e.g., retaining walls) |  |  |  |  |  |  |  |  |  |  |  |
| 2. Plate tectonics and large-scale system interactions |  |  |  |  |  |  |  |  |  |  |  |
| a. Earth’s structure (e.g., layers, composition, properties, and processes,  such as convection |  |  |  |  |  |  |  |  |  |  |  |
| b. Plate tectonics theory and supporting evidence |  |  |  |  |  |  |  |  |  |  |  |
| * Types of plate boundaries (e.g.,  convergent, divergent, transform) |  |  |  |  |  |  |  |  |  |  |  |
| * Folding and faulting (e.g., normal, reverse, strike-slip) |  |  |  |  |  |  |  |  |  |  |  |
| * Supporting evidence (e.g., ages of crustal rocks, hot-spot volcanoes, distribution of rocks and fossils, continental shapes) |  |  |  |  |  |  |  |  |  |  |  |
| c. Landforms (e.g., mountain ranges, rift valleys, mid-ocean ridges) |  |  |  |  |  |  |  |  |  |  |  |
| d. Prediction of natural hazards (e.g., earthquakes, volcanoes, tsunamis) and mitigation of their impact on humans (e.g., earthquake-resistant structures) |  |  |  |  |  |  |  |  |  |  |  |
| 3. Roles of water in Earth’s surface processes |  |  |  |  |  |  |  |  |  |  |  |
| a. Distribution of water |  |  |  |  |  |  |  |  |  |  |  |
| * Oceans |  |  |  |  |  |  |  |  |  |  |  |
| * Freshwater (e.g., lakes, rivers, streams, polar ice, icebergs, glaciers) |  |  |  |  |  |  |  |  |  |  |  |
| b. Water cycle, including the transfer of energy and the role of gravity |  |  |  |  |  |  |  |  |  |  |  |
| * Evaporation, sublimation, transpiration |  |  |  |  |  |  |  |  |  |  |  |
| * Condensation and crystallization |  |  |  |  |  |  |  |  |  |  |  |
| * Precipitation |  |  |  |  |  |  |  |  |  |  |  |
| * Runoff and infiltration |  |  |  |  |  |  |  |  |  |  |  |
| c. Oceanography |  |  |  |  |  |  |  |  |  |  |  |
| * Tides, waves, currents |  |  |  |  |  |  |  |  |  |  |  |
| * Global ocean circulation (e.g., driven by seawater density, transfer of heat) |  |  |  |  |  |  |  |  |  |  |  |
| * Ocean floor topography (e.g., continental shelf, continental slope, abyssal plain, islands, reefs) |  |  |  |  |  |  |  |  |  |  |  |
| d. Surface features and underground formations (e.g., watersheds, deltas, groundwater features) |  |  |  |  |  |  |  |  |  |  |  |
| e. Prediction of natural hazards (e.g., floods, storm surge) and mitigation of their impact on humans (e.g., dams, levees) |  |  |  |  |  |  |  |  |  |  |  |
| 4. Weather and climate |  |  |  |  |  |  |  |  |  |  |  |
| a. Meteorology |  |  |  |  |  |  |  |  |  |  |  |
| * Elements of weather and their measurement (e.g., temperature, pressure, humidity, precipitation, wind) |  |  |  |  |  |  |  |  |  |  |  |
| * Interpretation of basic weather data (e.g., maps, radar, probability, predictions) |  |  |  |  |  |  |  |  |  |  |  |
| * Effects of thermal energy transfer on the atmosphere |  |  |  |  |  |  |  |  |  |  |  |
| * Properties, motions, and interactions of air masses, including the Coriolis effect |  |  |  |  |  |  |  |  |  |  |  |
| * Prediction of severe weather events (e.g., hurricanes, tornadoes) and mitigation of their impact on humans (e.g., basements in tornado-prone regions) |  |  |  |  |  |  |  |  |  |  |  |
| b. Climate |  |  |  |  |  |  |  |  |  |  |  |
| * Effect of Earth’s tilt, latitude, and elevation on climatic zones |  |  |  |  |  |  |  |  |  |  |  |
| * Atmospheric patterns due to uneven  heating and rotation of Earth |  |  |  |  |  |  |  |  |  |  |  |
| * Effect of landforms (e.g., rain shadow  effect) |  |  |  |  |  |  |  |  |  |  |  |
| * Proximity to water (e.g., heat capacity of land and water, sea and land breezes, lake effect, ocean currents) |  |  |  |  |  |  |  |  |  |  |  |
| * Climate change (e.g., natural and human causes, effects and management) |  |  |  |  |  |  |  |  |  |  |  |