PHYS 113 – General Physics I – Fall 2012

Section:  
LEC: MW 8:30 & 9:30  CW103  Gary Wysin  CW309, 532-1628, wysin@phys.ksu.edu  
QUIZ: W 5:30 - 6:45  CW101-103  Gary Wysin  Office hours: MW 1:30-3:30 & appt.  
REC: T 8:30  CW143  Gary Wysin  CW309, 532-1628, wysin@phys.ksu.edu  
REC: T 9:30  CW146  Gary Wysin  CW309, 532-1628, wysin@phys.ksu.edu  
REC: T 10:30  CW143  Ellie Sayre  CW329, 532-2124, esayre@phys.ksu.edu  
REC: T 11:30  CW143  Ellie Sayre  CW329, 532-2124, esayre@phys.ksu.edu  
REC: T 12:30  W025  Andrew Ivanov  CW010, 532-1699, aivanov@phys.ksu.edu  
REC: T 1:30  CW146  Andrew Ivanov  CW010, 532-1699, aivanov@phys.ksu.edu  
REC: T 2:30  CW143  Shawn Westmoreland  CW33, 532-5768, westmore@phys.ksu.edu  
REC: T 3:30  CW143  Shawn Westmoreland  CW33, 532-5768, westmore@phys.ksu.edu  

Director of Labs:  Tracy Tuttle  CW402, 532-1605, trtutt@phys.ksu.edu  

Important!  
You must register for all four PHYS 113 sections, LEC, QZ, REC, and LAB. If you are missing any of these, get on the wait list immediately!  

Text  

Course Web Sites  
See lecture notes and other aids at  
www.phys.ksu.edu/personal/wysin/GPI/  
See your current grades at K-State Online  
online.ksu.edu  
Do the on-line homework assignments at  
www.masteringphysics.com  

Prerequisites  
A basic knowledge of algebra, trigonometry, geometry and a calculator.  

Description  
PHYS 113 is an algebra/trigonometry based introductory physics course dealing with the topics of motion, mechanics, matter and energy. Emphasis will be placed on the basic principles and concepts and their applications in everyday life.  

Objectives  
Successful students will obtain a broad idea of how to analyze the processes of nature, what goes on in the world, and how some technology works, including the basic concepts and how to make numerical estimates of interesting quantities. Also to learn critical analysis of real-life situations!  

Grading  
Grades will be determined from Recitation, Quiz, Labs, and Final Exam, as follows:  

<table>
<thead>
<tr>
<th>Task</th>
<th>Points</th>
<th>Grading scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour Exams (best 4/5)</td>
<td>500</td>
<td>A: 1000–901</td>
</tr>
<tr>
<td>Lab writeups (best 12/13)</td>
<td>200</td>
<td>B: 900–801</td>
</tr>
<tr>
<td>On-line homework (15 × 15 pts.)</td>
<td>225</td>
<td>C: 800–701</td>
</tr>
<tr>
<td>Recitation (show-work, 15 × 5 pts.)</td>
<td>75</td>
<td>D: 700–601</td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td>F: below 601</td>
</tr>
</tbody>
</table>

Recitation includes an in-class show-work element on paper (15 assignments × 5 pts. each) and an online homework in masteringphysics.com (15 assignments × 15 pts. each). Each lab writeup is worth 10 points; the best 12 will be scaled out of 200 points. The lowest of the hour exams, each worth 125 points, will be dropped. There are no makeup recitations, labs, or exams. The last hour exam takes the place of the final exam, 6:20 - 8:10 p.m., Tuesday, Dec. 11, in CW101, 102 & 103 (See http://courses.k-state.edu/fall2012/information/xam.htm).
Laboratory
The laboratory is a required and integrated part of the course, and counts 20% towards your grade. A passing grade (60%) in the laboratory is required to pass the course. See the lab manual and listen to your lab instructor for rules and grading procedures. Labs begin the second week of class. You do not need to buy any lab manual. The lab information will be found in electronic form on KSOL before each lab. Address your questions about lab grades and procedures either to your lab instructor or to Tracy Tuttle, the Director of Undergraduate Physics Labs, CW402.

Credit for Previous Lab Work
Students retaking the course, who have successfully completed the lab must contact Tracy Tuttle in CW402 (532-1605) during to the first week of lab to get credit for the previous lab work.

Homework and Recitation
Doing homework problems is an important part of obtaining success in physics, helping you organize your thoughts, learn the concepts, and apply them.

There will be two elements to submitting homework: a “show-work” problem submitted on paper in recitation class (5 points), and on-line submission of the full assignment at masteringphysics.com (15 points).

The recitation is where you can go for help with problem solving and learning the concepts. If you have already attempted some of the HW before the recitation, you will get more out of it. The recitation will be oriented towards learning and applying ideas in general, not necessarily to particular problems. The recitation should improve your overall understanding of physics, and help you prepare for exams as well.

Show-work: The choice of the show-work problem is up to your recitation instructor. It may be from the on-line assignment or it could be another problem. Your “show-work” problem must show the details of how you solved it: include necessary diagrams, identify the concepts or physics principles you are using, show the equations you apply, and show how the numbers with units are inserted after that, and finally, a numerical answer with the correct units. No credit will be given for just numbers or a yes/no response. Keep in mind that students who do best on exams are the ones who work carefully, writing things out clearly with well-organized presentation of the concepts and equations used before inserting numbers. See the problem solving tips on pages 3 and 4, and the Guide to Solving Physics Problem hand-out in KSOL.

On-line: Each on-line assignment will be available at www.masteringphysics.com about 10 days before the associated recitation. The problems are from the Giancoli text and other textbooks, as well as Pearson’s “self-tutorial-problems”. The due dates will be 11:59 pm Tuesdays. None of your on-line scores will be dropped. You are allowed to work with others (not copying) on your HW, which means discuss the ideas and things you don’t understand, until you do. Many of the problems have randomized numbers: everybody gets different numerical values. So you will be happiest if you understand what you are doing. You are not allowed to use solution manuals, on-line solution websites, etc. These are considered unauthorized aids and a violation of the honor code. The point of homework is to practice thinking, not copying a solution algorithm from another source.

To get access to the on-line homework you will need to buy an access code for masteringphysics. It can be purchased online at masteringphysics.com, at the bookstores, or also as an option to be included with a paper text or an e-text.

On exams, you will need to show how you solved problems, so it will be good to practice this when doing your HW, even if it is not necessary for submitting online HW. So for your own benefit, acquire the habit of writing out the details of your solutions. You can list the given quantities (with their symbols and values with units) and list the quantity you are looking for (with its symbol and units). Include necessary diagrams, the equations you applied, show how the numbers with units were inserted after that, and finally, give a numerical answer with the correct units. Remember that on exams, no credit will be given if just the final numerical answer is given.
Hour Exams
These take place on Wednesdays at 5:30–6:45 p.m. in CW 101,102,103, except for the last one, which will be in the final exam time, 6:20–8:10 p.m., Tuesday, Dec. 11, see the schedule. If you have an official University event, such as participation in a KSU sports team, debate team, etc., that conflicts with an exam time, you might be able to take that exam early, ask me. There are no makeup exams, but your lowest score of the five exams will be dropped.

The exam problems will be based on the same concepts as covered in the homeworks. Old exams and solutions can be found on the course website. Try to study the concepts and how to apply them, do not just try to memorize how to solve particular problems. One page on the exam will be an equation sheet that summarizes the important formulas you may need to do the problems in those chapters. This equation sheet will be posted to KSOL some days before the exams. Solution keys to the exams will be posted on the course website.

Final Exam
The Final Exam is the last hour exam, covering chapters 13, 14, & 15, on Tuesday, December 11, from 6:20 – 8:10 p.m. in CW 101,102,103. If you are satisfied with the grades you have up to that point, then the Final Exam could be the hour exam that you drop, and your grade will be calculated without it. Be aware that the course grade you see in KSOL is only an estimate of your grade.

Until all homework and lab grades are entered, KSOL does not give your precise grade, due to the low scores being dropped and scaling of points. Only when all components have been entered, is it correct.

Plan early, keep up with the course, take responsibility for your learning and your grade, and you can get done with PHYS 114 early! If in doubt, take the final exam, it can only raise your grade or leave it unchanged.
Tips on doing homework problems

* Don’t wait until the last minute.
  Begin homework assignments several days before they are due.
  You can surely do some of them even before hearing about the topic in lecture.

* What’s going on here?
  Sketch the situation. Make it seem real for yourself.
  Identify desired quantities, with their units.
  \( I \) \( want \) \( to \) \( find \) \( distance \), \( in \) \( meters \)
  List the quantities you know, with units.
  \( I \) \( know \) \( velocity \), \( in \) \( meters/sec \).
  Recall the definitions of these items, it may help a lot!
  What are the important equations or relations between them?
  \( Velocity \) \( times \) \( time \) \( equals \) \( distance \). \( x = vt \).

* Get help if you need it.
  Being completely stuck is no fun. If you really are getting nowhere, and have no idea what to do
  next, you are encouraged to cooperate with other students, or seek help from your instructors.

* What’s my strategy?
  What concepts and equations apply?
  Briefly state your strategy in words and sentences.
  (Pretend you are explaining to another student.)
  Write down the equation(s) you will use, in symbols.

* Solve algebraically for the desired quantity.
  You may need to combine some equations, or use trigonometry, that’s OK!
  Get the quantity you want on the left of the equals sign, and everything else on the right.
  Don’t skip steps.

* Do the arithmetic, with units.
  Substitute numbers with units in your equation.
  \( x = vt \) becomes \( x = (5.0 \) \( m/s)(2.0 \) \( s) = 10 \) \( m \).
  Keep the units on everything until the end. It’s a useful check.

* Write down the answer, with correct units!

* Does the answer make sense?
  Is the number of reasonable size, not excessively large or small?
  If you change the given numbers to very simple cases, will you get an expected result?
  If you modified the situation into a simpler one, will your approach still work?

* Enjoy the challenge.
  Hey, you figured out something new. Now you understand it.
  And it wasn’t so simple.
  Have confidence, you can do as well or better on the next problem!
Physics Study Hints:
1. Read the textbook, paying attention to the equations and figures.
2. When you take notes in class, don’t just copy equations and diagrams. Listen to the instructor and write down the ideas behind the equations and diagrams!
3. Study the examples in the book in order to learn how to solve problems.
4. If you don’t understand, formulate a question. Write down your questions so you can ask your instructor later. Then ask your instructor later!
5. Stop occasionally and think about what you just read. Try to think of real-life examples where the physics ideas might be applicable.
6. Look at extra questions and level I problems, just to see if you would know how to answer them. If so, you have a good grasp of the definitions of basic concepts.
7. If you can’t work a difficult homework problem, try to work a related, but easier one first. Or, try breaking your problem into steps or parts.
8. Keep in mind, the level II problems usually require you to apply more than one concept. You probably need to use more than one equation.
9. In physics, the same idea can be expressed several ways: as a picture or diagram, an equation, or a graph. Look for the main idea. Think about how the different presentations help you to understand it.
10. Remember, physics isn’t always complicated. Most of the ideas are of the simple, common-sense type.

Laboratory Hints:
1. Work smart, which is to say, efficiently. Check yourself as you go along (hints 3,5,6 above). Do it right the first time, because you won’t have time to do it over.
2. Write down the names and telephone numbers of your lab partners on your data sheet.
3. Read the lab manual before lab. Figure out what you want to look for, and how you will look for it. Write this down before you get to lab. (This is the start of your lab report.)
4. In lab, pay attention to the lab instructor’s explanation. Some things aren’t in the lab manual.
5. While taking data, make a graph right away so you can see if your data make sense. Professional physicists do this all the time. Plot each data point as soon as you’ve finished writing down the number. This habit can save a lot of trouble later, because you can immediately see what the data are doing!
6. After you have taken a few data points, do a sample calculation for analyzing the data. This will (a) let you know if your data make sense, (b) let you know whether you understand what you are doing, (c) let you know if you’ve forgotten to write down any quantities. A sample calculation will save you from getting home, then realizing that you forgot to get a number.
7. Write down everything on your data sheets. Never rely on your memory. Use pen. Never erase. Cross mistakes out neatly instead, so you can still read them if you have to. Write down ideas that occur to members of your lab group, too!
8. Work as a team. Make sure that everyone gets to play with the equipment. Report broken equipment to the lab instructor, so he can make sure it gets fixed.
9. Graphs on the data sheet may be crude. Graphs in the lab report should be drawn large enough to see, preferably on a full page. Graphs and tables must have titles. The axes on graphs must have labels (i.e., numbers, name of quantity being plotted, and its units).
10. Use words and sentences to describe what you are doing. Correct spelling and grammar are encouraged. Graphs, tables and equations supplement the words. They never replace words.
<table>
<thead>
<tr>
<th>Date</th>
<th>Reading</th>
<th>Lecture Topics / Recitation Conceptual Questions</th>
<th>Week's Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-20 Mo</td>
<td>1-4,5,6</td>
<td>1. Measurements, Units, Numbers</td>
<td></td>
</tr>
<tr>
<td>8-21 Tu</td>
<td>Recitation 1</td>
<td>1. Q3.7. See masteringphysics.com for online HW.</td>
<td>No Lab</td>
</tr>
<tr>
<td>8-22 We</td>
<td>1-1,2,3,7</td>
<td>1. Science, Estimations</td>
<td></td>
</tr>
<tr>
<td>8-27 Mo</td>
<td>2-1 to 2-4</td>
<td>2. 1-Dimensional Kinematics, Velocity, Acceleration</td>
<td></td>
</tr>
<tr>
<td>8-28 Tu</td>
<td>Recitation 2</td>
<td>2. Q7.11.</td>
<td>Intro. Kinematics</td>
</tr>
<tr>
<td>8-29 We</td>
<td>2-5 to 2-7</td>
<td>2. Motion with Constant Acceleration; Free Fall</td>
<td></td>
</tr>
<tr>
<td>9-03 Mo</td>
<td>no class</td>
<td>Labor Day Holiday</td>
<td></td>
</tr>
<tr>
<td>9-04 Tu</td>
<td>Recitation 3</td>
<td>3. Vectors: Addition, Subtraction, Components</td>
<td></td>
</tr>
<tr>
<td>9-05 We</td>
<td>3-1 to 3-4</td>
<td>3. Vectors: Addition, Subtraction, Components</td>
<td>Projectile Motion I</td>
</tr>
<tr>
<td>9-10 Mo</td>
<td>3-5 to 3-8</td>
<td>3. 2-Dimensional Motion, Projectiles; Relative Motion</td>
<td></td>
</tr>
<tr>
<td>9-11 Tu</td>
<td>Recitation 4</td>
<td>4. Q2,7,16,18.</td>
<td>Projectile Motion II</td>
</tr>
<tr>
<td>9-12 We</td>
<td>4-1 to 4-5</td>
<td>4. Newton’s Laws of Motion</td>
<td>Exam 1, Chs. 1,2,3</td>
</tr>
<tr>
<td>9-17 Mo</td>
<td>4-6</td>
<td>4. Newton’s Laws and Gravity</td>
<td></td>
</tr>
<tr>
<td>9-18 Tu</td>
<td>Recitation 5</td>
<td>4. Q3,8,9,14.</td>
<td>No Lab</td>
</tr>
<tr>
<td>9-19 We</td>
<td>4-7 to 4-9</td>
<td>4. Newton and Free-Body Diagrams; Friction</td>
<td></td>
</tr>
<tr>
<td>9-24 Mo</td>
<td>4-7 to 4-9</td>
<td>4. Problems with Friction, Inclines</td>
<td>Newton’s 2nd Law</td>
</tr>
<tr>
<td>9-26 We</td>
<td>5-1 to 5-5</td>
<td>5. Circular Motion and Centripetal Acceleration</td>
<td></td>
</tr>
<tr>
<td>10-01 Mo</td>
<td>5-6 to 5-9</td>
<td>5. Newton’s Law of Gravitation, Orbits</td>
<td>Centripetal Acceleration</td>
</tr>
<tr>
<td>10-02 Tu</td>
<td>Recitation 7</td>
<td>5. Q1,3,20,21.</td>
<td></td>
</tr>
<tr>
<td>10-03 We</td>
<td>6-1 to 6-5</td>
<td>6. Work, Kinetic and Potential Energy</td>
<td></td>
</tr>
<tr>
<td>10-08 Mo</td>
<td>6-6 to 6-10</td>
<td>6. Conservation of Mechanical Energy</td>
<td></td>
</tr>
<tr>
<td>10-09 Tu</td>
<td>Recitation 8</td>
<td>6. Q5,8,16,18.</td>
<td>Work &amp; Energy</td>
</tr>
<tr>
<td>10-10 We</td>
<td>7-1 to 7-5</td>
<td>7. Linear Momentum and 1D Collisions</td>
<td>Exam 2, Chs. 4,5,6</td>
</tr>
<tr>
<td>10-15 Mo</td>
<td>7-6 to 7-10</td>
<td>7. More on Collisions; Center of Mass</td>
<td>Momentum &amp; Collisions</td>
</tr>
<tr>
<td>10-16 Tu</td>
<td>Recitation 9</td>
<td>7. Q8,13,15,18.</td>
<td></td>
</tr>
<tr>
<td>10-17 We</td>
<td>8-1 to 8-4</td>
<td>8. Rotation: Kinematics, Torque</td>
<td></td>
</tr>
</tbody>
</table>
### Schedule for General Physics I, Fall 2012 (continued)

<table>
<thead>
<tr>
<th>Date</th>
<th>Reading</th>
<th>Lecture Topics / Recitation Conceptual Questions</th>
<th>Week's Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-22 Mo</td>
<td>8-5 to 8-8</td>
<td>8. Rotation: Dynamics, Inertia, Angular Momentum</td>
<td></td>
</tr>
<tr>
<td>10-23 Tu</td>
<td>Recitation 10</td>
<td>8. Q2,4,13,19.</td>
<td></td>
</tr>
<tr>
<td>10-24 We</td>
<td>9-1 to 9-4</td>
<td>9. Static Equilibrium of Objects</td>
<td>Torque &amp; Inertia</td>
</tr>
<tr>
<td>10-29 Mo</td>
<td>10-1 to 10-6</td>
<td>10. Static Fluids: Density and Pressure</td>
<td></td>
</tr>
<tr>
<td>10-31 We</td>
<td>10-7 to 10-10</td>
<td>10. Buoyant Forces, Bernouli &amp; Moving Fluids</td>
<td></td>
</tr>
<tr>
<td>11-05 Mo</td>
<td>11-1 to 11-4</td>
<td>11. Vibrations; Simple Harmonic Motion</td>
<td>Oscillations</td>
</tr>
<tr>
<td>11-06 Tu</td>
<td>Recitation 12</td>
<td>10. Q9,16. 11. Q1,10.</td>
<td></td>
</tr>
<tr>
<td>11-07 We</td>
<td>11-5 to 11-10</td>
<td>11. Waves: Frequency, Wavelength, Speed</td>
<td></td>
</tr>
<tr>
<td>11-12 Mo</td>
<td>11-11 to 11-13</td>
<td>11. Waves: Interference, Standing Waves</td>
<td>Intro. Waves</td>
</tr>
<tr>
<td>11-13 Tu</td>
<td>Recitation 13</td>
<td>12. Sound, Intensity and Level; Sources</td>
<td></td>
</tr>
<tr>
<td>11-19 Mo</td>
<td>no class</td>
<td>13. Atomic Theory, Temperature, Ideal Gas Law</td>
<td></td>
</tr>
<tr>
<td>11-20 Tu</td>
<td>no class</td>
<td>Thanksgiving Holiday</td>
<td></td>
</tr>
<tr>
<td>11-21 We</td>
<td>no class</td>
<td>Thanksgiving Holiday</td>
<td>No Lab</td>
</tr>
<tr>
<td>11-26 Mo</td>
<td>13-8 to 13-11</td>
<td>13. Ideal Gases and Kinetic Theory</td>
<td></td>
</tr>
<tr>
<td>11-28 We</td>
<td>14-1 to 14-5</td>
<td>14. Heat: Temperature Changes, Latent Heat</td>
<td></td>
</tr>
<tr>
<td>12-03 Mo</td>
<td>14-6 to 14-8</td>
<td>14. Heat: Conduction, Convection, Radiation</td>
<td></td>
</tr>
<tr>
<td>12-04 Tu</td>
<td>Recitation 15</td>
<td>14. Q2,7,11,19. 15. Q1,5.</td>
<td>No Lab</td>
</tr>
<tr>
<td>12-05 We</td>
<td>15-1 to 15-3</td>
<td>15. Thermodynamics, 1st Law, Energy Conservation</td>
<td></td>
</tr>
<tr>
<td>12-11 Tu</td>
<td>no lecture</td>
<td>Final Hour Exam, 6:20–8:10 p.m., CW101,102,103</td>
<td></td>
</tr>
</tbody>
</table>

Exam 5, Chs. 13,14,15
IMPORTANT STATEMENTS:

Disabilities
Any student with a disability who needs a classroom accommodation, access to technology or other assistance in this course should contact Disability Support Services and/or the instructor. DSS serves students with a wide range of disabilities including, but not limited to, physical disabilities, sensory impairments, learning disabilities, attention deficit disorder, depression, and anxiety.

University Statement Regarding Academic Honesty
Kansas State University has an Honor System based on personal integrity, which is presumed to be sufficient assurance in academic matters one’s work is performed honestly and without unauthorized assistance. Undergraduate and graduate students, by registration, acknowledge the jurisdiction of the Honor System. The policies and procedures of the Honor System apply to all full and part-time students enrolled in undergraduate and graduate courses on-campus, off-campus, and via distance learning. The honor system website can be reach via the following URL: www.ksu.edu/honor.

A component vital to the Honor System is the inclusion of the Honor Pledge which applies to all assignments, examinations, or other course work undertaken by students. The Honor Pledge is implied, whether or not it is stated: "On my honor, as a student, I have neither given nor received unauthorized aid on this academic work.” A grade of XF can result from a breach of academic honesty. The F indicates failure in the course; the X indicates the reason is an Honor Pledge violation.

My Additional Statements on Academic Honesty
Note that you are permitted to work with (not copy from!) other students on homework problems (and labs) if you acknowledge cooperation by writing “I worked with (name)” on the assignment. Use of a solution manual for doing homework is an unauthorized aid. All exams must be entirely your own work.

University Statement Defining Expectations for Classroom Conduct
All student activities in the University, including this course, are governed by the Student Judicial Conduct Code as outlined in the Student Government Association By Laws, Article VI, Section 3, number 2. Students that engage in behavior that disrupts the learning environment may be asked to leave the class.

University Campus Safety Statement
Kansas State University is committed to providing a safe teaching and learning environment for student and faculty members. In order to enhance your safety in the unlikely case of a campus emergency make sure that you know where and how to quickly exit your classroom and how to follow any emergency directives. To view additional campus emergency information go to the University’s main page, www.k-state.edu, and click on the Emergency Information button.

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Dear Student:
In this course you will be using MasteringPhysics®, an online tutorial and homework program that accompanies your textbook.

**What You Need:**
- A valid email address and your KSU WID
- A student access code: Purchase at bookstore or at MasteringPhysics.com
- The ZIP code for your school: 66502
- A Course ID: MPWYSIN2012F

**Register**
- Go to [www.masteringphysics.com](http://www.masteringphysics.com) and click New Students under Register.
- To register using the Student Access Code, select Yes, I have an access code. Click Continue. Or click No, I need to purchase access online now.
- License Agreement and Privacy Policy: Click I Accept to indicate that you have read and agree to the license agreement and privacy policy.
- Select the appropriate option under “Do you have a Pearson Education account?” (yes, if you used Mastering in another course) and supply the requested information. Upon completion, the Confirmation & Summary page confirms your registration. This information will also be emailed to you for your records. You can either click Log In Now or return to [www.masteringphysics.com](http://www.masteringphysics.com) later.

**Log In**
- Go to [www.masteringphysics.com](http://www.masteringphysics.com).
- Enter your Login Name and Password and click Log In.

**Enroll in Your Instructor’s Course and/or Access the Self-Study Area**
Upon first login, you’ll be prompted to do one or more of the following:
- Join your MasteringPhysics course by entering the Course ID provided by your instructor.
- Enter a Student ID, if prompted. This is your KSU WID, a nine-digit number. Do not enter your KSU eID here.

Click Save and OK.

Congratulations! You have completed registration and have enrolled in your instructor’s MasteringPhysics course. To access your course from now on, simply go to [www.masteringphysics.com](http://www.masteringphysics.com), enter your Login Name and Password, and click Log In. If your instructor has created assignments, you can access them in the Assignments Due Soon area or by clicking View All in this area. Otherwise, click on Study Area to access self-study material.

**Support**

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