Genesee Community College - PHY 131 – 01 Physics With Calculus 1 (4 credits)   Fall 2021

SYLLABUS

INSTRUCTOR: Mike Crittenden, macrittenden@genesee.edu
OFFICE HOURS: By appointment.
REQUIRED:
  1) Textbook. Serway & Jewett, Physics for Scientists and Engineers With Modern Physics, 10th ed. Available as an e-book or through Cengage Unlimited from GCC bookstore. If you prefer a hard copy ($184 new) order one at the bookstore or elsewhere. Less expensive older editions (as low as $5 on eBay) are organized a little differently, but otherwise just as good.
  Optional: WebAssign access comes with the text if you don't buy a used one. This contains practice problems and tutorials some students find useful. With older editions, look for a copy of the study guide.
  2) Calculator, with trig functions. For tests, it must not resemble a phone.

ANTICIPATED SCHEDULE:

(M 9/6 No class: Labor Day)	*(M 10/11 No class: Columbus Day)*	M 11/15 virtual
W 9/8 lab 1A	W 10/13 **quiz 5**, lab 5	W 11/17 **quiz 10**, lab 10 or 12
M 9/13 "virtual class" (watch videos)	M 10/18 **Exam 1 (Sec 1 - 4)**	M 11/22 virtual
W 9/15 **quiz 1**, lab 1B	W 10/20 **quiz 6**, lab 6	W 11/24 **quiz 11,** lab 11
M 9/20 virtual	M 10/25 virtual	M 11/29 virtual
W 9/22 **quiz 2**, lab 2	W 10/27 **quiz 7**, lab 7	W 12/1 **quiz 12**, lab 10 or 12
M 9/27 virtual	M 11/1 virtual	M 12/6 **Exam 3 (9–12)**
W 9/29 **quiz 3**, lab 3	W 11/3 **quiz 8**, lab 8	W 12/8 **quiz 13,** lab 13
M 10/4 virtual	M 11/8 **Exam 2 (5 - 8)**	M 12/13 **quiz 14/ Retests**
W 10/6 **quiz 4**, lab 4	W 11/10 **quiz 9**, lab 9	W 12/15 Final Exam

A snow day would cause a one week delay after that, and the Final would be W 12/22/21

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. (You fail if you miss more than four labs.) Otherwise, assuming no reduction 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.
Maximum score = 755, of which 140 points (18.5%) comes from quizzes, 140 points (18.5%) from labs, 300 (13.2% each for a total of 39.7%) from exams and 175 (23.2%) from the final.

A	92.6% - 100% (699 - 755 points)	C	70.6% - 74.2% (533 - 560)
A⁻	89.0% - 92.5% (672 - 698)	C⁻	67.0% - 70.5% (506 - 532)
B⁺	85.3% - 88.9% (644 - 671)	D⁺	63.3% - 66.9% (478 - 505)
B	81.6% - 85.2% (616 - 643)	D	59.6% - 63.2% (450 - 477)
B⁻	78.0% - 81.5% (589 - 615)	D⁻	56.0% - 59.5% (423 - 449)
C⁺	74.3% - 77.9% (561 - 588)	F	0 – 55.9% (0 - 422)

If a lab or test has to be canceled, the same percents will apply to the smaller number of possible points.

W: To withdraw, contact the records office by the ninth week. Ws can not be issued by faculty.
IP: Contact me by the day after the final. As with any time extension, you need a legitimate reason.

For a crude estimate of your grade before the course is over:

$$(1.85)(\text{quiz total so far})/(\text{number of quizzes so far}) = \underline{\hspace{2cm}}$$
$$(1.85)(\text{lab total so far})/(\text{number of labs so far}) = \underline{\hspace{2cm}}$$
$$(.630)(\text{exam total so far})/(\text{number of exams so far}) = \underline{\hspace{2cm}}$$
$$\text{Total:} \quad \underline{\hspace{2cm}}\%$$

With nearly perfect lab grades, which most people have, a little under 50% is needed on quizzes and exams to have 56% overall and get a D – . Mid 60s for a C (not C –), high 70s for a B. (This is based on the idea that B– means "slightly above average," together with the fact that a typical class on a typical test has an average grade around 75%..)

Retests. I do not drop any grades. Instead, you can take another test on the same material. The better of the two grades counts. You may retake a maximum of five quizzes, within one 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. Making up a quiz you missed is a retest unless I agree otherwise. There are no re-retests or retests on the final.

Videos. For videos of lectures, go to www.genesee.edu then click myGCC at the top. Click LOGIN to myGCC and then enter your ID and password. If necessary, click Student and then My Courses near the top. Click PHY-131-01 Fall 21 and look under Course Videos. Only the videos are in Blackboard. For all other materials, go to http://faculty.genesee.edu/macrittenden/phy131.html

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: Introduces fundamental principles of physics. Includes one and two dimensional motion, Newton's laws, energy, momentum, rotation, statics, harmonic motion, waves, gravitation, fluid mechanics, heat, and ideal gases. A calculus based physics course for students in science and engineering related programs. Three class hours, three lab hours. Fall only.

Prerequisite or corequisite: MAT 141 (Calculus 1) or higher or by placement.

Course Learning Outcomes (CLOs):

Upon the successful completion of this course, a student will be able to:

1. Apply basic principles of mechanics conceptually, using proper terminology. (This includes Newton's laws, energy, momentum and angular momentum applied to translational and rotational statics and dynamics. Also vibration, waves and fluid mechanics.)

2. Apply basic principles of thermal physics, using proper terminology. (This includes the ideal gas law and heat flow.)

3. Translate questions about physical topics into mathematical expressions.

4. Solve the equations they have set up. (This includes fluent use of algebra, trigonometry, differential calculus and vector arithmetic including dot and cross products. Also appropriate use of units and graphs.)

5. Reason creatively, developing solutions to multi-step problems which are not identical to others they have seen before.

6. Use laboratory equipment, given written instructions, to demonstrate and verify theoretical principles in actual physical systems.

7. Analyze the results of laboratory experiments, including their probable error, to draw conclusions on whether they are in agreement with generally accepted values or principles.

8. Prepare lab reports which clearly convey the underlying ideas of experiments as well as the methods and results.

RULES & POLICIES:

Attendance: I don't believe in giving away points for just sitting in a chair, so attendance is not part of calculating your grade. Contact me immediately about making up a missed lab or test. Unexcused absence on a quiz or exam earns a zero which you can improve by taking the retest.

Federal regulations require the College to report students who register for a class but "no show." You must take specific actions at least once **within the first three weeks** or you will be dropped from the course. Examples of what will satisfy the federal expectations include, but are not limited to, any one of the following:

- Showing up at least once in a face to face class meeting.
- Submission of a student-to-instructor message about a specific aspect of the course. (Taking a remote quiz or just emailing me about course content counts. Emailing about something else, like telling me your computer is broken, does not.)
- Students who simply log into the course but perform no student-initiated action do NOT satisfy the expectations of the federal No Show attendance reporting and will be dropped from the course. You must engage in at least one student-initiated activity to be counted as attending. (Going into Blackboard and looking around does not count.)

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 as promptly as possible.

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.

Cheating: 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. 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. More extreme cases may lead to suspension or expulsion from the college as described in the Code of Conduct.

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), Chicago or other style sheets or manuals adopted by Faculty 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. The purchasing or sharing of papers or projects between students or the re-use of papers or projects submitted for more than one assignment or class also constitutes plagiarism.

Examples of academic dishonesty include but are not limited to the following:
● Taking an exam for another student.
● Having another student take an exam for you.
● Arranging with other students to give or receive answers by the use of signals.
● Copying from someone's exam.
● Allowing another student to copy from you during an exam.
● Obtaining answers, information, translations or material from a source (ex. the Internet) without appropriate citation.
● Getting questions or answers from someone who has already taken the exam.
● Unauthorized use of information stored in the memory of an electronic device (ex. programmable calculators and cell phones) on a test or assignment. No information stored in any electronic devices may be used without explicit permission.

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, and there is no available setup, 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.

Accessibility Statement: If you have a physical, psychological, medical, or learning disability that may impact your coursework or participation in this class, please contact the Assistant Dean for Student Services/Disabilities Coordinator, Success Coach, or Academic Advisor who will arrange an intake meeting. The Assistant Dean/Coordinator will determine with you what accommodations are necessary, appropriate, and reasonable. All information and documentation is confidential.

If you encounter any course materials that are inaccessible with adaptive equipment or inaccessible due to extenuating circumstances please let me know or contact those above.

For Access & Accommodation Services phone 585-343-0055
x6219 or email AccessServices@genesee.edu

Please contact GCCOnline@genesee.edu or call 585-343-0055 extension 6969 with any questions you might have about studying online, support services for online students, or questions about enrolling in other online courses.

Support Services.

Ask me for help any time.

Tutoring is available. To find schedules, make appointments and view your tutoring history visit https://tutortrac.genesee.edu. To work with a tutor via email or to inquire about tutoring services, email tutoring@genesee.edu. Additional success resources are available in the Learning Center, which you can enroll in by visiting the Tutoring module within MyGCC.

STAR-NY is an online, evening tutoring service, available September 1 – December 9. It is open to all GCC students, whether they are in an online class or not. To work with a STAR-NY tutor, visit https://www.starny.org/ and log in with your GCC NetID and password. Questions about the STAR- NY service can be sent to GCCOnline@genesee.edu

For information on other 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.

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: Any course has some memorization, but this one is mostly about developing skills. Skill comes from actively practicing not passively watching something or reading about it. If you were taking piano lessons, looking at sheet music and reading about how to hold your hands might be a good place to start, but after that, re-reading and memorizing doesn't accomplish much. You have to start trying to play and the more you play the better you get. Likewise, the way to get good at solving physics problems is by solving physics problems. When you get stuck on the homework, spend a little time trying to figure it out. Look through your notes or the text for similar examples. After a certain point, if you're just going around in circles, look at the solutions. Then put the solutions away and finish the problem. If you get stuck again, take another peek. If you work on the homework until you can put the solutions on blank paper, just like during the quiz, you can do the same thing during the quiz. For some people, the weekly assignments may not be enough practice. It's better to do three different problems once than to do the same problem three times. If you need more practice than just the homework, go over sample problems from the notes, the text or WebAssign. Cover up the solutions, try them, then compare.

For the monthly exams and final: A month of material probably won't cram into your head in one night. If you've been keeping up each week, refresh your memory by reading back through your notes. If there are areas where you do not feel confident, solve problems, preferably new ones.

This is a fairly demanding course that an average person needs to take seriously. (The job you want isn't well-paid for nothing.) If you aren't willing to do what's necessary, others sitting near you are, and they will be the ones achieving your goals. So, make up your mind to come to class, do the homework and study. Don't be intimidated. Most people can succeed with enough time and effort. Getting good at a sport or musical instrument takes practice; the same is true here. And who knows? You may even discover that the mathematical description of nature can be an interesting subject.

Homework (Quiz Questions):

I will quiz you on homework rather than collecting it. Each assignment consists of six 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/phy131.html and at the library's circulation desk. (I use Blackboard only for videos; 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:

    <u>First</u>, 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.

    <u>Then</u>, use my solutions to help with the parts you're stuck on. If the part you're stuck on is the whole assignment, you should see me or a tutor.

<u>Remember, I'm paid to do this. It's not an imposition if you ask me to do my job.</u>

Sec. 1: Straight line motion:

Read: Chapter 1, sec. 6. Ch. 2, all except sec. 9

Quiz A. 1. (2 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. (8) A stone is thrown upward from the edge of a cliff which is 18.0 m high. It just misses the cliff on the way down, and hits the ground below 2.86 s after being thrown. (a) With what velocity was it released? (b) What is its maximum distance from the ground below?
           ans: 7.72 m/s, 21.0 m

Quiz B. 1. (2 points) If the velocity of a particle is zero at a certain instant, can its acceleration at that instant be nonzero? Explain.

2. (8) (a) An attacker at the base of a castle wall throws a rock straight up with a speed of 7.40 m/s. The top of the wall is 2.10 m higher than the point where it was thrown. Taking up to be positive, what is Δv, the change in the rock's velocity between these two points?
(b) Someone on the wall throws a rock straight down, such that it passes the top of the wall at 7.40 m/s. Taking up to be positive, what is Δv, the change in the rock's velocity between the same two points?
           ans: –3.71 m/s, –2.39 m/s

C. A particle moves along the x axis according to the equation $x = 5.50 + 3.50\,t - t^3$, where x is in meters and t is in seconds. At t = 2.00 s, find
    a. the position of the particle,   (ans: 4.50 m)
    b. its velocity, and   (ans: −8.50 m/s)
    c. its acceleration.   (ans: −12.0 m/s²)

D. A woman is reported to have fallen 144 ft from a building, to the top of a metal ventilator box, which she then crushed to a depth of 18 in. 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: − 96.3 ft/s, 3.09 x 10³ ft/s²

E. 1. (2 points) A car passes point A at a constant 10 m/s. As it nears point B, 120 m from A, its driver pushes down the accelerator. It passes B at 22 m/s, 3.0 sec after passing A. Note that $\Delta v/\Delta t = 4.0$ m/s². Explain why the equation $v_f^2 = v_i^2 + 2a\Delta x$ fails to give this same 4.0 m/s². (It gives $(22^2-10^2)/2(120) = 2.02$ m/s².)

2. (8) Find the instantaneous velocity of the particle described by the graph at the following times: (a) t = 1.00 s, (b) t = 3.00 s, (c) t = 4.50 s.
       ans: 5.00 m/s, − 2.50 m/s, 0
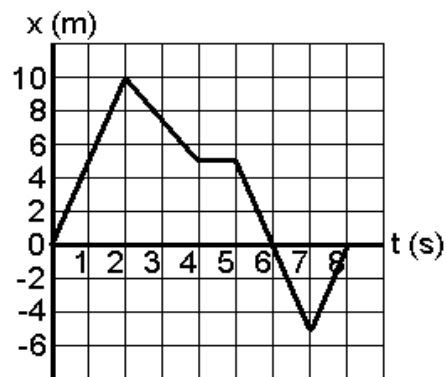
F. The height of a helicopter above the ground is given by $x = 3.00t^3$, where x is in meters and t in seconds. After 2.00 s, the helicopter releases a small mailbag. How much time after its release does it take the mailbag to fall the 24.0 m to the ground?
        ans: 7.96 s

Sec. 2: Vectors:

Read: All of ch. 3.   Ch 4, sec 1.

Quiz A. 1. (2 points)

This is an object's initial velocity: $\xrightarrow{\vec{v}_i}$ This is its final velocity: $\uparrow \vec{v}_f$

Draw an arrow in the approximate direction of the change in its velocity, $\Delta\vec{v}$.

2. (8 pts) A 4.00 kg object has a velocity of $3.00\,\hat{i}$ m/s at one instant. Eight seconds later, its velocity has increased to $(8.00\,\hat{i} + 10.0\,\hat{j})$ m/s. Assuming the object was subject to a constant total force, find (a) the force, $\vec{F}$, and (b) the magnitude of the force, F.

ans: $2.50\,\hat{i} + 5.00\,\hat{j}$ N, 5.59 N

B. 1. (1 point) Can the magnitude of a vector have a negative value?

2. (2 points) A book is moved once around the perimeter of a rectangular table of dimensions 1.0 m by 2.0 m. If the book ends up at its initial position, what is its displacement? What is the distance traveled?

3. (7) Find the magnitude and direction of the resultant of these displacements: $3.00\,\hat{i} + 2.00\,\hat{j}$, m, $-5.00\,\hat{i} + 3.00\,\hat{j}$ m and $6.00\,\hat{i} + 1.00\,\hat{j}$ m.

ans: 7.21 m at 56.3°

C. 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 x axis.

ans: 185 N at 77.8°

80 N   15°   30° / 120 N

y

x
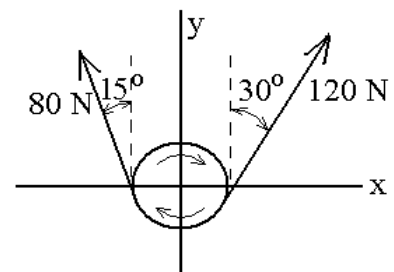
D. Vector $\vec{A}$ has a magnitude of 8.00 units and makes an angle of 45° with the positive x axis. Vector $\vec{B}$ also has a magnitude of 8.00 units, and is directed along the negative x axis. Using graphical methods, find the vector sum, $\vec{A} + \vec{B}$.

ans: 6.12 units at 112°. (Since the question asks for graphical methods, you will receive only 6 points for calculating the correct answer using the component method instead. Since a graphical solution is usually a little off it will receive full credit if you are within a few tenths of a unit, and within a few degrees.)

E. The direction of vector $\vec{A}$ is 45° above the x axis, and $\vec{B}$'s direction is 45° below the x axis. $|\vec{A}| =$ 40.0 units and $|\vec{B}| = 30.0$ units. Find (a) the x any y components of the resultant vector (expressed in unit-vector notation) and (b) the magnitude and direction of the resultant vector.

ans: $49.5\,\hat{i} + 7.07\,\hat{j}$, 50.0 units at 8.13°

F. 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) Two forces act on a 5.00 kg mass as shown. Find the magnitude and direction of the acceleration.
ans: 6.08 m/s² at 25.3°

15.0 N

60.0°

20.0 N

m
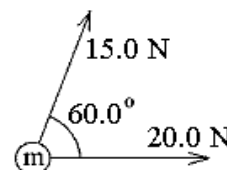
Sec. 3: Newton's Second Law:

Read: All of ch. 5 except sec. 5.6

A. A box is being pushed up a frictionless incline by a 35.0 N force. The force is horizontal, and the incline makes a 25° angle with the horizontal. If the box is accelerating at 2.00 m/s², what does it weigh?
ans: 50.6 N

Scale
reads-
58 N

40°

50°

T₂

B. If T_1 = 135 N, what are the tensions T_2, and T_3? (Find the magnitude of the force in each rope.)
ans: 128 N, 37.6 N

T_3

T_1

135 N
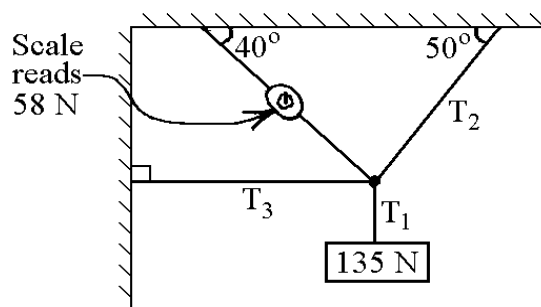
C. A 3.00 kg block starts from rest at the top of a 30° incline and slides down with an acceleration of 1.78 m/s². Find:
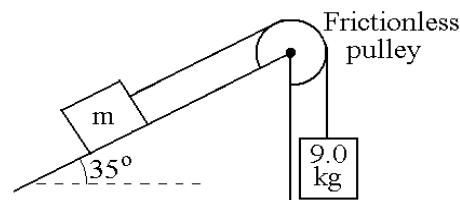a. The friction force on the block.
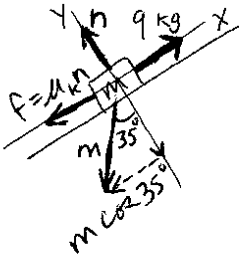b. The coefficient of kinetic friction between the block and the plane.
ans: 9.36 N, .368

D. 1. (4 points) The solution given with this problem contains six different mistakes. Point out any four of them for one point each.

Problem: The coefficient of kinetic friction is .250. Find the mass, m, which will slide downhill with a .950 m/s² acceleration.
Incorrect solution:

Frictionless
pulley

m

35°

9.0
kg

$-F = \mu_k n = (.25)(m)$

$\sum F_x = ma$

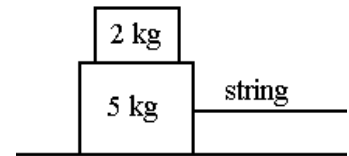$.25m + m \underbrace{\cos 35°}_{.819} - 9 = m(.95 \, m/s^2)$

$(.25 + .819 - .95)\, m = 9$

$.119 \, m = 9$ \qquad ANS

$m = \dfrac{9}{.119} = \boxed{75.5}$

2. (6) A 2.00 kg block is placed on top of a 5.00 kg block. A horizontal string attached to the 5.00 kg is pulled with a force that gives the blocks an acceleration of 3.00 m/s². Find the minimum coefficient of static friction between the blocks such that the 2.00 kg block does not slip.
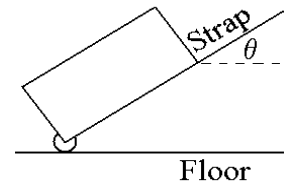

ans: .306

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.
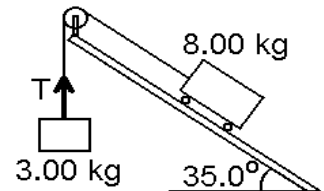   a. Draw a free-body diagram for the suitcase.
   b. What is θ?
   c. What normal force does the ground exert on the suitcase?
       ans: 55°, 167 N

F. The cart is accelerating down the ramp, lifting the 3.00 kg as it does so. The mass of the string, the mass of the pulley and all friction forces are negligible. Find the force, T, with which the string pulls up on the 3.00 kg.
       ans: 33.6 N

Sec. 4: Motion in a Plane

Read: sec. 4.2 - 4.4, 6.1

A. A Ferris wheel of diameter 18.0 m rotates four times each minute.
   (a) What is the centripetal acceleration of a rider?
   (b) What force does the seat exert on a 40 kg rider at the lowest point of the ride?
       ans: 1.58 m/s², 455 N

B. 1. (2 points) A student argues that as a satellite orbits the earth in a circular path, the satellite moves with a constant velocity and therefore has no acceleration. The professor claims that the student is wrong because the satellite must have a centripetal acceleration. What is wrong with the student's argument?

2. (8) An old musket with a muzzle velocity of 130 m/s is aimed horizontally at a mark on a vertical cliff 700 m away. Neglecting air drag, how far below the mark does the bullet strike the cliff?
>   ans: 142 m

C. 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) $13.1\,\hat{i} + 20.1\,\hat{j}$ m/s, $0\,\hat{i} - 9.8\,\hat{j}$ m/s² (b) $13.1\,\hat{i} + 0\,\hat{j}$ m/s, $0\,\hat{i} - 9.8\,\hat{j}$ m/s² (c) 4.11 s (d) 53.7 m

D. 1. (2 points) A projectile is fired at an angle of 30° from the horizontal. Firing at what other projectile angle results in the same horizontal range if the initial speed is the same in both cases? Neglect air resistance.

2. (8) This system is rotating about the vertical shaft. When θ = 40°, the tension in the upper arm is 10.0 N and in the lower arm is 2.33 N. What is the speed of the .600 kg in this situation? (Hint: The horizontal components of both the 10.0 N and the 2.33 N contribute to the net force toward the center.)
>   ans: 1.46 m/s

(Centrifugal governors, typically with two or more such masses, can be used to keep an engine's speed constant. If the engine starts speeding up, the collar is drawn up the shaft moving the throttle toward closed.)
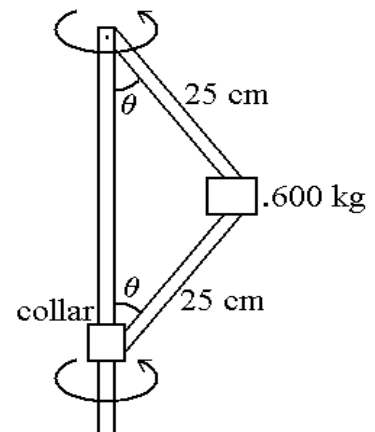
E. A placekicker must kick a football from a point 36.0 m from the goal. The crossbar is 3.05 m high. When kicked, the ball leaves the ground with a speed of 20.0 m/s at an angle of 53° to the horizontal. By how much does the ball clear or pass below the crossbar?
>   ans: clears by .889 m

F. 1. (2 points) Why does an astronaut in a spaceship orbiting the earth experience a feeling of weightlessness?

2. (8) A coin is placed 30.0 cm from the center of a record player turntable. The coin slips when its speed reaches 50.0 cm/s. What is the coefficient of static friction between the coin and turntable?
                    ans: .0850

(Sections 5 - 14 to be handed out later, or available now at
 http://faculty.genesee.edu/macrittenden/phy131.html)