Massachusetts Institute of Technology - Physics Department

Physics - 8.01 **Assignment #2** September 15, 1999.

It is strongly recommended *that you read about a subject* ***before*** *it is covered in lectures.*

Lecture Date	Material Covered	Reading from Ohanian
#5 Fri 9/17	Circular Motion - Centrifuges Perceived Gravity **Watch Videos on *PIVoT*** (reference frames)	Page 84 – 86
#6 Mon 9/20	Newton's Laws	Page 99 – 112
#7 Wed 9/22	Weight - Perceived Gravity - Weightlessness Free Fall - Zero-Gravity in Orbit (misnomer) **Watch Videos on *PIVoT*** (weightlessness)	Page 123 – 134
#8 Fri 9/24	Friction —There is an interesting article on Friction in Scientific American, Oct, 1996. **Watch Videos on *PIVoT*** (friction)	Page 134 – 140
#9 Mon 9/27	Exam Review	Lectures #1 – #5
Wed 9/29	**Exam #1**	**Handout of 9/22**

Due Friday, Sept 24, before 4 PM in 4-339B. Solutions will be posted on the Web Sat 9/25.

2.1 *Throwing Stones* – page 51, problem 51.

2.2 *Measurements of Gravitational Acceleration, g.*
Use the measurements made during your first lecture of the two falling apples to calculate two values for g and their associated uncertainties. Do the two values agree within the accuracy of the measurements? Use the measurements obtained in the lecture that you attended.

2.3 *Vector Addition* – page 70, problem 8.
Watch videos on *PIVoT* (under *vector* and look at the simulations).

2.4 *Vectors* – page 71, problem 26.

2.5 *Vector Scaling* – page 71, problem 27.

2.6 *Keep in Touch with the Dutch.*
Recently I drove in The Netherlands and I saw a road sign that indicated: *Venlo 31 km, Eindhoven 39 km.* Not knowing anything else, what is the minimum and what is the maximum distance (approximately) between these two towns.

2.7 *Perpendicular Vectors.*
The vectors $\mathbf{A} = 2\hat{\mathbf{x}} - 3\hat{\mathbf{y}}$ and $\mathbf{B} = -\hat{\mathbf{x}} + a\hat{\mathbf{y}} - 5\hat{\mathbf{z}}$ are perpendicular to each other. What is the value of a?

2.8 *Adding, Subtracting, and Multiplication of Vectors* – page 71, problem 25.
Watch videos on *PIVoT* (under *vector* and look at the simulations).
Calculate also:

d) $\mathbf{A} \cdot \mathbf{B}$ and $\mathbf{B} \cdot \mathbf{A}$

e) $\mathbf{A} \times \mathbf{B}$ and $\mathbf{B} \times \mathbf{A}$

2.9 *Unit Vectors*
Find two unit vectors which are perpendicular to both $2\hat{\mathbf{x}} - 3\hat{\mathbf{y}}$ and $-\hat{\mathbf{x}} + 4\hat{\mathbf{y}} - 5\hat{\mathbf{z}}$.

2.10 *Position, Speed, Velocity, and Acceleration.*
A particle is moving in three dimensions. Its position vector, $\boldsymbol{r}$, is given by

$$\boldsymbol{r} = (6 - 2t)\hat{\mathbf{x}} + (3 + 4t - 6t^2)\hat{\mathbf{y}} - (1 + 3t - 2t^2)\hat{\mathbf{z}}$$

Distances are in meters, and the time, t, in seconds.

a) What is the velocity vector at $t = +3$?

b) What is the speed at $t = +3$?

c) What is the acceleration vector and what is its magnitude at $t = +3$?

2.11 *Stunt Driver* – page 93, problem 10.

2.12 *Golf* – page 94, problem 24.

2.13 *Ski Jump* – page 95, problem 30.

2.14 *Centripetal Acceleration* – page 96, problem 45.

2.15 *Centripetal Acceleration of Planets in our Solar System* – page 97, problem 49.
Try: http://ask.com, and ask the question "what is the distance to our planets?"

You can find distances, rotational periods, orbital periods, mean orbital velocities, masses, sizes, and much more for all our planets.

2.16 *Roundtrip by Plane.*

An airplane makes a roundtrip between A and B (starting at A). Will the roundtrip take longer without wind or with wind? Assume that the wind is blowing in the direction from A to B. Before you make any calculations use your intuition and make a guess.

Let the distance between A and B be d, the speed of the plane relative to air be v, and the speed of the wind be w. What would happen if the wind speed became so high that $w = v$? How would your answer change if the wind were blowing in the direction from B to A?

Reminder.

There are 26 recitation sections. If you want to change, for whatever reason, please go to the physics education office (4-352).