

TABLE OF CONTENTS

COMPETENCY 1.0 SCIENCE METHODOLOGY, TECHNIQUES, AND HISTORY

Skill 1.1 Nature of scientific knowledge, inquiry, and historical perspectives: scientific methods and processes, facts, models, theories, and laws; historical roots of science; and contributions made by major historical figures..... 1

Skill 1.2 Mathematics, measurement, and data manipulation: measurement and notation systems, data presentation and interpretation, error analysis 4

Skill 1.3 Laboratory procedures and safety: techniques of safe preparation, storage, use, and disposal of laboratory and field materials, and, selection and use of appropriate laboratory equipment..... 6

COMPETENCY 2.0 THE PHYSICAL SCIENCES

Basic Principles

Skill 2.1 Matter and energy: structure and properties of matter, occurrence and abundance of elements, physical and chemical changes, forms and transformations of energy, conservation of mass and energy 10

Skill 2.2 Heat and thermodynamics: thermal energy, measurement, transfer and effects on matter, first and second laws of thermodynamics 14

Skill 2.3 Atomic and nuclear structure: atomic and nuclear structure and related chemical properties; nuclear transformations and characteristics of radioisotopes and radiation..... 18

Physics

Skill 2.4 Mechanics: straight-line, projectile, circular, and periodic motion; Newton’s laws of motion; work, energy and power; simple machines; torque; friction; conservation of energy and momentum; gravity; Archimedes’ principle and Bernoulli’s principle 21

Skill 2.5 Electricity and magnetism: characteristics of static and current electricity, electrical circuits, alternating and direct current, transformers and motors, sources of EMF, magnetism..... 27

Skill 2.6 Waves: characteristics of transverse and longitudinal waves; reflection, refraction, diffraction, and interference; Doppler Effect; sound; electromagnetic radiation; color; optics..... 32

TEACHER CERTIFICATION STUDY GUIDE

Chemistry

Skill 2.7	Periodicity: the periodic table, trends in chemical and physical properties.....	37
Skill 2.8	The mole and chemical bonding: the mole concept, the formulas and nomenclature of inorganic and simple organic compounds, bonding, electron dot and structural formulas, chemical composition and stoichiometry	39
Skill 2.9	Kinetic theory and states of matter: kinetic molecular theory, phase characteristics and transformations, gas laws, characteristics of crystals	48
Skill 2.10	Chemical reactions: types of reactions; endothermic and exothermic reactions; effects of temperature, pressure, concentration, and presence of catalysts on reactions; practical applications of electrochemistry; balancing chemical equations.....	53
Skill 2.11	Solutions and solubility: types of solutions; solvents and the dissolving process; effects of temperature and pressure on solubility; acids, bases, and salts; pH; buffers	58

COMPETENCY 3.0 THE LIFE SCIENCES

Skill 3.1	The Cell: biologically important inorganic and organic molecules, structure and function of cells, cell organelles, cellular bioenergetics, the cell cycle and cytokinesis, meiosis and mitosis, homeostasis	62
Skill 3.2	Molecular basis of heredity and classical genetics: DNA replication, protein synthesis, Mendelian and non-Mendelian inheritance, mutations and transposable elements, genetic engineering, human genetic disorders, recombinant DNA, mapping the human genome, the interaction between heredity and the environment.....	70
Skill 3.3	Evolution: evidence, theories and patterns of evolution, factors affecting evolution, speciation, hypotheses relating to the origin of life.....	77
Skill 3.4	Diversity of life: general characteristics, biological systems of classification, viruses, bacteria, protists, fungi, plants, and animals .	83
Skill 3.5	Plants: structure and function of roots, stems, and leaves; nonvascular plants; transport systems; control mechanisms; sexual and asexual reproduction	88

TEACHER CERTIFICATION STUDY GUIDE

Skill 3.6	Animals: anatomy and physiological systems, homeostasis, response to stimuli.....	90
Skill 3.7	Ecology: population dynamics, social behavior, interspecific relationships, community structure, and species diversity, succession and disturbance, ecosystems, food webs and energy flow, biomes, biogeochemical cycles.....	93

COMPETENCY 4.0 THE EARTH/SPACE SCIENCES

Skill 4.1	Physical geology: minerals and rocks, folding and faulting, earthquakes and volcanoes, structure of Earth, plate tectonic theory and its supporting evidence, hydrologic cycle, weathering, erosion and deposition	103
Skill 4.2	Historical geology: uniformitarianism, time scales, fossils and stratigraphy, Earth's history	113
Skill 4.3	Oceanography: waves, tides, and currents; ocean floor and margins; chemistry of seawater; shore processes; nutrient cycles of the ocean.....	115
Skill 4.4	Meteorology: structure and properties of the atmosphere; seasonal and latitudinal variation of solar radiation; heat budget; circulation patterns and winds; humidity, clouds, and precipitation; air masses, high and low pressure systems, frontal systems, maps, and forecasting; climate and climatic change	120
Skill 4.5	Astronomy: theories of the origin and structure of the universe, origins and life cycles of stars, major features and structure of the solar system, Sun-Moon-Earth relationships, artificial satellites and space exploration, Earth's seasons, time zones, large units of distance, contributions of remote sensing	127

COMPETENCY 5.0 SCIENCE, TECHNOLOGY, AND SOCIETY

Skill 5.1	Impact of science and technology on the environment and human affairs.....	139
Skill 5.2	Human and nature induced hazards.....	139
Skill 5.3	Issues and applications: production, use, management, and disposal of energy and consumer products, management of natural resources.....	140

TEACHER CERTIFICATION STUDY GUIDE

Skill 5.4	Social, political, ethical, and economic issues in science and technology	143
Skill 5.5	Societal issues with health awareness and medical advances.....	144
Sample Test	145
Answer Key	169
Rigor Table	170
Rationales with Sample Questions	171