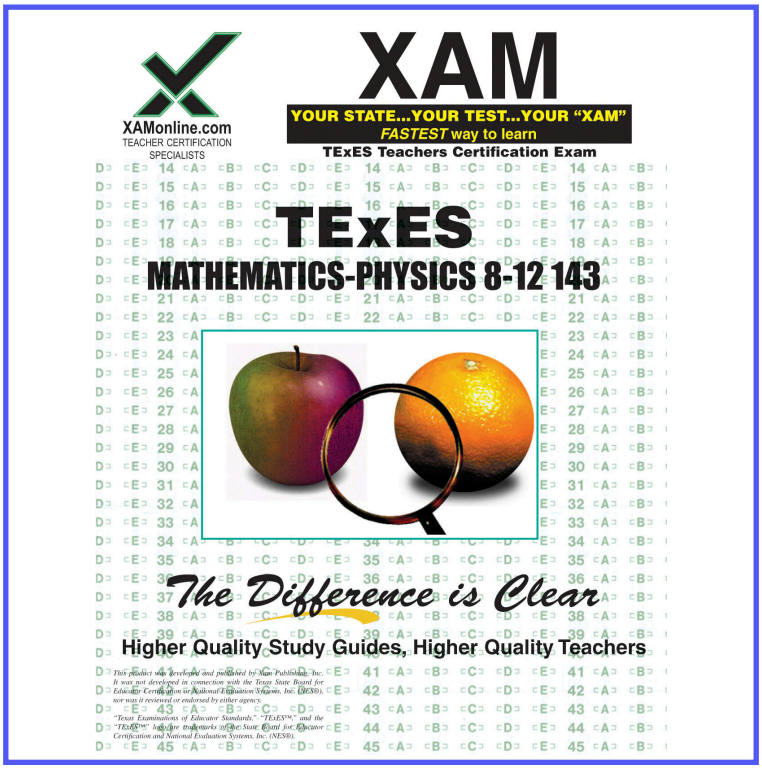


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Competency 21.0 The teacher understands assessment and uses a variety of formal and informal assessment techniques to monitor and guide mathematics instruction and to evaluate student progress.....203

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DOMAIN VII SCIENTIFIC INQUIRY AND PROCESS

COMPETENCY 22.0 THE TEACHER UNDERSTANDS HOW TO SELECT AND MANAGE LEARNING ACTIVITIES TO ENSURE THE SAFETY OF ALL STUDENTS AND THE CORRECT USE AND CARE OF ORGANISMS, NATURAL RESOURCES, MATERIALS, EQUIPMENT, AND TECHNOLOGIES 231

Skill 22.1 Uses current sources of information about laboratory safety, including safety regulations and guidelines for the use of science facilities.....231

Skill 22.2 Recognizes potential safety hazards in the laboratory and in the field and knows how to apply procedures, including basic first aid, for responding to accidents.....235

Skill 22.3 Employs safe practices in planning and implementing all instructional activities and designs, and implements rules and procedures to maintain a safe learning environment.....236

Skill 22.4 Understands procedures for selecting, maintaining, and safely using chemicals, tools, technologies, materials, specimens, and equipment, including procedures for the recycling, reuse, and conservation of laboratory resources and for the safe handling and ethical treatment of organisms 237

Skill 22.5 Knows how to use appropriate equipment and technology (e.g., Internet, spreadsheet, calculator) for gathering, organizing, displaying, and communicating data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations)241

Skill 22.6 Understands how to use a variety of tools, techniques, and technology to gather, organize, and analyze data and how to apply appropriate methods of statistical measures and analysis 245

Skill 22.7 Knows how to apply techniques to calibrate measuring devices and understands concepts of precision, accuracy, and error with regard to reading and recording numerical data from scientific instruments. 247

Skill 22.8 Uses the International System of Units (i.e., metric system) and performs unit conversions within and across measurement systems 249

COMPETENCY 23.0 THE TEACHER UNDERSTANDS THE NATURE OF SCIENCE, THE PROCESS OF SCIENTIFIC INQUIRY, AND THE UNIFYING CONCEPTS THAT ARE COMMON TO ALL SCIENCES..... 253

Skill 23.1 Understands the nature of science, the relationship between science and technology, the predictive power of science, and limitations to the scope of science (i.e., the types of questions that science can and cannot answer) 253

Skill 23.2 Knows the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis) and how and why scientists use different types of scientific investigations..... 257

Skill 23.3 Understands principles and procedures for designing and conducting a variety of scientific investigations, with emphasis on inquiry-based investigations, and how to communicate and defend scientific results 259

Skill 23.4 Understands how logical reasoning, verifiable observational and experimental evidence, and peer review are used in the process of generating and evaluating scientific knowledge 264

Skill 23.5 Understands how to identify potential sources of error in an investigation, evaluate the validity of scientific data, and develop and analyze different explanations for a given scientific result..... 265

Skill 23.6 Knows the characteristics and general features of systems; how properties and patterns of systems can be described in terms of space, time, energy, and matter; and how system components and different systems interact..... 267

Skill 23.7 Knows how to apply and analyze the systems model (e.g., interacting parts, boundaries, input, output, feedback, subsystems) across the science disciplines 268

Skill 23.8 Understands how shared themes and concepts (e.g., systems, order, and organization; evidence, models, and explanation; change, constancy, and measurements; evolution and equilibrium; and form and function) provide a unifying framework in science 269

Skill 23.9 Understands how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical) 270

COMPETENCY 24.0 THE TEACHER UNDERSTANDS THE HISTORY OF SCIENCE, HOW SCIENCE IMPACTS THE DAILY LIVES OF STUDENTS, AND HOW SCIENCE INTERACTS WITH AND INFLUENCES PERSONAL AND SOCIETAL DECISIONS 276

Skill 24.1 Understands the historical development of science, key events in the history of science, and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge..... 276

Skill 24.2 Knows how to use examples from the history of science to demonstrate the changing nature of scientific theories and knowledge (i.e., that scientific theories and knowledge are always subject to revision in light of new evidence) 279

Skill 24.3 Knows that science is a human endeavor influenced by societal, cultural, and personal views of the world, and that decisions about the use and direction of science are based on factors such as ethical standards, economics, and personal and societal biases and needs..... 280

Skill 24.4 Understands the application of scientific ethics to the conducting, analyzing, and publishing of scientific investigations..... 281

Skill 24.5 Applies scientific principles to analyze factors (e.g., diet, exercise, personal behavior) that influence personal and societal choices concerning fitness and health (e.g., physiological and psychological effects and risks associated with the use of substances and substance abuse) 282

Skill 24.6 Applies scientific principles, the theory of probability, and risk/benefit analysis to analyze the advantages of, disadvantages of, or alternatives to a given decision or course of action 285

Skill 24.7 Understands the role science can play in helping resolve personal, societal, and global issues (e.g., population growth disease prevention, resource use) 286

DOMAIN VIII PHYSICS

COMPETENCY 25.0 THE TEACHER UNDERSTANDS THE DESCRIPTION OF MOTION IN ONE AND TWO DIMENSIONS 288

Skill 25.1 Analyzes and interprets graphs describing the motion of a particle 288

Skill 25.2 Applies vector concepts to displacement, velocity, and acceleration in order to analyze and describe the motion of a particle 289

Skill 25.3 Solves problems involving uniform and accelerated motion using scalar and vector quantities 290

Skill 25.4 Analyzes and solves problems involving projectile motion 292

Skill 25.5 Analyzes and solves problems involving uniform circular and rotary motion 293

Skill 25.6 Understands motion of fluids 295

Skill 25.7 Understands motion in terms of frames of reference and relativity concepts 300

COMPETENCY 26.0 THE TEACHER UNDERSTANDS THE LAWS OF MOTION 302

Skill 26.1 Identifies and analyzes the forces acting in a given situation and constructs a free-body diagram 302

Skill 26.2 Solves problems involving the vector nature of force (e.g., resolving forces into components, analyzing static or dynamic equilibrium of a particle) 304

Skill 26.3 Identifies and applies Newton's laws to analyze and solve a variety of practical problems (e.g., properties of frictional forces, acceleration of a particle on an inclined plane, displacement of a mass on a spring, forces on a pendulum) 306

COMPETENCY 27.0 THE TEACHER UNDERSTANDS THE CONCEPTS OF GRAVITATIONAL AND ELECTROMAGNETIC FORCES IN NATURE 311

Skill 27.1 Applies the Law of Universal Gravitation to solve a variety of problems (e.g., determining the gravitational fields of the planets, analyzing properties of satellite orbits) 311

Skill 27.2 Calculates electrostatic forces, fields, and potentials 315

Skill 27.3 Understands the properties of magnetic materials and the molecular theory of magnetism 319

Skill 27.4 Identifies the source of the magnetic field and calculates the magnetic field for various simple current distributions 320

Skill 27.5 Analyzes the magnetic force on charged particles and current-carrying conductors 323

Skill 276 Understands induced electric and magnetic fields and analyzes the relationship between electricity and magnetism 326

Skill 27.7 Understands the electromagnetic spectrum and the production of electromagnetic waves 327

COMPETENCY 28.0 THE TEACHER UNDERSTANDS APPLICATIONS OF ELECTRICITY AND MAGNETISM 329

Skill 28.1 Analyzes common examples of electrostatics (e.g., a charged balloon attached to a wall, behavior of an electroscope, charging by induction) 329

Skill 28.2 Understands electric current, resistance and resistivity, potential difference, capacitance, and electromotive force in conductors and circuits 330

Skill 28.3 Analyzes series and parallel DC circuits in terms of current, resistance, voltage, and power 335

Skill 28.4 Identifies basic components and characteristics of AC circuits 336

Skill 28.5 Understands the operation of an electromagnet 337

Skill 28.6 Understands the operation of electric meters, motors, generators, and transformers 338

COMPETENCY 29.0 THE TEACHER UNDERSTANDS THE CONSERVATION OF ENERGY AND MOMENTUM 341

Skill 29.1 Understands the concept of work 341

Skill 29.2 Understands the relationships among work, energy, and power 341

Skill 29.3 Solves problems using the conservation of mechanical energy in a physical system (e.g., determining potential energy for conservative forces, analyzing the motion of a pendulum) 343

Skill 29.4 Applies the work-energy theorem to analyze and solve a variety of practical problems (e.g., finding the speed of an object given its potential energy, determining the work done by frictional forces on a decelerating car) 346

Skill 29.5 Understands linear and angular momentum 347

Skill 29.6 Solves a variety of problems (e.g., collisions) using the conservation of linear and angular momentum 350

COMPETENCY 30.0 THE TEACHER UNDERSTANDS THE LAWS OF THERMODYNAMICS 353

Skill 30.1 Understands methods of heat transfer (i.e., convection, conduction, radiation) 353

Skill 30.2 Understands the molecular interpretation of temperature and heat ... 355

Skill 30.3 Solves problems involving thermal expansion, heat capacity, and the relationship between heat and other forms of energy 356

Skill 30.4 Applies the first law of thermodynamics to analyze energy transformations in a variety of everyday situations (e.g., electric light bulb, power generating plant) 360

Skill 30.5 Understands the concept of entropy and its relationship to the second law of thermodynamics 362

COMPETENCY 31.0 THE TEACHER UNDERSTANDS THE CHARACTERISTICS AND BEHAVIOR OF WAVES 365

Skill 31.1 Understands interrelationships among wave characteristics such as velocity, frequency, wavelength, and amplitude and relates them to properties of sound and light (e.g., pitch, color) 365

Skill 31.2 Compares and contrasts transverse and longitudinal waves 367

Skill 31.3 Describes how various waves are propagated through different media 368

Skill 31.4 Applies properties of reflection and refraction to analyze optical phenomena (e.g., mirrors, lenses, fiber-optic cable) 369

Skill 31.5 Applies principles of wave interference to analyze wave phenomena, including acoustical (e.g., harmonics) and optical phenomena (e.g., patterns created by thin films and diffraction gratings) 376

Skill 31.6 Identifies and interprets how wave characteristics and behaviors are used in medical, industrial, and other real-world applications 380

COMPETENCY 32.0 THE TEACHER UNDERSTANDS THE FUNDAMENTAL CONCEPTS OF QUANTUM PHYSICS 382

Skill 32.1 Interprets wave-particle duality 382

Skill 32.2 Identifies examples and consequences of the Uncertainty Principle 383

Skill 32.3 Understands the photoelectric effect 384

Skill 32.4 Uses the quantum model of the atom to describe and analyze absorption and emission spectra (e.g., line spectra, blackbody radiation) 385

Skill 32.5 Explores real-world applications of quantum phenomena (e.g., lasers, photoelectric sensors, semiconductors, superconductivity) ... 390

DOMAIN IX. SCIENCE LEARNING, INSTRUCTION, AND ASSESSMENT

COMPETENCY 33.0 THE TEACHER UNDERSTANDS RESEARCH-BASED THEORETICAL AND PRACTICAL KNOWLEDGE ABOUT TEACHING SCIENCE, HOW STUDENTS LEARN SCIENCE, AND THE ROLE OF SCIENTIFIC INQUIRY IN SCIENCE INSTRUCTION 394

Skill 33.1 Knows research-based theories about how students develop scientific understanding and how developmental characteristics, prior knowledge, experience, and attitudes of students influence science learning 394

Skill 33.2 Understands the importance of respecting student diversity by planning activities that are inclusive and selecting and adapting science curricula, content, instructional materials, and activities to meet the interests, knowledge, understanding, abilities, and experiences of all students, including English Language Learners ... 395

Skill 33.3 Knows how to plan and implement strategies to encourage student self motivation and engagement in their own learning (e.g., linking inquiry-based investigations to students' prior knowledge, focusing inquiry-based instruction on issues relevant to students, developing instructional materials using situations from students' daily lives, fostering collaboration among students)....396

Skill 33.4 Knows how to use a variety of instructional strategies to ensure all students comprehend content-related texts, including how to locate, retrieve, and retain information from a range of texts and technologies 397

Skill 33.5 Understands the science teacher's role in developing the total school program by planning and implementing science instruction that incorporates schoolwide objectives and the statewide curriculum as defined in the Texas Essential Knowledge and Skills (TEKS)....399

Skill 33.6 Knows how to design and manage the learning environment (e.g., individual, small-group, whole-class settings) to focus and support student inquiries and to provide the time, space, and resources for all students to participate in field, laboratory, experimental, and nonexperimental scientific investigation 400

Skill 33.7 Understands the rationale for using active learning and inquiry methods in science instruction and how to model scientific attitudes such as curiosity, openness to new ideas, and skepticism....401

Skill 33.8 Knows principles and procedures for designing and conducting an inquiry based scientific investigation (e.g., making observations; generating questions; researching and reviewing current knowledge in light of existing evidence; choosing tools to gather and analyze evidence; proposing answers, explanations, and predictions; and communicating and defending results)....403

Skill 33.9 Knows how to assist students with generating, refining, focusing, and testing scientific questions and hypotheses....405

Skill 33.10 Knows strategies for assisting students in learning to identify, refine, and focus scientific ideas and questions guiding an inquiry-based scientific investigation; to develop, analyze, and evaluate different explanations for a given scientific result; and to identify potential sources of error in an inquiry-based scientific investigation 406