

## SOME P201 COURSE MATERIALS

R.R. Hake, Indiana University, Bloomington, IN 47405

### OBJECTIVES OF THE PHYSICS P201 COURSE (from Information Sheet distributed to students in Spring 1994)

Physics is concerned with the creation of theories or models (based on and tested by experiments) to account for the behavior of nature. Such accounts attempt to "predict or explain the maximum number of observable phenomena on the basis of the minimum number of basic premises." The current world view of nature is to a large extent contained in just *four* theories containing a total of only *eleven* laws or equations: Newtonian mechanics (Newton's three laws), thermodynamics (three laws) and statistical mechanics, electromagnetism (Maxwell's four equations), and quantum mechanics (Schrodinger's equation).

***The primary objective of the present P201 course is to help you ASCEND TO THE NEWTONIAN WORLD by achieving (a) a thorough understanding of the basic concepts of Newtonian mechanics (including wave phenomena), (b) the ability to apply this understanding to the solution of physical problems.*** The latter capability will be enhanced by a problem-solving emphasis on *critical thinking* and *effective problem-solving strategies* as used by scientists and as emphasized in the research-based course materials: the Reif Text & Workbook and the Socratic Dialogue Inducing Lab Manual.

The focus of the present course, as stated above, should help to prepare you for admission exams to professional and graduate schools. These exams increasingly emphasize conceptual understanding, problem solving, and critical thinking rather than mere regurgitation of memorized factual material. There is a growing realization that personal satisfaction and career success in a world of rapid change and vast electronic data banks will depend more on your ability to ask questions, think, learn new things, and understand concepts than on your memory capacity. Some material (e.g., solids and fluids, fluids in motion, thermodynamics, and sound in Chapters 9--13, 15 of the secondary text by Serway and Faughn) which sometimes appears on standardized tests such as the MCAT will *not* be covered in P201-2. However, such topics should be relatively easy for you to learn on your own if you understand the basic concepts and learning strategies emphasized in P201-2.

Experience has indicated that most students attain conceptual understanding and problem-solving ability only by *interactive engagement with* (not passive absorption of) course material: (a) *active* study of texts and workbooks, (b) *drawing a labeled diagram* and then working out as many problems as possible, (c) *vigorous* participation in lectures and demonstrations, (d) *dynamic* involvement in discussions and laboratories, (e) *diligent study and discussion of physics with instructors and student colleagues*. In order to learn physics it is essential that you ***take responsibility for your own learning*** and not regard yourself as a passive receptacle into which physics knowledge is to be poured.

**P201 ACADEMIC BACKGROUND QUESTIONNAIRE** (Spring 1995, R.R. Hake & R. Van Kooten)

NAME \_\_\_\_\_

LAST (Print Clearly)

First (Print Clearly)

ID Number

Class (*Encircle One*): Freshman; Sophomore; Junior; Senior; Graduate; Non-degree; Other (specify)\_\_\_\_\_.

**I. HIGH SCHOOL** (Please place a check \_\_\_ AFTER those you HAVE completed.)

- A. Algebra\_\_\_; B. Geometry\_\_\_; C. Trigonometry\_\_\_; D. Analytic Geometry\_\_\_; E. Calculus\_\_\_;
- F. Other Math Courses (Specify)\_\_\_\_\_;
- G. Biology\_\_\_; H. Chemistry\_\_\_; I. Physics\_\_\_ at \_\_\_\_\_ High School in (town&state) \_\_\_\_\_
- Physics taught by (teacher's name)\_\_\_\_\_; J. Geology (or Earth Sciences)\_\_\_;
- K. Astronomy\_\_\_; L. Other Sciences (Specify)\_\_\_\_\_
- Comments (e.g., please indicate AP, ACP, research projects, quality of courses, etc.)\_\_\_\_\_

**II. UNIV. SCIENCE COURSES COMPLETED** (at IU give No. or title, elsewhere give title & Univ.)

- A. Physics\_\_\_\_\_.
- B. Chemistry\_\_\_\_\_.
- C. Biology\_\_\_\_\_.
- D. Computer Science\_\_\_\_\_.
- E. Geography\_\_\_\_\_.
- F. Geology\_\_\_\_\_.
- G. Psychology\_\_\_\_\_.
- H. Environmental Studies\_\_\_\_\_.
- I. Engineering\_\_\_\_\_.
- J. Other Sciences (Specify)\_\_\_\_\_.
- Comments\_\_\_\_\_.

**III. UNIV. MATH COURSES** (Please place a check \_\_\_ AFTER those you HAVE completed.)

- A. M014 Basic Algebra\_\_\_; B. M110 Excursions into Math\_\_\_; C. M118 Finite Math\_\_\_;
- D. M119 Survey Calculus I\_\_\_; E. M120 Survey Calculus II\_\_\_; F. M125 Pre-Calculus\_\_\_; G. M126 Trig. \_\_\_;
- H. M215 Calculus I\_\_\_; I. M216 Calculus II\_\_\_; J. M217 Accelerated Calc. \_\_\_; K. K300 Statistics\_\_\_;
- L. M301 Linear Algebra\_\_\_; M. M303 Linear Algebra\_\_\_; N. K310 Statistics\_\_\_; O. M311 Calculus III\_\_\_;
- P. M312 Calculus IV\_\_\_; Q. Other Math Courses at IU (Specify)\_\_\_\_\_.
- R. Math Courses Elsewhere (specify title & Univ.)\_\_\_\_\_.
- Comments\_\_\_\_\_.

**IV. SOME QUESTIONS** (Please use the back of this sheet if you need more room.)

- A. What is your major (or intended major)?\_\_\_\_\_.
- B. Are you headed for a Professional or Graduate School? Yes\_\_\_; Maybe\_\_\_; No\_\_\_; Other (specify)\_\_\_\_\_.
- 1. If "Yes" or "Maybe," what type? Medical\_\_\_; Dental\_\_\_; Physical Therapy\_\_\_; Medical Technology\_\_\_;
- Sports Medicine\_\_\_; Optometry\_\_\_; Computer Science\_\_\_; Chemistry\_\_\_; Biology\_\_\_; Botany\_\_\_; Law\_\_\_;
- Business\_\_\_; Other (specify)\_\_\_\_\_.
- C. What minimum grade do you think you need to achieve in P201? (Encircle) A B C D F Any
- D. Are you left handed? No\_\_\_; Yes\_\_\_; If "yes," do you prefer a "left-handed seat" for exams? No\_\_\_; Yes\_\_\_.
- E. Are you color-blind? No\_\_\_; Yes\_\_\_; If "yes," which colors can you *not* discriminate?\_\_\_\_\_.
- F. Are you male or female? Male\_\_\_; Female\_\_\_.
- G. Do you have other comments? If so, please write them below (or on the back of this sheet):

**NOTE: TO AVOID AN "F" IN P201 YOU MUST HAND THIS IN BY 5 PM, WED., 18 JAN., 1995.**

## **GAG : Grading Acronym Guide** (R. R. Hake, 1/14/94)

### A. Usually Automatic One Point Off

<b>ND</b>	<b>No Diagram</b>
<b>NDC</b>	<b>Not Dimensionally Correct</b>
<b>NF</b>	<b>No Formula</b>
<b>NR</b>	<b>Non Reduction</b> of answer to simple one-number form
<b>PA</b>	<b>Physically Absurd</b> (as $m_{\text{ball}} = 1.8 \times 10^{46} \text{ kg}$ )
<b>U</b>	<b>Units</b> (missing or erroneous)
<b>NPI</b>	<b>No Plug In</b> (of numerical values in a problem asking for a numerical answer)

### B. May Receive Zero Credit (even if answer is correct)

<b>NJ</b>	<b>No Justification</b>
<b>RNWP</b>	<b>Right Number Wrong Physics</b>
<b>BPI</b>	<b>Blind Plug In</b> (No apparent physical understanding)

### C. Poor Technique or Lack of Understanding

<b>NMD</b>	<b>No Meaningful Diagram</b>
<b>BD</b>	<b>Bare Decimal</b> (write "0.12", <i>not</i> ".12")
<b>UGH</b>	<b>Ugly, Ghastly, Horrible</b>
<b>MA</b>	<b>Mathematically Absurd</b>
<b>UVF</b>	<b>Use Vertical Fractions</b> (esp. in doing unit cross-outs)
<b>VTOP</b>	<b>Vector Tails On Point</b>
<b>VTOB</b>	<b>Vector Tails On Body</b>
<b>DDTD</b>	<b>Don't Draw Tiny Diagrams</b>
<b>UCS</b>	<b>Use Color Code</b>
<b>VHA</b>	<b>Vertical and Horizontal Axes</b>
<b>SFAB</b>	<b>Subscript Force on body A by body B</b>
<b>CINW</b>	<b>Come Into the Newtonian World</b>
<b>ZEZK</b>	<b>Zero Effort Zero Knowledge</b> (pronounced "zeek" like geek)
<b>LAA</b>	<b>Learn About Algebra</b>
<b>LAU</b>	<b>Learn About Units</b>
<b>LAVD</b>	<b>Learn About Vector Diagrams</b>
<b>LAPT</b>	<b>Learn About Powers of Ten</b>
<b>LASF</b>	<b>Learn About Significant Figures</b>
<b>LAE</b>	<b>Learn About Equations</b>
<b>LAM</b>	<b>Learn About Mechanics</b>

### D. You Get a Break

<b>WBC</b>	<b>Wrong But Consistent</b> (You may get near full credit if your ONLY mistake was to substitute a wrong answer from an earlier part of a problem)
------------	--