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**School of Security and Global Studies
HLSS 230
Chemistry of Explosives
3 Credit Hours
8-Weeks
Prerequisite(s): None**

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Instructor Information

Instructor:

Email: Via Message Section in Sakai

Phone:

Fax

Office Hours:

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Course Description (Catalog)

HLSS 230 Chemistry of Explosives (3 hours)

This course offers an introduction to the chemical make-up, and associated hazards, of explosive substances. A combination of reference sources (text book and online) and instructional interaction explosive compounds as well as the research and development behind some of the explosive compounds widely used today throughout the world is explored and discussed to provide a solid grounding in the fundamentals of explosives design and handling. Using a combination of resource materials, the course covers basic scientific properties and classification for the seemingly endless list of safety precautions and handling procedures encountered when dealing with explosive materials. The course is designed to prepare the next generation of explosive handlers. [3 Semester Hours]

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Course Scope

As a General Studies course and the introductory course for an Associates degree program in EOD, this course offers explosive handlers, bomb disposal technicians and responders an introduction to the chemical make-up and associated hazards of explosive substances. The combination of challenging reference sources and instructional interchange immerses the student in the world of explosive compounds including the research and development behind many explosive compounds widely used throughout the world today. This combination of reference materials, website research and group-related projects, allows the new explosive handler to learn the scientific basis for the long lists of safety precautions involved when handling explosives. Topics include, but are not limited to, history of explosives; basic chemical composition of explosives; and, safety precautions and guidelines when approaching or handling explosives. It will also cover researching information sites and references for material ranging from basic safety precautions of explosives to the resources available for emergency handlers and responders. The course helps students understand the hazards associated with common explosive materials.

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Course Objectives

Course Objectives:

- CO-1 Explain the history & development of explosive use
- CO-2 Recognize the importance of chemical composition data related to explosive materials
- CO-3. Define and differentiate between combustion, deflagration & detonation related to explosive chemicals
- CO-4 Discuss thermal decomposition, ignition, & initiation of explosive chemicals
- CO-5 Differentiate between the various uses of explosive chemicals in relation to inherent hazards
- CO-6 Explain the important role of safer nitroglycerin development
- CO-7 Determine the proper course of action given the response atmosphere and explosive material/s encountered.
- CO-8 Identify environmental concerns, and, the local, state, and federal regulations regarding the handling, use and transportation of explosive chemical materials.
- CO-9 Discuss the importance of oxidation in explosive molecules
- CO-10 Delineate the hazards between explosive chemicals in their normal 'states' and uses versus abnormal/unbalanced states and incorrect or criminal uses.
- CO-11 Describe and define activation energy and the 'heats of formation
- CO-12 Identify the protective equipment associated with handling explosive chemicals
- Co-13 Explain the need for DOT regulations regarding the handling. Transportation and use of explosive chemicals

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Course Delivery Method

This course will offer the student an interactive classroom. Each week's lesson will have a course announcement, assigned readings; four Forum topics (discussion group question based on either course readings or an internet-based project), and notes provided by the instructor in the Resources section. The course will provide the student with the necessary knowledge of the international system to better appreciate and comprehend world events and motivations of the numerous international actors.

Since the student is expected to fully participate in discussions and interact with the instructor and other students, reading assignments and assigned projects should be completed in a timely manner.

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Course Materials

1. Akhavan, J. *The Chemistry of Explosives* (2nd ed.). RSC. **NOTE:** You have an electronic version of this text book provided in the Resources section of the LMS; also an electronic version of the Tenny Davis book previously used as a text book for this course.
2. Guest Website Assigned Readings include:
DoD Directive 5160.62. Single Manager Responsibility for Military Explosive Ordnance Disposal Technology and Training (EOD T&T) at: <http://www.dtic.mil/whs/directives/>
Articles and topics available from The Domestic Preparedness Office from sources such as Ask.com <http://www.answers.com/topic/domestic-preparedness-office-ndpo-united-states-national>
Various search engines: Google, Bing or Ask (.com)
3. Weekly Notes in the Course Materials Section.

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Evaluation Procedures

Grades for this course will be based upon four grading instruments. There are weekly discussion questions that are provided in the Forum Section. The student – when directed by the instructor -- will respond to the posting of other students. The mid-term and final exams will be a composite of multiple choice questions and short essays.

The grade scale and due dates for each of the evaluation are provided below:

<u>Grade Instruments:</u>	<u>Points</u>	<u>% of Final Grade</u>
Discussion Group Topics	05 pts	05%
Homework Assignments	15 pts	15%
Abstract Article	10 pts	10%
Research Paper	100 pts	30%
Mid-Term Exam	100 pts	10%
Final Exam	<u>100 pts</u>	<u>30%</u>
	330 pts	100%

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Grading Scale

Please see the [Student Handbook](#) (click here) to reference the University's grading scale

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Course Online

<u>8-Week</u>	<u>Topics</u>	<u>Course Objectives</u>	<u>Readings</u>	<u>Assignments</u>
1	Introduction to chemical explosive properties & classifications. Explosive nomenclature and types by composition	<p>CO- Week 1</p> <p>Explain the history & development of explosive (chemicals) use.</p> <p>Identify the major classifications of explosive chemical substances.</p> <p>List and define basic explosive definitions and terms.</p> <p>Differentiate between primary and secondary explosives</p> <p>Discuss various health and safety concerns.</p> <p>Recognize the importance of chemical data on explosive material.</p>	<p>Akhavan, Chapters 1 & 2.</p> <p>Supplemental Readings: Appropriate chapter URL's for entire course – new URL's added as required: **The first 2 links are excellent sources!</p> <p>http://www.rsc.org/chemistryworld/</p> <p>www.azleg.state.az.us/ars/36/01601.htm</p> <p>http://www.niehs.nih.gov/about/stewardship/</p> <p>www.cdmha.org/definitions.htm#Access.survey</p> <p>www.fas.org/news/reference/lexicon/dee.htm</p> <p>www.fhwa.dot.gov/environment/conformity/con_laws.htm</p> <p>http://www.access.gpo.gov/nara/cfr/</p>	<p>Forum 1 Posting: Introductions</p> <p>Homework in 'Assignments' Section</p> <p>Website: Refer to above 'Guest Websites' and review the website links in the 'Selected Bibliography'</p> <p>Resources: Copied Resources</p>

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2	Explosive chemical functions & reactions	<p>CO-2</p> <p>Define and differentiate between combustion, deflagration & detonation.</p> <p>Explain the propagation of a shockwave detonation.</p> <p>Describe the effect of density & how it pertains to the velocity of detonation.</p> <p>Discuss thermal decomposition, ignition, & initiation.</p> <p>Describe hotspots & the mechanisms for their formation.</p>	<p>Akhavan Chapters 3 & 4</p> <p>Supplemental Readings: Refer to previous URL's from Week 1 for additional reference information.</p>	<p>Forum 1 Posting continues</p> <p>Homework in 'Assignments' Section</p> <p>Website: Refer to above 'Guest Websites'</p> <p>Resources: Copied Resources</p>
3	Pyrotechnics properties. Specifics of smokeless powder, Black Powder and nitric esters. Abstract #1 Due	<p>CO-3</p> <p>Discuss the concerns when handling pyrotechnic compounds.</p> <p>Recognize the difference between state governments when dealing with firework sales.</p> <p>Describe several health and safety concerns.</p> <p>Discuss the similarities and differences between BP and PYRO explosive compositions and hazardous properties.</p> <p>Explain how experimentation with PRYO compounds advanced the overall use of such materials.</p> <p>List the basic safety precautions for handling PYRO and BP.</p> <p>Describe the military importance of these chemicals.</p> <p>Differentiate between the various uses of explosives in relation to inherent hazards.</p> <p>Explain the important role of safer nitroglycerin development.</p>	<p>Notes for Davis (no longer a text resource), Chapters 3-5 in Course Materials section from Akhavan Chapter 8.</p> <p>Supplemental Readings: Refer to previous URL's for additional reference information.</p>	<p>Forum 2 Topic</p> <p>Homework in 'Assignments' Section</p> <p>Website: Refer to above 'Guest Websites'</p> <p>Resources: Copied Resources</p>

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		<p>Define the orienting effect.</p> <p>List the hazards involved when handling various nitro compounds.</p> <p>Explain the nitration process in relation to smokeless powder</p> <p>Discuss Alfred Nobel's contributions</p> <p>Explain the importance of controlling rate burn</p>		
4	<p>Aspects of thermo chemistry Mid-Term Exam</p>	<p>CO-4</p> <p>Discuss the importance of oxidation in explosive molecules</p> <p>Explain the effect of a positive and negative oxygen balance on TNT</p> <p>Define the 'heats of formation'</p> <p>Describe activation energy</p> <p>Discuss the importance of gas volume in relation to the energy produced by an explosive</p> <p>Explain what is meant by the 'lift and heave' effect</p> <p>Define equilibria</p> <p>Discuss the kinetics decomposition</p>	<p>Akhavan - Chapters 5 and 6</p> <p>Supplemental Readings: Appropriate URLs.</p>	<p>Forum 2 continues</p> <p>Homework in 'Assignments' Section</p> <p>Website: Refer to above 'Guest Websites'</p> <p>Resources: Copied Resources</p> <p>Exam: Access Mid-Term Exam in</p> <p>Test and Quizzes</p>
5	<p>Primers & detonators. Dynamite & other High Explosive related chemicals.</p>	<p>CO-5</p> <p>Explain the difference/s between civilian and military dynamite</p> <p>Discuss the chemical composition of civilian dynamite in detail</p> <p>List the various dissolution methods for handling dynamite exudates</p> <p>Define permissible explosives</p> <p>Identify the protective equipment associated with handling dynamite, primers and detonators</p> <p>List the safety precautions for handling</p>	<p>Akhavan, Chapter 8 and notes in Course Materials Section.</p> <p>Supplemental Readings: Appropriate URLs.</p>	<p>Forum 3 Begins</p> <p>Homework in 'Assignments' Section</p> <p>Website: Refer to above 'Guest Websites'</p> <p>Resources: Copied Resources</p>

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		<p>primary and secondary explosive materials</p> <p>Discuss the importance of fulminating compounds</p> <p>Describe how primary explosives ‘explode’</p> <p>Explain why Nobel’s invention of the blasting cap ushered in the ‘modern age’ of explosives</p>		
6	<p>Manufacture of Explosive chemicals. Federal Regulations and impact.</p>	<p>CO-6</p> <p>Discuss the role of nitration in the manufacturing process of explosives</p> <p>Explain the pitfalls of improper waste residue removal to finished explosive products</p> <p>Describe how mercury fulminate is prepared</p> <p>Explain the casting process in detail</p> <p>Define DOT’s role in relation to emergency response.</p> <p>Explain the need for DOT regulations</p> <p>Describe the interactive process between the DOT & the emergency responder for the local, state, & federal levels of government</p> <p>Discuss the seriousness of jurisdiction as it pertains to fines and possible legal adjudication.</p> <p>Define the role of the 1st responder in relation to incidents involving hazardous explosive chemicals.</p>	<p>Akhavan, Chapter 7 and notes in Course Materials Section</p> <p>Supplemental Readings: Appropriate URLs.</p>	<p>Forum 3 Continues</p> <p>Homework in ‘Assignments’ Section</p> <p>Website: Refer to above ‘Guest Websites’</p> <p>Resources: Copied Resources</p>
7	<p>Overview of Federal oversight on</p>	<p>CO-7</p> <p>Underline FEMA’s managerial role in</p>	<p>http://training.fema.gov/EMIWeb/IS/crslist.asp</p> <p>(Mandatory)</p>	<p>Forum 4 Begins</p> <p>Check progress</p>

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	<p>activities related to manufacturer, transportation, handling of explosive chemicals to include criminal and terrorist activities.</p> <p>Essay Paper Due</p>	<p>incidents involving chemical spills and manufacturing plant accidents</p> <p>Discuss the organizational response flow chart when managing scenarios such as seen in the Oklahoma City and more recent Boston (2013) bombings.</p> <p>Discuss how oversight (local/state/federal) of openly purchased chemical substances has changed with the threat of Homemade Explosives</p> <p>Recognize DHS's role via the Office for Bombing Prevention</p> <p>Discuss current threats associated with explosive chemicals in a post 9/11 environment</p>	<p>After accessing the above site, scroll down to the Basic ICS course and follow all instructions</p> <p>http://www.training.fema.gov/</p> <p>http://www.whitehouse.gov/homeland/</p>	<p>of all Assignments</p>
8	Final Exam			Exam: Access Final Term Exam

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Polices

Please see the [Student Handbook](#) to reference all University policies. Quick links to frequently asked question about policies are listed below.

- [Drop/Withdrawal Policy](#)
- [Plagiarism Policy](#)
- [Extension Process and Policy](#)

WRITING EXPECTATIONS

All written submissions should be submitted in a font and page set-up that is readable and neat. It is recommended that students try to adhere to a consistent format, which is described below.

- Typewritten in double-spaced format with a readable style and font and submitted inside the electronic classroom (unless classroom access is not possible and other arrangements have been approved by the professor).
- Arial 11 or 12-point font or Times New Roman styles.
- Page margins Top, Bottom, Left Side and Right Side = 1 inch, with reasonable accommodation being made for special situations and online submission variances.

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- **Smarthinking:** Students have access to ten free hours of tutoring service per year through [Smarthinking](#). Tutoring is available in the following subjects: math (basic math through advanced calculus), science (biology, chemistry, and physics), accounting, statistics, economics, Spanish, writing, grammar, and more. Additional information is located in the Online Library. From the Online Library home page, click on either the "Writing Center" or "Tutoring Center" and then click "Smarthinking." All login information is available.
- Online assistance is available at <http://www.tutor.com/>

CITATION AND REFERENCE STYLE

Assignments completed in a narrative essay or composition format must follow APA guidelines. This course will require students to use the citation and reference style established by the American Psychological Association (APA), in which case students should follow the guidelines set forth in *Publication Manual of the American Psychological Association* (6th ed.). (2001). Washington, D.C.: American Psychological Association.

LATE ASSIGNMENTS

Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. As adults, students, and working professionals I understand you must manage competing demands on your time. Should you need additional time to complete an assignment please contact me before the due date so we can discuss the situation and determine an acceptable resolution. Routine submission of late assignments is unacceptable and may result in points deducted from your final course grade.

DISABILITY ACCOMMODATIONS

This institution complies with the Americans with Disabilities Act, Section 504 of the Rehabilitation Act, and state and local requirements regarding students with disabilities. In compliance with federal and state regulations, reasonable accommodations are provided to qualified students with disabilities.

A request for accommodation is deemed reasonable if the request:

- is based on documented individual needs.
- does not compromise essential requirements of a course or program.
- does not impose an undue financial or administrative burden upon APUS.

A qualified student can, with or without reasonable accommodations, perform the essential functions of program or course requirements. The essential requirements of an academic course or program need not be modified to accommodate an individual with a disability.

Final responsibility for selection of the most appropriate accommodation rests with the University's Disability Support Services Committee and is determined on an individual case-by-

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case basis, based on the nature of the student's disability. Students are encouraged email registrar@apus.edu to discuss potential academic accommodations and begin the review process. It is the student's responsibility to:

- follow the accommodation procedure outlined in this section,
- identify the disability to the staff and/or faculty of the university,
- provide (and incur expense for) current appropriate documentation of disability and accommodation needed from a qualified medical or other licensed professional, and
- request specific accommodations or services.

NETIQUETTE

Online universities promote the advance of knowledge through positive and constructive debate--both inside and outside the classroom. Discussions on the Internet, however, can occasionally degenerate into needless insults and "flaming." Such activity and the loss of good manners are not acceptable in a university setting--basic academic rules of good behavior and proper "Netiquette" must persist. Remember that you are in a place for the fun and excitement of learning that does not include descent to personal attacks, or student attempts to stifle the discussion of others.

- **Technology Limitations:** While you should feel free to explore the full-range of creative composition in your formal papers, keep e-mail layouts simple. The Educator classroom may not fully support MIME or HTML encoded messages, which means that bold face, italics, underlining, and a variety of color-coding or other visual effects will not translate in your e-mail messages.
- **Humor Note:** Despite the best of intentions, jokes and--especially--satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add "emoticons" to help alert your readers: ;-), :), ☺

DISCLAIMER STATEMENT

Course content may vary from the outline to meet the needs of this particular group.

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Online Library

The Online Library is available to enrolled students and faculty from inside the electronic campus. It provides access to subscription article databases, periodicals, books, video and more to support your research and studies. In addition, the Online Library provides access to special learning resources like tutoring services and Turnitin.com, which the University has contracted to boost your academic success.

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- **Library Course Guides:** APUS librarians have created guides for each degree program and many courses. Each guide compiles the most relevant research tools (subscription article databases, journals and ebooks), as well as authoritative websites, multimedia and more. Explore the guides at <http://apus.campusguides.com/>.
- **Ask a Librarian:** librarians are on duty approximately 18 hours per day, 365 days per year. At <http://apus.libanswers.com/>, you can search for answers to library questions, or use the “Ask” button to submit a question of your own.
- **Electronic Books and Journals:** You can use the online library to access over 150,000 ebooks and 40,000 journals, which are licensed for use by APUS students and faculty only. Visit the [Licensed Library Databases](#) guide to explore search options.
- **Research and Writing Help:** librarians have created tutorials for college-level research and writing. [Click here to explore them all.](#)
- **Online Tutoring:** AMU and APU students are eligible for up to 10 free hours of online tutoring provided by APUS. Some military students are eligible for additional hours through their Armed Forces education offices. For more information, visit <http://apus.campusguides.com/tutor>.
- **Interlibrary Loan and other services:** when you need a book or article not held in the APUS Online Library, you may request it via interlibrary loan (ILL). [Read more about ILL and other library services.](#)

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Turnitin.com

Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. Typically the course professor will establish a Turnitin.com access code for his/her classes. If the code has not been established, those who wish to use Turnitin.com may ask their professor to establish the code. [Click here for more information about Turnitin.](#)

Selected Bibliography

Website Sources: All listed in week 1 syllabus section above