Hilliard City Schools
Physics
Course Proficiency Study Guide

I. Course Proficiency Purpose:
The purpose of this study guide is to aid the students who wish to take the proficiency assessment for the credit flex option. Items that the student will be required to know for proficiency will be administered in two portions. The first part of the assessment is a two hour written exam. The second part is a two hour lab.

II. Description of the Assessment Format:
1. The written test has 100 multiple choice questions worth 100 points. The problem solving section of the exam is 14 questions worth 175 points.
2. The lab is 25% of the overall assessment grade equaling 50 points.

III. Proficiency Content:
1. Written Test
    - i. Basic Concepts
        1. Significant Figures
        2. Converting Units
        3. Mathematical Relationships (direct, inverse, quadratic,…)
    - ii. Motion in 1-Dimension with Constant Acceleration
        1. Horizontal Motion
        2. Free Fall
    - iii. Motion in 2-Dimensions with Constant Acceleration
        1. Projectile Motion
    - iv. Forces
        1. Newton's Laws
        2. Free Body Diagrams
        3. Types of Forces
    - v. Conservation of Momentum
        1. Collisions
            - i. Elastic
            - ii. Inelastic
            - iii. Perfectly Inelastic Collisions
        2. Impulse
    - vi. Energy
        1. Potential Energy
        2. Kinetic Energy
        3. Conservation of Energy
    - vii. Waves
        1. Basic Concepts (types, amplitude, frequency, wavelength, period,…)
        2. Sound Waves
            - i. The Doppler Effect
            - ii. Music (Open & Closed Pipes)

3. Light & Color

i. Reflection

ii. Refraction

1. Snell's Law
2. Total Internal Reflection
3. Critical Angles

viii. Electrostatics

1. Coulomb's Law
2. Electric Fields
3. Electric Potential Difference

ix. Circuits

1. Current
2. Resistance
3. Power
4. Potential Difference
5. Series And Parallel Circuits (Ohm's Law)

2. Lab

The lab component will involve a computer, the LoggerPro software and Circuits. It will involve taking data, evaluating data, and performing an error analysis.

IV. Suggested Resources:

Textbook: Physics Principles & Problems, by McGraw-Hill Companies, Inc. © 2005

Online Resource: www.physicsclassroom.com

Average velocity (m/s)	$V = \frac{d_f - d_i}{t_f - t_i}$	Use only when a = 0
Acceleration (m/s^2)	$a = \frac{\Delta v}{\Delta t}$	
	$v_f = v_i + a\Delta t$	
	$V^2_f = v^2_i + 2a\Delta d$	
	$\Delta d = v_i t + \frac{1}{2} at^2$	
Pythagorean theorem	$a^2 + b^2 = c^2$	
Newton's Laws (Newtons)	$F_{net} = ma$	$F_{A\ on\ B} = -F_{B\ on\ A}$
Friction (Newtons)	$F_s \leq \mu_s N$	$F_k = \mu_k N$
	$F_g = mg$	
Work (Joules)	$W = Fd$	
Work (Angle between F & d)	$W = Fd\cos\theta$	
Power (Watts)	$P = \frac{W}{t} = IV = I^2R = \frac{V^2}{R}$	$P = Fv$
Kinetic energy (Joules)	$KE = 1/2mv^2$	
Potential energy (Joules)	$PE = mgh$	
Work Energy Therorem	$W = \Delta K$	
Conservation of energy	$KE_{before} + PE_{before} = KE_{after} + PE_{after}$	
Momentum (kg m/s or N s)	$p = mv$	
Conservation of Momentum	$P_f = p_i$	
Impulse	$F\Delta t = p_f - p_i$	
Illuminance	$E = \frac{P}{4\pi r^2}$	
Doppler Effect	$f_d = f_s \frac{(v + v_d)}{(v - v_s)}$	
Period of a Pendulum	$T = 2\pi\sqrt{(L/g)}$	
Wavelength	$\lambda = v/f$	
Hooke's Law	$F = -kx$	
PE of a spring	$PE_{spring} = \frac{1}{2} kx^2$	
Frequency	$f = \frac{1}{T}$	
Frequencies in a closed pipe	$f_1 = \frac{v}{4L}$	$f_3 = \frac{3v}{4L}$, $f_5 = \frac{5v}{4L}$
Frequencies in an open pipe	$f_1 = \frac{v}{2L}$	$f_2 = \frac{v}{L}$, $f_3 = \frac{3v}{2L}$
Law of Reflection	$\Theta_r = \theta_i$	
Snell's law	$n_1 \sin\theta_1 = n_2 \sin\theta_2$	
Mirror/Thin Lens Equation	$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$	
Magnification	$m = \frac{h_i}{h_0} = \frac{-d_i}{d_o}$	

Index of Refraction	$n = \frac{c}{v}$	
Critical Angle for Total Internal Reflection	$\sin\theta_c = \frac{n_2}{n_1}$	
Coulomb's Law	$F = K\frac{q_A q_B}{r^2}$	
Electric Field Strength	$E = \frac{F_{on\ q'}}{q'} = K\frac{q'}{r^2}$	
Electric Potential Difference	$\Delta V = \frac{W_{on\ q'}}{q'} = Ed$	
Ohm's Law	V = IR	
Equivalent Resistance for Resistors in Series	$R = R_A + R_B + \ldots$	
Equivalent Resistance for Resistors in Parallel	$\frac{1}{R} = \frac{1}{R_A} + \frac{1}{R_B} + \frac{1}{R_C} + \ldots$	

Constants:

g = $\pm$9.8 m/sec^2

c = 3.00 x 10^8 m/sec

K = 9.00 x 10^9 $\frac{Nm^2}{C^2}$