MOSCOW SCHOOL DISTRICT
CURRICULUM GUIDE
Subject/Course: Physics
Grade 12

PURPOSE:

Physics is a laboratory science dealing with the physical properties of matter and their relationship to energy in its many forms. By the end of the class students should be able to apply knowledge of the principles of physics to analyze problems and evaluate given situations involving but not limited to mechanics, properties of matter, waves and wave phenomenon, electricity and magnetism and modern physics. Students will also access and evaluate information related to physics and communicate findings, use scientific processes and various technologies to design, conduct, evaluate, and communicate the finding of scientific investigations related to physics.

UNIT 1: Vectors and Mathematics - one week

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 1*
Goal 1.1: Mathematics is the toolkit for the physicist. A good understanding of the concepts is an important foundation.	• 1.1.1. Understand the basic properties of vectors • 1.1.2. Add/Subtract vectors both graphically and algebraically • 1.1.3. Decomposition of vectors into its components	• Force table lab • Vernier tension lab	• Components • Tip to Tail Method • Resultant • Parallelogram Method	• Acceleration • Acceleration due to gravity • Average speed • Displacement • Elapsed time • Free fall • Instantaneous speed • Rate • Relative Speed • Velocity

UNIT 2: Motion and Kinematics - three weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 2*
Goal 2.1: Motion in one and two dimensions is analyzed with a distinction between the how and why of motion.	• 2.1.1. Differentiate between the concepts of position, velocity, and acceleration. • 2.1.2. Identify velocity and acceleration vectors. • Recognize the relationship between velocity and acceleration when an object is speeding up,	• Trip around the room to compare distance vs. displacement. • Vernier Lab – Graph matching	•	• Acceleration • Acceleration due to gravity • Average speed • Displacement • Elapsed time • Free fall • Instantaneous speed • Rate • Relative Speed • Velocity

	slowing down, curving, or at a turning point. • 2.1.3. Interpret kinematics graphs. • 2.1.4. To begin to develop problem-solving strategy. • 2.1.5. Understand free fall motion in one and two dimensions. • 2.1.6. Solve quantitative kinematics problem and interpret results.			

UNIT 3: Force and Newton's Laws - four weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 3*
Goal 3.1: To learn about what is a force, its connection with motion, and how forces are related when two objects interact.	• 3.1.1. Identify forces. • 3.1.2 Identify specific forces acting on an object • 3.1.3. Draw and use accurate free-body diagrams. • 3.1.4. Understand the connection between force and motion. (650-04.b) • 3.1.5. Learn problem-solving strategies for force and motion. (650-04.b) • 3.1.6. Identify action/reaction pairs.	• Curved Track with ball. • Vernier labs – Newton's 1st, 2nd , and 3rd laws • Tow lab • Water rocket lab	•	• Equilibrium • Force • Friction • Inertia • Mass • Net force • Newton • Newton's 1st Law • Normal force • Support force • Weight

UNIT 4: Impulse and Momentum - two weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 4*
Goal 4.1: To develop an understanding of collisions, momentum and conservations of momentum.	• 4.1.1. Understand interactions within the framework of impulse and momentum. (650-04.b) • 4.1.2. Learn what is meant by an isolated system	• Vernier lab – Impulse momentum • Collision plate lab	•	• Conservation of p • Conserved • Elastic collision • Impulse • Inelastic collision • Momentum

	• 4.1.3. Apply conservation of momentum in simple situations. (650-04.b) • 4.1.4. Understand ideas of inelastic and elastic collisions.			

UNIT 5: Energy - two weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 5*
Goal 5.1: To apply energy concepts to problem solving.	• 5.1.1. Develop a concept of energy, its transformations and how it's transformed. (650-05.a) • 5.1.2. To calculate potential and kinetic energy. (650-05.b) • 5.1.3. To apply the work-energy theorem. • 5.1.4. To understand and analyze problems with conservation of energy. (650-05.a) • 5.1.5. Recognize transformations between kinetic, potential, and thermal energy. (650-05.a**)**	• Hot Wheel Lab • Pendulum Lab • Energy conversion lab • Rubber band lab • Mouse trap car lab • Web lab	•	• Efficiency • Energy • Fulcrum • Joule • Kinetic energy Law of conservation of energy • Lever • Machine • Mechanical advantage • Mechanical energy • Potential energy • Power • Pulley • Watt • Work

UNIT 6: Rotational Motion - two weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 6*
Goal 6:1: Student will use concepts from linear motion and Newton's laws to analyze and solve problems that involve objects moving in nonlinear motion.	• 6.1.1. To understand centripetal acceleration. • 6.1.2. To understand rotational velocity and acceleration. • 6.1.3. To understand torque. (650-04.b) • 6.1.4. To be able to calculate moment of inertia for a given body. • 6.1.5. To use angular momentum and its	• Balance lab	•	• Angular momentum • Axis • Centrifugal forces • Centripetal force • Law of conservation of angular momentum • Lever arm • Linear momentum

	conservation to solve problems. (650-04.b)			• Linear speed • Revolution • Rotation • Rotational inertia • Rotational speed • Rotational velocity • Tangential speed • torque

UNIT 7: Thermal Physics and Thermodynamics - three weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 7*
Goal 7.1: Thermal physics is concerned with understanding the properties of macroscopic systems. Thermodynamics is a more general study of how energy is transfer and transformed.	• 7.1.1. To recognize and use the state variables- temperature, pressure, volume, moles- that characterize macroscopic phenomena. • 7.1.2. To understand the ideal gas law. • 7.1.3. To understand and practice using pV-diagrams. • 7.1.4. To understand heat and the process of heat transfer. (650-05.a-c) • 7.1.5. To understand temperature change and phase change. (650-05.c) • 7.1.6. To understand the laws of thermodynamics and apply these concepts to a heat engine.	• Vernier lab – thermodynamics • Soap bubble demo • Paper cup demo	•	• Absolute zero • Bimetallic strip • Calorie • Celsius scale • Fahrenheit scale • Heat • Internal energy • Kelvin scale • Kilocalorie • Specific heat capacity • Temperature • Thermal contact • Thermal equilibrium • thermostat

UNIT 8: Oscillations and Waves - five weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 8*
Goal 8.1: Applying the concepts from oscillations students will	• 8.1.1. To draw and interpret oscillatory graphs. • 8.1.2. To learn the concepts of phase and	• Wave machine lab • Vernier lab – sound • Speaker demos • Resonance demo • Crumple horn lab	•	• Amplitude • Beats • Compression • Constructive Interference

develop their understanding of waves. Waves will then be used to develop an understanding of sound and will be used later in light.	phase constant • 8.1.3. To understand and use energy conservation in oscillatory systems. (650-05.d) • 8.1.4. To understand the basic ideas of damping and resonance. (650-04.b) • 8.1.5. To become familiar with properties of sinusoidal waves. • 8.1.6. Apply the ideas of phase and phase difference to waves. • 8.1.7. To understand and use the principle of superposition. • 8.1.8. To understand standing waves. • 8.1.9. To understand the basic properties of standing waves. • 8.1.10. To study the properties of common waves – waves on strings, sound waves and light. (650-05.d) • 8.1.11. To understand reflection and refraction of waves. • 8.1.12. To understand the Doppler affect and how it applies to sound and light.			• Damped Vibrations • Destructive Interference • Forced vibration • Frequency • Infrasonic • Longitudinal wave • Natural frequency • Natural frequency • Period • Pitch • Rarefaction • Resonance • Resonance Wavelength • Simple Harmonic Motion • Simple pendulum • Sinusoidal • Transverse wave • Ultrasonic • Wave velocity

UNIT 9: Electrostatics - two weeks

Goal – The student will:	***Objectives (to be reached by the end of twelfth grade)***	***Samples of Applications***	***Curriculum Materials (including technological resources)***	***Key Vocabulary for Unit 9***
Goal 9.1: To become familiar with basic electric phenomena.	• 9.1.1. To learn the charge model and apply it to conductors and insulators. • 9.1.2. To understand charge polarization and the attraction between neutral and charged objects. • 9.1.3. To understand	•	•	• Charge • Charging by Contact • Charging by Induction • Conductor • Conservation of energy • Coulomb's Law • Electric field

	the use of Coulomb's law for point charges. (650-04.a) • 9.1.4. To understand the field model and the concept of a field. (650-05.b) • 9.1.5. To understand the use the electric filed of a point charge.			• Electric field lines • Insulator • Quantized

UNIT 10: Electric Fields and Electric Potential - three weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 10*
Goal 10.1: To develop the quantitative analysis of electric fields and of the motion of charged particles in the field.	• 10.1.1. To use the principle of superposition to calculate the electric field of multiple point charges and of continuous distributions of charge. (650-05.b) • 10.1.2. To learn the electric fields of common charge distributions. • 10.1.3. To study the motion of charged particles and dipoles in simple electric fields.(650-04.b) • 10.1.4. To introduce electric potential energy and use it in conservation of energy problems.(650-05.b) • 10.1.5. To define electric potential. • 10.1.6. To find the electric potential of a continuous distribution of charge. • 10.1.7. To establish a relationship between E and V. (650-05.b) • 10.1.8. To learn the properties of a conductor in electrostatic equilibrium.	•	•	• Capacitance • Capacitor • Dielectric • Electric potential • Electron volt • Energy density • Equipotential lines • Equipotential surfaces • Farad • Potential • Voltage

	• 10.1.9. To find the connection between charge and potential difference for a capacitor.			

UNIT 11: Current, Conductivity and Circuits AC/DC - three weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 11*
Goal 11.1: To apply the charge model and the field model to current flow in AC/DC circuits.	• 11.1.1. To use the charge model and the field model to develop a concrete model of current flow through conductors. (650-05.d) • 11.1.2. To introduce conductivity and resistivety as important parameters describing the electrical properties of materials. • 11.1.3. To introduce resistance and Ohm's law. • 11.1.4. To understand series and parallel resistances. • 11.1.5. To apply Kirchhoff's laws to the analysis of circuits. • 11.1.6. To understand how and why circuits are grounded.	•	•	• Amperes • Conventional current • Direct current • Electric current • Kilowatt-hour • Ohm • Ohm's Law • Power • Resistance • Resistivity

UNIT 12: Magnetic Fields - one week

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 12*
Goal 12.1: To acquire familiarity with basic magnetic phenomena.	• 12.1.1. To develop a dipole model of magnetism, analogous to the charge model of electricity. (650-04.c) • 12.1.2. To learn the magnetic fields due to currents in wires, loops and solenoids.	•	•	•

	• 12.1.3. To study the motion of charge particles in magnetic fields. (650-04.c) • 12.1.4. To understand the magnetic forces and torques on wires and current loops. • 12.1.5. To learn a simple atomic-level model of ferromagnetism.			

UNIT 13: Electromagnetic Induction - two weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 13*
Goal 13.1: To use Faraday's law to describe electromagnetic phenomenon.	• 13.1.1. To observe the experimental evidence for electromagnetic induction. • 13.1.2. To understand and use Lenz's law for induced currents. • 13.1.3. To learn of Faraday's law as a new law of nature. • 13.1.4. To understand basic application of electromagnetic induction to technology. (650-04.c)	•	•	•

UNIT 14: Light, Geometrical and Physical Optics - three weeks

Goal – The student will:	*Objectives (to be reached by the end of twelfth grade)*	*Samples of Applications*	*Curriculum Materials (including technological resources)*	*Key Vocabulary for Unit 14*
Goal 14.1:	• 14.1.1. To understand the ray model and its domain of applicability. • 14.1.2. To apply ray tracing form situations ranging form apertures to image formation. • 14.1.3. To understand images and image	• Polarizing filter lab • Vernier lab - light	•	• Additive primary colors • Complementary colors • Diffraction • Electromagnetic spectrum • Electromagnetic wave • Huygens' Principle

	formation. • 14.1.4. To understand the wave nature of light. • 14.1.5. To understand the wave-particle description of light. • 14.1.6. To understand how and why interference occurs. • 14.1.7. To understand diffraction and how it relates to optical instruments. • 14.1.8. To understand refraction and reflection of light rays and how they relate to natural phenomenon.			• Infrared • Interference • Light-year • Opaque • Penumbra • Photon • Polarization • Ray • Shadow • Subtractive primary colors • Transparent • Ultraviolet • Umbra

Idaho State Science Standards

650 Concepts of Physical Science

04. Understand concepts of motion and forces.

a. Know that gravitational force and electrical force are universal forces.

b. Know that objects change their motion only when a net force is applied.

c. Understand that moving electrical charges produce magnetic forces, and moving magnets produce electrical forces.

05. Understand that the total energy in the universe is constant.

a. Understand that energy can be transferred but it can neither be destroyed nor created.

b. Know that energy can be classified as either potential energy, kinetic energy, or energy contained by a field.

c. Know that heat is evidenced by random motion and the vibrations of atoms, molecules, and ions.

d. Know that energy is transferred by various types of waves and by electrons flowing through matter.