Blackhawk School District

CURRICULUM

Course Title:	**Conceptual Physics**
Grade Level(s):	**Eleventh-Twelfth**
Length of Course:	**Daily (1 period)**
Faculty Author(s):	**Russell Couch and Stew Kirk**
Date:	**Fall 2008 / Revised January 2010 and October 2012**

Mission Statement:
The goal of science education is to develop within students an understanding of the world around us by fostering curiosity, developing inquiry skills, and creating an excitement for learning science.

COURSE DESCRIPTION:
This is a basic physics course for the non-science oriented student. Emphasis is placed on conceptual understanding of physical interactions rather than mathematical solutions to those interactions. Though a STRONG math background is NOT required, the student should be able to perform simple algebraic calculations and have the ability to manipulate multiple variable formulas.

TEXTBOOK
Conceptual Physics, Paul G. Hewitt, Prentice Hall, 2002.
SUPPLIMENTARY MATERIALS
Physics Laboratory Experiments, Holt, Rinehart, and Winston, Inc. 1990
Modern Physics Laboratory Experiments, Holt, Rinehart and Winston, Inc 1990
Practical Physics Labs, J. Weston Walch, 1990

PA Common Core Standards for Reading and Writing in Science and Technical Subjects:
Pennsylvania Department of Education has released standards that describe what students in the science and technical subjects' classrooms should know and be able to do with the English language in reading and writing, grade 6 through 12. The standards provide the targets for instruction and student learning essentials for success in all academic areas, not just language arts classrooms. Although the standards are not a curriculum or a prescribed series of activities, Blackhawk School District has used them to develop this science curriculum.
The standards for Reading are available at:
http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Reading_in_Science_And_Technical_Subjects_8-7-12.pdf
The standards for Writing are available at:
http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Writing_in_Science_and_Technical_Subjects_8-7-12_rev_2.pdf

ESSENTIAL QUESTIONS:

Essential questions are the heart of the curriculum. Essential questions are conceptual commitments that teachers will use to guide instructional decision-making. In addition, they are kid friendly so that students can easily understand them. Essential questions are meant to be shared with students in either discussion or posting in the classroom. Essential questions provide the focus for teaching and learning.

Assessing Essential questions is key to a robust curriculum. If Essential Questions are the focal point of learning, how then do we assess students? The following are the Essential Questions and an overview of recommended assessments to the Essential Questions. In addition, Differentiated learning opportunities are embedded as well (noted by DI).

1. How do I use the Scientific Method while making everyday decisions?
    a. Open ended question on test
2. How do I use technology in my home?
    a. Classroom discussion.
3. How do I solve word problems in Physics?
    a. DI: Individuals will solve several word problems, some students are given more clues than others, but all have enough information to answer the question.
4. Can I calculate how much gas I will need to reach my vacation destination?
    a. Calculation problems on a test,
5. What forces allow me to walk, run, and stand still?
    a. DI: Students will be asked to convey information via different media.
6. What are Newton's Laws of Motion, and how do they apply to me?
    a. Students will create a PowerPoint or Active Inspire presentation.
7. How fast will I need to row my boat to get it across the stream within 10ft. of where Iwant to land.
    a. Cooperative problem solving.
8. At what angle will I have to set my release lever on my Trebuchet to achieve a maximum distance?
    a. Trebuchet Project Assessment.
9. In what ways does friction keep my car on the road?
    a. Friction lab question and graph.
10. How will an object move if I apply a directional force to it?
    a. Essay question on Newton Test.
11. If there is gravity in near space, why do objects in the shuttle appear to float?
    a. Open Ended question on Mid-Term.
12. How is the momentum between two football players conserved when they collide?
    a. Collision Lab questions.
13. Why can a machine never have a greater work output than work input?

a. Essay question on Chapter Test.

14. When does an object exhibit circular motion and what causes an object to follow a curved path?
    a. Essay question on Mid-Term or Final Exam.
15. What is a black hole and how is it created?
    a. Open – Ended Question on Unit Test.
16. Why is centripetal force considered a real force and centrifugal force not?
    a. Centripetal Force Lab
17. When does an object exhibit simple harmonic motion?
    a. Essay question on a Chapter Test.
18. How does a rainbow form and why do we see different colors?
    a. Open – Ended question on Unit Test.
19. How do different instruments produce different sounds?
    a. Student will create a PowerPoint describing different instruments.
20. What are the results of waves refracting, reflecting, and diffracting?
    a. Class discussion and demonstration of wave properties.
21. How is lightning produced and what form of electricity is it?
    a. Electrostatics Lab and questions.

ROBUST VOCABULARY:

Robust vocabulary words are Tier 2 words, meaning that they are complex, powerful, and generalizable. Robust vocabulary words support language development of both lower and high level learners. In addition, robust vocabulary instruction helps prepare students for SATs, upper level high school classes, and college. "Studies showed that robust instruction was quite effective not only for learning the meanings of words but also for affecting reading comprehension." (p. 2 *Bringing Words to Life*)

Teachers are asked to commit to teaching and students USING these words throughout the entire year. Using a variety of instructional strategies, students will learn the meaning of these words in a deep and meaningful way in this content and across other content areas.

The Robust Vocabulary for this class are: **Equilibrium, Geologic Hazard, Hydrology, Inquiry, Model, Renewable, Topographic Map, Manipulate, Scenario, Static**

COURSE OUTLINE	OBJECTIVES (PA Anchors)	PROPOSED TIME	RESOURCES	SUGGESTED LAB ACTIVITIES	LESSON REFLECTION (for future revisions)
1. Introduction to Physics a. Safety in the Lab b. Scientific Method c. Measurements	s11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs. s11.A.2.1.1 Critique the elements of an experimental design (e.g. raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data and drawing conclusions) applicable to a specific experimental design. s11.A.2.1.2 Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design.	12 days	Textbook Lab Manuals Equipment: Basic physics equipment including but not limited to: carts, meter sticks, stopwatches, spark timers, masses, triple beam balances, etc…	Modern Physic Lab Manual Experiment 1 and 2	
2. Linear Motion a. Motion is relative b. Measuring speed, velocity and acceleration c. Free fall d. Graphing motion	s11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g. solar system, tectonic plates, weather systems, atomic motion, waves). s11.C.3.1.3 Describe the motion of an object using variables (I.e. acceleration, velocity, displacement).	8-12 days	Chapter 2	Conceptual Physics Lab Manual Labs 4 and 6	
3. Projectile Motion a. Vector and Scalar Quantities b. Components of vectors c. Vertically launched vs. horizontally launched d. Satellites as projectiles	s11.A.2.1.2 Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design.	15-20 days	Chapter 3	Conceptual Physics Lab Manual Lab 7 Trebuchet Project	
4. Newton's First law of Motion a. Understanding mass and inertia b. Net forces and equilibrium c. Aristotle, Galileo Copernicus and Newton on motion		7 days	Chapter 4	Conceptual Physics Lab Manual Lab 9	
5. Newton's Second Law of	s11.A.1.3.2 Describe or interpret dynamic changes	7 days	Chapter 5	Conceptual	

Motion a. Force causes acceleration b. Mass resists acceleration c. Types of friction d. Free fall explained	to stable systems (e.g. chemical reactions, human body, food webs, tectonics, homeostasis). s11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole.			Physics Lab Manual Labs 12 and 13 Modern Physics Lab Experiment 7	
6. Newton's Third Law of Motion a. Forces and interactions b. Identifying action reaction pairs		10 days	Chapter 6	Conceptual Physics Lab Manual Lab 16and 17 Balloon Cars	
7. Momentum a. What is Impulse? b. Types of Collisions c. Conservation of Momentum	s11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). s11.C.3.1.1 Explain common phenomena (e.g. a rock in a landslide, an astronaut during a space walk, a car hitting a patch of ice on the road) using an understanding of conservation of momentum.	10 days	Chapter 7	Conceptual Physics Lab Manual Lab 20	
8. Circular Motion a. Rotation and revolution b. Centripetal and Centrifugal forces c. Simulated gravity and the ISS	s11.C.3.1.1 Explain common phenomena (e.g. a rock in a landslide, an astronaut during a space walk, a car hitting a patch of ice on the road) using an understanding of conservation of momentum.	15 days	Chapters 9-11	Conceptual Physics Lab Manual Labs 33-34 Modern Physic Lab Experiment 9	
9. Universal Gravitation a. Gravity and distance: The Inverse Square Law b. The falling apple, moon, and Earth relationship	s11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). s11.C.3.1.1 Explain common phenomena (e.g. a rock in a landslide, an astronaut during a space	10 days	Chapters 12-14	H-R Diagram Activity Harmonic Law Activity Blackholes Conceptual Physics Lab	

	walk, a car hitting a patch of ice on the road) using an understanding of conservation of momentum. s11.D.3.1.2 Describe the structure, formation, and life cycle of stars. s11.D.3.1.3 Explain the current scientific theories of the origin of the solar system and universe (e.g. big bang theory, solar nebular theory, stellar evolution)			Manual Lab 40 Solar System Scale Model	
10. Energy a. Work and Power b. Potential and kinetic energy c. Conservation of energy d. Machines e. Efficiency	s11.A.3.1.4 Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g. heating, motor, food production) and identify the resources necessary for operation of the system. s11.C.3.1.2 Design or evaluate simple technological or natural systems that incorporate the principals of force and motion (e.g. simple machines, compound machines). s11.C.3.1.5 Calculate the mechanical advantage for moving an object by using a simple machine. s11.C.3.1.6 Identify elements of simple machines in compound machines.	15 days	Chapter 8	Conceptual Physics Lab Manual Lab 21 and 27 Simple Machine Packet Inclined Plane Lab (MA, Efficiency) Bridge Project	
11. Waves a. Types of waves b. Properties of waves c. Wave Behavior		10 days	Chapters 25 and 29	Conceptual Physics Lab Manual Labs 65, 75, 76, and 77	
12. Sound a. The origin of sound b. Media that produce sound c. Properties of sound waves	s11.A.1.2.2 Use case studies (e.g. Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for real-world problems.	10 days	Chapter 26	Modern Physic Lab Experiment 25	
13. Light a. Electromagnetic radiation b. Wave theory versus Quantum theory c. Speed of light and space travel	s11.C.2.1.1 Compare or analyze waves in the electromagnetic spectrum (e.g. ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels, and motions). s11.C.3.1.4 Explain how electricity induces magnetism and how magnetism induces electricity as two aspects of a single electromagnetic force.	7 days	Chapter 27 and 28	Spectroscopy Lab Electromagnetic activity	

d. Understanding the visible spectrum					
14. Electrostatics a. Electrical forces and charges b. Conservation of charge c. Charging by induction or friction d. Conductors and insulators		5 days	Chapters 32-33	Modern Physics Lab Experiemnt 36 Van De Graaff Lab	
15. Electric currents a. Ohm's Law and electrical resistance b. Electric current and voltage c. Direct current and alternating current	s11.C.2.1.4 Use Ohm's Law to explain relative resistances, currents, and voltage.	5 days	Chapter 34	Conceptual Physics Lab Manual Labs 87, 88, and 89	
16. Electric Circuits a. Series circuits b. Parallel circuits c. Schematic diagrams		10 days	Chapter 35		
Items done at various times during the year	s11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. s11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps).				
Items done through lab exercises at various times during the year	s11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g. behavior of atoms, functions of cells, birth of stars). s11.A.1.3.1 Use appropriate quantitative data to describe or interpret change in systems (e.g. biological indices, electrical circuit data, automobile diagnostic systems data). s11.A.2.1.3 Use data to make inferences and predictions, or to draw conclusions, demonstrating understand of experimental limits. s11.A.2.1.4 Critique the results and conclusions of		Supplementary Lab manuals Modern Physics-Exercises and Laboratory Experiments; Frederick E. Trinklain; Holt, Rinehart, and Winston.		

	scientific inquiry for consistency and logic. s11.A.3.1.3 Use appropriate quantitative data to describe or interpret a system (e.g. biological indices, electrical circuit data, automobile diagnostic systems data). s11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. s11.A.2.1.5 Communicate results of investigations using multiple representations. s11.A.2.2.1 Evaluate appropriate methods, instruments, and scales for precise quantitative and qualitative observations (e.g. to compare properties of materials, water quality). s11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. s11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts. s11.A.1.1.3 Evaluate the appropriateness of research questions(i.e. testable vs. non-testable). s11.A.2.2.2 Explain how technology (e.g. GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision.		Practical Physics Labs: Peter Goodwin; J. Weston Walsh, Publisher.		