

TEACHER CERTIFICATION EXAM

Table of Contents

COMPETENCY/SKILL #	PG #
COMPETENCY 1.0 - KNOWLEDGE OF THE INVESTIGATIVE PROCESSES OF SCIENCE	
Skill 1.1 Proper use and care of the light microscope	1
Skill 1.2 Recognize and distinguish between the types of microscopy and uses	1
Skill 1.3 Identify common laboratory techniques (e.g., dissection; preserving, staining, and mounting microscope specimens; preparing laboratory solutions)	2
Skill 1.4 Identify proper field techniques (e.g., site selection, field procedures, sampling, capture/recapture, transects, collecting techniques, environmental quality assessment)	4
Skill 1.5 Identify the uses of PCR, chromatography, spectrophotometry, centrifugation, and electrophoresis	6
Skill 1.6 Identify terms in a formula (e.g., chemical, ecological, physical) and assess the relationships among the terms.....	7
Skill 1.7 Identify the units in the metric system and convert between dimensional units for one-, two-, and three-dimensional objects.....	8
Skill 1.8 Identify assumptions, observations, hypotheses, conclusions, and theories and differentiate between them	9
Skill 1.9 Evaluate, interpret, and predict from data sets, including graphical data	9
Skill 1.10 Differentiate the characteristics of scientific research from other areas of learning	10
Skill 1.11 Distinguish between accuracy and precision, and between systematic error and random error.....	11
Skill 1.12 Characterize variables and the outcomes for appropriate experimental designs	12
Skill 1.13 Recognize that the validity and reliability of scientific knowledge is based on reproducibility of results and statistical significance of results, and is limited by the state of current technology and possible bias	12

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

Skill 1.14 Identify the development of biological knowledge through important historical events, individuals (e.g., Robert Hooke, Mattias Schleiden, Francis Jacob, Jacques Monod), and experimental evidence	13
Skill 1.15 Differentiate between qualitative and quantitative data in experimental, observational, and modeling methods of research.....	15
Skill 1.16 Recognize the elements of a well-designed and controlled experiment	16
Skill 1.17 Evidence of the evolutionary nature of science in the face of new observations	17
Skill 1.18 Identify the consistent patterns that govern the occurrence of most natural events	20

COMPETENCY 2.0 - KNOWLEDGE OF THE INTERACTION OF SCIENCE, TECHNOLOGY, AND SOCIETY INCLUDING ETHICAL, LEGAL, AND SOCIAL ISSUES

Skill 2.1 Identify and analyze areas of scientific research that may contribute to ethical, legal, and social conflicts (e.g., reproductive and life-sustaining technologies; genetic basis for behavior, population growth and control; government and business influences on biotechnology).....	22
Skill 2.2 Identify principles and uses of cloning, genomics, proteomics, and genetic engineering and analyze possible ethical conflicts	22
Skill 2.3 Recognize and analyze global environmental challenges that may result from scientific and technological advances and the subsequent resolution of these problems (e.g., CFCs as coolants and ozone depletion; insecticides for protecting crops and pollution events)	23
Skill 2.4 Analyze the synergistic relationship between basic and applied research, technology, the economy and public welfare	24
Skill 2.5 Analyze the causes and effects of multidrug resistance and globalization on the spread and treatment of human pathogens	26
Skill 2.6 Demonstrate knowledge of pertinent legislation and national guidelines (e.g., NABT, ISEF) regarding laboratory safety, hazardous materials, experimentation, and/or the use of organisms in the classroom	27

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

COMPETENCY 3.0 - KNOWLEDGE OF THE CHEMICAL PROCESSES OF LIVING THINGS

Skill 3.1 Identify the structures, functions, and importance of inorganic and organic compounds (e.g., water, mineral salts, carbohydrates, lipids, proteins, nucleic acids) in cells	31
Skill 3.2 Compare and apply the laws of thermodynamics to living systems, including the role of enzymes in biological reactions	35
Skill 3.3 Predict the effects of changes in pH, temperature, substrate concentration, and enzyme concentration on enzyme activity	36
Skill 3.4 Identify substrates, products, and relationships between glycolysis, Krebs cycle, and electron transport, including the respiration of carbohydrates, fats, and amino acids	36
Skill 3.5 Compare end products and energy yields of alcoholic fermentation, lactic acid fermentation, and aerobic respiration	38
Skill 3.6 Identify the raw materials and products of C-3 photosynthesis, including the Calvin cycle, light dependent and light independent reactions, and factors that affect their rate	39
Skill 3.7 Identify key differences between C-3, C-4, and CAM photosynthesis, and the ecological significance of these pathways	41
Skill 3.8 Identify and analyze the process of chemiosmosis in photosynthesis and respiration	42
Skill 3.9 Compare heterotrophy and autotrophy and the roles of these processes in the environment	43
Skill 3.10 Define antigen and antibody and recognize the antigen-antibody reaction	43
Skill 3.11 Compare active and passive immunity, identifying the positive and negative effects of vaccines and inoculations	44
Skill 3.12 Evaluate the roles of cell recognition (e.g., cell-to-cell signaling, autoimmune diseases, tissue rejection, cancer, pollen/stigma-style interaction) in normal and abnormal cell activity	45

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

Skill 3.13 Identify the effect of environmental factors on the biochemistry of living things (e.g., UV light effects on melanin and vitamin D production).....	45
Skill 3.14 Identify the roles of ATP and ADP in cellular processes.....	47
Skill 3.15 Compare chemosynthetic and photosynthetic processes and the roles of organisms using these processes in the ecosystem.....	48
Skill 3.16 Identify cell-to-cell communication in living things (e.g., electrical, molecular, ionic).....	49

COMPETENCY 4.0 - KNOWLEDGE OF THE INTERACTION OF CELL STRUCTURE AND FUNCTION

Skill 4.1 Identify and analyze the major events in the development of the cell theory.....	51
Skill 4.2 Distinguish between the major structural characteristics of prokaryotic and eukaryotic cells	51
Skill 4.3 Relate the structure of cell organelles to their functions	53
Skill 4.4 Identify and evaluate the events of each phase of the cell cycle (G1, S, G2, M) and the regulatory mechanisms of the cycle.....	51
Skill 4.5 Compare the mechanisms and results of nuclear division (karyokinesis) and cell division (cytokinesis) in plant and animal cells.....	58
Skill 4.6 Compare characteristics of the major taxa (domains/kingdoms), focusing on cellular characteristics	58
Skill 4.7 Evaluate the relationships between the structures and functions of cell membrane elements	60
Skill 4.8 Identify and compare active and passive transport mechanisms	61

COMPETENCY 5.0 - KNOWLEDGE OF GENETIC PRINCIPLES AND PRACTICES

Skill 5.1 Evaluate the relationships between the structure and function of DNA....	63
Skill 5.2 Identify and sequence the principal events in DNA replication.....	64

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

Skill 5.3 Identify and sequence the principal events of protein synthesis.....	65
Skill 5.4 Distinguish between the various functions of DNA and RNA.....	66
Skill 5.5 Distinguish between the regulatory systems for prokaryotic and eukaryotic protein synthesis.....	67
Skill 5.6 Evaluate the appropriate application of DNA manipulation techniques (e.g. gene splicing, recombinant DNA, gene identification, PCR technique).....	68
Skill 5.7 Predict the effects of environmental and other influences on gene structure and expression (e.g. viruses, oncogenes, carcinogenic agents, mutagenic agents)	68
Skill 5.8 Analyze the processes and products of meiosis (e.g., gametogenesis in male and female vertebrates; plant, animal and fungi meiosis) in representative examples from various kingdoms.....	69
Skill 5.9 Differentiate between classical laws of inheritance, their relationship to chromosomes, and related terminology	71
Skill 5.10 Analyze applications of probability and chi-square analysis in genetics	72
Skill 5.11 Analyze various patterns of inheritance (e.g., sex-linked, sex-influenced, sex-limited, incomplete dominance, autosomal linkage, multiple alleles, polygenic inheritance).....	74
Skill 5.12 Identify the causes of genetic disorders (e.g., point mutation, nondisjunction, translocation, deletion, insertion, inversion, duplication)	75
Skill 5.13 Identify the effect of a mutation in a DNA sequence on the products of protein synthesis	76

COMPETENCY 6.0 - KNOWLEDGE OF THE STRUCTURAL AND FUNCTIONAL DIVERSITY OF VIRUSES AND PROKARYOTIC ORGANISMS

Skill 6.1 Distinguish the structure and function of viruses and prokaryotic organisms	77
Skill 6.2 Identify the effects of viruses (e.g., HIV, influenza, measles, TMV, feline leukemia, genital warts, some human cancers) on organisms.....	78

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

Skill 6.3 Relate the structures and functions (e.g. morphology, motility, reproduction and growth, metabolic diversity) of prokaryotic organisms to their behavior and identification 78

Skill 6.4 Differentiate between the major types of bacterial genetic recombination (i.e., transduction, transformation, and conjugation) 79

Skill 6.5 Relate microbial processes and products that are helpful or harmful to human beings and their use in biotechnology 80

COMPETENCY 7.0 - KNOWLEDGE OF THE STRUCTURAL AND FUNCTIONAL DIVERSITY OF PROTISTS, FUNGI, AND PLANTS

Skill 7.1 Identify major types of protists, fungi, and plant 81

Skill 7.2 Characterize the relationships of protists, fungi, and plants to other living things 82

Skill 7.3 Distinguish between the structures and functions of various plant tissues..... 83

Skill 7.4 Identify the characteristics of vascular and nonvascular plants and relate these characteristics to adaptations allowing these plants to broaden their ecological niches..... 84

Skill 7.5 Identify the functions and survival advantages of the major organs of angiosperms and gymnosperms 84

Skill 7.6 Distinguish between the structures of monocots and dicots (e.g., seeds, vascular bundles, venation, flower parts)..... 85

Skill 7.7 Identify the major mechanisms (e.g., transport, storage, conservation) in plants and evaluate the survival advantages these mechanisms give to different groups of plants 85

Skill 7.8 Analyze the role of major plant growth regulators 85

Skill 7.9 Apply concepts of major methods of reproduction in plants, including dispersal mechanisms 86

Skill 7.10 Analyze patterns of alternation of generations in various groups of plants and algae..... 88

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

COMPETENCY 8.0 - KNOWLEDGE OF THE STRUCTURAL AND FUNCTIONAL DIVERSITY OF ANIMALS

Skill 8.1	Relate the structures of major animal tissue types to their function.....	89
Skill 8.2	Identify major animal body plans (e.g., symmetry, coelomic character, embryonic origin)	89
Skill 8.3	Relate the processes of animal growth and development to early embryological development (e.g. embryonic induction, ontogeny recapitulating phylogeny)	90
Skill 8.4	Relate the structures to functions of circulatory and respiratory systems	90
Skill 8.5	Relate the structures to functions of excretory and digestive systems	92
Skill 8.6	Relate the structures to functions of endocrine and nervous systems	94
Skill 8.7	Relate the structures to functions of integumentary and musculoskeletal systems.....	96
Skill 8.8	Relate the structures to functions of reproductive systems	97
Skill 8.9	Relate the structures to functions of the human immune system	98
Skill 8.10	Analyze the interconnectedness of animal organ systems.....	99
Skill 8.11	Analyze the effects of feedback loops in human systems (e.g., classical vertebrate hormones, fight or flight)	100
Skill 8.12	Identify aspects of animal social behavior (e.g., communication and signals, dominance hierarchy, territoriality, aggression, courtship, innate and learned behavior)	100

COMPETENCY 9.0 - KNOWLEDGE OF ECOLOGICAL PRINCIPLES AND PROCESSES

Skill 9.1	Distinguish between individuals, populations, communities, ecosystems, biomes, and the biosphere.....	102
Skill 9.2	Analyze the relationship between organisms and their niches	102

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

Skill 9.3 Analyze the roles of organisms in the major biogeochemical cycles and processes	103
Skill 9.4 Analyze patterns of energy flow in the biosphere	103
Skill 9.5 Evaluate factors that affect population composition, growth, size, and geographic distribution	104
Skill 9.6 Distinguish between examples of competition, predation, and differing types of symbioses (e.g., parasitism, mutualism, commensalism).....	106
Skill 9.7 Evaluate succession in communities	106
Skill 9.8 Identify renewable and nonrenewable resources and compare management strategies for each, including environmental quality assessment and mitigation	107
Skill 9.9 Analyze the effects of resource availability on society.....	107
Skill 9.10 Identify the potential local and global economic, aesthetic, and medical consequences of air, land, and water pollution and evaluate proposed solutions	108
Skill 9.11 Identify the potential local and global economic, aesthetic, and medical consequences of global warming and evaluate proposed solutions	108
Skill 9.12 Analyze the local and global consequences of loss of biodiversity	110
Skill 9.13 Characterize ecosystems unique to Florida (i.e., terrestrial, marine, freshwater) and identify indicator species of each	110

COMPETENCY 10 - KNOWLEDGE OF EVOLUTIONARY MECHANISMS

Skill 10.1 Compare evolution by natural selection with other theories (e.g., Lamarck, Darwin).....	113
Skill 10.2 Analyze the classical species concept and its limitations	113
Skill 10.3 Compare systems of classification (e.g., classical taxonomy, phenetics, cladistics).....	114
Skill 10.4 Apply a taxonomic key to a set of objects.....	115

TEACHER CERTIFICATION EXAM

COMPETENCY/SKILL

Skill 10.5 Analyze variation within a species and its relationship to changes along an environmental cline	116
Skill 10.6 Identify factors affecting speciation and evolution in general (e.g., mutation, recombination, isolation, sexual reproduction and selection, genetic drift, plate tectonics and geographic distribution).....	116
Skill 10.7 Evaluate the role of mutation, recombination, isolation, sexual reproduction and selection, genetic drift, and plate tectonics and geographic distribution on evolution	117
Skill 10.8 Compare the concepts of punctuated equilibrium and gradualism	119
Skill 10.9 Distinguish between examples of evidences for evolutionary theory (e.g., biochemical, morphological, embryological, paleontological).....	119
Skill 10.10 Analyze aspects of modern theories on the origin of life on Earth	120
Skill 10.11 Recognize general evolutionary trends as they relate to major taxa	120
Skill 10.12 Apply the Hardy-Weinberg formula and identify the assumptions upon which it is based.....	121
Sample Test	123
Answer Key	150
Rationale	151