ETS PPAT

Measuring the Power of Learning.®

PPAT® Assessment

Alignment with *Praxis*® Test Specifications for General Science: Content Knowledge

ETS® Professional Educator PROGRAMS

PPAT® Assessment Alignment with *Praxis*® Test Specifications for General Science: Content Knowledge

PPAT® assessment Tasks 2 through 4 all require candidates to provide evidence of content knowledge both in their teaching practices as well as in the assessment of student learning.

While all the prompts for each task do not prescribe the specific content that must be included, they do draw upon a broad spectrum of content knowledge relevant to an individual candidate's particular area. Candidate responses, which include content, are scored by trained raters who have expertise in the same content area.

Given that PPAT assessment tasks are limited to the content teacher candidates are allowed or instructed to deliver in their assigned clinical experience classrooms, the PPAT assessment does not cover the full breadth and depth of a content discipline. However, successful completion of the PPAT assessment does require that candidates demonstrate the ability to accurately and effectively teach the content that they choose or are given, and also requires raters to evaluate whether the instructional delivery of the content is accurate and effective.

The PPAT assessment emphasizes that the appropriateness and relevance of content selected by candidates in the completion of the assessment in the area of Science may include, but is not limited to, the following categories.

PPAT® Assessment Task 1: Knowledge of Students and the Learning Environment

Task 1 Steps	*Praxis*® Test Specifications
Step 1 **Factors, Resources, and Protocols** Candidates' ability to identify and reflect on a variety of factors and resources that can be used to communicate and cultivate partnerships with students and the community	**I. Scientific Methodology, Techniques, and History** **D. Procedures for Correct Preparation, Storage, Use, and Disposal of Laboratory Materials** 1. Appropriate and safe use of materials (e.g., chemicals, lab specimens) 2. Safe disposal of materials 3. Appropriate storage 4. Preparation for classroom or field use (e.g., how to prepare a solution of given concentration, staining slides, labeling samples) **E. How to Use Standard Equipment in the Laboratory and the Field** 1. Appropriate and safe use (e.g., Bunsen burner, glassware, G P S, microscope) 2. Appropriate storage (e.g., p H probes stored in appropriate buffer solution, dissection equipment, glassware) 3. Maintenance and calibration (e.g., cleaning microscopes, calibration of balances) 4. Preparation for classroom or field use (e.g., prelaboratory setup, classroom demonstrations, field research) **F. Safety and Emergency Procedures in the Laboratory** 1. Location and use of standard safety equipment (e.g., eyewash, shower) 2. Laboratory safety rules for students 3. Appropriate apparel and conduct in the laboratory (e.g., wearing goggles) 4. Emergency procedures (e.g., fires, chemical spills, handling of injuries)
Step 2 **Knowledge of Students** Candidates' ability to cultivate relationships with your students (e.g., through the co-creation of rigorous, relevant learning opportunities) and acquire increasing in-depth knowledge about each students' academic and nonacademic strengths, skills, competencies, and interests.	**I. Scientific Methodology, Techniques, and History** **A. Methods of Scientific Inquiry and Design** 1. Identifying problems based on observations 2. Forming and testing hypotheses 3. Development of theories, models, and laws 4. Experimental design, including independent and dependent variables, controls, and sources of error 5. Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding 6. Nature of scientific knowledge **B. Processes Involved in Scientific Data Collection and Manipulation** 1. Common units of measurement (metric and English) including unit conversion and prefixes such as *milli* and *kilo* 2. Scientific notation and significant figures in collected data 3. Organization and presentation of data 4. Basic data and error analysis including determining mean, accuracy, precision, and sources of error **C. Interpret and Draw Conclusions from Data Presented in Tables, Graphs, Maps, and Charts** 1. Trends in data 2. Relationships between variables

Task 1 Steps	*Praxis*® Test Specifications
	3. Predictions based on data 4. Drawing valid conclusions based on the data

PPAT® Assessment Task 2: Assessment and Data Collection to Measure and Inform Student Learning

Task 2 Steps	*Praxis*® Test Specifications
Step 1 **Planning the Assessment** Candidates' ability to plan an assessment that uses appropriate assessment tools to meet student needs and the learning goal(s)	**I. Scientific Methodology, Techniques, and History** **A. Methods of Scientific Inquiry and Design** 1. Identifying problems based on observations 2. Forming and testing hypotheses 3. Development of theories, models, and laws 4. Experimental design, including independent and dependent variables, controls, and sources of error 5. Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding 6. Nature of scientific knowledge **B. Processes Involved in Scientific Data Collection and Manipulation** 1. Common units of measurement (metric and English) including unit conversion and prefixes such as *milli* and *kilo* 2. Scientific notation and significant figures in collected data 3. Organization and presentation of data 4. Basic data and error analysis including determining mean, accuracy, precision, and sources of error **C. Interpret and Draw Conclusions from Data Presented in Tables, Graphs, Maps, and Charts** 1. Trends in data 2. Relationships between variables 3. Predictions based on data 4. Drawing valid conclusions based on the data **D. Procedures for Correct Preparation, Storage, Use, and Disposal of Laboratory Materials** 1. Appropriate and safe use of materials (e.g., chemicals, lab specimens) 2. Safe disposal of materials 3. Appropriate storage 4. Preparation for classroom or field use (e.g., how to prepare a solution of given concentration, staining slides, labeling samples) **E. How to Use Standard Equipment in the Laboratory and the Field** 1. Appropriate and safe use (e.g., Bunsen burner, glassware, GPS, microscope) 2. Appropriate storage (e.g., pH probes stored in appropriate buffer solution, dissection equipment, glassware) 3. Maintenance and calibration (e.g., cleaning microscopes, calibration of balances) 4. Preparation for classroom or field use (e.g., prelaboratory setup, classroom demonstrations, field research) **F. Safety and Emergency Procedures in the Laboratory** 1. Location and use of standard safety equipment (e.g., eyewash, shower) 2. Laboratory safety rules for students 3. Appropriate apparel and conduct in the laboratory (e.g., wearing goggles)

Task 2 Steps	*Praxis*® Test Specifications
	4. Emergency procedures (e.g., fires, chemical spills, handling of injuries) **G. Major Historical Developments of Science** 1. Accepted principles and models develop over time 2. Major developments in science (e.g., atomic theory, plate tectonics) 3. Contributions of major historical figures (e.g., Darwin, Newton) **II. Physical Science** **A. Basic Principles** 1. Structure of matter 2. Basic structure of the atom 3. Basic characteristics of radioactive materials 4. Basic concepts and relationships involving energy and matter **B. Chemistry** 1. Periodicity and states of matter 2. Chemical nomenclature, composition, and bonding 3. Chemical reactions 4. Acid-based chemistry 5. Solutions and solubility **C. Physics** 1.Mechanics 2. Electricity and magnetism 3. Optics and waves **III. Life Science** **A. Basic Structure and Function of Cells and Their Organelles** 1. Structure and function of cell membranes (e.g., phospholipid bilayer, passive and active transport) 2. Structure and function of animal and plant cell organelles 3. Levels of organization (cells, tissues, organs, organ systems) 4. Major features of common animal cell types (e.g., blood cells, muscle, nerve, epithelial, gamete) 5. Prokaryotes (bacteria) and eukaryotes (animals, plants, fungi, protists) **B. Key Aspects of Cell Reproduction and Division** 1. Cell cycle 2. Mitosis 3. Meiosis 4. Cytokinesis **C. Basic Biochemistry of Life** 1. Cellular respiration 2. Photosynthesis 3. Biological molecules (e.g., DNA, carbohydrates, proteins, lipids, enzymes) **D. Basic Genetics** 1. Structure (double helix, single stranded, and base pairs) and function of DNA and RNA (replication, transcription, and translation) 2. Chromosomes, genes, alleles 3. Dominant and recessive traits

Task 2 Steps	*Praxis*® Test Specifications
	4. Mendelian inheritance (e.g., genotype, phenotype, use of Punnett squares, pedigrees) 5. Mutations, chromosomal abnormalities, and common genetic disorders **E. Theory and Key Mechanisms of Evolution** 1. Mechanisms of evolution (e.g., natural selection) 2. Isolation mechanisms and speciation 3. Supporting evidence (e.g., fossil record, comparative genetics, homologous structures) **F. Hierarchical Classification Scheme** 1. Classification schemes (e.g., domain, class, genus) 2. Characteristics of bacteria, animals, plants, fungi, and protists **G. Major Structures of Plants and Their Functions** 1. Characteristics of vascular and nonvascular plants 2. Structure and function of roots, leaves, and stems (e.g., stomata, xylem, phloem) 3. Asexual (budding) and sexual reproduction (flowers, fruit, seeds, spores) 4. Growth (e.g., germination, elongation) 5. Uptake and transport of nutrients and water 6. Responses to stimuli (e.g., light, temperature, water, gravity) **H. Basic Anatomy and Physiology of Animals, including the Human Body** 1. Response to stimuli and homeostasis 2. Exchange with the environment (e.g., respiratory, excretory, and digestive systems) 3. Internal transport and exchange (e.g., heart, arteries, veins, capillaries) 4. Control systems (e.g., nervous and endocrine systems) 5. Movement and support (e.g., skeletal and muscular systems) 6. Reproduction and development 7. Immune system (e.g., antibodies, autoimmune disorders) **I. Key Aspects of Ecology** 1. Population dynamics 2. Community ecology 3. Ecosystems **IV. Earth and Space Science** **A. Physical Geology** 1. Types and basic characteristics of rocks and minerals and their formation processes 2. Processes involved in erosion, weathering, and deposition of Earth's surface materials and soil formation 3. Earth's basic structure and internal processes 4. The water cycle **B. Historical Geology** 1. Historical geology **C. Earth's Bodies of Water** 1. Characteristics and processes of Earth's oceans and other bodies of water **D. Meteorology and Climate**

Task 2 Steps	*Praxis*® Test Specifications
	1. Basic structure and composition of Earth's atmosphere 2. Basic concepts of meteorology 3. Major factors that affect climate and seasons **E. Astronomy** 1. Major features of the solar system 2. Interaction of the Earth-Moon-Sun system 3. Major features of the universe 4. Contributions of space exploration and technology to our understanding of the universe **V. Science, Technology, and Society** **A. Impact of Science and Technology on the Environment and Society** 1. Air and water pollution (e.g., acid rain, eutrophication, groundwater pollution) 2. Climate change and greenhouse gases 3. Irrigation 4. Reservoirs and levees 5. Depletion of aquifers 6. Ozone layer depletion 7. Loss of biodiversity 8. Space exploration 9. Waste disposal (e.g., landfills) 10. Recycling 11. Environmentally friendly consumer products (e.g., biodegradable materials) **B. Major Issues Associated with Energy Production and the Management of Natural Resources** 1. Renewable and nonrenewable energy resources 2. Conservation and recycling 3. Pros and cons of power generation based on various resources including fossil and nuclear fuel, hydropower, wind power, solar power, geothermal power, and alternative energy sources 4. Issues associated with the use and extraction of Earth's resources (e.g., mining, land reclamation, deforestation) **C. Applications of Science and Technology in Daily Life** 1. Chemical properties of household products 2. Communication (e.g., wireless devices, GPS, satellites) 3. Science principles applied in commonly used consumer products (e.g., batteries, lasers, polarized sunglasses, and fiber optic cables) 4. Water purification 5. Common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides) 6. DNA evidence in criminal investigations 7. Nanotechnology **D. Impact of Science on Public Health Issues** 1. Nutrition, disease, and medicine (e.g., vitamins, viruses, vaccines) 2. Biotechnology (e.g., genetic engineering, in vitro fertilization)

Task 2 Steps	*Praxis*® Test Specifications
	3. Medical technologies (e.g., medical imaging, X-rays, radiation therapy)
Step 2 **Administering the Assessment and Analyzing the Data** Candidates' ability to administer their assessment and to collect, record, and analyze the data	
Step 3 **Reflecting** Candidates' ability to reflect on their assessment by providing evidence of student learning that resulted from the administered assessment plan Candidates' ability to reflect on the data-based decisions that occurred through data analysis	

PPAT® Assessment Task 3: Designing Instruction for Student Learning

Task 3 Steps	*Praxis*® Test Specifications
Step 1 **Planning the Lesson** Candidates' ability to plan an effective lesson that facilitates student learning	**I. Scientific Methodology, Techniques, and History** **A. Methods of Scientific Inquiry and Design** 1. Identifying problems based on observations 2. Forming and testing hypotheses 3. Development of theories, models, and laws 4. Experimental design, including independent and dependent variables, controls, and sources of error 5. Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding 6. Nature of scientific knowledge **B. Processes Involved in Scientific Data Collection and Manipulation** 1. Common units of measurement (metric and English) including unit conversion and prefixes such as *milli* and *kilo* 2. Scientific notation and significant figures in collected data 3. Organization and presentation of data 4. Basic data and error analysis including determining mean, accuracy, precision, and sources of error **C. Interpret and Draw Conclusions from Data Presented in Tables, Graphs, Maps, and Charts** 1. Trends in data 2. Relationships between variables 3. Predictions based on data 4. Drawing valid conclusions based on the data **D. Procedures for Correct Preparation, Storage, Use, and Disposal of Laboratory Materials** 1. Appropriate and safe use of materials (e.g., chemicals, lab specimens) 2. Safe disposal of materials 3. Appropriate storage 4. Preparation for classroom or field use (e.g., how to prepare a solution of given concentration, staining slides, labeling samples) **E. How to Use Standard Equipment in the Laboratory and the Field** 1. Appropriate and safe use (e.g., Bunsen burner, glassware, GPS, microscope) 2. Appropriate storage (e.g., pH probes stored in appropriate buffer solution, dissection equipment, glassware) 3. Maintenance and calibration (e.g., cleaning microscopes, calibration of balances) 4. Preparation for classroom or field use (e.g., prelaboratory setup, classroom demonstrations, field research) **F. Safety and Emergency Procedures in the Laboratory** 1. Location and use of standard safety equipment (e.g., eyewash, shower) 2. Laboratory safety rules for students 3. Appropriate apparel and conduct in the laboratory (e.g., wearing goggles) 4. Emergency procedures (e.g., fires, chemical spills, handling of injuries)

Task 3 Steps	*Praxis*® Test Specifications
	G. Major Historical Developments of Science 1. Accepted principles and models develop over time 2. Major developments in science (e.g., atomic theory, plate tectonics) 3. Contributions of major historical figures (e.g., Darwin, Newton) **II. Physical Science** **A. Basic Principles** 1. Structure of matter 2. Basic structure of the atom 3. Basic characteristics of radioactive materials 4. Basic concepts and relationships involving energy and matter **B. Chemistry** 1. Periodicity and states of matter 2. Chemical nomenclature, composition, and bonding 3. Chemical reactions 4. Acid-based chemistry 5. Solutions and solubility **C. Physics** 1. Mechanics 2. Electricity and magnetism 3. Optics and waves **III. Life Science** **A. Basic Structure and Function of Cells and Their Organelles** 1. Structure and function of cell membranes (e.g., phospholipid bilayer, passive and active transport) 2. Structure and function of animal and plant cell organelles 3. Levels of organization (cells, tissues, organs, organ systems) 4. Major features of common animal cell types (e.g., blood cells, muscle, nerve, epithelial, gamete) 5. Prokaryotes (bacteria) and eukaryotes (animals, plants, fungi, protists) **B. Key Aspects of Cell Reproduction and Division** 1. Cell cycle 2. Mitosis 3. Meiosis 4. Cytokinesis **C. Basic Biochemistry of Life** 1. Cellular respiration 2. Photosynthesis 3. Biological molecules (e.g., DNA, carbohydrates, proteins, lipids, enzymes) **D. Basic Genetics** 1. Structure (double helix, single stranded, and base pairs) and function of DNA and RNA (replication, transcription, and translation) 2. Chromosomes, genes, alleles 3. Dominant and recessive traits

Task 3 Steps	*Praxis*® Test Specifications
	4. Mendelian inheritance (e.g., genotype, phenotype, use of Punnett squares, pedigrees) 5. Mutations, chromosomal abnormalities, and common genetic disorders **E. Theory and Key Mechanisms of Evolution** 1. Mechanisms of evolution (e.g., natural selection) 2. Isolation mechanisms and speciation 3. Supporting evidence (e.g., fossil record, comparative genetics, homologous structures) **F. Hierarchical Classification Scheme** 1. Classification schemes (e.g., domain, class, genus) 2. Characteristics of bacteria, animals, plants, fungi, and protists **G. Major Structures of Plants and Their Functions** 1. Characteristics of vascular and nonvascular plants 2. Structure and function of roots, leaves, and stems (e.g., stomata, xylem, phloem) 3. Asexual (budding) and sexual reproduction (flowers, fruit, seeds, spores) 4. Growth (e.g., germination, elongation) 5. Uptake and transport of nutrients and water 6. Responses to stimuli (e.g., light, temperature, water, gravity) **H. Basic Anatomy and Physiology of Animals, including the Human Body** 1. Response to stimuli and homeostasis 2. Exchange with the environment (e.g., respiratory, excretory, and digestive systems) 3. Internal transport and exchange (e.g., heart, arteries, veins, capillaries) 4. Control systems (e.g., nervous and endocrine systems) 5. Movement and support (e.g., skeletal and muscular systems) 6. Reproduction and development 7. Immune system (e.g., antibodies, autoimmune disorders) **I. Key Aspects of Ecology** 1. Population dynamics 2. Community ecology 3. Ecosystems **IV. Earth and Space Science** **A. Physical Geology** 1. Types and basic characteristics of rocks and minerals and their formation processes 2. Processes involved in erosion, weathering, and deposition of Earth's surface materials and soil formation 3. Earth's basic structure and internal processes 4. The water cycle **B. Historical Geology** 1. Historical geology **C. Earth's Bodies of Water** 1. Characteristics and processes of Earth's oceans and other bodies of water

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	D. Meteorology and Climate 1. Basic structure and composition of Earth's atmosphere 2. Basic concepts of meteorology 3. Major factors that affect climate and seasons **E. Astronomy** 1. Major features of the solar system 2. Interaction of the Earth-Moon-Sun system 3. Major features of the universe 4. Contributions of space exploration and technology to our understanding of the universe **V. Science, Technology, and Society** **A. Impact of Science and Technology on the Environment and Society** 1. Air and water pollution (e.g., acid rain, eutrophication, groundwater pollution) 2. Climate change and greenhouse gases 3. Irrigation 4. Reservoirs and levees 5. Depletion of aquifers 6. Ozone layer depletion 7. Loss of biodiversity 8. Space exploration 9. Waste disposal (e.g., landfills) 10. Recycling 11. Environmentally friendly consumer products (e.g., biodegradable materials) **B. Major Issues Associated with Energy Production and the Management of Natural Resources** 1. Renewable and nonrenewable energy resources 2. Conservation and recycling 3. Pros and cons of power generation based on various resources including fossil and nuclear fuel, hydropower, wind power, solar power, geothermal power, and alternative energy sources 4. Issues associated with the use and extraction of Earth's resources (e.g., mining, land reclamation, deforestation) **C. Applications of Science and Technology in Daily Life** 1. Chemical properties of household products 2. Communication (e.g., wireless devices, GPS, satellites) 3. Science principles applied in commonly used consumer products (e.g., batteries, lasers, polarized sunglasses, and fiber optic cables) 4. Water purification 5. Common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides) 6. DNA evidence in criminal investigations 7. Nanotechnology **D. Impact of Science on Public Health Issues** 1. Nutrition, disease, and medicine (e.g., vitamins, viruses, vaccines)

Task 3 Steps	*Praxis*® Test Specifications
	2. Biotechnology (e.g., genetic engineering, in vitro fertilization) 3. Medical technologies (e.g., medical imaging, X-rays, radiation therapy)
Step 2 **The Focus Students** Candidates' ability to differentiate instruction for individual students	
Step 3 **Analyzing the Instruction** Candidates' ability to analyze their lesson plan and evidence of student learning	**I. Scientific Methodology, Techniques, and History** **A. Methods of Scientific Inquiry and Design** 1. Identifying problems based on observations 2. Forming and testing hypotheses 3. Development of theories, models, and laws 4. Experimental design, including independent and dependent variables, controls, and sources of error 5. Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding 6. Nature of scientific knowledge **B. Processes Involved in Scientific Data Collection and Manipulation** 1. Common units of measurement (metric and English) including unit conversion and prefixes such as *milli* and *kilo* 2. Scientific notation and significant figures in collected data 3. Organization and presentation of data 4. Basic data and error analysis including determining mean, accuracy, precision, and sources of error **C. Interpret and Draw Conclusions from Data Presented in Tables, Graphs, Maps, and Charts** 1. Trends in data 2. Relationships between variables 3. Predictions based on data 4. Drawing valid conclusions based on the data **D. Procedures for Correct Preparation, Storage, Use, and Disposal of Laboratory Materials** 1. Appropriate and safe use of materials (e.g., chemicals, lab specimens) 2. Safe disposal of materials 3. Appropriate storage 4. Preparation for classroom or field use (e.g., how to prepare a solution of given concentration, staining slides, labeling samples) **E. How to Use Standard Equipment in the Laboratory and the Field** 1. Appropriate and safe use (e.g., Bunsen burner, glassware, GPS, microscope) 2. Appropriate storage (e.g., pH probes stored in appropriate buffer solution, dissection equipment, glassware) 3. Maintenance and calibration (e.g., cleaning microscopes, calibration of balances) 4. Preparation for classroom or field use (e.g., prelaboratory setup, classroom demonstrations, field research) **F. Safety and Emergency Procedures in the Laboratory**

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	1. Location and use of standard safety equipment (e.g., eyewash, shower) 2. Laboratory safety rules for students 3. Appropriate apparel and conduct in the laboratory (e.g., wearing goggles) 4. Emergency procedures (e.g., fires, chemical spills, handling of injuries) **G. Major Historical Developments of Science** 1. Accepted principles and models develop over time 2. Major developments in science (e.g., atomic theory, plate tectonics) 3. Contributions of major historical figures (e.g., Darwin, Newton) **II. Physical Science** **A. Basic Principles** 1. Structure of matter 2. Basic structure of the atom 3. Basic characteristics of radioactive materials 4. Basic concepts and relationships involving energy and matter **B. Chemistry** 1. Periodicity and states of matter 2. Chemical nomenclature, composition, and bonding 3. Chemical reactions 4. Acid-based chemistry 5. Solutions and solubility **C. Physics** 1. Mechanics 2. Electricity and magnetism 3. Optics and waves **III. Life Science** **A. Basic Structure and Function of Cells and Their Organelles** 1. Structure and function of cell membranes (e.g., phospholipid bilayer, passive and active transport) 2. Structure and function of animal and plant cell organelles 3. Levels of organization (cells, tissues, organs, organ systems) 4. Major features of common animal cell types (e.g., blood cells, muscle, nerve, epithelial, gamete) 5. Prokaryotes (bacteria) and eukaryotes (animals, plants, fungi, protists) **B. Key Aspects of Cell Reproduction and Division** 1. Cell cycle 2. Mitosis 3. Meiosis 4. Cytokinesis **C. Basic Biochemistry of Life** 1. Cellular respiration 2. Photosynthesis 3. Biological molecules (e.g., DNA, carbohydrates, proteins, lipids, enzymes) **D. Basic Genetics**

Task 3 Steps	*Praxis*® Test Specifications
	1. Structure (double helix, single stranded, and base pairs) and function of DNA and RNA (replication, transcription, and translation) 2. Chromosomes, genes, alleles 3. Dominant and recessive traits 4. Mendelian inheritance (e.g., genotype, phenotype, use of Punnett squares, pedigrees) 5. Mutations, chromosomal abnormalities, and common genetic disorders **E. Theory and Key Mechanisms of Evolution** 1. Mechanisms of evolution (e.g., natural selection) 2. Isolation mechanisms and speciation 3. Supporting evidence (e.g., fossil record, comparative genetics, homologous structures) **F. Hierarchical Classification Scheme** 1. Classification schemes (e.g., domain, class, genus) 2. Characteristics of bacteria, animals, plants, fungi, and protists **G. Major Structures of Plants and Their Functions** 1. Characteristics of vascular and nonvascular plants 2. Structure and function of roots, leaves, and stems (e.g., stomata, xylem, phloem) 3. Asexual (budding) and sexual reproduction (flowers, fruit, seeds, spores) 4. Growth (e.g., germination, elongation) 5. Uptake and transport of nutrients and water 6. Responses to stimuli (e.g., light, temperature, water, gravity) **H. Basic Anatomy and Physiology of Animals, including the Human Body** 1. Response to stimuli and homeostasis 2. Exchange with the environment (e.g., respiratory, excretory, and digestive systems) 3. Internal transport and exchange (e.g., heart, arteries, veins, capillaries) 4. Control systems (e.g., nervous and endocrine systems) 5. Movement and support (e.g., skeletal and muscular systems) 6. Reproduction and development 7. Immune system (e.g., antibodies, autoimmune disorders) **I. Key Aspects of Ecology** 1. Population dynamics 2. Community ecology 3. Ecosystems **IV. Earth and Space Science** **A. Physical Geology** 1. Types and basic characteristics of rocks and minerals and their formation processes 2. Processes involved in erosion, weathering, and deposition of Earth's surface materials and soil formation 3. Earth's basic structure and internal processes 4. The water cycle

Task 3 Steps	*Praxis*® Test Specifications
	B. Historical Geology 1. Historical geology **C. Earth's Bodies of Water** 1. Characteristics and processes of Earth's oceans and other bodies of water **D. Meteorology and Climate** 1. Basic structure and composition of Earth's atmosphere 2. Basic concepts of meteorology 3. Major factors that affect climate and seasons **E. Astronomy** 1. Major features of the solar system 2. Interaction of the Earth-Moon-Sun system 3. Major features of the universe 4. Contributions of space exploration and technology to our understanding of the universe **V. Science, Technology, and Society** **A. Impact of Science and Technology on the Environment and Society** 1. Air and water pollution (e.g., acid rain, eutrophication, groundwater pollution) 2. Climate change and greenhouse gases 3. Irrigation 4. Reservoirs and levees 5. Depletion of aquifers 6. Ozone layer depletion 7. Loss of biodiversity 8. Space exploration 9. Waste disposal (e.g., landfills) 10. Recycling 11. Environmentally friendly consumer products (e.g., biodegradable materials) **B. Major Issues Associated with Energy Production and the Management of Natural Resources** 1. Renewable and nonrenewable energy resources 2. Conservation and recycling 3. Pros and cons of power generation based on various resources including fossil and nuclear fuel, hydropower, wind power, solar power, geothermal power, and alternative energy sources 4. Issues associated with the use and extraction of Earth's resources (e.g., mining, land reclamation, deforestation) **C. Applications of Science and Technology in Daily Life** 1. Chemical properties of household products 2. Communication (e.g., wireless devices, GPS, satellites) 3. Science principles applied in commonly used consumer products (e.g., batteries, lasers, polarized sunglasses, and fiber optic cables) 4. Water purification 5. Common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides)

Task 3 Steps	*Praxis*® Test Specifications
	6. DNA evidence in criminal investigations 7. Nanotechnology **D. Impact of Science on Public Health Issues** 1. Nutrition, disease, and medicine (e.g., vitamins, viruses, vaccines) 2. Biotechnology (e.g., genetic engineering, in vitro fertilization) 3. Medical technologies (e.g., medical imaging, X-rays, radiation therapy)
Step 4 **Reflecting** Candidates' ability to reflect on the strengths of their lesson plan as well as on the components of the lesson that are in need of improvement	

PPAT® Assessment Task 4: Implementing and Analyzing Instruction to Promote Student Learning

Task 4 Steps	*Praxis*® Test Specifications
Step 1 **Planning** Candidates' ability to plan an effective lesson that facilitates student learning	**I. Scientific Methodology, Techniques, and History** **A. Methods of Scientific Inquiry and Design** 1. Identifying problems based on observations 2. Forming and testing hypotheses 3. Development of theories, models, and laws 4. Experimental design, including independent and dependent variables, controls, and sources of error 5. Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding 6. Nature of scientific knowledge **B. Processes Involved in Scientific Data Collection and Manipulation** 1. Common units of measurement (metric and English) including unit conversion and prefixes such as *milli* and *kilo* 2. Scientific notation and significant figures in collected data 3. Organization and presentation of data 4. Basic data and error analysis including determining mean, accuracy, precision, and sources of error **C. Interpret and Draw Conclusions from Data Presented in Tables, Graphs, Maps, and Charts** 1. Trends in data 2. Relationships between variables 3. Predictions based on data 4. Drawing valid conclusions based on the data **D. Procedures for Correct Preparation, Storage, Use, and Disposal of Laboratory Materials** 1. Appropriate and safe use of materials (e.g., chemicals, lab specimens) 2. Safe disposal of materials 3. Appropriate storage 4. Preparation for classroom or field use (e.g., how to prepare a solution of given concentration, staining slides, labeling samples) **E. How to Use Standard Equipment in the Laboratory and the Field** 1. Appropriate and safe use (e.g., Bunsen burner, glassware, GPS, microscope) 2. Appropriate storage (e.g., pH probes stored in appropriate buffer solution, dissection equipment, glassware) 3. Maintenance and calibration (e.g., cleaning microscopes, calibration of balances) 4. Preparation for classroom or field use (e.g., prelaboratory setup, classroom demonstrations, field research) **F. Safety and Emergency Procedures in the Laboratory** 1. Location and use of standard safety equipment (e.g., eyewash, shower) 2. Laboratory safety rules for students

Task 4 Steps	*Praxis*® Test Specifications
	3. Appropriate apparel and conduct in the laboratory (e.g., wearing goggles) 4. Emergency procedures (e.g., fires, chemical spills, handling of injuries) **G. Major Historical Developments of Science** 1. Accepted principles and models develop over time 2. Major developments in science (e.g., atomic theory, plate tectonics) 3. Contributions of major historical figures (e.g., Darwin, Newton) **II. Physical Science** **A. Basic Principles** 1. Structure of matter 2. Basic structure of the atom 3. Basic characteristics of radioactive materials 4. Basic concepts and relationships involving energy and matter **B. Chemistry** 1. Periodicity and states of matter 2. Chemical nomenclature, composition, and bonding 3. Chemical reactions 4. Acid-based chemistry 5. Solutions and solubility **C. Physics** 1. Mechanics 2. Electricity and magnetism 3. Optics and waves **III. Life Science** **A. Basic Structure and Function of Cells and Their Organelles** 1. Structure and function of cell membranes (e.g., phospholipid bilayer, passive and active transport) 2. Structure and function of animal and plant cell organelles 3. Levels of organization (cells, tissues, organs, organ systems) 4. Major features of common animal cell types (e.g., blood cells, muscle, nerve, epithelial, gamete) 5. Prokaryotes (bacteria) and eukaryotes (animals, plants, fungi, protists) **B. Key Aspects of Cell Reproduction and Division** 1. Cell cycle 2. Mitosis 3. Meiosis 4. Cytokinesis **C. Basic Biochemistry of Life** 1. Cellular respiration 2. Photosynthesis 3. Biological molecules (e.g., DNA, carbohydrates, proteins, lipids, enzymes) **D. Basic Genetics** 1. Structure (double helix, single stranded, and base pairs) and function of DNA and RNA (replication, transcription, and translation) 2. Chromosomes, genes, alleles

Task 4 Steps	*Praxis*® Test Specifications
	3. Dominant and recessive traits 4. Mendelian inheritance (e.g., genotype, phenotype, use of Punnett squares, pedigrees) 5. Mutations, chromosomal abnormalities, and common genetic disorders **E. Theory and Key Mechanisms of Evolution** 1. Mechanisms of evolution (e.g., natural selection) 2. Isolation mechanisms and speciation 3. Supporting evidence (e.g., fossil record, comparative genetics, homologous structures) **F. Hierarchical Classification Scheme** 1. Classification schemes (e.g., domain, class, genus) 2. Characteristics of bacteria, animals, plants, fungi, and protists **G. Major Structures of Plants and Their Functions** 1. Characteristics of vascular and nonvascular plants 2. Structure and function of roots, leaves, and stems (e.g., stomata, xylem, phloem) 3. Asexual (budding) and sexual reproduction (flowers, fruit, seeds, spores) 4. Growth (e.g., germination, elongation) 5. Uptake and transport of nutrients and water 6. Responses to stimuli (e.g., light, temperature, water, gravity) **H. Basic Anatomy and Physiology of Animals, including the Human Body** 1. Response to stimuli and homeostasis 2. Exchange with the environment (e.g., respiratory, excretory, and digestive systems) 3. Internal transport and exchange (e.g., heart, arteries, veins, capillaries) 4. Control systems (e.g., nervous and endocrine systems) 5. Movement and support (e.g., skeletal and muscular systems) 6. Reproduction and development 7. Immune system (e.g., antibodies, autoimmune disorders) **I. Key Aspects of Ecology** 1. Population dynamics 2. Community ecology 3. Ecosystems **IV. Earth and Space Science** **A. Physical Geology** 1. Types and basic characteristics of rocks and minerals and their formation processes 2. Processes involved in erosion, weathering, and deposition of Earth's surface materials and soil formation 3. Earth's basic structure and internal processes 4. The water cycle **B. Historical Geology** 1. Historical geology **C. Earth's Bodies of Water**

Task 4 Steps	*Praxis*® Test Specifications
	1. Characteristics and processes of Earth's oceans and other bodies of water **D. Meteorology and Climate** 1. Basic structure and composition of Earth's atmosphere 2. Basic concepts of meteorology 3. Major factors that affect climate and seasons **E. Astronomy** 1. Major features of the solar system 2. Interaction of the Earth-Moon-Sun system 3. Major features of the universe 4. Contributions of space exploration and technology to our understanding of the universe **V. Science, Technology, and Society** **A. Impact of Science and Technology on the Environment and Society** 1. Air and water pollution (e.g., acid rain, eutrophication, groundwater pollution) 2. Climate change and greenhouse gases 3. Irrigation 4. Reservoirs and levees 5. Depletion of aquifers 6. Ozone layer depletion 7. Loss of biodiversity 8. Space exploration 9. Waste disposal (e.g., landfills) 10. Recycling 11. Environmentally friendly consumer products (e.g., biodegradable materials) **B. Major Issues Associated with Energy Production and the Management of Natural Resources** 1. Renewable and nonrenewable energy resources 2. Conservation and recycling 3. Pros and cons of power generation based on various resources including fossil and nuclear fuel, hydropower, wind power, solar power, geothermal power, and alternative energy sources 4. Issues associated with the use and extraction of Earth's resources (e.g., mining, land reclamation, deforestation) **C. Applications of Science and Technology in Daily Life** 1. Chemical properties of household products 2. Communication (e.g., wireless devices, GPS, satellites) 3. Science principles applied in commonly used consumer products (e.g., batteries, lasers, polarized sunglasses, and fiber optic cables) 4. Water purification 5. Common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides) 6. DNA evidence in criminal investigations 7. Nanotechnology **D. Impact of Science on Public Health Issues**

Task 4 Steps	*Praxis*® Test Specifications
	1. Nutrition, disease, and medicine (e.g., vitamins, viruses, vaccines) 2. Biotechnology (e.g., genetic engineering, in vitro fertilization) 3. Medical technologies (e.g., medical imaging, X-rays, radiation therapy)
Step 2 **Implementing the Plan** Candidates' ability to implement the lesson plan, interact with their students, and analyze their practice	**I. Scientific Methodology, Techniques, and History** **A. Methods of Scientific Inquiry and Design** 1. Identifying problems based on observations 2. Forming and testing hypotheses 3. Development of theories, models, and laws 4. Experimental design, including independent and dependent variables, controls, and sources of error 5. Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding 6. Nature of scientific knowledge **B. Processes Involved in Scientific Data Collection and Manipulation** 1. Common units of measurement (metric and English) including unit conversion and prefixes such as *milli* and *kilo* 2. Scientific notation and significant figures in collected data 3. Organization and presentation of data 4. Basic data and error analysis including determining mean, accuracy, precision, and sources of error **C. Interpret and Draw Conclusions from Data Presented in Tables, Graphs, Maps, and Charts** 1. Trends in data 2. Relationships between variables 3. Predictions based on data 4. Drawing valid conclusions based on the data **D. Procedures for Correct Preparation, Storage, Use, and Disposal of Laboratory Materials** 1. Appropriate and safe use of materials (e.g., chemicals, lab specimens) 2. Safe disposal of materials 3. Appropriate storage 4. Preparation for classroom or field use (e.g., how to prepare a solution of given concentration, staining slides, labeling samples) **E. How to Use Standard Equipment in the Laboratory and the Field** 1. Appropriate and safe use (e.g., Bunsen burner, glassware, GPS, microscope) 2. Appropriate storage (e.g., pH probes stored in appropriate buffer solution, dissection equipment, glassware) 3. Maintenance and calibration (e.g., cleaning microscopes, calibration of balances) 4. Preparation for classroom or field use (e.g., prelaboratory setup, classroom demonstrations, field research) **F. Safety and Emergency Procedures in the Laboratory** 1. Location and use of standard safety equipment (e.g., eyewash, shower) 2. Laboratory safety rules for students

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Step 3 **Understanding the Two Focus Students** Candidates' ability to provide evidence of student learning resulting from the implemented lesson	
Step 4 **Reflecting** Candidates' ability to reflect on the effectiveness of their lesson for the entire class	