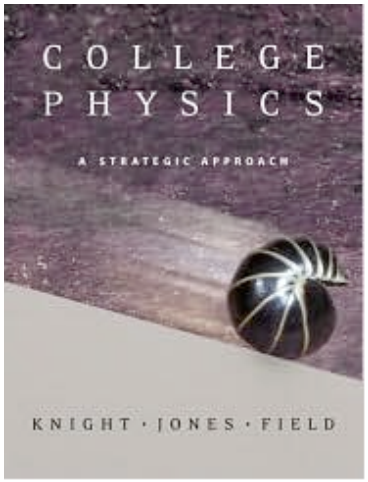
# PHYS 1206EL - Concepts in Physics I - Fall 2009

**Instructor:** Dr. Christine Kraus, Office F511, ckraus@laurentian.ca

**Schedule:** Course: Mo, We, Fr from 10:30 to 11:30, Auditorium FA-055
Tutorial: Mo 16:30 - 18:00, FA-055
Lab : Mark Brown

**Textbook:** College Physics - A Strategic Approach
Knight * Jones * Field
Pearson, Addison Wesley
ISBN: 0-8053-0634-X (student edition)




**Calculator:** non programmable scientific calculator

**Grading:** Lab: 15%
Homework: 15%
(need 50% of all homework points to write exams)
Midterm exam: 20%
(optional second midterm if needed to replace first one)
Final exam: 50%

No prerequisite necessary.

## Course general description

The course begins with an introduction to the basic elements of the scientific methods, followed by a review of basic notations in physics (units, figures, vectors, kinematic). Elements of classical mechanics will be introduced and used on concrete examples (dynamics, work, energy, law of conservation, momentum). Solids and fluids will be covered as well.
Introduction to heat and thermodynamics is the next part, this includes temperature, the state equation, heat and laws of thermodynamics.
In the third part oscillatory phenomena (harmonic) will be introduced, followed by mechanical waves and sound.
If there is time left, we will take a look at some modern physics examples as well.

# COURSE OUTLINE

## 1. Properties of Matter

***Chapter 1 – Introduction***

What is physics?
Concepts, models, and theories
Units
Power of ten notation and significant figures
Reference frames and coordinate systems

***Chapter 2 – Vectors***

Scalars and vectors
Vector addition
Components and unit vectors
Scalar (dot) product

***Chapter 3 – One-dimensional kinematics***

Particle kinematics
Displacement and velocity
Instantaneous velocity
Acceleration
The equations of kinematics for constant acceleration
Vertical free-fall

***Chapter 4 – Inertia and two-dimensional motion***

Newton's first law
Two-dimensional motion
Projectile motion
Uniform circular motion
Inertial reference frames
Relative velocity
The galilean transformation

***Chapter 5 – Particle dynamics I***

Force and mass
Newton's second law
Weight
Newton's third law
Applications of Newton's law

***Chapter 6 – Particle dynamics II***

Friction
Dynamics of circular motion
Satellite orbits

***Chapter 7 – Work and energy***

Work done by a constant force
Work done by a variable force in one dimension
Work-energy theorem in one dimension
Power

***Chapter 8 – Conservation of mechanical energy***

Potential energy
Conservative forces
Potential energy and conservative forces
Potential energy functions
Conservation of mechanical energy
Mechanical energy and nonconservative forces
Conservative forces and potential energy functions

***Chapter 9 – Linear momentum***

Linear momentum
Conservation of linear momentum
Elastic collision in one dimension
Comparison of linear momentum with kinetic energy
Elastic collisions in two dimensions

***Chapter 10 – Solids and fluids***

Density
Elastic moduli
Pressure in fluids
Archimede's principle
The equation of continuity
Bernoulli's equation

**2. Heat and thermodynamics**

***Chapter 11 – Temperature, thermal expansion, and ideal gas law***

Temperature
Temperature scales
The zeroth law of thermodynamics
The equation of state of an ideal gas
Thermal expansion

***Chapter 12 – First law of thermodynamics***

Specific heat
Latent heat
The mechanical equivalent of heat
Work in thermodynamics
First law of thermodynamics
Applications of the first law of thermodynamics
Ideal gases
Heat transport

***Chapter 13 – Kinetic theory***

The model of an ideal gas
Kinetic interpretation of pressure
Kinetic interpretation of temperature
Specific heats of an ideal gas
Equipartition of energy

**3. Waves**

***Chapter 14 – Oscillations***

Simple harmonic oscillation
The bloc-spring system
Energy in simple harmonic motion
Pedulums

***Chapter 15 – Mechanical waves***

Wave characteristics
Superpositions of waves
Traveling waves
Traveling harmonic waves
Standing waves
The wave equation

***Chapter 16 – Sound***

The nature of a sound wave
Resonant standing sound waves
The Doppler effect