PHYS*1A03
Introductory Physics

Fall 2015

http://avenue.mcmaster.ca/

PHYS 1A03

Section C02:

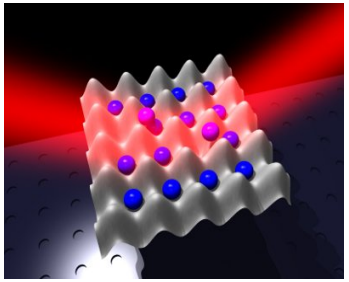
Tuesday & Friday, 8:30-9:20, JHE 376

- Lecturer: Maikel Rheinstädter
  rheinstadter@mcmaster.ca
  Office: ABB-237A

Physics Impact

The Nobel Prize in Physics 2012

Serge Haroche, David J. Wineland

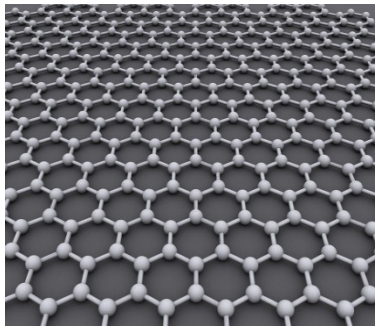


"for ground-breaking experimental methods that enable measuring and manipulation of individual quantum systems"

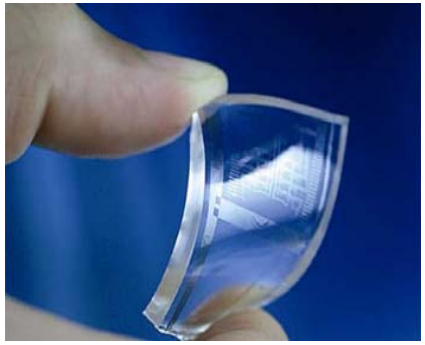
The Quantum Computer

The Nobel Prize in Physics 2010

Andre Geim, Konstantin Novoselov



"for ground-breaking experiments regarding the two-dimensional material graphene"



Physics Impact

The Nobel Prize in Physics 2009

Charles K. Kao, Willard S. Boyle, George E. Smith

"for the invention of an imaging semiconductor circuit – the CCD sensor"

"for groundbreaking achievements concerning the transmission of light in fibers for optical communication"

The Nobel Prize in Physics 2007

Albert Fert, Peter Grünberg

"for the discovery of Giant Magnetoresistance"

Physics 1A03

- Introductory course in physics
  - We have discussed how the course works
  - This is a brand new course, redesigned from the ground up with a different focus:
    - **This course is not:**
      - a weeder course
      - a gate keeper to other programs
    - **This course is:**
      - designed to give you an appreciation for physics
      - designed to teach you how to *model* the real world
      - designed with faculty input from other programs
      - designed keeping in mind different backgrounds

Course Materials

Textbook (Recommended): ***Physics for the Life Sciences, 2nd edition*** by Zinke-Allmang and co-authors is an ideal companion to the material presented.

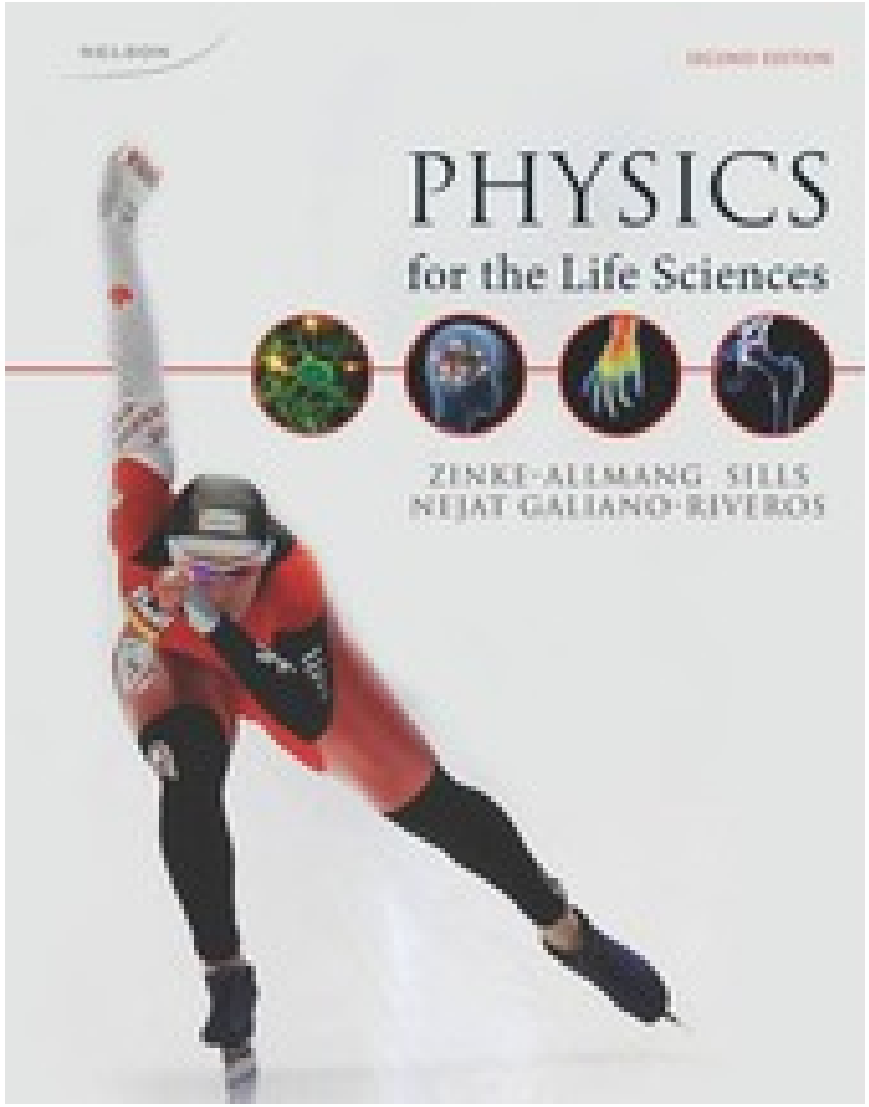
i>clickers (Required): i>clickers will be used in every class and are an integral part of the course.

Lab manual (Required): PHYS 1A03 Laboratory course manual available from the bookstore.

Lab notebook (Required): Black hard cover bound Physics Laboratory Notebooks available from the bookstore.

Calculator (Required): Only the McMaster Standard Calculator will be permitted during tests and examinations

Course Textbook



"Physics for the Life Sciences, 2nd Edition" by Zinke-Allmang

Available in the bookstore

Course Format

- **On-line modules** (11 in total) will provide an introduction to the course material
- **Lectures** (2 hrs per week) will serve to reinforce your understanding of the material
- **Labs** (5 in total: 4 typical labs + 1 home experiment)
- **Homework** will be assigned throughout the term – this may include on-line assignments & quizzes
- **Midterm tests**
  - Friday, October 9, 2015, 7-9 pm
  - Tuesday, November 10, 2015, 7-9 pm
- **Final Exam**
  - see McMaster Examination Timetable

Assessment in the Course

	Option 1	Option 2	Option 3
Class activities (i-clicker questions)	5%	5%	5%
Homework	5%	5%	5%
Labs	20%	20%	20%
Midterm 1	20%	15%	20%
Midterm 2	15%	20%	20%
Final Exam	35%	35%	30%

Avenue to Learn

- Avenue is your main portal into the course material
  - Calendar of events
  - News items
  - Course outline – you must read this in carefully, the outline represents the contract between you and me
  - Online modules
  - Extra resources

- It is your responsibility to check Avenue regularly

LON-CAPA

- "Learning Online Network with Computer Assisted Personalized Approach"
- You log in and receive personalized questions (numbers are different)

https://loncapa.physics.mcmaster.ca

- On a nearly weekly basis questions will be assigned for practice **[these are NOT for marks]**
- **HOWEVER!** In class, we will have you solve one of your homework problems
  - Don't forget to bring yourself some paper!!

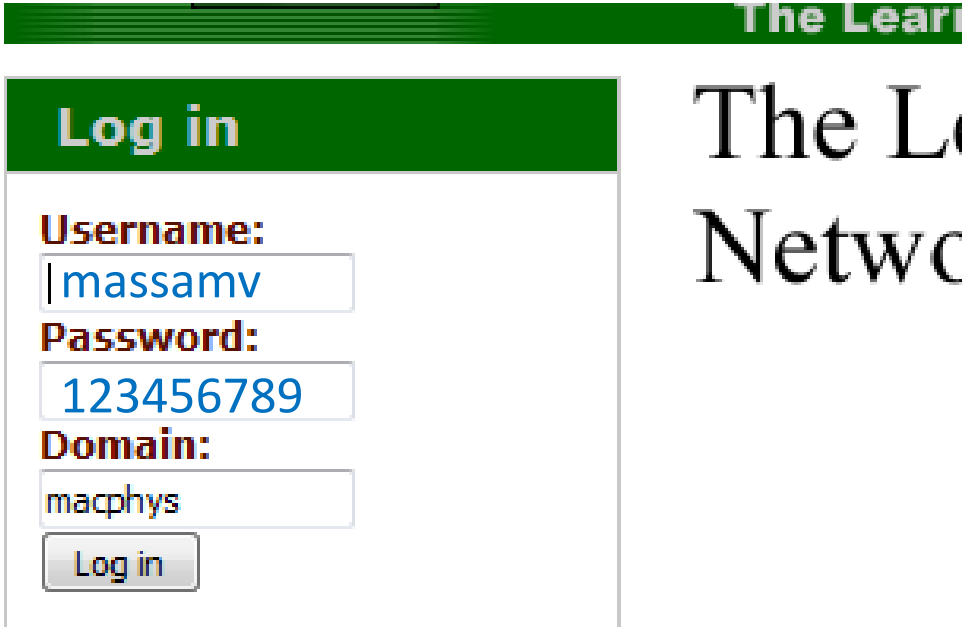
LON-CAPA

https://loncapa.physics.mcmaster.ca

Login:

Username is MacID

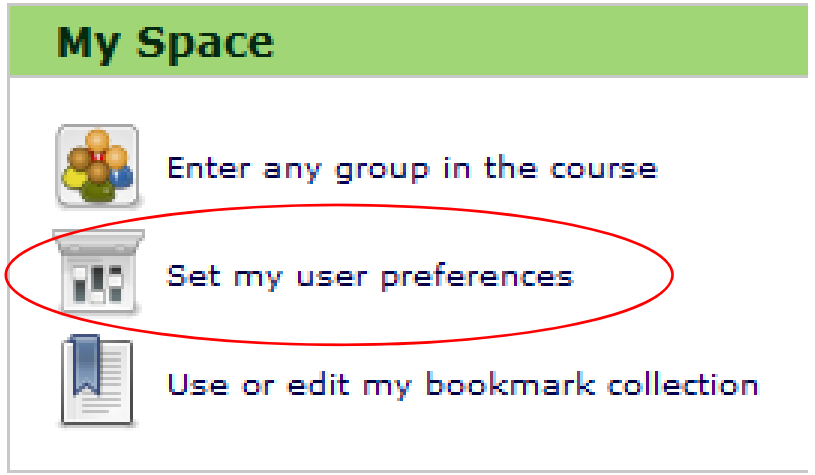
Password is Student #



Change your password!!

Click on “Main Menu”

then find this:



i-Clicker

- We will pose questions in class on a regular basis
  - Multiple choice
  - You click, we get instant feedback!
  - Participation is a crucial part of this course

General in-class questions

strictly participation

In-class Quizzes (based on modules)

additional marks for correct answers

- All questions count towards your total grade for class activities (5%)
- **Must have your iClicker by next class!!**

i-Clicker Registration

- i>clicker Web Registration
- Have questions about clicker registration?
- Contact us at support@iclicker.com or 866-209-5698.
- Thank you for using i>clicker! Please complete the form below. Your professor will then be able to give you credit for using your i>clicker in class.

First Name
Mike

Last Name
Massa

Student ID
massamv

Clicker ID
NOYB123

Labs

- 5 labs during the semester
  - 4 in the lab room
    - Kinematics in 1D
    - Forces
    - Conservation of energy
    - Waves, superposition and reflections
  - 1 home experiment on fluids
- Lab room is BSB B115, there are 18 sections, check your section carefully

Labs

- Labs start Monday September 28 (see AtL for schedule)
- Lab sections alternate week by week:
  - L01-L09:
    - Lab#1 week of 05.10.2015
    - Lab#2 week of 19.10.2015
    - Lab#3 week of 02.11.2015
    - Lab#4 week of 16.11.2015
  - L10-L18:
    - Lab#1 week of 28.09.2015
    - Lab#2 week of 26.20.2015
    - Lab#3 week of 09.11.2015
    - Lab#4 week of 23.11.2015
- Lab#5 will be assigned when we start topic on Fluids

Topics

- Broken up into 4 Themes, with sub-modules (see AtL)
  - Introduction and core concepts
    - Units, conversion, precision, estimation
  - Mechanics
    - Kinematics, forces, energy and momentum
  - Waves
    - Wave motion, superposition, sound, light
  - Fluids
    - Fluids, pressure, surface tension, flow, turbulence

Academic Integrity

- ***If it feels like cheating, it probably is!***

- It is your responsibility to understand what constitutes academic dishonesty.

- For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at

  http://www.mcmaster.ca/academicintegrity/

C02: In-class Quizzes & Homeworks

September

M	T	W	Th	F
	8	9	10	11
14	15 Q	16	17	18
21	22 Q	23	24	25
28	29 Qh	30		

October

M	T	W	Th	F
			1	2
5	6 Qh	7	8	9
12	13	14	15	16
19	20 Qh	21	22	23
26	27 Qh	28	29	30

November

M	T	W	Th	F
2	3 Qh	4	5	6
9	10 Qh	11	12	13
16	17 Qh	18	19	20
23	24 Qh	25	26	27
30				

December

M	T	W	Th	F
	1 Qh	2	3	4
7	8 h			

Physics?

- The goal of physics is to understand the way the world works
  - It's the study of the fundamental laws of nature

- Why study physics?
  - Physics is at the intersection of many disciplines (biophysics, medical physics, geophysics, etc.), ties these disciplines together, and bridges them to mathematics.

Physics and other areas of Science

- Chemistry – deals with interactions between atoms and molecules
- Medicine – diagnostic equipment and practices
  - Ultrasound & CT scans image using sound/electromagnetic waves
  - MRI & PET imaging use magnetic properties of atoms and exotic particles (positrons)
- Cell biology
  - Membrane structure and function
- Architecture
  - Structural stability, acoustics, heating, lighting…

The Chain Fountain

Image taken from: http://phys.org/news/2014-01-chain-fountain-problem-solving-partnership-video.html

Can you beat a phone book in a tug-of-war?

Images taken from:
http://sciphile.org/lessons/phone-book-friction

http://www.france5.fr/emissions/on-n-est-pas-que-des-cobayes/experiences/experience-1-defi-suspendre-une-voiture-avec-deux-annuair-0

How does Physics work?

- Our understanding of the way the world works comes through observation, measurement and modeling
- **Observation** is essential for understanding a phenomenon
  - In physics, observations should be quantitative
- **Measurements** are observations with a numerical value (i.e. a "quantity", rather than a "quality")
  - Quantitative observations can tell us about the consistency and the extent of a phenomenon, how factors affect its behaviour
- **Models** are created to capture the essential features of a phenomenon
  - they offer a concise, often approximate, representation (analogy) for something that is difficult to describe directly

Models in physics

PANIC!!

- What can we say about how people panic in, say, a crowded classroom that's on fire?
- What kind of observations might we make of people leaving a room?

Simulating dynamical features of escape panic

Dirk Helbing*†, **Illés Farkas**‡ **& Tamás Vicsek***‡

* *Collegium Bu*
H-1014 Budape
† *Institute for E*
D-01062 Dresd
‡ *Department o*
H-1117 Budapest, Hungary

$$m_i \frac{d\mathbf{v}_i}{dt} = m_i \frac{v_i^0(t)\mathbf{e}_i^0(t) - \mathbf{v}_i(t)}{\tau_i} + \sum_{j(\neq i)} \mathbf{f}_{ij} + \sum_W \mathbf{f}_{iW}$$

Problem solving

- Lots of people say “physics is hard”.
- It can evoke feelings similar to filling in your forms for university registration
  - You don’t know if you’re doing it correctly, and you’re worried that a single mistake will invalidate the whole process!

1. By far, the biggest mistake people make is giving up before you even get started

2. A second pitfall is thinking that physics is formulaic
   - If you’ve done a problem throwing a ball from a window, then you’ve done them all, and they all solve the same way

Problem solving

1. By far, the biggest mistake people make is giving up before you even get started
   - There are always things that can be done to start a problem
   - Write down what you know, and what you are asked to find
   - Draw a picture of what's going on in the problem

2. A second pitfall is thinking that physics is formulaic
   - Physics is not about memorizing formulas and jamming numbers into them

The real skills that we would like you to develop are:

- Assess what is going on in a problem
- Decide what's relevant
- Know what tools would be needed to solve the problem
- Be able to break the problem down into small steps, and approach the problem systematically

Problem solving

To repeat

- Physics is NOT about memorizing a lot of complicated equations
  - If you take this approach, you will do poorly

- Physics is about understanding a very small number of simple natural laws and learning to apply them to a wide variety of problems
  - We will encounter perhaps 10 important rules/ideas over the course

Closing Comments

- Watch the module T1M1
- **Next class:**
  - Units and unit conversion
  - Dimensional analysis
  - Proportionality
  - Vectors
    - If you have never worked with vectors, watch the additional **Vector Module** for an introduction
    - If you have vector experience, take a quick look through the **Vector Review Notes** posted
- **In one week:**
  - We will begin class with a clicker quiz on T1M1

Module Dos and Don'ts

- Writing stuff down:
  - Build your own formula sheet
  - Consider writing down formulas, and even write down what each symbol is in the formula.
  - Ex: $v_f = v_i + a\Delta t$

    v_i initial velocity
    v_f final velocity
    a acceleration
    Δt time interval
  - You'll notice that there are often Checkpoints on slides immediately afterwards, which build your understanding of the formulas (so, write them down!)
  - Evaluate your comfort/understanding level after watching the module
  - **ENJOY!!!**