PHYS 1443 – Section 003
Lecture #10

Wednesday, Oct. 1, 2003

Dr. Jaehoon Yu

- Exam review
- Newton's Law of Gravitation
- Kepler's Laws

No homework today!!

Homework #5 deadline extended till noon, next Wednesday, Oct. 10!!

Exam Results

- Class average: 53
- Top score: 90.5
- Remember that
  - There are three exams of which two bests are used for final grade
  - Each exam accounts for 25% ➔ 50% total
- Other factors
  - Lab: 20%
  - Homework: 15%
  - Quiz: 15%
  - Extra credits: 10%
- Final grades will be assigned on a sliding scale
- Exam can be easily made up by other credits

Presidential Lecture

Physics Department & The Center of Nanostructured Materials
College of Science
The University of Texas at Arlington

Magnetics of Cluster- and Self Assembled Nanostructures

Dr. David J. Sellmyer

Director of NSF/MRSEC of University of Nebraska

1:30 pm Wednesday, October 1, 2003
SH 100

Abstract

The theme of this talk is centered around the important nanometer length scales in magnetism and our ability to create structures on these length scales. This leads to improvement of the properties of hard, soft and semi-hard magnetic materials, and to new technologies such as spintronics, NEMS and biomagnetic applications. Examples discussed include cluster-assembled nanoscale films for future high-density data storage, self-organized ferromagnetic arrays, and magnetic nanotubes.

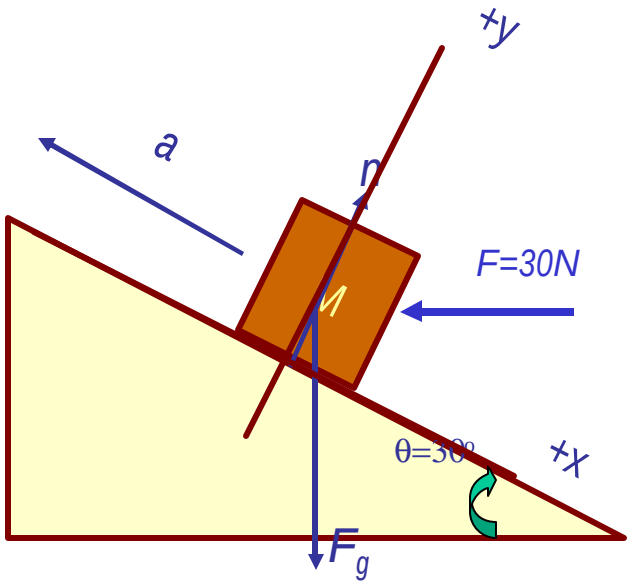
Dr. D.J. Sellmyer is a University Professor and George Holmes Distinguished Professor of Physics at University of Nebraska. He was on the faculty at MIT before moving to the University of Nebraska. He has served as Chairman of Physics and is the Director of the Center for Materials Research and Analysis, the NSF Materials Research Science and Engineering Center, and the W.M. Keck Center for Mesospin and Quantum Information Systems. He is a fellow of the American Physical Society and the chairperson of the Magnetic Materials group at the American Physical Society. He won the Outstanding Research and Creativity Award of the University of Nebraska System in 1996. He is internationally known for his work on nanoscale magnetic materials and applications.

Refreshments will be served in the Physics Library at 1:00pm

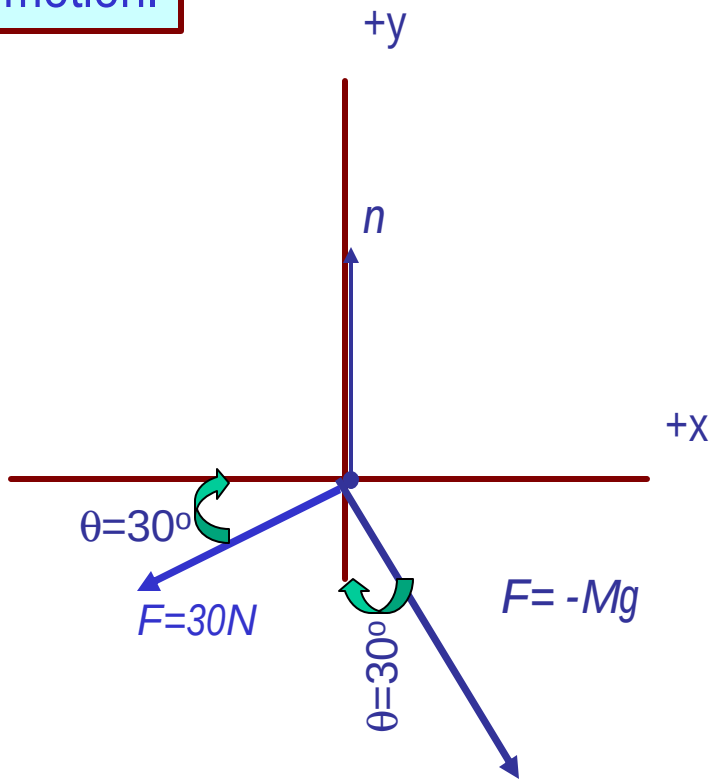
Exam problems 14 – 18

A 5 kg block is placed on a frictionless inclined plane of angle 30° and pushed up the plane with a horizontal force of magnitude 30 N.

14. Draw a free-body diagram for this motion.



Free-body Diagram



16. What are the direction and magnitude of block's acceleration?

x comp. $\sum F_x = Mg\sin 30^o - F\cos 30^o = Ma_x$

thus $a_x = \dfrac{Mg\sin 30^o - F\cos 30^o}{M} =$

$$\frac{5\cdot 9.8\cdot \sin 30^o - 30\cos 30^o}{5} = -0.30 m/s^2$$

y comp. $\sum F_y = n - Mg\cos 30^o - F\sin 30^o = Ma_y = 0 \quad \therefore a_y = 0$

Thus the block's acceleration is up the incline. The magnitude is

$$a = \sqrt{a_x^2 + a_y^2} = 0.3 m/s^2$$

17. What is the magnitude of force exerted on the plane by the block?

Since this force is the same magnitude as the normal force but opposite direction, one can obtain the magnitude from y-component of the net force

$$\sum F_y = n - Mg\cos 30^\circ - F\sin 30^\circ = 0$$

$$n = Mg\cos 30^\circ + F\sin 30^\circ = 5\cdot 9.8\cdot \cos 30^\circ + 30\sin 30^\circ = 57\,N$$

18. What is the smallest horizontal force needed to move the block up the plane?

In order for the block to be pushed up the plane, the component of the horizontal force up along the plane must overcome the component of the gravitational force downward.

$$\sum F_x = Mg\sin 30^\circ - F\cos 30^\circ \quad < 0$$

$$F > \frac{Mg\sin 30^\circ}{\cos 30^\circ} = 5\cdot 9.8\cdot \tan 30^\circ = 28\,N \qquad F = 28N$$