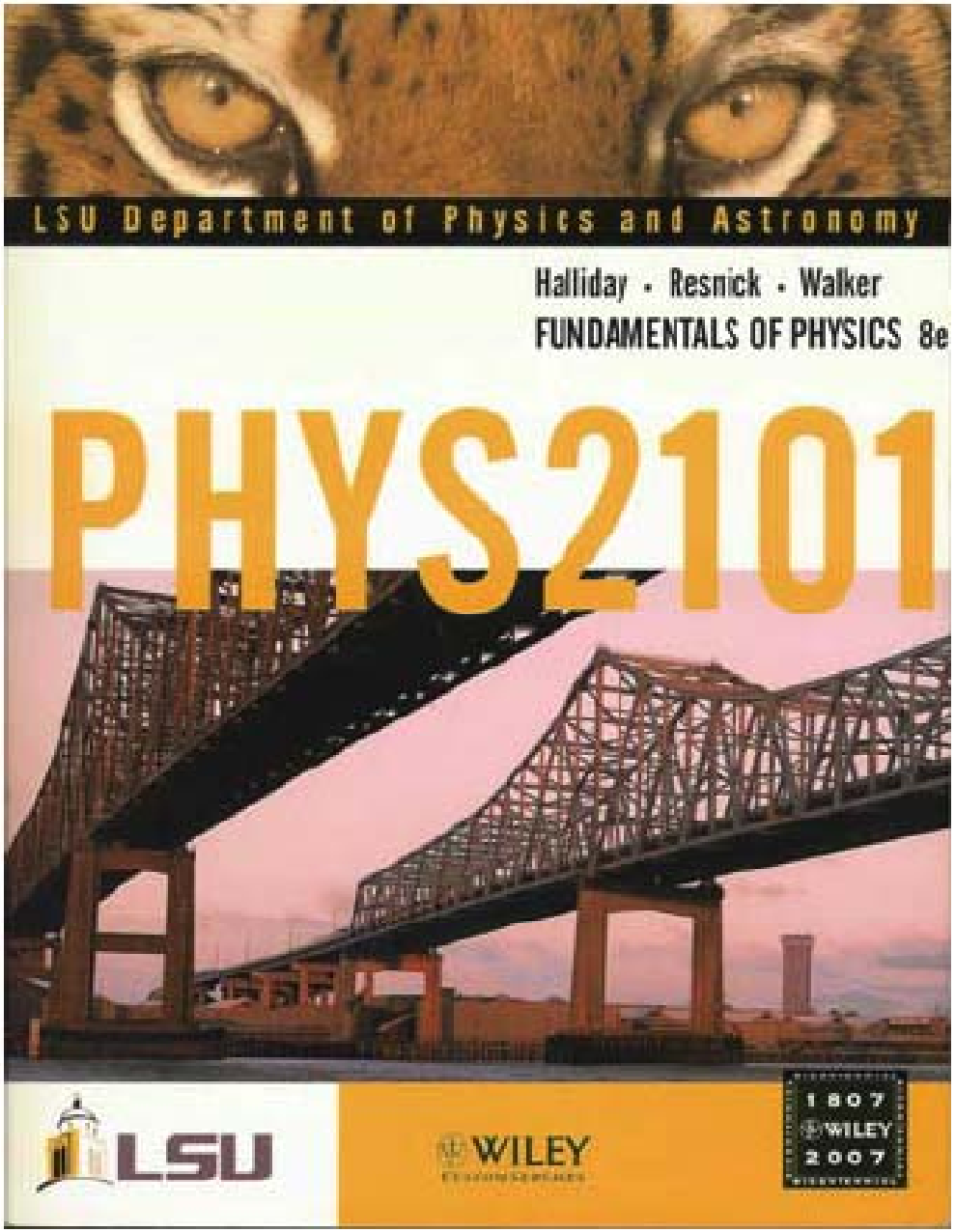


Physics for Technical Students

- Who am I ?
- Who are you?
- Why are you here?
- What are you suppose to learn here?

Who I am?

Jiandi Zhang, Professor of Physics
Office : 229A Nicholson Hall
http://www.phys.lsu.edu/~jzhang/

jiandiz@lsu.edu
225-578-4103

What I am doing? Experimental Condensed Matter Physics

http://www.lsu.edu/highlights/2009/06/NSF.shtml

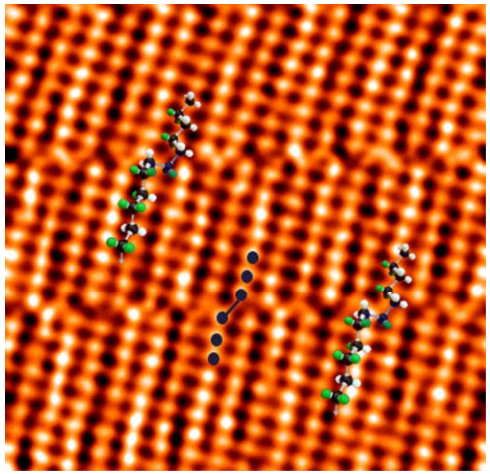
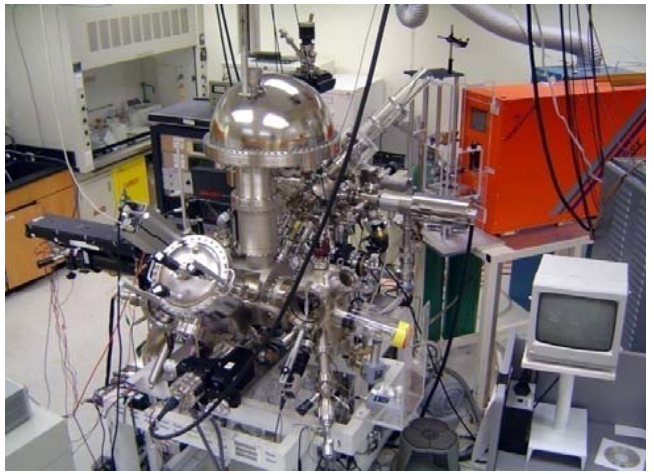


image of atomic scale manipulation

4.4 nm x 4.4 nm polymer film



experimental toys

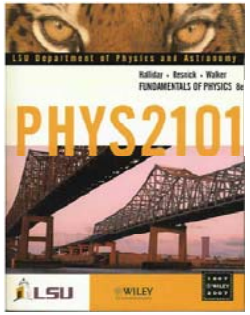
PHYS2101

Class time: Mon, Wed, & Fri: 12:40 -1:30 PM

Office Hours: Mon, Wed, & Fri: 2:00PM – 3:30PM

Class Website: http://www.phys.lsu.edu/classes/spring2010/phys2101/

http://www.phys.lsu.edu/~jzhang/teaching.html : **lecture notes / announcement**



Pre-requisites : Basic Algebra & Calculus; Physics 1100

Textbook: *Fundamentals of Physics*, Halliday, Resnick, and Walker, 8th ed

Class: Covers Ch 1-6 Review only(fast) & Ch 7- 20 Standard teaching

Reading Assignments: Lecture schedule is provided
- read material before lecture!

Lectures: Concepts will be developed through the lectures, demonstrations and class discussion

Homework: Best way to learn the material

Class Information is also through WebAssign

WebAssign will handle most of your class-related needs. On it you will find: homework, formulae sheets, practice tests

http://webassign.net/student.html

logon id is your PAWS e-mail address without the @lsu.edu
e.g. I am *jiandiz@lsu.edu* so my id is **jiandiz**

Your initial password is ***hello*** … change it to something else…

Try logging into WebAssign TODAY:

If you have used WebAssign before, your old password will be in effect

If you have a problem logging in, e-mail me and I will reset your password

Today's lecture notes and the first homework assignment are posted.

HW will be due in 1 week ! Start early and ask questions!!

Course details *(see syllabus)*

Class Format

- Announcements
- Mixture of Power Point and Chalk Board/Overhead
- Some theory …. Some problems…
- Power Point slides are available on class website & my own website
- Please ask questions (and correct me!).

Grade

See details from the syllabus

Help??

- Yourself…
- Friends, neighbors, family …
- Tutoring room (Rm 102), grad students …
- me (office, help sessions, email…)

Announcement: if they are taking a physics lab class, they need to attend this week or they will be dropped from the rolls

Any question…?

Chapter 1: Measurement

Basic concepts:

1. Measurement of a physical parameter
2. Units, systems of units (example: SI)
3. Basic units in mechanics
4. Changing units
5. Significant figures

As your field guide, Chapter 1 was a cake walk… Now let's start hiking some hills…

Chapter 2: Motion along a Straight Line

Basic Concepts:

Displacement: $\Delta x = x_2 - x_1$ (Units: m)

Average velocity: $v_{\text{avg}} = \dfrac{x_2 - x_1}{t_2 - t_1} = \dfrac{\Delta x}{\Delta t}$ (Units: m/s)

Instantaneous velocity: $v = \lim\limits_{\Delta t \to 0} \dfrac{\Delta x}{\Delta t} = \dfrac{dx}{dt}$

Average acceleration: $a_{\text{avg}} = \dfrac{v_2 - v_1}{t_2 - t_1} = \dfrac{\Delta v}{\Delta t}$ (Units: m/s^2)

Instantaneous acceleration $a = \lim\limits_{\Delta t \to 0} \dfrac{\Delta v}{\Delta t} = \dfrac{dv}{dt}$, $a = \dfrac{dv}{dt} = \dfrac{d}{dt}\left(\dfrac{dx}{dt}\right) = \dfrac{d^2x}{dt^2}$

Special Case: Motion with constant acceleration (a = const.)

$a = \frac{dv}{dt} \rightarrow dv = adt.$ If we integrate both sides of the equation we get:

$\int dv = \int adt = a\int dt \rightarrow v = at + C.$ Here C is the integration constant.

C can be determined if we know the velocity $v_0 = v(0)$ at $t = 0$:

$v(0) = v_0 = (a)(0) + C \rightarrow C = v_0 \rightarrow \quad v = v_0 + at \qquad$ (eq. 1)

$v = \frac{dx}{dt} \rightarrow dx = vdt = \left(v_0 + at\right)dt = v_0 dt + atdt.$ If we integrate both sides we get:

$\int dx = \int v_0 dt + a\int tdt \rightarrow x = v_0 t + \frac{at^2}{2} + C'.$ Here C' is the integration constant.

C' can be determined if we know the position $x_o = x(0)$ at $t = 0$:

$x(0) = x_o = (v_0)(0) + \frac{a}{2}(0) + C' \rightarrow C' = x_o$

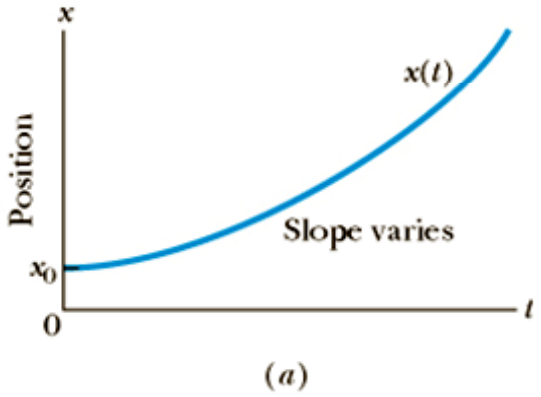
$x(t) = x_o + v_0 t + \frac{at^2}{2} \qquad$ (eq. 2)

If we eliminate the time t between equation 1 and equation 2 we get:

$v^2 - v_0^2 = 2a\left(x - x_0\right) \qquad$ (eq. 3)

Below we plot the position $x(t)$, the velocity $v(t)$, and the acceleration a versus time t:

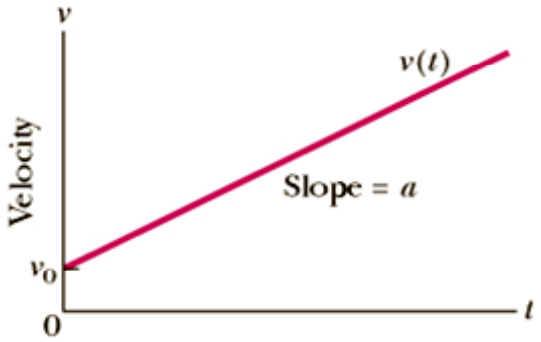
Motion with Constant Acceleration:



(a)

$$x = x_0 + v_0 t + \frac{at^2}{2}$$

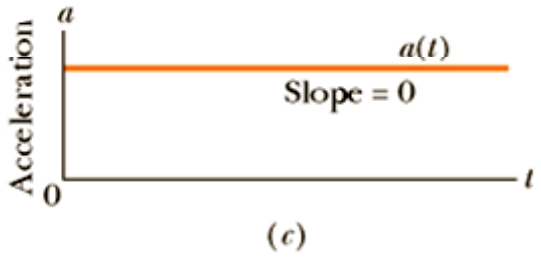
The $x(t)$ versus t plot is a parabola that intercepts the vertical axis at $x = x_0$.



(b)

$$v = v_0 + at$$

The $v(t)$ versus t plot is a straight line with slope = a and intercept = v_0.



(c)

$$a = const.$$

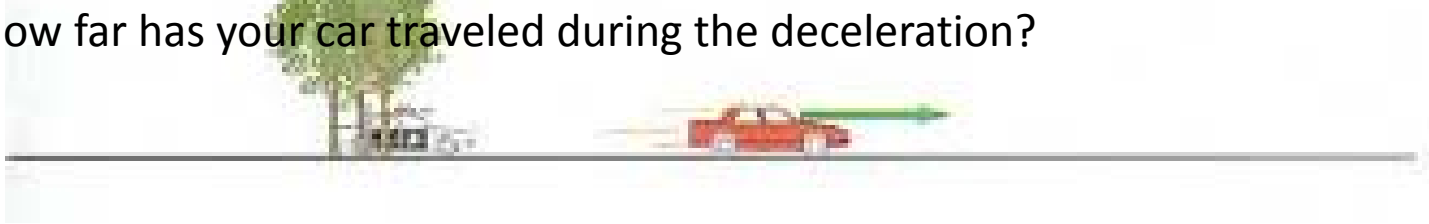
The acceleration a is a constant.

Example

The brakes on your car are capable of creating a *constant* deceleration of 5.2 m/s^2.

a) If you are going 137 km/hr and suddenly see a state trooper, what is the minimum time in which you can get your car under the 90 km/hr speed limit?

b) How far has your car traveled during the deceleration?



It is a contant deceration process! $a = -5.2\ m/s^2$

Initial speed: $v_0 = 137\ km/s = 38\ m/s$

Final speed: $v = 90\ km/hr = 25 m/s$

a) Pick up the first kinematic equation: $v = v_0 + at$

$$t = \frac{v - v_0}{a} = \frac{25 m/s - 38 m/s}{-5.2 m/s^2} = 2.5 s$$

b) Use the third kinematic equation: $v^2 = v_0{}^2 + 2a(x - x_0) = v_0{}^2 + ad$

$$d = \frac{v^2 - v_0{}^2}{2a} = 78.75 m$$