May, 2006
Preparation for Physics
PH 100-MC ("Preparatory Physics" – Call number, 3033)

***Instructor*: Professor David Agresti**
Office hours: 1 to 1:45 pm daily, and by appointment.
Location: Campbell Hall, Room 380
Phone: 934-8032; E-mail: agresti@uab.edu

***Course meetings*: 2:00-4:40 pm daily, from Tuesday, May 10, through Friday, May 26, in Education Building Room 237**
***Last Day to Withdraw*: May 11, 2006**

***Course description and objectives*: The purpose of this course is to help prepare you for your full-year physics course, PH 201 or PH 221, by introducing you to basic techniques for solving physics "problems." It will develop your skill in applying these techniques through numerous examples, worked in full detail.**

***Text*: *Required*: Beginning Physics I, Chapters 1-5, by Alvin Halpern, Schaum's Outline Series (1995)**
***Recommended*: PH 201 textbook by Cutnell & Johnson or PH 221 textbook by Halliday, Resnick, and Walker**
Students are responsible for material presented in the lectures and practiced in homework. The required text helps provide a structure for the presentation of topics and is a resource for example problems.

***Grade Calculation*:**
45% - Average of 3 best of 4 Quizzes (omitting lowest score)
25% - Final (Tuesday, May 30, at 2:00 pm)
There are no make-up exams
(See Prof. Agresti in case of a special circumstance.)
20% - Homework (as assigned)
(½ credit for one day late; no credit past one day late)
10% - Attendance (required)
***Scale*: A (90-100); B (80-89); C (70-79); D (60-69); F (<60)**
***NS&M Grade Appeal Policy*:**
Link from http://www.phy.uab.edu/syllabi/index.shtml

See attached sheets for schedule of activities and additional information.

SCHEDULE (worksheet)

PH 100-MC - Room EB 237, 2-4:40 pm, M-F **May, 2006**

Instructor: Prof. David Agresti Office hours: 1-1:45 pm daily, & by appointment

Text: Schaum's Beginning Physics I, Chapters 1-5 Prerequisite: MA 106

Day	Date	Lecture	Homework Assignment	Due
1	May 10, Wed.	Course philosophy; Math. background; Chapter 1	Chapter 1: Numbers 45, 46, 48, 50, 52(i,iii), 54(i,iii). (see also notes)	May 15
2	May 11, Thurs.			
3	May 12, Fri.	Chapter 2;		
4	May 15, Mon.	Quiz #1 (at end of class)		
5	May 16, Tues.			
6	May 17, Wed.	Chapter 3;		
7	May 18, Thurs.	Quiz #2 (at end of class)		
8	May 19, Fri.			
9	May 22, Mon.	Chapter 4;		
10	May 23, Tues.	Quiz #3 (at end of class)		
11	May 24, Wed.	Chapter 5;		
12	May 25, Thurs.			
13	May 26, Fri.	Quiz #4 (at end of class)		
Final	May 30, Tues.	Final covers Chapters 1-5	**Enjoy your summer!**	

Grade Average = 45% (best quizzes) + 25% Final + 20% Homework + 10% Attendance & Participation

Note that start dates for chapters are approximate.

About PH 100 - Preparation for Physics

This course is designed to help you learn the techniques and develop the skills required to analyze and solve physics "problems." It is extremely important that the examples in the text be "worked" through ***in detail***, since these start you on the road to being able to apply concepts and generalizations to ***other*** situations. You must practice regularly, because learning to do physics requires a "settling time," much like other skills such as music or sports. To do this, you must use a systematic, step-wise approach, such as the following. This same method must be shown on homework and tests. You should think of each question you answer as a sort of performance.

1) ***Carefully read*** the description of the physical ***situation***, ***form a mental image*** of what is happening, ***determine*** the physical ***principles*** involved, and ***decide*** on the ***reasoning*** you will use to answer the questions.

2) ***Sketch the geometry*** of the situation, ***labeling*** your drawing ***with*** appropriate algebraic ***symbols***. ***Write down*** (e.g. on the drawing) any values ***given and*** what you are asked to ***find***.

3) ***Write down*** the relevant ***principles*** (in words) ***and/or algebraic formulas***.

4) Finally (*not earlier*!), ***do the mathematics*** (i.e. solve for unknowns using algebra, plug in, calculate) ***and obtain numerical results, with units***;

5) To conclude, ***check*** that ***results*** are reasonable and ***write a complete sentence*** answering the question posed by the problem.

Two Types of Drawing Commonly Used in Physics

Sketch - A drawing showing the geometry of a physical situation, with location of particles and/or other objects, their motion if any, and relevant physical quantities such as the forces (with directions) tending to influence that motion. It is drawn as it might be seen by the naked eye or through a special microscope or telescope and includes relevant algebraic symbols, values, and/or descriptive phrases as properly placed labels.

Graph - A drawing using two (or more) axes showing the relationship between dependent variable(s) and independent variable(s) as a curve (or more than one curve), with axes labeled to show the range of values of independent and dependent variables. In a two-dimensional graph (two axes), by convention the independent variable corresponds to the horizontal axis (- to + runs left to right) and the vertical axis corresponds to the dependent variable (- to + runs bottom to top); each point on the graph is defined by an ordered pair of values, which can be written in parentheses as:

(value of independent variable, value of dependent variable).

Minimum Mathematical Background (Prerequisite: MA 106 or equivalent)
Required for PH 101-103 and PH 221-222 (with calculus)
by David G. Agresti, Professor of Physics, UAB
Bring to all classes: Scientific calculator and centimeter-based ruler and/or triangles.

1. Arithmetic

+ , - , $\times$ (or $\cdot$) , $\div$ (or /) , and powers

Examples: $4 \times 6 - 7 \times 5 = -11$; $1 / (1/3 + 1/7) = 21/10 = 2.1$; Note order!
$1/x^4 = x^{-4}$; $x^6 \cdot x^3 = x^9$; $x^2 \div x^{-4} = x^6$; $\pi = 3.14159...$
$x = (\sqrt{x})^2$; $x^{1/3} = \sqrt[3]{x}$; $(x^9)^{-4} = x^{-9/4}$; $e = \exp(1) = 2.718...$
$x^0 = 1$; $e^{2.30...} = 10$; $\ln(10) = 2.30...$; $10^{0.434...} = e$; $\log(e) = 0.434...$

2. Scientific Notation

Powers of 10

Examples: $0.000157 = 1.57 \times 10^{-4}$; 1,320,000 $= 1.32 \times 10^6$ (both have 3 sig. digits)
$1.57 \times 10^{-4} \times 1.32 \times 10^6$; $1.57 \times 10^{-4} / 1.32 \times 10^6$; $1.57 \times 10^{-4} + 1.32 \times 10^{-6}$

3. Geometry

Drawing and properties of 2 and 3-D figures

Examples: Properties of rectangles, triangles, cylinders, spheres, etc.
Formulas for areas, volumes, perimeters of above
Angles in triangles and intersecting lines; degrees and radians
Compass directions; vectors and vector operations (optional)

4. Trigonometry

Relations among sides (a, b, c) and angles (α, β) in a right (90°) triangle
Find missing information, given two sides or one side and an angle ($\neq$90°)

Examples: $\sin\alpha = \text{opp/hyp} = a/c$; $\cos\alpha = \text{adj/hyp} = b/c$;
$\tan\alpha = \text{opp/adj} = a/b$; $\alpha = \arcsin(a/c) = \sin^{-1}(a/c)$, etc.
$a^2 + b^2 = c^2$; $\alpha + \beta = 90°$; $\sin^2\alpha + \cos^2\beta = 1$

5. Graphing

2- and 3-D figures showing functional relationships and position in space

Examples: Position coordinates in 2-D: (x,y) ; (r,θ)
Position coordinates in 3-D: (x,y,z) ; (ρ,ϕ,z); (r,θ,ϕ)
Functions of one and two variables: $y = f(x)$; $z = g(x,y)$
Graphs of simple functions: $\sin(x)$; x^2 ; $e^x = \exp(x)$; etc.

6. Algebra

Manipulation of expressions with variables

Examples: Addition of polynomials
Solving quadratic equations
Solving for unknowns in one or more equations
Note two rules for equations:
Do unto one side as you do unto the other.
N unknowns require N independent equations.

7. Proportions and ratios

Change in one variable when another one changes

Examples: Suppose $a = b/c$. Then, *assuming the other quantity is constant*:
Direct proportions are: $a \propto b$; $b \propto c$; (read: "a is proportional to b")
Thus, e.g., if b is doubled, then a is doubled also.
Inverse proportion is: $a \propto 1/c$; ("a is inversely proportional to c")
Thus, if c is doubled, then a is halved.
Ratios: Direct prop.: $a_2/a_1 = b_2/b_1$; or $a_2 b_1 = a_1 b_2$ (ratio is constant)
Inverse prop.: $a_2/a_1 = c_1/c_2$; or $a_2 c_2 = a_1 c_1$ (product is constant)

8. Use of the calculator

Scientific calculator is required.

Examples of calculator operations you should be able to perform:
$+$, $-$, $\times$ ($\cdot$) , $\div$ (/),
$x^{-1} = 1/x$, x^2 , $\sqrt{x}$, x^3 , x^y , $\sqrt[y]{x} = x^{1/y}$,
ln x , log x , e^x , 10^y ,
sin x , cos x , tan x , $\sin^{-1} x$, $\cos^{-1} x$, $\tan^{-1} x$,
sinh x , cosh x , tanh x , arcsinh x , arccosh x , arctanh x (optional)

9. Calculus (required only for PH 221-222)

Simple derivatives, integrals, and related concepts,
including analytic geometry, limits, slopes, and extrema

Examples: Derivatives of simple functions: x^2 ; x^n ; sin x ; ln x ; e^x
Graphical interpretation of slope; rate
Maxima, minima, inflection points
Antiderivatives of simple functions
Definite integrals, area, volume

Due May 15, 2006
Homework #1, from the Text:

→Chapter 1: Numbers 45, 46, 48, 50, 52(i,iii), 54(i,iii).

For numbers 45, 46, 48, graph each function and its inverse. For the straight line graphs, a table of values of plotted points is not required.
For numbers 52, 54, show the original angle on an axis cross (with the four quadrants shown). Sketch the fully labeled right triangle used to get the answer.

Please fill out lower half of page, and hand it in after lecture.

PH 100-MC – May, 2006

Name _____

Student Number _____

Major _____

Most advanced math course _____

e-mail address (if any) _____

Other contact point, if no e-mail _____

Permission to communicate grades and other evaluation
by e-mail or to other contact point (please sign) _____

Thanks,
Prof. Agresti