Manhattan Comprehensive Night & Day High School

Fall, 2004-2005 ***Cycle I & II***

Course Name: Physics (Regents Course)

Code Name: SP 1 & 2 (double period)

A. *Course Requirements:*

Students are required to have their own:

. 3-ring binder physics notebook

. scientific calculator

. ruler/protractor

. dictionary

B. *Assessment Rubric (grading)*

. regular attendance

. active class participation

. complete and submit assigned homework/portfolio

. pass class tests/quizzes

. pass midterm exam, final exam and physics regents

Cycle I.

Week	Topics	Performance Objects; Students Will be able to:
Week 1 **Measurement And Mathematics**	1. Introduction(various activities) 2. How do we make measurements? (Meter stick and textbooks) 3. How do we convert among the metric units? (Handout on metric prefixes) 4. What are distance and displacement? (Meter stick, book) 5. Vectors vs. scalars (ruler, protractor for blackboard addition of vectors worksheets) 6. Addition of parallel and anti-parallel vectors: at tight angles. (Ruler, protractor for blackboard addition of vectors, worksheets) 7. Addition of vectors at any angle. (protractor, worksheets) **Lab. #1 Lab Safety**	-Compare and contrast distance and displacement -Define the terms vector and scalar -Construct and interpret graphs of position, velocity or acceleration versus time -Determine and interpret slopes and areas of motion graphs -Determine that motion is relative to the observer -Distinguish between speed and velocity

Week 2 **Mechanics**	1. Resolution of vectors (I) (graphically) (string, force meter, two weights, wheel of forces) 2. Resolution of vectors (II) (algebraically) (laboratory handout 1), Equilibrants(wheel of forces, weights on string) 3. What are speed and velocity? (Cart, meter stick, stopwatch, straws) 4. How do we differentiate between instantaneous and average speeds?(Cart meter stick, stopwatch, straws) Test.1 Kinematics (1) **Lab. #2 Measurement**	-Determine the resultant of two or more vectors graphically or algebraically. -Apply the parallelogram method to find the resultant of any two vectors. -Construct and label proper vector diagrams. -Draw scaled diagrams, using a ruler and protractor. -Resolve a vector into perpendicular components: graphically and algebraically. -Apply the parallelogram method in reverse to find the perpendicular components. -Draw scaled diagrams, using a ruler and a protractor. -Relate trigonometry to solving for the components.

Week 3	1. What is acceleration? (Inclined plane, cart, stopwatch, meter stick, straws) 2. Sheets, group& board work. 3. Summary of the equations of motions. (Problem sheets, group & board work.) 4. Distance—time graphs. (Straws and tape to mark distances on table, meter stick, stopwatch, cart, graph sheets.) 5. Speed—time graphs. (problem sheets, group& board work) **Lab #3 Black Box**	
Week 4	1. Compare and contrast speed-time and distance- time graphs. (handouts of various graphs of motion) 2. Free falling objects (1) (ticker timer, two very dissimilar objects that fall at the same rate.) 3. Free falling objects (2) (handouts& problems) 4. Summary of kinematics (handouts & problems) Test.2 Kinematics (2) **Lab # 4 The inclined Plane**	-Determine the acceleration due to gravity near the surface of the Earth -Analyze why mass as a scalar quantity and weight is a vector

Week 5	1. Newton's first law Large mass, plastic beaker piece Of cardboard 2. Newton's Second Law: **F=ma** 3. Newton's Third Law 4. Momentum (series pendulum, collision carts) 5. The law of conservation of momentum, (Exploding carts) 6. Impulse (design platform to catch a falling egg.) 7. Momentum problems (handouts / group work) 8. Universal law of gravitation (Cavendish experiment chart) 9. Gravitational fields (map gravitational field of the classroom with test mass) 10. Gravitational problems (handouts) Test.3 Newton's Law & Gravity **Lab.# 5 Hooke's law**	-Compare and contrast Aristotle's and Galileo's ideas of motion. -Explain how Newton's concept of inertia improved upon their laws. -Distinguish between mass and weight. -Demonstrate the relationship between mass and inertia. -Verify Newton's Second Law for linear motion. -Reason the relationship between mass and acceleration -Apply the mathematical principle that governs the mass-acceleration relationship by deriving the formula: F=ma -Define momentum -Distinguish between impulse and change in momentum -Explain how forces interact -Distinguish between action and reaction forces -Show how action/reaction pairs do not cancel out -Verify conservation of momentum -Distinguish between elastic and inelastic collisions -Describe Newton's Law of Universal Gravitation -Describe gravitation filed strength

Week 6	1. Projectile motion(I) (comparison of objects dropped with and without initial horizontal velocities) 2. Projectile motion(II) examples of projectile motion 3. projectile motion problems (handouts, group work) 4. Uniform midterm (uniform midterm) 5. What is centripetal motion? (Observe a mass moving in a circle at the end of a string- what kind of motion id this? Give similar examples.) 6. (Derivation of equation for centripetal force) 7. Centripetal motion problems (handouts/ group work) Test.4 Motion in a plane **Lab. # 6 Centripetal Force**	-Demonstrate the independence of the horizontal and vertical components of motion. -Compare the motion of projectiles launched at an angle to that of projectiles launched horizontally. -Relate projectile motion to linear and free fall motion. -Use vector diagrams to analyze mechanical system(equilibrium and no equilibrium) -Determine the coefficient of friction for two surfaces. -Relate friction to the normal force.

Week 7 **Energy**	1. Work and energy (large, heavy mass to be held by student, stopwatch) 2. Power& work (large, heavy mass to be held by student, stopwatch) 3. Potential energy(masses and meter stick) 4. Kinetic energy (carts with various masses) 5. Problems with PE and KE (handouts/ examples) 6. The relationship between energy and work/ potential energy (objects thrown into the air) 7. KE, PE and TE (masses and meter stick, mode, roller coaster) Test.5 Work & Energy **Lab. # 7 Conservation of Mechanical Energy**	-Define and calculate work done on or by a system. -Recognize that a force must be exerted in the direction of motion for work to be done. -Calculate the work done by a force exerted at an angle. Resolve a vector into perpendicular components. -Distinguish between work and energy and recognize that work and energy are scalar quantities. -Define and compute power. -Recognize the relationship between power used and time elapsed. -Speculate the power developed when the same work is done at different rates.

Week 8	1. Applications of total mechanical energy (everyday examples) 2. PE of springs (springs and masses) 3. Spring problems (handouts) 4. Unit test 4: gravity and work 5. Conservation of energy (model roller coaster, handouts) 6. Efficiency with work input and work output. (Inclined plane, pulley system) 7. determining energy lost due to friction (handouts) 8. Review of energy and power **Lab. #8 Components of Force And Coefficient of Force**	-Describe the role of friction in resisting forces. -Calculate the kinetic and static friction of given systems. -Recognize the six types of simple machines, and provide a real world example of each. -Calculate the efficiency of the machine. -Explain the relationship between the work input and the work output in a practical machine. -Calculate the efficiency of the machine. -Determine that gravitational potential energy depends on an object's height above a given reference point. -Determine that kinetic energy is dependent on the mass and speed of an object. -Explain the meaning and importance of the law of conservation of mass and energy---a keystone in our understanding of the physical world. -Describe and explain the exchange between potential energy, kinetic energy, and internal energy for simple mechanical systems, such as pendulum, a roller coaster, a freely falling object. -Determine the factors that affect the period of a pendulum. -Predict velocities, heights and spring compressions based on energy conservation. -Apply the principle and explain an energy conversion is real-world situations. -Determine the energy stored in a spring. -Predict velocities, heights, and spring compressions based on energy conservation. -Verify Hooke's Law.

Week 9	1. Review of energy, work and power. (handouts) 2. Energy problems (handouts/ group work) 3. Summary of work and energy (handouts concerning real world issues) Test.6 Conservation of Energy 4. Review # 1 (various forms of review) 5. Review # 2 (various forms of review) 6. Review #3 (various forms of review) **Lab.# 9 Simple Pendulum**	
Week 10	1. Review #4 (various form of review) 2. Review #5 (various forms of review) 3. Review #6 (various forms of review) Final Test (Cycle 1) Regents Examinations	

Cycle II.

Week	Topics	Performance Object; Students will be able to:
Week 11 **Electrostatics**	1. Static electricity & the microstructure of matter 2. Transfer of charge Conduction Induction (Electrostatic Kit) 3. Applications of static electricity **Lab. #10 Electrostatics**	-Examine the evidence that all bodies of matter contain positive and negative electric charges. -Define electrostatic force. -Propose a theory to explain how bodies gain or lose electric charges. -Design an experiment to test the validity of the theory of electron loss and electron gain.
Week12	1. Elementary charge and coulomb's law (electrostatic kit, van de graaf generator, handouts) 2. Units of charge (electrostatic kit, van de graaf generator, handouts) 3. Problem's with coulomb's law (handouts) 4. Milliken's experiment (blackboard description of Milliken's experiment, electrostatic kit.) Test.1: Electrostatics	-Explore quantitatively the nature of the forces between electric charges. -Verify, define and use Coulomb's Law. -Compare Coulomb's Law to the Law of Universal Gravitation. -Apply Newton's Third Law to Coulomb's Law.

Week 13 **Electric current**	1. Electric current (conductivity apparatus, samples of carious materials 2. Conduction in solids (conductivity apparatus, samples of carious materials) 3. Ohm's law (ohm's law apparatus) 4. Ohm's law problems, Characteristics of resistance Electric energy & power (handout) **Lab. #11 Ohm's Law**	-Explore how a steady direct current may be et up and maintained in an electric circuit. -Define charge movement as current. -State the conditions necessary for an electric current. - Draw a simple circuit.

Week 14 **Parallel Circuits**	1. Electric potential (Van de graaf generator 2. Kirchhoff's laws (blackboard sketches, handouts) 3. Series circuits (series circuit demo, handouts) 4. Series circuit problems (series circuit demo, handouts) 5. Parallel circuits & problems (parallel circuit demo, handouts) 6. General circuit problems / energy usage (handouts / problem sets) 7. Summary of electricity (handouts / problem sets) Test. 8 Circuits **Lab. #12** **Series & Parallel circuits**	-Explore the characteristics of parallel connections in circuits. -Measure current and voltage in a circuit. -Use measurements to determine the resistance of a circuit element. -Construct simple series and parallel circuits. -Draw and interpret circuit diagrams using Kirchoff's Rules for conservation of energy and charge, which include voltmeters and ammeters. -Predict the behavior of light bulbs in series and parallel circuits.

Week15 **Magnetism**	1. Magnetism and magnetic forces (overhead projector with glass plate, magnets iron filings) 2. Magnetic flux density (same as (1)) 3. Magnetic fields & objects (same as (1) & (2)) 4. Magnetic effects of moving charge 5. Forces on and between current carrying conductors (wire with current suspended between poles of a C magnet.) 6. Electromagnetic induction Lenz's law (wire with current suspended between poles of a C magnet) Test. 9 Magnetism **Lab. #13 Magnetic Field**	-Map the magnetic field of a permanent magnet, indicating the direction of the field between the N (north-seeking) and S (south-seeking) poles. -Identify magnetic properties of the Earth. -Draw magnetic field lines surrounding a bar magnet, two like-pole magnets, two unlike-pole magnets, horseshoe magnet. -Define magnetic field strength (flux density). -Understand the inter-relationships between electric currents and magnetic fields. -Associate a magnetic field with a moving charge. -Investigate the nature of the force exerted by a magnetic field on electric currents and moving charges. -Apply the right hand rule for determining the direction of a magnetic field around a current carrying wire and a solenoid. -Explain how magnetic forces are used in metes to measure electric currents. -Apply the right hand rule for determining the direction of magnetic force when current and magnetic field are known. -Understand how this effect is applied in the electric generator to convert mechanical energy into electrical energy? -Explore how a changing current in one circuit induces an EMF in a nearby circuit. -Understand how the above effect is used in the transformer to increase or decrease the EMF applied to the transformer.

Week 16 **Waves**	1. Waves as a means of transferring energy (slinky, rope) 2. Types of waves (slinky, rope) 3. Factors affecting wave speed (plastic, metal slinkier, rope, meter stick, stopwatch) 4. Wave characteristics: phase and wavelength (slinky, handouts) 5. Wave characteristics: phase and wavelength (slinky) 6. Wave properties (ripple tank / handouts) **Lab. #14 Waves**	-Relate periodic motion to circular motion. -Describe the properties of a wave, and define amplitude, frequency, wavelength, and period. -Describe the nature of wave motion as a means of transferring energy. -Draw waveforms with various characteristics. -Differentiates between transverse and longitudinal waves. -Calculate the speed of a Wave. -Predict the relationship between wavelength, frequency and amplitude.

Week 17	1. Wave problems / equation (slinky, problem sheet. Ripple tank) 2. Doppler effect (ripple tank) 3. Interference of pulses Interference from two sources in phase (slinky, diagrams, handout of interference pattern / ripple tank with double source) 4. Standing waves / resonance (slinky, resonance boxes, tuning forks 5. Review of waves / problems (slinky, handouts) Test. 10 Waves	-Describe the nature and transmission of sound as an example of wave motion. -Determine the speed of sound in air. -Compare the characteristics of two transverse waves such as amplitude, frequency, wavelength, speed, period, and phase. -Draw wave forms with various characteristics. -Identify nodes and antinodes in standing waves. -Predict the superposition of two waves interfering constructively and destructively (indicating nodes, antinodes, and standing waves). -Draw wave forms with various characteristics. -Explain how a moving wave apparently changes pitch. -Observe the natural frequency of an object. -Describe examples of resonance.

Week 18 **Light**	1. Characteristics of light & law of reflection for light. (Light source, mirrors, blackboard optics kit) 2. Refraction of light (1) (backboard optics kit, handouts on refraction) 3. Interference of light (young's experiment) (showcase light bulb, class set of double slits and diffraction gratings.) 4. Uses of interference (showcase light bulb, class set of double slits and diffraction gratings, handouts.) 5. Electromagnetic spectrum & Doppler effect for 6. light (chart electromagnetic spectrum, handout) Review of waves & light Test. 11 Light **Lab.#15 Light**	-Identify light as a form of energy. -Describe the properties and behavior of light -Describe the experiments conducted to verify the speed of light. -Review the electromagnetic spectrum. -Investigate and evaluate the different theories that have been advanced to explain the properties and behavior of light. -Observe, sketch and interpret the behavior of wave fronts as they reflect, refract, and diffract. -Define and implement the law of reflection. -Compare regular and diffuse reflection. -Draw ray diagrams to represent the reflection and refraction of waves. -Investigate how light is reflected and refracted. -Explain how the wave theory of light accounts for its reflection and refraction. -Determine empirically the index of refraction of a transparent medium. -Observe, sketch and interpret the behavior of wave fronts as they reflect, refract and diffract. -Draw ray diagrams to represent the reflection and refraction of waves. -Investigate how light is reflected and refracted. -Use Snell's law to calculate the angle of refraction of a given incident ray. -Define critical angle. -Describe total internal reflection. -Observe, sketch and interpret the behavior of wave fronts as they reflect, refract and diffract. -Draw ray diagrams to represent the reflection and refraction of waves. -Investigate how light is reflected and refracted. -Define dispersion and show how the refraction of light through a prism can be used to separate white light into its component colors. -Observe, sketch and interpret the behavior of wave fronts as they reflect, refract and diffract. -Draw ray diagrams to represent the reflection and refraction of waves. -Investigate how plane mirrors form images. -Explain how the wave theory accounts for the diffraction pattern. -Apply constructive and destructive

		interference to diffraction. -Explain how a direct measurement of the wavelengths of light of different colors can be made. -Speculate that infinite number of shades of colors could be constructed as a result of wavelengths and interference.

Week 19 **Modern Physics**	1. Dual nature of light (charts, handouts) 2. Photoelectric effect-classical (photoelectric tube, micrometer, handout) 3. Photoelectric effect modern 4. Quantum theory (charts of ionization energies for H atomic models) 5. Momentum of photons (handouts) 6. Classification of matter (classification of matter chart) 7. Standard model of particle physics (standard model of particle physics chart) 8. Properties of leptons (handouts / problem sets uniform final) 9. Properties of hadrons (handouts) Test. 12 Modern Physics	-Examine the evidence that light has particle-like properties. -Explain the evidence that matter has wave-like properties. -Compare the effect of intensity on maximum kinetic energy of the emitted photoelectrons and on the number of emitted photoelectrons. -Derive Planck's constant. -Define threshold frequency, work function, maximum kinetic energy of emitted photoelectrons. -Describe how the quantum theory provides an explanation for both particle-like and wave-like properties of electromagnetic radiation as well as of matter. -Describe the Compton Effect. -Apply the laws of conservation of energy and momentum to collisions between photons and electrons at the atomic level. -Recognize and describe conversions among different forms of energy in real or hypothetical devices such as a motor a generator, a photocell, a battery. -Describe the deBroglie theory of mater waves, recognizing the relationship between the momentum of a photon or particle and its corresponding wavelength. -Describe how, by applying the quantum idea to the Rutherford model of the atom, Bohr developed a model of the hydrogen atom that fully explained its emission and absorption of light. -Evaluate the successes and limitations of the Bohr atomic model. -Interpret energy level diagrams. -Correlate spectral lines with an energy level diagrams. -Compare the charge of an atom to the charge at the subatomic level. -Define the terms quark, muon, lepton and baryon. -Describe the four forces that account for all the properties and changes in matter. -Compare the differences and similarities of these forces. -Describe the principles underlying nuclear reactions. -Explain the methods whereby large quantities of nuclear energy may be released to become sources of useful power.

Week 20 **Review for Regents**	1. Final Test (cycle II) 2. Regents review (handouts / past regents) 3. Regents review (handouts / past regents) 4. Regents review (handouts / past regents) 5. Regents review (handouts / past regents)	