

Table of Contents

		Pg.
Domain I.	Mechanics	
Skill 1.	Vectors (properties; addition and subtraction) Error! Bookmark not defined.	
Skill 2.	Vector multiplication (dot and cross product).. Error! Bookmark not defined.	
Skill 3.	Motion along a straight line (displacement, velocity, acceleration) Error! Bookmark not defined.	
Skill 4.	Motion in two dimensions (projectile motion, uniform circular motion) Error! Bookmark not defined.	
Skill 5.	Reference frames and relative motion (relative velocity, Galilean relativity) Error! Bookmark not defined.	
Skill 6.	Force and Newton's laws of motion (Newton's first law, inertia, inertial reference frames, Newton's second law, force and acceleration, addition of forces, balanced versus unbalanced forces, Newton's third law, action-reaction forces, weight and mass) Error! Bookmark not defined.	
Skill 7.	Friction (static friction, kinetic friction, rolling friction)..... Error! Bookmark not defined.	
Skill 8.	Equilibrium of forces Error! Bookmark not defined.	
Skill 9.	Equilibrium of moments (torques).... Error! Bookmark not defined.	
Skill 10.	Dynamics of uniform circular motion Error! Bookmark not defined.	
Skill 11.	Work, energy, and power (relationship between work and kinetic energy, work done by a variable force)..... Error! Bookmark not defined.	
Skill 12.	Conservation of energy (potential energy, conservative and nonconservative forces) Error! Bookmark not defined.	
Skill 13.	Simple harmonic motion and oscillations (Hooke's law, graphical and mathematical representations, energy considerations, pendulums, springs) Error! Bookmark not defined.	
Skill 14.	Linear momentum and impulse (momentum-impulse relationship, conservation of linear momentum; elastic and inelastic collisions) Error! Bookmark not defined.	

- Skill 15. Rigid body motion (angular velocity and angular acceleration, angular momentum, moment of inertia, torque, and center of mass, conservation of angular momentum, rotational kinetic energy)**Error! Bookmark not defined.**
- Skill 16. Mass-energy relationships (conservation of mass-energy)**Error! Bookmark not defined.**
- Skill 17. Newton's law of universal gravitation and orbital motion (motion of satellites) **Error! Bookmark not defined.**
- Skill 18. Kepler's laws (law of orbits (first law), law of areas (second law), law of periods (third law)) **Error! Bookmark not defined.**
- Skill 19. Fluids (density and pressure, ideal fluids at rest, Pascal's law, Archimedes' principle and buoyant forces).....**Error! Bookmark not defined.**
- Skill 20. Ideal fluids in motion (Bernoulli's principle, streamlines, equation of continuity) **Error! Bookmark not defined.**

Domain II. Electricity and Magnetism

- Skill 1. Electric forces and Coulomb's law... **Error! Bookmark not defined.**
- Skill 2. Electric fields, Gauss's law, electric potential energy, electric potential, and potential difference.... **Error! Bookmark not defined.**
- Skill 3. Conductors, insulators and semiconductors (charging by friction, conduction and induction)..... **Error! Bookmark not defined.**
- Skill 4. Capacitance and dielectrics..... **Error! Bookmark not defined.**
- Skill 5. Conductors, insulators, and semiconductors as used in circuits **Error! Bookmark not defined.**
- Skill 6. Sources of EMF (batteries, photocells, generators) **Error! Bookmark not defined.**
- Skill 7. Current and resistance (Ohm's law, resistivity) **Error! Bookmark not defined.**
- Skill 8. Capacitance and inductance **Error! Bookmark not defined.**
- Skill 9. Energy and power **Error! Bookmark not defined.**
- Skill 10. Analyzing circuits (series and parallel circuits using Ohm's law or Kirchhoff's rules, resistors and capacitors in series or parallel, internal resistance, RC circuits)..... **Error! Bookmark not defined.**
- Skill 11. Power in alternating-current circuits (average power and energy transmission) **Error! Bookmark not defined.**

- Skill 12. Measurement of potential difference, current, resistance, and capacitance (ammeter, galvanometer, voltmeter and potentiometer) **Error! Bookmark not defined.**
- Skill 13. Magnets, magnetic fields, and magnetic forces (magnetic dipoles and materials, forces on a charged particle moving in a magnetic and/or electric field (Lorentz force law, cyclotron, mass spectrometer) forces or torques on current carrying conductors in magnetic fields) **Error! Bookmark not defined.**
- Skill 14. Magnetic flux (Gauss's law of magnetism) **Error! Bookmark not defined.**
- Skill 15. Magnetic fields produced by currents (Biot-Savart law, Ampere's law, magnetic field of a wire, magnetic field of a solenoid, displacement current) **Error! Bookmark not defined.**
- Skill 16. Electromagnetic induction (magnetic flux, Lenz's law, Faraday's law, transformers, generators and motors)..... **Error! Bookmark not defined.**
- Domain III. Optics and Waves**
- Skill 1. Wave speed, amplitude, wavelength, and frequency **Error! Bookmark not defined.**
- Skill 2. Inverse square law for intensity **Error! Bookmark not defined.**
- Skill 3. Reflection, refraction, absorption, transmission, and scattering (Snell's law, Rayleigh scattering)..... **Error! Bookmark not defined.**
- Skill 4. Transverse and longitudinal waves and their properties (Doppler effect, resonance and natural frequencies, polarization) **Error! Bookmark not defined.**
- Skill 5. Sound waves (pitch and loudness, air columns and standing waves open at both ends and closed at one end, harmonics, beats) . **Error! Bookmark not defined.**
- Skill 6. Electromagnetic spectrum (frequency regions, color)..... **Error! Bookmark not defined.**
- Skill 7. Principle of linear superposition and interference (diffraction, dispersion, beats and standing waves, interference in thin films and Young's double-slit experiment) **Error! Bookmark not defined.**
- Skill 8. Reflection and refraction (Snell's law, total internal reflection, fiber optics)..... **Error! Bookmark not defined.**
- Skill 9. Thin lenses **Error! Bookmark not defined.**
- Skill 10. Plane and spherical mirrors **Error! Bookmark not defined.**
- Skill 11. Prisms **Error! Bookmark not defined.**

Skill 12. Optical instruments (simple magnifier, microscope, telescope)
..... **Error! Bookmark not defined.**

Domain IV. Heat and Thermodynamics

Skill 1. Measurement of heat and temperature (temperature scales)..**Error! Bookmark not defined.**

Skill 2. Thermal expansion **Error! Bookmark not defined.**

Skill 3. Thermocouples..... **Error! Bookmark not defined.**

Skill 4. Heat capacity and specific heat, Latent heat of phase change (heat of fusion, heat of vaporization) **Error! Bookmark not defined.**

Skill 5. Transfer of heat (conduction, convection and radiation)..... **Error! Bookmark not defined.**

Skill 6. Kinetic molecular theory (ideal gas laws) **Error! Bookmark not defined.**

Skill 7. First law of thermodynamics (internal energy, energy conservation)
..... **Error! Bookmark not defined.**

Skill 8. Thermal processes involving pressure, volume and temperature
..... **Error! Bookmark not defined.**

Skill 9. Second law of thermodynamics (entropy and disorder, reversible and irreversible processes, spontaneity, heat engines, Carnot cycle, efficiency) **Error! Bookmark not defined.**

Skill 10. Third law and zeroth law of thermodynamics (absolute zero of temperature, law of equilibrium) **Error! Bookmark not defined.**

Skill 11. Energy and energy transformations (kinetic, potential, mechanical, sound, magnetic, electrical, light, heat, nuclear, chemical).....**Error! Bookmark not defined.**

Domain V. Modern Physics, Atomic and Nuclear Structure

Skill 1. Nature of the atom (Rutherford scattering, atomic models, Bohr model, atomic spectra) **Error! Bookmark not defined.**

Skill 2. Atomic and nuclear structure (electrons, protons and neutrons; electron arrangement, isotopes, hydrogen atom energy levels, nuclear forces and binding energy) . **Error! Bookmark not defined.**

Skill 3. Radioactivity (radioactive decay, half life, isotopes, decay processes, alpha decay, beta decay, gamma decay, artificial radioactivity) **Error! Bookmark not defined.**

Skill 4. Elementary particles (ionizing radiation)..... **Error! Bookmark not defined.**

- Skill 5. Organization of matter (elements, compounds, solutions, and mixtures)..... **Error! Bookmark not defined.**
- Skill 6. Physical properties of matter (phase changes, states of matter) **Error! Bookmark not defined.**
- Skill 7. Nuclear energy (fission and fusion, nuclear reactions and their products) **Error! Bookmark not defined.**
- Skill 8. Blackbody radiation and photoelectric effect .. **Error! Bookmark not defined.**
- Skill 9. de Broglie’s hypothesis and wave-particle duality **Error! Bookmark not defined.**
- Skill 10. Special relativity (Michelson-Morley experiment (ether and the speed of light), simultaneity, Lorentz transformations, time dilation, length contraction, velocity addition) **Error! Bookmark not defined.**

Domain VI. History and Nature of Science; Science, Technology, and Social Perspectives (STS)

- Skill 1. Scientific method of inquiry (formulating problems, formulating and testing hypotheses, making observations, developing generalizations) **Error! Bookmark not defined.**
- Skill 2. Science process skills (observing, hypothesizing, ordering, categorizing, comparing, inferring, applying, communicating) . **Error! Bookmark not defined.**
- Skill 3. Distinguish among hypotheses, assumptions, models, laws, and theories..... **Error! Bookmark not defined.**
- Skill 4. Experimental design (Data collection, interpretation and presentation, significance of controls) **Error! Bookmark not defined.**
- Skill 5. Integrate the overarching concepts of science **Error! Bookmark not defined.**
- Skill 6. Historical roots of the physical sciences and the contributions made by major historical figures to the physical sciences **Error! Bookmark not defined.**
- Skill 7. Scientific knowledge is subject to change **Error! Bookmark not defined.**
- Skill 8. Scientific measurement and notation systems **Error! Bookmark not defined.**
- Skill 9. Processes involved in scientific data collection and manipulation (organization of data, significant figures, linear regression)..... **Error! Bookmark not defined.**

- Skill 10. Interpret and draw conclusions from data, including those presented in tables, graphs, and charts.....**Error! Bookmark not defined.**
- Skill 11. Analyze errors in data that is presented (sources of error, accuracy, precision)..... **Error! Bookmark not defined.**
- Skill 12. Safety procedures involved in the preparation, storage, use, and disposal of laboratory and field materials**Error! Bookmark not defined.**
- Skill 13. Identify appropriate use, calibration procedures, and maintenance procedures for laboratory and field equipment**Error! Bookmark not defined.**
- Skill 14. Preparation of reagents, materials, and apparatus for classroom use..... **Error! Bookmark not defined.**
- Skill 15. Knowledge of safety and emergency procedures for the science classroom and laboratory **Error! Bookmark not defined.**
- Skill 16. Knowledge of the legal responsibilities of the teacher in the science classroom **Error! Bookmark not defined.**
- Skill 17. Impact of science and technology on the environment and human affairs..... **Error! Bookmark not defined.**
- Skill 18. Issues associated with energy production, transmission, management, and use (including nuclear waste removal and transportation) **Error! Bookmark not defined.**
- Skill 19. Issues associated with the production, storage, use, management, and disposal of consumer products. **Error! Bookmark not defined.**
- Skill 20. Issues associated with the management of natural resources **Error! Bookmark not defined.**
- Skill 21. Applications of science and technology in daily life**Error! Bookmark not defined.**
- Skill 22. Social, political, ethical, and economic issues arising from science and technology **Error! Bookmark not defined.**

Sample Test.....	159
Answer Key	188
Rigor Table	189
Rationales with Sample Questions	190