CHEMISTRY 13600 FALL 2018
COURSE PACKET

Professor:  Adam Wasserman, WTHR-265B, phone: 494-4234, awasser@purdue.edu

Teaching Assistants:  Yan Oueis, WTHR-260A, youeis@purdue.edu
                     Victor Chávez, WTHR-261, gonzac4@purdue.edu

Class Schedule:

- **Lectures:**  Monday and Wednesday: 8:30-9:20 AM in WTHR 160
  Friday: 8:30 – 9:20 AM in WALC 3154

- **Lab:**  Tuesday: 11:30 - 2:20 PM or 2:50 - 5:40 PM in BRWN 2135

- **Voluntary Help Session (PSO):**  Thursday: 3:30 - 4:20 PM in WALC 3132 or
  4:30 - 5:20 PM in BRWN 3102

- **Office hour:**  Thursday: 2:00 PM in WTHR-265B

Textbook and Laboratory Materials:

  ISBN: 978-1-891389-60-3

- *Chemistry 13600 Laboratory Experiments*; Purdue University Department of
  Chemistry, Fall, 2018

- Student Lab Notebook, Hayden-McNeil, 100 carbonless page sets

- **Required Safety Equipment:**  Approved Safety Goggles

Course materials including homework and problem sets discussed in Friday lectures may not be distributed or posted on-line.
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Week at a glance</th>
<th>Topic</th>
<th>Chapters</th>
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</thead>
</table>
| 1    | 08/20 – 08/24 | M: Course intro. Why Chemistry?  
T: See “Safety training” on Blackboard. No lab.  
W: Baseline assessment.  
F: Length-scales and time-scales | Intro to Chemistry                             | 1 - 3    |
| 2    | 08/27 – 08/31 | M: Ionization energies of atoms; emission spectra.  
T: Lab: Check-in.  
W: Energy quantization.  
F: Quiz 1 | Light and Matter                        | 4        |
| 3    | 09/03 – 09/07 | M: No class (Labor day)  
T: Lab # 1: How Much is too Much?  
W: Wavefunctions; electron configuration of atoms.  
F: Quiz 2 | Atomic structure                      | 5        |
| 4    | 09/10 – 09/14 | M: Importance of electrostatic forces in chemistry.  
T: Lab # 2: What is the Structure of a Crystal?  
W: Ionic bond energies.  
F: Quiz 3 | Ionic bonds                           | 6        |
| 5    | 09/17 – 09/21 | M: Electron pair; Lewis formulas.  
T: Lab # 3: What Can We Learn About Polymers?  
W: Partial charges and electronegativities.  
*Form groups and assign topics for final presentation.*  
F: Quiz 4 | Covalent bonds                        | 7 Exam I:  
Thurs. 09/20 |
| 6    | 09/24 – 09/28 | M: Shapes of molecules via VSEPR.  
T: Lab # 4: How can we Rank Oxidizing and Reducing Agents?  
W: Chirality.  
F: Quiz 5 | The structure of molecules            | 8        |
| 7    | 10/01 – 10/05 | M: Quantum-mechanical origin of covalent bonds; diatomics.  
T: Lab # 5: Is there experimental Evidence for Hund’s rule?  
W: Orbital hybridization; polyatomics.  
F: Quiz 6 | Molecular orbitals                    | 9        |
| 8    | 10/08 – 10/12 | M: No class (October break)  
T: No lab.  
W: Properties of gases.  
F: Quiz 7 | Gases                               | 13       |
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>9</td>
<td>10/15 – 10/19</td>
<td>M: <strong>Enthalpy, internal energy, and specific heat.</strong>&lt;br&gt;T: Lab #6: How Much Heat is transferred in a Reaction?&lt;br&gt;W: <strong>Heat transfer in phase transitions and chemical reactions.</strong>&lt;br&gt;F: <strong>Quiz 8</strong></td>
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<td>10</td>
<td>10/22 – 10/26</td>
<td>M: <strong>Properties of liquids</strong>&lt;br&gt;T: Lab #7: How is the Concentration of a Solution determined?&lt;br&gt;W: <strong>Properties of solids</strong>&lt;br&gt;F: <strong>Quiz 9</strong></td>
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<td>11</td>
<td>10/29 – 11/02</td>
<td>M: <strong>Rate laws of chemical reactions.</strong>&lt;br&gt;T: Lab #8: How Can a Rate Law be determined?&lt;br&gt;W: <strong>More on rate laws.</strong>&lt;br&gt;F: <strong>Quiz 10</strong></td>
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<td>12</td>
<td>11/05 – 11/09</td>
<td>M: <strong>Activation energies.</strong>&lt;br&gt;T: Lab #9: Why Does a Battery “Run Down”?&lt;br&gt;W: <strong>Catalysis.</strong>&lt;br&gt;F: <strong>Quiz 11</strong></td>
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<td>13</td>
<td>11/12 – 11/16</td>
<td>M: <strong>Equilibrium constants.</strong>&lt;br&gt;T: Lab #10: How Do Buffers Resist Changes in pH?&lt;br&gt;W: <strong>Away from and toward equilibrium.</strong>&lt;br&gt;F: <strong>Quiz 12</strong></td>
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<td>14</td>
<td>11/19 – 11/23</td>
<td>M: <strong>Meaning of entropy.</strong>&lt;br&gt;T: No lab (Compensation for evening exams)&lt;br&gt;W: No class (Thanksgiving break)&lt;br&gt;F: No class (Thanksgiving break)</td>
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<tr>
<td>15</td>
<td>11/26 – 11/30</td>
<td>M: <strong>Free energy.</strong>&lt;br&gt;T: Lab #11: How Can the Entropy Change Be Measured?&lt;br&gt;W: <strong>Free energy and equilibrium.</strong>&lt;br&gt;F: <strong>Quiz 13</strong></td>
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<tr>
<td>16</td>
<td>12/03 – 12/07</td>
<td>M: 2 presentations&lt;br&gt;T: Check out.&lt;br&gt;W: 2 presentations&lt;br&gt;F: 2 presentations</td>
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**Courses:**
- Heat (Week 9, Exam II: Thurs. 10/18)
- Liquids and solids (Week 10)
- Chemical kinetics (Week 11, Exam III: Thurs. 11/08)
- Mechanisms (Week 12)
- Equilibrium (Week 13, Exam I)
- Entropy (Week 14, Exam II)
- Entropy (Week 15)
- Connection of Chemistry with other fields (Week 16)
COURSE POLICIES

Attendance

We don’t take attendance in lecture. However, you will be responsible for any announcements or course changes that are made in lecture and you will be responsible, of course, for the content discussed in lecture. Quizzes will be given during the first 10 minutes of lecture on most Fridays (please refer to the syllabus). No make-up quizzes will be given.

Chemistry 13600 is a laboratory course and attendance in the laboratory is mandatory so attendance will be taken for laboratory sessions. It is not possible to make-up a missed lab. Students who fail to complete, or miss more than two lab experiments will automatically earn a grade of “F”. Completion of an experiment includes completion and timely submission of a satisfactory laboratory report.

University Deadlines

- **September 3**: Last day to cancel (drop) a course without it appearing on your record; consult academic advisor.
- **September 17**: Last day to cancel (drop) a course with a grade of “W”; advisor signature required. **Note**: Exam I is Sept. 20.
- **October 23**: Last day to cancel (drop) a course with a passing or failing grade; advisor and instructor’s signature required if classification is 3 or above.

Laboratory Reports (See Laboratory Manual for formats.)

Each student must turn in a data sheet when leaving the lab.

Each student must turn in a report when the experiments are done by individuals or sign a group report indicating that they contributed to that report for a group experiment. Reports that consist of a copy of the data/calculations/results that you record in your lab notebook will be due at the end of the laboratory session.

Lab reports are due at (no more than 15 minutes after) the beginning of the lab period one week from the day you did the experiment.

Late Laboratory Reports

For any lab report late no more than one week, 50% of the maximum points will be deducted from the score. If the lab report is more than a week late, it will receive a grade of zero.

Safety Certification

You must complete the online safety certification found on Blackboard with a score of 20/25 or better by **11:59 PM on Monday, September 3**. You must confirm your score in the Blackboard grade center by clicking the My Grades link. You will be sent home and will receive a zero for each lab you miss due to an incomplete safety certification.
Laboratory Notebook

You are responsible for maintaining a laboratory notebook each time you are in the laboratory. Your graduate instructor will check this before you begin the experiment.

Guidelines for the Laboratory Notebook:
- The required lab notebook for Chemistry 13600 is the Student Lab Notebook published by Hayden-McNeil. (Available in the bookstores.)
- Record the title of the experiment, the date on which it was done, data obtained in the experiment, and any observations made while doing the experiment in the notebook.
- All entries are to be written in pen.
- All entries in the laboratory notebook must be legible.
- When you make a mistake while entering data or observations into the laboratory notebook, cross out the mistake with a single line so that the erroneous entry remains legible.
- Date and sign each page of the laboratory notebook upon completing the work.

Laboratory Final

There will be no “laboratory final” in this course. Questions based upon laboratory experiments may appear on the hour exams, however.

Homework and Reading

Homework gives you first-hand experience in solving problems to master the contents of this course. A list of assigned reading and homework problems will be posted on Blackboard every Monday and will be due the same week on Friday at 8:30 AM. One of the two quiz questions each Friday will be taken directly from the homework (but homework itself will not be graded).

Quizzes

As many as thirteen 10-minute quizzes will be given (see schedule). Each quiz will consist of two questions: one question taken directly from the homework due that day and one question from the class notes for the week.

Final Presentation

Guidelines for the final presentation will be posted on Blackboard and explained in Week 5. Topics will be assigned on 09/19.

Exams

There will be three exams given in the evening during the course of the semester and a comprehensive final exam given during Final Exam week. The date and time and location of each exam is given below.

<table>
<thead>
<tr>
<th>Exam</th>
<th>Points</th>
<th>Date/Time</th>
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<tbody>
<tr>
<td>Exam I</td>
<td>140</td>
<td>Thursday, September 20, 8:00-9:30 PM, FRNY G140</td>
</tr>
<tr>
<td>Exam II</td>
<td>140</td>
<td>Thursday, October 18, 8:00-9:30 PM, FRNY G140</td>
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<tr>
<td>Exam III</td>
<td>140</td>
<td>Thursday, November 8, 8:00-9:30 PM, FRNY G140</td>
</tr>
<tr>
<td>Final Exam</td>
<td>280</td>
<td>TBA</td>
</tr>
</tbody>
</table>

Wait until you know the date of the final exam before you make travel plans that might conflict with the exam. Early exams will not be given to accommodate your travel plans.
No make-up quizzes, or exams will be given. We will not be evaluating reasons for exam absences and, therefore not prorating any exam scores (note that the lowest exam score will be dropped at the end of the semester but, if you miss two exams, the second missed exam will count as a zero toward your final exam grade).

During exams:
- Cell phones, i-pods, PDAs, laptops, etc. may not be used during exams.
- Simple scientific calculators are the only electronic tools that can be used during exams.
- Programmable, graphing, alpha-numeric calculators may not be used during exams.
- You may not share a calculator with another student.
- If you arrive late for an exam (within the first 15-minute window) you will not receive additional time to complete the exam and scan sheet.

Accessibility and Accommodations:

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are encouraged to let the Professor know so that options can be discussed. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

If you require accommodations to access course activities or materials, the accommodations must be described and approved by Disability Resource Center*. To implement accommodations, you must follow the instructions listed in the “Student Responsibility” section in the letter prepared by Disability Resource Center. Give a copy of the accommodation letter to your professor and another copy to your TA within the first three (3) weeks of the semester to discuss your accommodations. If you have accommodations identified and approved during the semester, you are encouraged to initiate a meeting with the professor in charge of the course to discuss these accommodations within one (1) week of the date of the letter. (*The Disability Resource Center’s office is in Room 830, Young Hall, 155 S. Grant Street.)

Grief Absence Policy for Students (GAPS)

A student should contact the Office of the Dean of Students (ODOS) to request that a notice of his or her leave be sent to instructors. The student will provide documentation of the death or funeral service attended to the ODOS. Given proper documentation, the instructor will excuse the student from class and provide the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments.

Military Absence Policy for Students (MAPS)

A student should contact the Office of the Dean of Students (ODOS) to request that a notice of the leave be sent to instructors as soon as the student is informed of the dates of mandatory military training. Given proper documentation, the instructor will excuse the student from class and provide the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments.
Total Points

Exams (3 @ 140 points each) ..................................................420
Final exam (280 points) ..........................................................280
Total from exams (drop lowest or half of the final) ................560
Quizzes (13 @ 14 points each; drop 3 lowest) ......................140
Laboratory (11 reports @ 20 points each; drop lowest) ........200
Final presentation .................................................................100

Total ....................................................................................1000

Grades:

A: 850, and completed a minimum of 9 labs.
B: 750, and completed a minimum of 9 labs.
C: 650, and completed a minimum of 9 labs.
D: 550, and completed a minimum of 9 labs.
F: < 550 OR did not meet the requirement of completing a minimum of 9 labs.

No make-up work will be available for missed exams, quizzes, or labs.

Saving Graded Materials

Save all of your quizzes, exams, laboratory reports and your laboratory notebook until your final grade for the course is given.

Calculators

The teaching staff of CHM 13600 may tell you to erase the memory register of any alphanumeric calculator before or during exams and quizzes.

Purdue Honors Pledge

“As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.” https://www.purdue.edu/provost/teachinglearning/honor-pledge.html

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

Cheating (including plagiarism) will be punished as severely as allowed under University guidelines. See the Office of the Dean of Students publication, Academic Integrity: A Guide for Students, which is available at https://www.purdue.edu/odos/academic-integrity and is an excellent summary of expectations for Purdue students.

Having been found guilty of cheating can be as bad as having had a felony conviction when employers look over your college record. It is a serious offense, and students have been expelled from the University (and subsequently denied admission to another University) for cheating on exams, quizzes, or lab reports.
Students caught copying a lab experiment, altering data on a lab experiment, turning in photocopies of laboratory data (i.e., graphs, data tables, calculations, etc.) or turning in a lab report or other work which they didn’t do will face consequences ranging from a zero on the report to a zero in the lab for the entire semester. This information will be sent to the Dean of Students Office, who might take additional action.

Students caught copying or with a written or electronic crib in their possession during an exam or quiz will fail the course. The Dean of Students Office will be informed of this action, which may result in their being expelled from Purdue.

**Examples of academic dishonesty (Cheating)**

While the following list of examples of academic dishonesty is not complete, the examples are provided for your information. If you have any questions at all about permissible behavior, save yourself some grief and ask before acting.

- Plagiarism in any form. Using the exact language of someone else without the use of quotation marks and without giving proper credit to the author is plagiarism.
- Copying or possessing an unauthorized crib (written or electronic) during an exam.
- Copying from another student's exam. Allowing another student to copy from your exam.
- Copying a lab report; giving your lab report to someone else to copy. This includes files on computer disks and websites as well as paper copies.
- Changing data for a lab project to fit the perceived answer (that is, what you think the answer should be).
- Using someone else's data as if the data were your own.
- Submitting a lab report or other work that you did not do.

**Rudeness** (n. The state or quality of being impudent. Synonyms: cheek, gall, audacity, boldness, insolence, impertinence, impudence, brazenness, disrespect, forwardness, sauciness)

The Oxford English dictionary defines rude as 1. Uneducated, unlearned; ignorant; characterized by ignorance or lack of learning. 2. Uncultured, unrefined, unsophisticated, ... also, uncivilized, primitive. 3. Inexperienced; inexpert, unskilled. 4. Ill-mannered, impolite; offensive or discourteous, esp. intentionally. ...

Rudeness won’t be tolerated in this course. The professor in charge reserves the right to lower the letter grades of students exhibiting this behavior by as much, but not more than, one letter grade.

**A Few Words About Your Graduate Instructor**

Your graduate instructor is the person who has the closest contact with you in this course. The graduate instructors in the Department of Chemistry aren’t just “a bunch of grad students.” They are graduate students, all of whom have been through a training program in teaching and tutoring skills and some of whom have several years of experience in teaching. If you are having a problem with some aspects of the course, go first to your graduate instructor. He/she wants to get to know you and help you and is available for consultation both at specific hours and by appointment. However, he/she isn’t going to “spoon-feed” chemistry to you. Your success is this course depends on the amount of work you put into it.
SECRETS OF SUCCESSFUL STUDENTS


- Get to know at least one faculty member each semester. Even if you succeed only half the time, four years later, you will have four faculty members who can write a job recommendation or serve as a reference.
- Students who were the least happy tended to be those who followed advice from their parents (and others) to get the requirements out of the way before getting to the “good stuff.” The happiest students took a mix of courses that included small seminars.
- The one word that most sharply differentiates between students who prospered and those who struggled was the word “time.” Students have to keep an eye on how they spend their time.
- The most important change students need to make is not how much they study, but when. Studying in a long uninterrupted block is much more effective than in short bursts.
- No one has enough time; it’s how you divide up that time that makes the difference. As one student described it: “Every day has three halves: morning, afternoon and evening. And if I can devote any one of those blocks of time to getting my academic work done, I consider that day a success.” (This quote, from an undergraduate at Harvard, reminds me of the comment made each week by a pair of MIT graduates on the show *Car Talk* about the “third half of the show.” Apparently residents of Cambridge, MA have more “halves” than we do.)
- Students who are involved in extracurricular activities are the happiest students on campus and also tend to be the most successful in the classroom.

TEACHING LABORATORY POLICIES

Questions and comments concerning these policies may be directed to the General Chemistry Office, BRWN 1144.

Safety Goggles

*Complete safety goggles (not safety glasses) must be worn in the laboratory at all times, including the day of check-out. Safety goggles may be purchased at the local bookstores or outside of WTHR 200 during the first week of the semester. Any student who is not wearing safety goggles will be asked to leave the laboratory, will not be allowed to make up the laboratory, and will receive a grade of zero for the experiment scheduled for that period.*

Appropriate Dress

*Everyone working in a teaching lab must be appropriately clothed at all times, including check-out. Appropriate clothing covers the body from the neck to the ankles, shoulders, and feet. Shirts (tops) must cover shoulders, underarms, and the entire abdominal area when standing, sitting or reaching. Pants and skirts must be long enough to reach the ankle when standing or sitting. Hose or tights are not to be used as a substitute for proper length pants or skirts. Shoes must cover the entire foot. Footwear with open toes, open heels or other decorative openings are not allowed to be worn. Socks covering the foot and ankle must be worn.*

Gloves

*Gloves serve two purposes: not only do they protect your skin from potential hazardous materials they can prevent transfer of potentially hazardous materials to locations outside the lab. You will be required to wear protective gloves for many lab activities. When you leave lab, recycle your gloves. Get new gloves when you return to lab.*
Contact Lenses

Contact lens wearers are encouraged to wear glasses in the laboratory. Chemicals and vapors can lodge behind the contact lens and cause severe damage to the eyes. Contact lenses also make the use of an eye wash ineffective. If you insist on wearing contact lenses in the laboratory, you need to inform your graduate instructor of this at the beginning of the semester.

Hair

To avoid contact with lighted Bunsen burners, hair longer than shoulder length must be appropriately contained. Rubber bands are available in the laboratory.

Audio-Visual Equipment

Audio-visual equipment is prohibited in the laboratory unless the professor in charge of the course is using such equipment for educational purposes. This means no radios of any kind.

Food and Beverages are Prohibited in the Laboratory. No water bottles are allowed in the laboratory.

Dropping a Chemistry Course / Check-Out

A. Dropping a course: If a student drops a freshman chemistry course after having checked into a locker drawer, it is the student's responsibility to immediately follow check-out procedures.

B. Check-out: Check-out procedures are required of every student on the last day of lab for each freshman chemistry course.

Failure to Check-Out of Lab

For anyone who does not check out of a locker drawer after dropping the course or by the scheduled or designated time:
- his/her padlock will be cut (this may also happen for students who arrive late for the scheduled lab check-out),
- he/she will be charged a $45 fee and,
- he/she will forfeit the right to determine the acceptability of all locker drawer equipment.

SOURCES OF HELP FOR CHEMISTRY 13600

Chemistry 13600 Bulletin Board

Periodically we will post information for the average scores on hour exams, quizzes, and laboratory reports. This information will be posted on Blackboard.

PSO Sessions and Professor’s Office Hours

The TAs will hold weekly PSO sessions and Prof. Wasserman will hold office hours every Thursday at 2:00pm.
Resource Room

In addition to the sources of assistance described above, you can use the facilities provided by the Resource Room (WTHR 117). Between 600 and 800 general chemistry students use the Resource Room each day. This suggests that the Resource Room has something to offer. For example, copies of exam cribs as well as exams from previous years of other courses are available in the Resource Room. A complete description of the resources that are available in the Resource Room are listed below:

- Free help and tutoring from the staff assigned to this area
- A variety of course materials (cribs of hour exams, the course text, and lab manuals)
- A small library of general chemistry texts and programmed learning materials
- Current issues of Chemical and Engineering News
- Electronic calculators for doing chemistry problems
- Molecular and crystal models
- Computers

A student ID card is required to check out most of the materials. Open hours for the Resource Room are MTWR 8:30-8:30, F 8:30-5:30, Sat 10-6. Sun 12-4.

Wetherill Instructional Computing Laboratory

The chemistry department has a microcomputer laboratory located in WTHR 113/114 and WTHR 214. The laboratory contains IBM-compatible computers connected to ITaP and two local high-speed laser printers. The computing laboratory will have open hours for student work. Announcements will be made in lecture and by your TA's regarding the use of this computing laboratory.

Mental Health:

CAPS Information: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and http://www.purdue.edu/caps/ during an after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Emergencies:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to CHM 13600 will be posted on the course Blackboard site or can be obtained by contacting the instructors or TAs via email or the General Chemistry office via phone at 765-494-5250.

You are expected to read your @purdue.edu email on a frequent basis.

“Shelter in Place” means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, earthquake, release of hazardous materials in the outside air, active shooter, building intruder, or a civil disturbance. If you hear the All Hazards Outdoors Emergency Warning Sirens or are notified via text or other means, immediately go inside a building to a safe location and use all communication means available to find out more details about the emergency. Remain in place until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave. There is no “all safe siren;” the notification will come via text, internet, or email announcement.