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**PHYS-1070 (18) Elementary Physics (CRN:20592-Kaldon)**  
*Western Michigan University*

Dr. Philip Edward Kaldon  
2203 Everett Tower  
Office: (269) 387-4942 Dept: 387-4940 FAX: 387-4939 Internet:  
philip.kaldon@wmich.edu  
1-xxx-xxx-xxxx (Home) <http://homepages.wmich.edu/~kaldon/>  
Class: MTu ThF 2:00-3:40pm 1110 Rood Hall  
Office Hours: MTu ThF @ 10:10-11:50am, MTu Th @ 4:00-5:00pm –  
or stop in or by appointment.

Summer I 2006  
Version 18.03

<http://homepages.wmich.edu/~kaldon/classes/ph107-18.htm>

**PHYS-1070 + PHYS-1080 is the same course as the old course PHYS-109**  
**PHYS-1070 has a Laboratory Component – You Must Register for PHYS-1080 separately.**  
**Your Lab starts after Labor Day, the week of Sept. 7th; check outside lab door.**

**PHYS-1070 is the Physics Course You Missed in High School**  
**So Attendance is NOT Optional.**  
**BUT... There is Nothing to Be Scared of – We WILL Get You Through This!**

**Please Note That There Are Many Different Parts to This Course.**  
**You Must Complete All of Them To Receive Your Participation Points.**

**Three-Times Rule:** It is University policy that the number of times a course can be taken is limited to three (including withdrawals). A student whose current enrollment is in violation of this policy must drop this course as soon as possible and no later than the deadline for no refund of tuition.

**C -or- Better Requirement:** It is Department policy that a grade of “C” or better in a prerequisite course is required before enrollment is permitted in the next-sequence course. A student who does meet this requirement must drop this course as soon as possible and no later than the no-refund deadline.

**Textbook:** Inquiry Into Physics / Vern J. Ostdiek and Donald J. Bord (5th Edition)  
[hereafter known as “O & B”] NOTE: New Edition!

**Supplies:** A standard inexpensive calculator is recommended. One with trig functions (sin, cos, tan) will prove useful. (We can help teach you how to use this tool.)

**Math Level:** It is perfectly normal to approach a course such as PHYS-1070 with a certain level of math anxiety. Science so often appears as a numbers game, yet there is a lot of information contained in those numbers. We will work toward a reasonable proficiency of reasonable calculations, consistent with the course content and the abilities of the class. Rote memorization of complex formulas is not part of this course.

**Prerequisites:** MATH-1100 or equivalent. A previous high school knowledge of algebra, and some geometry and trigonometry is expected for this course, but we will go over the details in class. Since Physics is a kind of applied mathematics, many students feel uncomfortable about Physics because they

Note: This Syllabus is Updated from files for previous semesters and previous courses. Every attempt has been made to keep it current to the Summer-I 2006 Semester and PHYS-1070 at Western Michigan University. Please Report any errors or inconsistencies immediately to Dr. Phil.

are uncomfortable about their math skills. Although we do not have time to extensively review mathematics in this course, help is available on campus! Don't delay if you need help.

**Significant Dates:**

- May 8 Mon - PHYS-1070 Begins for Summer I Session 2006
- May 11 Thu - *Regular Daily Quizzes Begin*
- May 12 Fri - Drop/Add Ends (100% Refund)
- May 12 Fri - Last Day to Drop without "W"
- May 19 Fri - Hour Exam 1**
- May 24 Wed - Hour Exam 1L – for students enrolled after Week 1**
- May 29 Mon - Memorial Day < No Classes >
- June 2 Fri - Hour Exam 2**
- June 5 Mon - Last Day to Drop with "W"
- June 15 Thu - Topic 1 (Book Report) (due by 5pm Thursday)**
- June 16 Fri - Hour Exam 3**
- June 19 Mon - Grace Period for Topic 1 ends at 5pm**
- June 23 Fri - Last Regular Day of Class
- June 26 Mon - Review Class
- June 27 Tue - Final Exam 2:00-3:40pm (2 hours)\*\***
- June 28 Wed - End of Summer I Session @ Noon
- July 3 Mon - Grades Due at Noon

“All Exam dates are fixed in stone.” See Dr. Phil otherwise.

**Office Hours:** There are scheduled office hours every day of the week. A copy of Dr. Phil's schedule is posted on the door to his office, so you can figure out when I am already committed to be elsewhere. You are perfectly free to make office appointments. If you are planning to stop by during a regularly scheduled office hour, I would appreciate a comment from you before or after class, but this is not necessary. Note: Office hours are provided for your benefit. They don't do me any good, but I do get lonely from time to time. Which is really strange come exam time...

**Grading Scheme:**

	A	AB	B	BC	C	CD	D	E
%-age	100-95	94-90	89-85	84-80	79-75	74-70	69-65	64-0

**The Million Point Grading Scale:** There has been much talk about grade inflation in recent years. Well, here's an example of grade hyperinflation: the total number of points this semester will be 1,000,000. Seriously, our modern society tends to use a lot of very large and very small numbers, and the million point grading scale is very useful to break some prejudices about grades and have some fun at the same time.

Final Exam	200,000	20%
3 One-Hour Exams (100,000 pts ea.)	300,000	30%
20 Quizzes (15,000 pts each)	300,000	30%
Special Topics (Papers, etc.)	200,000	20%
Laboratory ( <i>see PHYS-1080</i> )	–	0%
<b>Total Points</b>	<b>1,000,000</b>	<b>100.0%</b>

**“The Instructor reserves the right to curve grades.”**

**Catalog Descriptions:** **PHYS 1070 Elementary Physics – 4 hrs.** – This course surveys physics from mechanics to modern physics in one semester. It is designed for students in curricula requiring a one semester course at the level of general college physics.

Prerequisite: MATH 1100 or equivalent. Corequisite: PHYS 1080.

**PHYS 1080 Elementary Physics Laboratory – 1 hrs.** – This is a laboratory course which includes exercises related to topics covered in PHYS 1070. Corequisite: PHYS 1070.

**Course Goals:** TO BECOME KNOWLEDGEABLE and FUNCTIONAL in using physical science concepts and conceptual relationships to describe, predict and explain events in the everyday world. TO UNDERSTAND the basic nature of science, that it consists of two kinds of truths, some observationally true and other truths that are accepted because of supported theories. TO UNDERSTAND how scientists talk about the world and to understand how this differs from how non-scientists talk about the world. TO ACCEPT the importance of the knowledge of “how we know something is so” in science. TO UNDERSTAND the importance of prior conceptions about the physical world in learning (and teaching) physical science and how it interacts with Nature.

**Laboratory:** Lab is an integral part of any serious study of Physics. Lab is handled separately by your lab instructors, and for Summer I 2006 is once again registered for as a separate 1-credit course, PHYS-1080. Unless Dr. Phil is your lab instructor (which won't happen this semester), don't bug Dr. Phil with specific questions about the lab.

**The Textbook:** You will very quickly learn that Dr. Phil does not drone on and on, reading straight out of the textbook (O & B). In this class, the textbook serves as a “second voice” so that you can see the same material presented in a different way, with different examples. We will not necessarily go in a linear fashion through the book, despite the Topic calendar on the last page of the syllabus. You should keep up with where we are in the textbook as part of your daily study habits. *Reading ahead to the next section may significantly improve your comprehension of lecture.* In addition, you should make it a habit to check the class web site, which also includes a brief discussion of what was covered in class, along with some important examples and equations. The time to ask questions about differences between what is in your notes (which may or may not be what was on the blackboard) and what you find in O & B, is the next class period. Most of the differences come from differences in notation, or from errors in transcribing Dr. Phil's enthusiastic but sometimes illegible scrawl on the board. Occasionally mistakes crop in – you'll notice that Dr. Phil doesn't work from prepared notes, preferring to work “without a safety net” – we try to correct them As Soon As Possible. Bottom line? You *always* have something to do when you use your notes and your books to good advantage. DON'T get behind – the next test is sooner than you think!

**New or Used?** There's no denial – buying a Physics textbook is expensive. The Old Rule was that it was a Significant Investment, part of your growing library of reference tools that you will keep and use throughout your career. One look in Dr. Phil's office should convince you that I have never sold a single textbook. But today, most students “rent” their texts, selling them as soon as they are “out of here”. But for a new edition, like O & B 5<sup>th</sup> edition, there's not a huge number of used copies around. So should you buy New or Used? Here's a hint: You want CLEAN. There have been studies that show that previously marked-up or highlighted textbooks may do you a real disservice: (1) Your eye will be drawn to whatever the previous reader marked, not what is emphasized by the author – remember the author and publisher are PAID professionally, the previous reader is NOT; (2) Different readers mark or highlight differently – some mark only what is important, some mark what is difficult or obscure, some are trying to cross out what they *don't* need – any way you cut it, it is unlikely you would mark it the same way; (3) Simple statistics should convince you that the average marked-up copy you pick up was marked by a less than ace student – we don't hand out A's in Physics, you *earn* them. Now Dr. Phil is NOT trying to tell you to

buy new books, but he IS urging you to invest your money wisely. Remember, relying on someone else's marking, when it is YOUR career, your grades and your tuition money you're dealing with, means you should really give this some thought. As far as your own marks – hey, it's your book. But remember that light pencil erases and Post-It™ notes are removable.

**Homework:** O & B provides a variety of thought questions and exercises, which are very useful as warm-ups – *this should not take a huge amount of your time!* Additional problems will come on handouts in the form of Sample Exam pages – actual Dr. Phil PHYS-1070 exams given to actual Dr. Phil PHYS-1070 students. Which problems should you do for homework? Well... “all of them”. Or at least all that you need to do. It's part of the daily work you need to do to keep up. The study of Physics is also a study of problem solving and practicing the manipulation of variables and formulas. This H.W. will not be turned in, but you will be responsible for it. It does no good to just hand out detailed solutions for all the problems, because then people tend not to actually work on the H.W., they just study the solutions. That's like only reading a book about running in order to prepare to run a race.

**Work To Hand In:** All work that is to be handed in (which includes Quizzes, Exams, Papers, Special Topics) must include your name (you'd think that would be obvious, but...) – PAPERS WITHOUT NAME MAY NOT BE GRADED! **Staples:** Any papers turned in that are supposed to be stapled, but aren't, are subject to a 3000 point penalty. Any papers turned in with a *fold-and-tear* corner will get an automatic 5000 point penalty. **Late Papers:** lose 10% (one letter grade) per day, but it is better to *do the work at all* than turn in nothing.

**Writing Assignments:** There will be outside reading and writing assignments: this includes a science literacy opinion paper on a book from a booklist that will be provided in the first week. Complete instructions will be in the Topic 1 handout. The full booklist will be available on the class website (to save trees). The paper is due Thursday June 15th by 5pm. There will be a penalty for each day a paper is late. *A grace period is included in the schedule.* A second assignment, Topic 2, deals with collecting some real-world data and will be discussed later in the course.

**Quiz Schedule:** Expect to have a quiz every day (starting May 11th – Quiz 1 is for taking attendance). Quiz problems will be based on the assigned homework UNITS, SIGN, POWER OF TEN and VALUE of your ANSWER will all be evaluated on numerical problems. Reasonable units and significant figures are required. You must CIRCLE your ANSWER. Work must be shown to receive credit, though the work itself may not be evaluated. There will be twenty-three 15,000 point quiz problems; the lowest three will be dropped. There will be no further adjustment of quiz grades. Quizzes may sometimes be graded on an “all-or-nothing” basis and cannot be made up, though up to three zeroes can be dropped.

**Exam Schedule:** There will be three hour exams, scheduled for **19 May 2006, 2 June 2006 and 16 June 2006 – all these are on FRIDAY. Schedule these dates and times now.** These exams will be closed-book, but you will be allowed to bring a **FORMULA CARD**. On this “card” (includes cards, paper, spiral bound note cards), you may write down any formula, physical constant, definition or a brief note on any historical figure that you feel is relevant or useful; short examples are allowed but *you may not include worked out problems.* Formula cards will be turned in with the exam, with a deduction for an illegal formula card. Each exam is worth 100,000 points. Scores may be adjusted on a curve to meet the Grading Scheme noted above. Exam questions will vary, but will include some complex problems that will test your understanding of and ability to apply the material. You may be surprised to hear this, but I do *not* expect you to be able to do 100% of the exam; in all likelihood, you've probably never taken exams like this before. They won't really get any easier, but you will get used to them. Review sessions for the exams will be scheduled as the exams near.

The Final Exam will be **Tuesday 27 June 2006** with a REVIEW class on Monday June 26th. This is our Final Exam date – it is a major inconvenience to produce a final at another time, so plan your Finals Week accordingly. The Final is worth 200,000 points. It is cumulative and you can use your previous

formula cards. It may emphasize concepts and relationships over number crunching. If a curve is used on any exam, it will only bring grades up. If you have any special needs – see Dr. Phil *early* in the semester!

#### **Exam and Quiz Policy**

For all exams, you are expected to sit with at least one space between you and the next person in your row. If this is not possible, we will alternate versions of the exam. For all exams and in-class quizzes: You are allowed your “legal” calculator and formula card(s), and a pen or pencil (do not use red). Pre-printed commercial physics and math summary sheets, such as are available laminated in the bookstore, do NOT count as your self-made formula card. Dr. Phil can be very generous, but when he calls for all papers to be turned in, you must turn them in – if you want it graded.

#### **Make-Ups:**

Quizzes cannot be made up. You are expected to attend classes anyway, but this is especially true of laboratories and examinations. Provided you have a valid reason for missing class (illness, etc.), if you miss: (1) a lab you must contact the appropriate instructor as soon as possible to see if you can make up the lab; (2) an exam, you must contact me as soon as possible to let me know you won't be there, and the later to arrange an exam within a few days. *Dr. Phil dislikes having to write up new exams for people.*

#### **Late Quizzes:**

Most take-home quizzes can be turned in by 5pm on their due date if they are not ready to turn in at class time. Some take-home quizzes *may* be made up, provided the solutions have not been given in class or posted on the class web site. If Dr. Phil starts going over a quiz problem you have not turned in, please turn it in immediately. If two or more quizzes are being turned in on any given day, PLEASE make sure that they are in separate piles.

#### **Catastrophes**

People do get ill, have deaths in the families or have a “really bad test day” from time to time. Dr. Phil is interested in teaching Physics and looking for progress from people. “It will all work out in the end.”

**The Professional Concerns Committee of the Faculty Senate recommends that all faculty include the following paragraph in each syllabus that they prepare for the upcoming semester:**

“You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate (pp. 274-276) [Graduate (pp. 25-27)] Catalog that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with me if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.”

#### **Introductions**

#### **Hello, World**

In computer programming, one of the first programs you learn to write in a new computer language is a simple one that has the computer printing “hello world” so that you know that you can get information out of the computer. Here are a few thoughts and comments that I include to give you some things to read and think about from the beginning.

**Dr. Philip Edward Kaldon** - Born western upstate New York; Junior High near New York City; High School in Greensboro, North Carolina (1976). B.A. Integrated Sciences, Northwestern University (1980); M.S. Physics, Michigan Technological University (1986/88); Ph.D. in Applied Physics, Michigan Technological University (1989). Physics Teaching: WMU, KVCC, GVSU, Hope College. Former President—Michigan Section of the American Association of Physics Teachers (MIAAPT). Dr. Phil

pursues many science and science literacy efforts, and on the first day of class, he is on Day 3054 of writing a massive science fiction romantic epic novel. A fourth readable draft of a complete novel, The Devil's Coffin, set in the same sci-fi universe, is on Day 1872. No – it's not ready for you guys to read yet. After sending out thirty-seven short stories one-hundred times, Dr. Phil has two stories published in anthologies and four more slated for publishing in 2006-7. “The Pulse of the Sea”, Dr. Phil's first commercial sale, was published in September 2005. No – Dr. Phil has no intentions of making you read his fiction. But he did attend the prestigious 2004 Clarion Science Fiction and Fantasy Writers Workshop, an intensive six-week boot camp for SF writing, so he is well on his way to becoming a real science fiction author!

#### **What Do We Need A Calculator For?**

Although much of what we are trying to accomplish is hands-on experience, we need to use numbers sometimes. And most of you can't tell me what 4/5ths of 137 is off the top of your head anyway... <grin> (me neither). On the other hand, we'll be doing things with calculators that many of you have never seen done before! So, it is very important to make sure that you can do all the neat things we have to do.

#### **The First Thing You Should Do Each Day When You Come Into Class...**

(after getting comfortable and pulling out your notebook and pencil)

... And Turning OFF The Ringer Of Your Stupid Cellphone and Pager...

(but being a clever and caring student in 2006 you thought of that already, right?)

...Is To Take OUT Your Calculator And Have It Ready At All Times

(it doesn't do you any good all closed up in your book bag, or at home)

#### **Small Group Work**

If you are expecting dull lectures that you can either skip or use to catch up on your sleep or ignore while you work on the homework for your 1:00 class – forget it. This class has an interactive component to it. But more than just making you do some work *in* class, you will find yourself a part of a larger team who will try to work through our fun & games!

#### **Study Groups**

You may find that studying by yourself can be difficult. As is stated elsewhere, we are trying to change the way that you think – sometimes this means you need a different perspective. This is where working with someone may prove useful. Gosh, maybe that Small Group you'll be working with *in* class might be useful to you *outside* of class. If you wish, that is.

#### **Why Is The Grading Scale So High?**

Maneuvering room. A certain number of points are assigned on the basis of attending and participating in our class activities, so that tends to keep point totals high. But rest assured, exam and course grades may be curved up to keep things high, too. If you're comfortable with what we are doing in class, you're doing fine. If it all seems foreign and makes you ill, that's natural, too. Feel free to get in touch with me and talk things out. You need this class and I'm here to help you.

#### **Grading:**

The process and the concepts are so important, that getting the correct numerical answer is sometimes the least important part of a calculation. Therefore, there will be some partial credit on some exam problems for taking the correct line of reasoning, even if the answer is wrong. This does not excuse you from taking reasonable care in a calculation!

#### **“My Side” of the Table**

It's a small point, but the front lab table is divided in Dr. Phil's mind between "my side" and "your side". Please do not ever pick up papers from Dr. Phil's side of the table. Sometimes they are not for your class, sometimes they may be your papers that have not yet been recorded in my grading spreadsheets. (If they are never recorded, then they are still 0's.) You may think that it makes sense to grab graded papers from both sides of the lab table, but that blocks my access to my piles and the blackboard, which slows things down for everyone. So, "stay on your own side of the table" will make things move smoother for all.

#### **What's My Grade?**

Part of keeping up with the workload in PHYS-1070 is knowing where you stand in the class. There is a delay, however, between when work is handed in and when it gets back to you. We endeavor to get Exams back to you within one week of when they are given. Quizzes have tended to get batched and backlogged – a new system for Fall 2004 should get quizzes turned around faster. Grades are recorded in a Microsoft Excel 7.0 spreadsheet. After the first exam is graded, Dr. Phil will create The Predictor, which basically fills in all the final grade columns with estimated answers, even though most of the work of the semester has not been actually done yet. The Predictor uses actual Exam and Quiz scores to estimate what their final values will be, based on your past performance. By the time 7 to 10 quiz grades are recorded, The Predictor will start dropping your three current lowest quiz grades. The Topics (such as the Book Report) are automatically given the lowest "B" grade of 85%. Once The Predictor is set up, you can always stop by office and see what your current projected grade is, or send me e-mail (along with your PHYS-1070 Personal ID number [PID]) and I will e-mail your current projected grade. Posting grades on Dr. Phil's office door or at the back of the lecture room is usually done around the exams, sorted by your 5 digit PID, but this information has a short shelf-life. Check the Post date on the printout. During Spring 2001, someone kept stealing (or just throwing out) my printouts, which is very odd behavior.

#### **What's The Answer?**

I am currently making available solutions to the Exams, so that you will know what the correct (or at least Dr. Phil's version) answer to a problem is. Most quizzes will be gone over the next class period, again so that you will have the correct answer. (Check the class website!) This is easiest for the in-class quizzes – take-home quizzes have a tendency to dribble in over a few days, so there's no point in giving people the answer before they get their papers in! I do not usually give out answer sheets to the Sample Exam Problems, on the theory that you don't have the answers on a real exam, so you need to learn how to PTPBIP – and it encourages students to study together, compare notes or even come to Dr. Phil's office hours. Sometimes I feel like the Maytag™ repairman – it's lonely in my office at office hours.

#### **Extra Credit:**

I don't "do" extra credit. Students who wish extra credit primarily do so because they aren't using their time effectively already, so why would I wish you to divert even more of your valuable time on additional work?

#### **E-Mail**

The university is in the process of changing how e-mail is handled on campus. The following language has been suggested for inclusion in Fall 2004 Syllabi:

"The only email address that should be used by WMU students and WMU faculty and staff is the email address that typically takes the form "firstname.middleinitial.lastname@wmich.edu" or "firstname.lastname@wmich.edu". An example is buster.h.bronco@wmich.edu. Email users will not be able to automatically forward email from this address to other addresses. Students and faculty can access this email account via their BroncoNet ID or get instructions for obtaining a BroncoNet ID at GoWMU.wmich.edu."

#### **Some Helpful Information**

#### **Units, Numbers and other parts**

For a business that relies so heavily on numbers, it is very rare that the answer to a Physics problem is just a number, like "five". "Five what?" is usually a reasonable question, so units are a very important part of a number. Indeed, if you keep units with their respective numbers, units can be used to save your life in a problem. If you are expecting a velocity and get an answer that isn't in units of a velocity, then it may be possible to find your mistake. Likewise, the sign of an answer can be very important in some problems. Your bank has no trouble with telling the difference between having a \$500 checking account balance and being overdrawn with a -\$500 balance, for example; these are very different answers. One must also watch out for powers of 10, since the metric system is based on a decimal system, just like the American money system. A kilometer is a kilo-meter or 1000 meters. Another number problem: 4.97 is a number that is about five, but 4.97 is not the same as 5.00. Again, your own background with money can help you. Your calculator is not very intelligent, so you must determine which numbers in the display represent significant figures, based on the actual numbers you used as input to your calculations. This is particularly important in lab; in lecture and discussion, you will find that we tend to use "reasonable" numbers in answers. I cannot guarantee that you will get exactly the same answer as I do, since the order you do math operations and the brand of calculator can have some impact on the final result.

**FOR SUMMER-I, UNITS WILL BE REQUIRED IN ALL INTERMEDIATE CALCULATIONS JUST AS DR. PHIL DOES THEM ON THE BOARD – FAILURE TO KEEP UNITS WITH NUMBERS WILL COST POINTS.**

#### **Natural Philosophy**

Physics was once called Natural Philosophy in colleges and the term has some very good connotations. Physics is a study of Nature and how Nature operates. Physics is often a philosophical arena, where meaning and understanding are gleaned, debated and tested from observations of the real world, experiments in the laboratory, with theories and long "what-if?" and "what-about?" sessions. I often suggest to students that "We are here to change the way that you think" and this is borne out in the many students who comment at the end of the course that they do think about and see the world is a different way. Many tell of how sick to death their friends and family are to here them babble on about "this is how that works" or "don't you wonder why that happened?" Most people go through life not thinking those thoughts or asking those questions. (Or else believe that it must be too difficult for them to understand.)

#### **Common Sense**

It is sometimes thought that good Physics thinking is just good Common Sense. All of us have some idea how at least part of the world works, but Common Sense doesn't always seem to be so Common among us, or so Sensible. Instead, we will work to a logical model of how things work, one that is independent of personal feeling (red cars don't really go faster than blue ones). This is not easily done, since most students don't get very much Physics education early on: a survey done a few years ago suggests that even students in graduate physics classes tend to write one thing on a test paper and believe in their "common sense experience" in everyday life. But don't despair - there are a lot of common sense experiences that do work in Physics under the appropriate conditions, such as "what goes up must come down."

#### **Vocabulary**

It is not surprising to think that a science such as Physics should have developed a vocabulary of its own. But Physics tries to be a precise description of the world and so therefore the meanings of many ordinary everyday words must take on a new precision of their own, too. We will see that mass and weight are very different, even though they might seem to describe the same thing. Or that work has a special definition, a precise meaning, that is understandable to physicists and physics students around the world. Indeed, the concept of doing "no work" in Physics is very different from the usage we have in everyday speech.

#### **Equations**

Physicists are capable of driving other people crazy, as we can happily work all day with equations without ever once feeling the need to plug in a number. The concepts and the theory frame the question and the answer, it is the equations that supply the tools for our solution. It all looks like shorthand because in reducing numbers down to letters, we are limited by the number of upper and lower case letters in the English and Greek alphabets. Having said that, it won't end up being "all Greek to you" in PHYS-1070.

### Theory

The theories presented in this course have a long and colorful history that is interesting in its own right. Much like case law to the legal profession, current Physics theory has been "tried and proven" over the years. Unlike law, however, it isn't how slick or well-paid your physicist is versus mine, here the burden of proof falls on experimental verification. Even so, "proof" is too strong a word for some in science, rather one might say that something is true within these limitations. The material covered in PHYS-1070 has been around for some time. While some modern material may creep into the later chapters of this course, new editions of books like Ostdiek & Bord come out because of the editors, publishers and authors, as well as advances in science education theory, not because the Physics is changing, unlike the situation you might face if you were trying to teach a course called "Eastern Europe Today".

### Experiment

Years ago I saw a T-shirt that said "If it's Green and Wriggles, it's Biology; If it Stinks, it's Chemistry; And if it doesn't work, it's Physics". We say that the theory developed in Physics has been verified by Experiment, but surely we cannot mean Physics Lab! Still-reading, thinking and calculating can only take you so far; sometimes you have to see and measure for yourself. The purpose of lab is to put the scientific method into practice and see where event, observation and theory meet. But remember! The theory we develop in class has simplified and "cleaned" up Nature, so we cannot expect perfect experimental results; but careful and repeatable experiments will go a long way to helping you "see" the Physics.

### Time Management (Studying)

Since we have a lot of material to cover, and it is probable that you won't have time to work out ahead of time every Physics problem in the book, it becomes important to manage your study time wisely. **It is very common to end up spending hours banging your head against one stupid little problem. Don't do this!** Mostly this involves doing the same solution over and over again, or dragging in every conceivable (and inappropriate) formula under the sun. Most of the textbook problems have only one or two elements in them, so in general you may need to simplify your work, not make it overly complicated. Problems numbered in black are considered easy - if you are having trouble with a black problem and some of the blue problems, you are probably making them way too hard. Think basic definitions! If you find yourself spending long hours without getting any benefit, come and see me and we'll try to help. Very few students can get by without doing any work outside of class.

### Time Management (Exams)

Staring at an exam page is not the time to learn how to do Physics. Good exam time management starts with being familiar with the homework problems, the basic concepts and the formulas on your formula card. Beyond that, you should remember that most parts of the test are equally important, so don't spend all your time on one problem or part. Go onto another problem that you can do. Don't worry about what other students are doing. The student who gets up and hands their paper in halfway through the hour has used up as much time as they care to (for good or bad); it should have no bearing on your test. Do look through the whole test when you get it, making sure that yours is complete. Do keep units with your numbers and check to make sure that (a) the numbers and (b) the units of your answers makes sense. Don't leave any parts blank if you can help it.

### Still Having Problems?

#### Killer Equations

There is no one equation to "Life, The Universe and Everything". Every equation developed has some built-in limitations and some very real restrictions on when you can and can not use them. There are plenty of examples done in class and in the text which result in equations to solve a particular case. Students are inevitably tempted to use such "killer equations" for any problem that involves those quantities, because they think that the work has been done for them. The range equation is a classic example in ballistics, but this equation cannot be used unless the launch points and landing points are at the same height. Despite that warning, freely given in class, the range equation will be used to find out how far away an arrow will land, even if the archer is standing on a hilltop. In most cases, you are better off using the more basic, more general, more useful equations than searching for that "killer equation" that will solve the problem with one plug-in. Somehow the latter hardly seems like the kind of examination that would prove that you had learned anything.

#### Graphing Calculators

Just in the years that I have been in school, I have seen the rise of the calculator, the decline of the slide rule, and a definite drop in the ability to do simple error-free mathematics. The current crop of graphic calculators, typically *Texas Instruments TI-81 through TI-89 models*, seem to be more than a little bit of trouble to many students. As a result, Dr. Phil is NOT a fan of these machines. Worse are the keyboard type of "calculator," such as the *TI-92 family*. They are way too much for this course. If you are fighting your calculator - then it is no friend to you. Get rid of it. Sell it. Give it to your kid brother or sister.

#### The Only Calculator You Need

All you really need is a calculator that can do the following: the standard arithmetic functions (add, subtract, multiply and divide), the standard trigonometric functions (sin, cos and tan - don't even worry if you don't know what they mean, just look to see that your calculator has these buttons), the standard physics math functions ( $x^2$ ,  $\sqrt{x}$ ,  $\log x$ ,  $\ln x$ ,  $10^x$ ,  $e^x$ ). The current model of the *TI-30* series calculator has all those functions and costs about \$15. Dr. Phil is "this close" (imagine Dr. Phil holding two fingers really close together) to imposing a Required Calculator for his courses.

#### "It Must Be The Pretzels"

My view of the situation is this: Very few students, who buy a fancy calculator in order to substitute its power for their studying, do very well. Frankly, from what I've seen, most of their built-in solutions are either too general, too specific or just too inconvenient to be useful, and most students find that either they use that big brick like a regular calculator, or they write their own functions, just as you would write out your own formula card. Those who master the capabilities of a powerful calculator generally end up knowing or learning the subject anyway, so it's not the calculator. I wouldn't worry one iota about whether the person next to you has an unfair advantage because they spent \$85-\$260 on a calculator, and you didn't. As for transferring data between calculators, folks, it's a little too obvious and way too klutzy to get away with in class. Why not just learn the Physics?

#### MTBF (Mean Time Between Failures)

No, this isn't some sick statistic on awarding F's to students. MTBF is actually a term to describe how often computer equipment breaks down. I have seen many three and four year old calculators get chewed up in PHYS-1070 and learning to use a new calculator in the middle of a course can be traumatic. It became a common sight in the mid-70's to see many of us carrying two calculators to exams, just in case one of them tubed out on us. Today's calculators are a lot more reliable than in those "old" days, but often they were still never built to survive more than a year or two. While I can appreciate that no one wants to spend more money, we do depend a lot on our calculators in a course like this, and having a calculator that has keys that don't work right is just begging for trouble. Do yourself a favor: if you need a new calculator, buy it now, before a change becomes unsettling. At the very least, many older

calculators need new batteries right about now. You'll thank me later. *Dr. Phil last changed the AAA's again in his 1995 HP-48GX in 2005 – one set of batteries seems to last me 2½ years... not forever.*

#### "I Understand the Physics, I Just Can't Do The Problems"

This is a refrain that is heard all the time. Yet the truth is that if you can't do the problems, then you probably don't really understand the physics. Physics isn't just equations, however, it is what you do with them.

#### Practice, Practice, Practice

Very few people are so talented that they can leap into any new endeavor and have permanent success without every practicing. Beginner's luck usually doesn't last very long. So you're in a Physics class... what do you do? Well, besides coming to class, reviewing your notes, opening your textbook occasionally, the best advice is to do some Physics problems. Start with the assigned (i.e. recommended) problems. If you have problems, don't just race to the answers in the back of the book, or look for posted solutions, try looking at the worked out examples in the text or from the class and reproduce that work.

#### PTPBIP (Put The Physics Back Into the Problem)

So you've read the problem, figured out what's given, determined what is being asked for, decided on what equation(s) you need and played plug-'n- chug on your calculator. So you're done, right? Well, how do you know if the answer is right? Well, first off, you can check to see if the answer makes sense. This is what I refer to as "PTPBIP", Putting The Physics Back Into the Problem. It is very important, "real" physicists do it all the time. You needn't write anything extra down, but if you expect that the block should go to the right, then it is very satisfying if your answer also says that the block will go to the right. It may be that the block will go to the left, and that the Physics is trying to tell you something, but rarely will a horizontally moving block travel up. That would be a hint that something funny is going on.

#### The Physics Keeps on Building!

One of the most remarkable things about Physics is that the everything we learn, keeps on depending on everything else we've done. In a History class, once you've learned that the Battle of Hastings was 1066 (or whenever it was), that's it. That's the answer. While today's history depends on what happened before, in a History class you might be able to get away with ignoring the 11<sup>th</sup> Century when you get to the Industrial Revolution. But not so here. You might be worried about having a comprehensive Final Exam. But if you've been awake all semester, you'll find that this isn't a crisis – you'll have been using it all along anyway.

#### Expectations:

Make a mental note of two things: (1) the grade you realistically would like to get in PHYS-1070 and (2) the minimum grade that you have to get. If you aren't sure of the latter, now is the time to check with your department (or your school, for those of you not full-time WMU students). These two grades should represent attainable goals, and given your quiz and exam performance you can plan your study schedule accordingly. Week 6 is not the time to realize that your GPA is too low for you to keep your scholarship.

#### Dr. Phil to English Translation:

Speaking of Dr. Phil's handwriting, you should realize that writing on the blackboard is not the same as writing on a piece of paper. I'm only a few inches from my writing – I can see it and read *just fine*. If you can't, then either (1) put on your glasses, (2) sit closer or if you've already done that, (3) jump up and down and shout "Dr. Phil, I can't read THAT!", and Dr. Phil (after he climbs down from the ceiling) will cheerfully go back to writing larger and more legibly. You'd be amazed at how many "lurkers" in the back of the lecture hall have faulty equations on their formula cards, terrible notes and oh-by-the-way have stinky Physics grades. Don't be embarrassed if you can't read my handwriting – I probably can't read yours either! (This is an occupational hazard of typing on a PC so much – I never *write* anymore!)

#### Drop Dates:

You may wonder why drop dates are so prominently mentioned in this syllabus. Actually it is to make everyone's life easier. Let's face it: most of you aren't so interested (right now) in learning some Physics as in surviving the course and putting that grade in the bank. You will have just gotten your second exams back before the last possible drop date. If you are concerned with passing the course, I would be happy to consult with you to give you a quick read on where you stand.

#### Overloads:

It's a Y2K6 college fact: You are probably taking too many classes and working too many hours. In a perfect world, the best way to do Physics is to abandon everything else and just do the Physics. Since you probably can't do that, now is the time to figure out what you can cut out of your schedule. Hey, you'll thank me later if you at the very least arrange a day off before each exam, especially the final.

#### Office Hours:

It will take a few days to shake down everyone's schedule and get into a rhythm. Frankly, I don't get enough business during office hours, but boy do I hear the kvetching about how hard Physics is and how awful the Quizzes are. If my office hours are not convenient to your schedule, then it is up to you to make an appointment.

#### Physics is Phun:

No one ever believes that on the first day. And for some, it never is fun. But we can try! Really!

#### Why We Do All This:

**science literacy** *n.* An exposure to science in a historical context that serves to allow a person to observe the world around them with understanding, deal with technological applications at home and work, appreciate the distinction between fact and speculation in the media and politics, have a working knowledge of numbers and the scale of the universe, and be able to pursue more information if desired, as a function of everyday life.

Philip Edward Kaldon, Fall 1995

This is summer in Michigan – Land of Driving Adventures. Dr. Phil has a long commute (154 miles/day) *and* we are in the middle of massive construction projects *and* we are still waiting to see what new paving contracts blow into town. Dr. Phil will make gallant efforts to be here on time every day – *but* ultimately all of us have to be intelligent enough to make decisions between *trying to get to class* and oh, say... *living*. Physics is important, but if you or your vehicle can't make it, then you can't make it.

*We Are Here To Change The Way You Think*  
**There Are No Stupid Questions · (Just Ones That Half The Class Wanted Asked Anyway)**  
*UNITS Will Save Your Life*  
**PTPBIP ! (Put The Physics Back Into the Problem !)**  
*Physics is Phun*

**PHYS-1070 (18) (Kaldon) < MTu ThF 2:00-3:40pm 1110 Rood >** Rev. 5/08/2006

Chapter assignments are approximate – actual chapters will depend on our actual pace.

Week	Class Dates	Topic (Ostdiek & Bord, 5 <sup>th</sup> edition)	Special
1.	8,9 May	Inquiry Into Physics	Topic 1 Assigned
	11,12 May	Ch. 1 - Study of Motion	Quiz 1,2
2.	15,16,18 May	Ch. 2 - Newton's Law	Quiz 3,4,5
	<b>19 May</b>		<b>Exam 1 - 5/19 Fri.</b>
3.	22,23 May	Ch. 3 - Energy & Conservation	Quiz 6,7
	25,26 May.	Ch. 4 - Physics of Matter	Quiz 8,9
4.	<b>29 May</b>	<b>(You do NOT get a 4 day weekend!)</b>	
	30 May, 1 June	Ch. 5 - Temperature & Heat	Quiz 10,11
	<b>2 June</b>		<b>Exam 2 - 6/2 Fri</b>
5.	5,6 June	Ch. 6 - Waves & Sound	Quiz 12,13
	8,9 June	Ch. 7 - Electricity	Quiz 14,15
6.	12,13 June	Ch. 8 - Electromagnetism & EM Waves	Quiz 16,17
	15 June	Ch. 10 - Atomic Physics	Quiz 18
			Topic 1 due - 6/15 @ 5pm
	<b>16 June</b>		<b>Exam 3 - 6/16 Fri</b>
7.	19,20 June	Ch. 10-11 - Atomic & Nuclear Physics	Quiz 19,20
	22,23 June	Ch. 12 - Special Relativity & Elementary Particles	Quiz 21,22
			Topic 2 due - 6/23 @ 5pm
8.	26 June	<b>PHYS-107 Course Review</b>	Quiz 23
	<b>27 June</b>	<b>FINALS</b>	<b>Final Exam - 6/27 Tue - 2:00-3:40pm (2 hours)</b>
9.	3 July	Grades due on <u>Monday</u> at Noon	