Genesee Community College - PHY 121 – 01: College Physics I (4 credits)  

SYLLABUS

INSTRUCTOR: Mike Crittenden, phone 343-0055 ext. 6397, e-mail macrittenden@genesee.edu  
check email more often than voicemail. I sometimes check email on weekends, but not always.

OFFICE HOURS: M,W 1:25 – 2:25. Tu,Th 2:00 – 3:00 pm, F 11:00 - 12:00
Available at other times also. Feel free to walk into a lab.

OFFICE: D369 (I may sometimes spend my office hours in the lab, B202).

TEXT: College Physics by OpenStax. An electronic version is available for free at
https://openstaxcollege.org/textbooks/college-physics/get
(Click one of the options at the right.)
An inexpensive hard copy is available in the GCC bookstore and elsewhere.

STUDENT SOLUTIONS MANUAL, recommended. Free. Same link, click on Student Resources.

CALCULATOR with trig functions is required. For tests it must not resemble a phone.

Anticipated Schedule:

<table>
<thead>
<tr>
<th>M</th>
<th>W</th>
<th>lab 1A</th>
<th>W 9/27</th>
<th>Exam 1 (sec1-4), start lab 5</th>
<th>M 11/6</th>
<th>lab 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>M</td>
<td>lecture on sec. 1</td>
<td>M 10/2</td>
<td>Q 5, finish 6, finish lab 5</td>
<td>W 11/8</td>
<td>Q 10, section 11</td>
</tr>
<tr>
<td>W 8/30</td>
<td>W 8/30</td>
<td>Quiz 1, lecture 2, start 3</td>
<td>W 10/4</td>
<td>lab 6</td>
<td>M 11/13</td>
<td>lab 11</td>
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<tr>
<td>(M 9/4 No class: Labor Day)</td>
<td>W 10/11</td>
<td>Q 6, section 7/ start 8</td>
<td>(M 10/9 No class: Columbus Day)</td>
<td>W 11/15</td>
<td>Q 11, sec. 12, start 13</td>
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<tr>
<td>W 9/6</td>
<td>M 9/11</td>
<td>Quiz 2, finish 3, start 4</td>
<td>M 10/16</td>
<td>lab 7</td>
<td>M 11/20</td>
<td>lab 12</td>
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<tr>
<td>W 9/13</td>
<td>W 9/18</td>
<td>Quiz 3, finish 4, start 5</td>
<td>W 10/18</td>
<td>Q 7, finish 8, start 9</td>
<td>W 11/22</td>
<td>Q 12, finish 13, review</td>
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<tr>
<td>W 9/20</td>
<td>M 9/25</td>
<td>Quiz 4, fin 5, start 6, review</td>
<td>M 10/23</td>
<td>lab 8</td>
<td>M 11/27</td>
<td>Exam 3, lab 13</td>
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<td></td>
<td>W 10/25</td>
<td>Quiz 5, finish 9, review</td>
<td>M 10/30</td>
<td>Exam 2 (5-8), lab 9</td>
<td>W 11/29</td>
<td>Q 13, sec. 14</td>
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<td></td>
<td>M 11/1</td>
<td>Q 9, section 10</td>
<td>W 12/4</td>
<td>Retests</td>
<td>M 12/6</td>
<td>Q 14, review</td>
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</tbody>
</table>

Final Exam (sec 1-14): Dec. 11, 12 or 13. The exact time will be announced when I know it.

(Students with accommodations are expected to take quizzes & exams the same day as everyone else.)

GRADING SYSTEM/COURSE REQUIREMENTS:

You must earn at least two thirds of the possible lab points or you will receive an F for the course, regardless of your test scores. (This means you fail if you miss more than four labs.) Otherwise, and assuming no deduction for dishonesty, your grade is determined as follows. (You can keep track of your grades below. Keep graded papers in case you find an error in my records.)

Quizzes (10 pt each): ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ =

Labs (10 pt each): ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ + ____________ =

Exams 1, 2 & 3 (100 pts each): ________ + ________ + ________ =

Final Exam (175 pts): ________

Total: ________

No grades are dropped, except when replaced by a retest. No extra credit.
<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
<th>Range</th>
<th>Points</th>
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<tbody>
<tr>
<td>A</td>
<td>92.6% - 100%</td>
<td>(699 - 755)</td>
<td></td>
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<tr>
<td>A-</td>
<td>89.0% - 92.5%</td>
<td>(672 - 698)</td>
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<tr>
<td>B</td>
<td>85.3% - 88.9%</td>
<td>(644 - 671)</td>
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<tr>
<td>B-</td>
<td>81.6% - 85.2%</td>
<td>(616 - 643)</td>
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<tr>
<td>C</td>
<td>70.6% - 74.2%</td>
<td>(533 - 560)</td>
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<tr>
<td>C-</td>
<td>67.0% - 70.5%</td>
<td>(506 - 532)</td>
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<tr>
<td>D</td>
<td>63.3% - 66.9%</td>
<td>(478 - 505)</td>
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<tr>
<td>D-</td>
<td>59.6% - 63.2%</td>
<td>(450 - 477)</td>
<td></td>
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<tr>
<td>F</td>
<td>0 - 55.9%</td>
<td>(0 - 422)</td>
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I might lower the cuts between letter grades a little (improving borderline grades) based on effort and the difficulty of the tests. If a lab or test has to be canceled, the same percents will apply to the smaller number of possible points.

To estimate your grade before the course is over:

\[
\frac{(1.85)(\text{quiz total so far})}{\text{(number of quizzes so far)}} = \underline{\ \ \ } \\
\frac{(1.85)(\text{lab total so far})}{\text{(number of labs so far)}} = \underline{\ \ \ } \\
\frac{(0.630)(\text{exam total so far})}{\text{(number of exams so far)}} = \underline{\ \ \ } \\
\text{Total: } \underline{\ \ \ \ \ \ } \%
\]

(Some people vary a lot between exams, so early in the course, this estimate would be very crude.)

With nearly perfect lab grades, which most people have, roughly 50% is the minimum needed on quizzes and exams to pass with a D. Low 60's for a C, mid 70's for a B, upper 80's for an A. (The idea is that "B" means "above average;" about half of a typical class scores above 75% on a typical test.)

Other grades:

W: To withdraw, contact the records office by the ninth week. Ws cannot be issued by faculty.

IP: Contact me by the day after the final. As with any time extension, you need a legitimate reason.

Retests:

I do not drop any grades; instead, you can take another test on the same material. The better of the two grades counts. Making up a test you missed counts as a retest unless I agree otherwise.

You may take retake a maximum of five quizzes, within 1 week of the original, but not after the final exam. You may take one of the 100 point exams over, on the date in the schedule above. A retest gets "used up" even if it does not improve your grade. There are no retests on the final.

IS THIS THE RIGHT PHYSICS COURSE FOR YOU?

PHY 100 is for students with an unrelated major such as Elementary Ed, Business or Drama.

PHY 121 & 122: for technology or health-related majors such as Drafting, Chiropractic or Pharmacy.

131, 132 & 133: for majors closely related to Physics such as Physics, Engineering or Mathematics.

It’s fine to take a course which is more than the minimum necessary. Also, requirements vary between four-year schools; you should check what is required where you want to go.

COURSE DESCRIPTION:
Catalog description: An algebra/trigonometry based introduction to physics for career or transfer students with majors somewhat, but not closely, related to physics. Topics include one and two dimensional motion, Newton's laws, energy, momentum, rotation, statics, fluid mechanics, heat and thermodynamics, and special relativity. Three class hours, three lab hours. Fall only. Prerequisite: MAT 121 or MAT 136 or higher or by placement.

Student Learning Outcomes:

Upon successful completion of the course, students will be able to demonstrate:

*1. The ability to explore natural phenomena using scientific methods, in the course's laboratory. ("Natural phenomena" means actual physical processes taking place live, as opposed to videos or simulations. "Laboratory" means an appropriate facility containing necessary equipment, as defined by the list included in the Course Outline. For a minimum of ten of the three-hour labs, students must measure something real, in the presence of the instructor.) This includes the ability to
a. use laboratory equipment when given written instructions.
b. use methods covered in class to determine desired quantities from measurements.
c. determine the probable error in what has been calculated from the measurements.
d. draw valid conclusions on whether their results are in agreement with generally accepted values or principles.

Students must submit lab reports worth at least two thirds of the possible lab points to receive credit for the course.

*2. The ability to apply data, concepts, and models in the field of physics, as documented by performance on quizzes, exams and the comprehensive departmental final. These tests contain both conceptual questions and quantitative problems, with the emphasis on quantitative problems. Partial credit will be given based on how closely a student's solution resembles a correct one. The following will be demonstrated:
   a. fluency in the course's prerequisite mathematics.
   b. the ability to interpret graphs.
   c. consistent use of units.
   d. the ability to apply the meaning of terminology verbally and in solving problems.
   e. the ability to apply basic physical principles verbally and in solving problems.
   f. the ability to do the above in the context of a variety of topics, as listed in the course's content outline.

3. Critical thinking (reasoning) ability as documented by solving exam problems which are not identical to others they have seen before, and whose solution involves two or more steps, including:
   a. algebraic problems in which one equation must be used to find something needed in another.
   b. problems involving the manipulation of vectors in a plane.

Students must show, in written form, how they have done this; that is, present a well-reasoned argument for their answer.

* This course objective has been identified as a student learning outcome that must be formally assessed as part of the
Comprehensive Assessment Plan of the college. All faculty teaching this course must collect the required data and submit the required analysis and documentation at the conclusion of the semester to the Office of Institutional Research and Assessment.

RULES & POLICIES:

Attendance is only monitored so I can report it to others, not for any purpose of my own. (I’m here to judge how good you are at physics, not to be your mother. Keep in mind that people who don’t come to class often get low grades because they don’t learn much.)

Missing a quiz or exam: If possible, contact me on or before the day of the test. You will probably need to document the fact that missing the test was beyond your control. (Paperwork from your medical treatment, the receipt for your car’s repairs or parts, the police report …) If you’re sick for a quiz but not sick enough to see a doctor, just take the retest. If this happens for a big test, discuss it with me. If it’s a day or two after the test, you will need to explain why you couldn’t contact me sooner. I try to be reasonable; however, the final judgment as to what is reasonable is mine, and I may reject any undocumented excuse. If I do, the zero can be raised by a retest the same as any other grade. Don’t miss the Final without a good reason.

Missed or late labs: Labs are due when you leave the laboratory; get written permission to finish one at home. I do not accept late papers without a reason; "I forgot to bring it" will work a few times. Make a missed lab up within one week of the scheduled date, unless you have a documented hardship.

Behavior: If I feel you are unacceptably offensive or distracting, I may deny you permission to be in class for however long seems appropriate to me. This includes possible expulsion from the course, with zeros on all remaining work. I’ve never had to do this; let’s keep it that way. For more information on behavior, put “student code of conduct” in the search box at genesee.edu.

Plagiarism and Cheating: Cheating is obtaining or intentionally giving unauthorized information to create an unfair advantage in an examination, assignment, or classroom situation. Plagiarism is the act of presenting and claiming words, ideas, data, programming code or creations of others as one’s own. Plagiarism may be intentional – as in a false claim of authorship – or unintentional – as in a failure to document information sources using MLA (Modern Language Association), APA (American Psychological Association) or other style sheets or manuals adopted by instructors at the College. Presenting ideas in the exact or near exact wording as found in source material constitutes plagiarism, as does patching together paraphrased statements without in-text citation. Disciplinary action may include a failing grade on an assignment or test, a failing grade for the course, suspension or expulsion from the college, as described in the Code of Conduct.

A first offense will result in a course grade reduction of one letter. (If you cheat on an exam, the average of the other two exams will be used as the grade for that exam. If you cheat on a quiz, the average of the other quizzes will be used as its grade. If you cheat on a lab (fabricate or copy data for a lab you did not participate in), the average of the other labs will be used as its grade. After that, 83 points = 11% will be subtracted from your grade for the course.) I will notify the Dean of Students, which will lead to more severe penalties if you have a previous history of dishonesty. A second offense, meaning you previously cheated in any course at GCC, will result in a course grade of F.
Punctuality: If you are late for a quiz or exam, your paper will be collected when everyone else's is, unless you offer a reasonable explanation. If you arrive over 15 minutes after the class has started a lab, you will have to make it up, within one week.

Storm cancellation policy: If the college is open, I will almost certainly hold class. Use your judgment as to whether you come. If driving seems unsafe to you, don't. I consider a storm to be a legitimate excuse like being sick.

TIPS ON STUDYING & WHAT TO EXPECT FROM THE COURSE:

In class: Take good notes. A lot of this material will not stick to you the first time you hear it. You need something to refer to as you do the homework. If following the lectures is hard, do the reading before I go over it so you have an idea of what I’m talking about.

At home each week: It’s more important to practice solving problems than to read the text over and over. Work on the homework until you can put the solutions on blank paper, just like during the quiz. Once you can do it at home, you can do the exact same thing in class. (Unless you have some issues with test taking. Go to the CAP center for help in that case.) If you need more practice than just the homework, go over the sample problems from the notes and text: cover up the solutions, try them, then compare. Work on end of chapter problems with the help of the student solutions manual.

For the monthly exams (and final): Cramming a month of material into your head in one night isn't going to work. But, if you've been preparing properly each week, you may only need to refresh your memory by reading back through your notes. If there are areas where you do not feel confident, practice by solving problems. Doing new ones is better than the same old ones over again.

This is a fairly demanding course for the average student. Expect to follow the 2 to 1 rule (Two hours outside of class per credit, meaning 8 hours per week for this course). You don't get good at a sport or musical instrument without regular practice; the same is true here. On the other hand, don't be intimidated. Just because every detail is not crystal clear does not mean you're doomed to failure. While people who study hard don't always get A’s, it's rare for them to actually fail. And who knows? You may even discover that the mathematical description of nature can be an interesting subject.

SUPPORT SERVICES: If you need any sort of help, please ask me for it; repeatedly if necessary. A tutor is usually available. Ask me or at the C.A.P. to find out.

For information on other kinds of support such as testing services, disabilities support, internet access, help desk, financial, transfer or career services, or contact information for GCC people or offices, see genesee.edu. There is an “Information for All Students” document: From www.genesee.edu, click Student, just below the search box. Under Student Services, click Help Desk/Technical info. Click IFAS.
Homework:

I will quiz you on homework rather than collecting it. Each assignment consists of several quizzes; on the dates indicated earlier, you will be given one of them in class, with the numbers changed.

Complete, line by line solutions are at [http://faculty.genesee.edu/macrittenden/phy121.htm](http://faculty.genesee.edu/macrittenden/phy121.htm) and at the library's circulation desk. (I do not use Blackboard; this website is on a different server.)

Do not try to save time by just memorizing these solutions. The quizzes are only 19% of your grade; the rest of the time, you need to understand what you're doing. You can't learn to play the piano by just watching other people play, and you can't learn physics by just watching problems be solved. This course is primarily about analytical skills, and skill comes from practice:

  First, try to do the assignment yourself, from just your book and notes. If you don't spend at least 3 hours on it before you decide you need help, you're not making a serious attempt.

  Then, use my solutions to help with the parts you're stuck on. If the part you're stuck on is the whole assignment, you'd better see me or a tutor.

Remember, I'm paid to do this. It's not an imposition if you come to my office and ask me to do my job.

Sec. 1: Straight line motion:

Reading: All of Ch. 2.

Quiz A. 1. (2.5 points) Is it possible to have a situation in which the velocity and acceleration have opposite signs? If so, sketch a velocity-time graph to prove your point.

2. (7.5) A stone is thrown upward from the edge of a cliff 18.0 m high. It just misses the cliff on the way down, and hits the ground below at 20.3 m/s. With what velocity was it released?

   ans: 7.70 m/s

Quiz B. 1. (3 points) You throw a ball straight up, which then drops back into your hands. If up is positive and down is negative, (a) As it rises, is its acceleration positive, negative or zero? (b) At the instant when it's highest, is its acceleration positive, negative or zero? (c) As it falls, is its acceleration positive, negative or zero?

2. (7) A stone is thrown upward from the edge of a cliff 18.0 m high. It just misses the cliff on the way down, and hits the ground below at 20.3 m/s. What is its maximum distance from the ground?

   ans: 21.0 m

C. 1. (4 points) With the help of conversion factors from your formula sheet, find the speed in kilometers per hour equivalent to 90.0 ft/s.

   ans: 99.0 km/hr

2. (6 points) A car accelerating uniformly is going 6.00 m/s when it passes one checkpoint. It passes a
second checkpoint 100 m away 10.0 s later. What is its acceleration?
ans: .800 m/s²

D. A woman is reported to have fallen 43.9 m (144 ft) from a building, to the top of a metal ventilator box, which she then crushed to a depth of 46.0 cm. She suffered only minor injuries. Neglecting air resistance, calculate her
(a) velocity just before she reached the box.
(b) average acceleration while in contact with the box.
ans: 29.3 m/s, –935 m/s² if down is positive. (Opposite signs if up is positive.)

E. 1. (4.5 points) A ball is thrown straight up, and then returns to its starting point. Taking up to be positive, fill in these graphs of the ball’s motion. (Sketches – They don’t need to be to scale.)

2. (5.5 points) A car moving at 20.0 m/s has its brakes slammed on, and stops in a distance of 40.0 m. What was the car’s acceleration, assuming it to be constant? Include the correct sign.
ans: -5.00 m/s²

Sec. 2: Vectors. Projectiles.

Read: Pages 91 – 100 & 104 – 111.

A. 1. (2 pts) A bullet is fired horizontally over level ground. In order to spend the most time in the air, its speed should be as __________ (fast? slow? doesn’t matter?) as possible. (Ignore air friction and the curvature of the earth.)

2. (8) A rifle is aimed horizontally at a mark on a large wall 2000 m away. The initial speed of the bullet is 500 m/s. Neglecting air drag, how far below the mark does the bullet strike the wall?
ans: 78.4 m

B. 1. (3 points) You walk around the block and end up at your starting point. If each of its four sides is 140 m long,
a. How large is your resultant displacement?
b. How far did you walk?
ans: 0, 560 m

2. (7) Add the following displacement vectors by direct measurement on a scale drawing. (I have rulers and protractors to loan during the quiz.) Vector A: 8.00 m at 45°. Vector B: 8.00 m at 180°. (Give both
the magnitude and direction of the answer.)
ans: 6.12 m at 112°. (Since this asks for a graphical solution, correctly calculating the answer with the component method will get half credit. Since a graphical solution is usually a little off, being within a few tenths of a meter, and a few degrees will get full credit.)

C. 1. (1 point) Can the magnitude of a vector have a negative value?
2. (9) A ball is thrown horizontally from the top of a building 35.0 m high. The ball strikes the ground at a point 80.0 m from the base of the building. Find (a) the time the ball is in flight, (b) its initial speed.
ans: 2.67 s, 29.9 m/s

D. Hitting a tennis ball at ground level gives it an initial velocity of 24 m/s at 57° above the horizontal.
(a) As it leaves the racket, what are
\- the x and y components of the ball's velocity?
\- the x and y components of the ball's acceleration?
(b) When at its maximum height, what are
\- the x and y components of the ball's velocity?
\- the x and y components of the ball's acceleration?
(c) How much time is the ball in the air?
(d) When the ball lands, how far is it from the place where it was hit?
ans: (a) 13.1 m/s, 20.1 m/s, 0, -9.8 m/s² (b) 13.1 m/s, 0, 0, -9.8 m/s² (c) 4.11 s (d) 53.7 m

E. 1. (2 points) For each of the following, state whether or not it is a vector: (a) temperature, (b) volume, (c) velocity, (d) age.
2. (8) You drop a crumpled ball of paper off a bridge. At one point as it falls, the forces on it are as shown. Use a scale drawing to find their resultant. (I have rulers and protractors to loan during the quiz. Give both the magnitude and direction of the answer.)
ans: 1.37 N at -15.0°. (Since this asks for a graphical solution, correctly calculating the answer with the component method will get half credit. Since a graphical solution is usually a little off, being within a tenths of a newton, and a few degrees will get full credit.)

Sec. 3: Newton's Second Law:

Read: In Ch. 4, sections 4.1 – 4.3 and 4.5 – 4.7

A. 1. (2 points)
- A heavy pair of shoes hangs from a clothesline. In terms of components, explain why it is impossible to remove all sag from the line no matter how much you tighten it.
Would it be possible with just one side of the line horizontal?

2. (8) The tension in the cord equals $W$, the weight hung on its end.  a) What is $L$, the magnitude of the force from the leg muscles?  b) How much does the leg weigh?  
   ans: 67.9 N, 39.2 N

B. The horizontal force that holds the pendulum aside is 20.0 N. If the cord makes an angle of 37° to the vertical, find the tension in the cord and the weight of the ball.  
   ans: 33.2 N, 26.5 N

C. 1. (2 points) If a car is traveling westward with a constant speed of 20 m/s, what is the resultant force acting on it?

2. (8) Add the following displacement vectors by the trigonometric component method: Vector A: 8.00 m at 45°. Vector B: 8.00 m at 180°. (Give both the magnitude and direction of the answer.)  
   ans: 6.12 m at 112°. (Half credit for a correct graphical solution.)

D. The picture shows the pulley on a car’s crankshaft. The arrows represent the tension in a belt passing over the pulley. (Unlike a freely turning frictionless pulley, the tension is not the same on each side.) Find the magnitude and direction of the single force which is equivalent to these two forces ($\vec{F}_1 + \vec{F}_2$). Give the direction in the usual way, using an angle from the positive x axis.  
   ans: 185 N at 77.8°

E. The uniform metal plate is in a vertical plane, and weighs 50 N. Rods A, B and C are being pulled; D is being pushed.  $F_A = 75$ N, $F_B = 150$ N, $F_C = 150$ N and $F_D = 200$ N. Find the magnitude and direction of the net force acting on it.  
   ans. 372 N at 138°

Sec. 4: More F = ma. Friction.

Read: Continue sections 4.5 – 4.7, and also section 5.1
A. 1. (2) In a world where all surfaces were completely frictionless, could you
a. walk across the floor?
b. climb a ladder? (It’s attached to a wall so it won’t slide off.)
c. climb a vertical pole?
d. jump straight up into the air?

2. (8) A 500 g box hangs by a string from another 500 g box, which hangs from another string. The system is accelerating downward at 1.20 m/s².
   a. What is P, the tension in the upper string?
   b. What is the tension in the connecting string?
      ans: 8.6 N, 4.3 N

B1. (2) a. A box weighing 10 N is sitting on the floor in an elevator which has a constant upward velocity. The normal force on this box is ________ 10 N. (equal to? more than? less than?)
   b. A box weighing 10 N is sitting on the floor in an elevator which has a constant upward acceleration. The normal force on this box is ________ 10 N. (equal to? more than? less than?)

B 2. (8) A car weighing 12.4 kN, moving at 9.10 m/s slows uniformly to a stop in a time of 5.00 s. Find the magnitude of (a) the car’s acceleration and (b) the net force on the car.
      ans: 1.82 m/s², 2.30 kN

C1. (2 pts) A car's driver steps hard on the brakes, locking the wheels so that it skids to a stop. Does this stop the car in the shortest possible distance? Explain.

C 2. (8) The coefficient of kinetic friction between a 4.00 kg box and the floor is .600. How large is the horizontal force needed to give the box an acceleration of 2.00 m/ s²?
      ans: 31.5 N

D. A 500 gram block originally moving at 80 cm/s slides 60 cm across a table before stopping. Find (a) its acceleration, (b) the magnitude of the friction force that stopped it, and (c) μk
      ans: -.533 m/s², .267 N, .054

E. A woman at an airport is towing her 20.0 kg suitcase at a constant speed by pulling a strap which makes an angle of θ with the horizontal. She pulls the strap with a 35.0 N force, and the frictional force on the suitcase is 20.0 N.
   a. Draw a free-body diagram for the suitcase.
   b. What is θ?
   c. What normal force does the floor exert on the suitcase?
      ans: 55°, 167 N

(Sections 5 - 14 will be handed out later, and are available now at http://faculty.genesee.edu/macrittenden/phy121.htm)