Content				
Unit	Topics	Labs/Activities	Big Ideas	Learning Objectives/ Science Practices
1: Electrostatics [CR2c]	• Electric force • Electric field • Electric potential		1 2 3 4 5	Learning Objectives: 1.B.1.1, 1.B.1.2, 1.B.2.2, 1.B.2.3, 1.B.3.1, 2.C.1.1, 2.C.1.2, 2.C.2.1, 2.C.3.1, 2.C.4.1, 2.C.4.2, 2.C.5.1, 2.C.5.2, 2.C.5.3, 2.E.2.1, 2.E.2.2, 2.E.2.3, 2.E.3.1, 2.E.3.2, 3.A.2.1, 3.A.3.2, 3.A.3.3, 3.A.3.4, 3.A.4.1, 3.A.4.2, 3.A.4.3, 3.B.1.3, 3.B.1.4, 3.B.2.1, 3.C.2.1, 3.C.2.2, 3.C.2.3, 3.G.1.2, 3.G.2.1, 3.G.3.1, 4.E.3.1, 4.E.3.2, 4.E.3.3, 4.E.3.4, 4.E.3.5, 5.A.2.1
		1. Electrostatics Investigations (GI) [CR6b] To investigate the behavior of electric charges, charging processes, and the distribution of charge on a conducting object.		Science Practices 1.1, 3.1, 4.1, 4.2, 5.1, 5.3, 6.1, 6.2, 6.4, 7.2
		2. The Electroscope (GI) [CR6b] To make qualitative observations of the behavior of an electroscope when it is charged by conduction and by induction.		Science Practices 1.1, 3.1, 4.1, 4.2, 5.1, 5.3, 6.1, 6.2, 6.4, 7.2
		3. **Coulomb's Law** To estimate the net charge of identical spherical pith balls by measuring the deflection (angle and separation) between two equally charged pith balls.		Science Practices 1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2
		4. Electric Field and Equipotentials (GI) [CR6b] To map equipotential isolines around charged conducting electrodes painted with conductive ink and construction of isolines of electric fields.		Science Practices 1.1, 1.2, 1.4, 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.4, 7.2

2: Electric Circuits [CR2d]	• Electric resistance • Ohm's Law • DC circuits with resistors only • Kirchhoff's Laws • Series, parallel, and series-parallel circuits • Capacitance • DC circuits with resistors and capacitors	5. Resistance and Resistivity (GI) [CR6b] To explore the microscopic and macroscopic factors that influence the electrical resistance of conducting materials. Students will investigate how geometry affects the resistance of an ionic conductor using Play-Doh™. 6. DC Circuits: Brightness (GI) [CR6b] To make predictions about the brightness of light bulbs in a variety of DC circuit configurations (series, parallel, and series-parallel) when some of the bulbs are removed. 7. DC Circuits: Resistors To investigate the behavior of resistors in series, parallel, and series-parallel DC circuits. The lab includes measurements of cur- rents and potential differences. 8. RC Circuits: Resistors and Capacitors (GI) [CR6b] This investigation consists of two parts: • An observational experiment where the students make qualitative	1 4 5	Learning Objectives: 1.E.2.1, 4.E.4.1, 4.E.4.2, 4.E.4.3, 4.E.5.1, 4.E.5.2, 4.E.5.3, 5.B.9.4, 5.B.9.5, 5.B.9.6, 5.B.9.7, 5.B.9.8, 5.C.3.4, 5.C.3.5, 5.C.3.6, 5.C.3.7 **Science Practices** 1.2, 1.4, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4, 7.2 **Science Practices** 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.2, 6.4, 7.2 **Science Practices** 1.2, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.2, 6.4, 7.2 **Science Practices** 1.2, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.2, 6.4, 7.2

		descriptions of the charging and discharging of a capacitor. • To investigate the behavior of resistors in a series-parallel combination with a capacitor in series. Their investigation includes measurement of currents and potential differences.		
3: Magnetism and Electromagnetic Induction [CR2e]	• Magnetic field • Magnetic force on a charged particle • Magnetic force on a current-carrying wire • Magnetic flux • Electromagnetic induction: Faraday's Law • Lenz's Law • Motional emf	9. Magnetic Field of the earth (GI) [CR6b] To measure the horizontal component of the Earth's magnetic field using a solenoid and a compass. 10. Magnetic Force on a Current-Carrying Wire (GI) [CR6b] To determine the magnitude and direction of the magnetic force exerted on a current-carrying wire. 11. Electromagnetic Induction (GI) [CR6b] The students move a bar magnet in and out of a solenoid and observe the deflection of the galvanometer. They examine the effects of a changing magnetic field by observing currents induced in a solenoid and determine whether the observations agree with the	1 2 3 4	Learning Objectives: 2.C.4.1, 2.D.1.1, 2.D.2.1, 2.D.3.1, 2.D.4.1, 3.A.2.1, 3.A.3.2, 3.A.3.3, 3.A.4.1, 3.A.4.2, 3.A.4.3, 3.C.3.1, 3.C.3.2, 4.E.1.1, 4.E.2.1 **Science Practices** 1.4, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.1, 1.2, 1.4, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.2, 6.4, 7.2

		theory of electromagnetic induction and Lenz' Law.		
4: Thermodynamics [CR2a]	• Kinetic theory • Ideal gases • First law of thermodynamics • Thermodynamic processes and PV diagrams • Heat engines • Carnot cycle • Efficiency • Second law of thermodynamics: entropy	12. Gas Laws To verify the relationships between pressure, temperature, and volume of a gas (air). 13. Thermal Conductivity (GI) [CR6b] To determine the thermal conductivity of a material by comparing the difference in temperature across one material to the difference in temperature across a second material of known thermal conductivity. 14. Heat engine (GI) [CR6b] To determine how the work done by an engine that raises mass during each of its cycles is related to the area enclosed by its *P-V* graph. 15. Efficiency of a Hair Dryer (GI) [CR6b] To determine the efficiency of a hair dryer as it dries a wet towel.	1 4 5 7	Learning Objectives: 1.E.3.1, 4.C.3.1, 5.A.2.1, 5.B.4.1, 5.B.4.2, 5.B.5.4, 5.B.5.5, 5.B.5.6, 5.B.6.1, 5.B.7.1, 5.B.7.2, 5.B.7.3, 7.A.1.1, 7.A.1.2, 7.A.2.1, 7.A.2.2, 7.A.3.1, 7.A.3.2, 7.A.3.3, 7.B.1.1, 7.B.2.1 Science Practices 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2 Science Practices 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.4, 7.2 **Science Practices** 1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.4, 7.2 **Science Practices** 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2, 6.4, 7.2

5. Fluids [CR2b]	• Density • Pressure: atmospheric and fluid pressure • Pascal's principle • Buoyant force • Archimedes' principle • Flow rate • Continuity equation • Bernoulli's principle	**16. Archimedes' Principle** To determine the densities of a liquid and two unknown objects by using the method that is attributed to Archimedes. 17. Torricelli's Theorem (GI) [CR6b] To determine the exit velocity of a liquid and predict the range attained with holes at varying heights using a clear 2 L plastic bottle. 18. Water Fountain Lab (GI) [CR6b] The students design an investigation to detemine: • Exit angle and exit speed of the water • Maximum height of water • Radius of the fountain's exit hole • Flow volume rate	1 3 5	Learning Objectives: 1.E.1.1, 1.E.1.2, 3.C.4.1, 3.C.4.2, 5.B.10.1, 5.B.10.2, 5.B.10.3, 5.B.10.4, 5F.1.1 **Science Practices** 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2
6. Geometric and Physical Optics [CR2f]	• Reflection • Image formation by flat and curved mirrors • Refraction and Snell's Law • Image formation by thin lenses • Interference and diffraction • Double slit, single slit, and diffraction grating interference • Thin film interference	19. Reflection (GI) [CR6b] The students design an investigation to answer the following question: "Are there any patterns in the way plan mirrors and curved mirrors reflect light?" 20. Concave Mirrors (GI) [CR6b] This investigation has two parts:	6	Learning Objectives: 6.A.1.2, 6.A.1.3, 6.A.2.2, 6.B.3.1, 6.C.1.1, 6.C.1.2, 6.C.2.1, 6.C.3.1, 6.C.4.1, 6.E.1.1, 6.E.2.1, 6.E.3.1, 6.E.3.2, 6.E.3.3, 6.E.4.1, 6.E.4.2, 6.E.5.1, 6.E.5.2, 6.F.1.1 ,6.F.2.1 Science Practices 1.1, 1.2, 1.3, 1.4, 3.3, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4,7.2 **Science Practices** 1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.4, 7.2

		• To determine the focal length of a concave mirror. • To determine two locations where a magnified image can be formed using a concave mirror. 21. Index of Refraction (GI) [CR6b] To determine the index of refraction of an acrylic block. 22. Lenses (GI) [CR6b] This investigation is divided into two parts: • To directly determine the focal length of a converging lens directly. • To determine the focal length of a diverging lens by combining it with a converging lens. 23. Double-slit interference and Diffraction This lab activity consists of three parts where the students design each investigation: • To determine the wavelength of a green laser using a double slit. • The students apply the results of the previous experiment to predict the location of bright and dark fringes when a red laser of known wavelength is used. • The students determine the spacing in a		**Science Practices** 1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.4, 7.2

		diffraction grating using either the green or the red laser.		
7. Quantum Physics, Atomic and Nuclear Physics [CR2g]	• Atoms, atomic mass, mass number, and isotopes • Atomic energy levels • Absorption and emission spectra • Models of light: wave and particle • Photoelectric effect • DeBroglie wavelength • Wave function graphs • Mass-energy equivalence • Radioactive decay: alpha, beta and gamma decay • Half life • Conservation of nucleon number: fission and fusion	24. Spectroscopy (GI) [CR6b] Students use a quantitative analysis spectroscope to analyze flame tests and spectrum tubes. 25. Photoelectric effect The determine Planck's constant from data collected from a circuit with an LED color strip. 26. Radioactive Decay and Half-life (GI) [CR6b] In this investigation, students simulate radioactive decay and determine half-life.	1,3,4, 5,6,7	Learning Objectives: 1.A.2.1, 1.A.4.1, 1.C.4.1, 1.D.1.1, 1.D.3.1, 4.C.4.1, 5.B.8.1, 5.B.11.1, 5.C.1.1, 5.D.1.6, 5.D.1.7, 5.D.2.5, 5.D.2.6, 5.D.3.2, 5.D.3.3, 5.G.1.1, 6.F.3.1, 6.F.4.1, 6.G.1.1, 6.G.2.1, 6.G.2.2, 7.C.1.1, 7.C.2.1, 7.C.3.1, 7.C.4.1 **Science Practices** 1.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1,5.2, 5.3, 6.1, 6.4, 7.2 **Science Practices** 1.1, 1.2, 1.3, 1.4, 2.3, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2