GRADUATE COUNCIL: NEW COURSE PROPOSAL

Originating Unit: Chemistry & Biochemistry

Type of action: ☑ New course ☐ Full online course**

Semester and year course will take effect: Spring 2024

New course title: How Chemists Win Wars

Appropriate computer abbreviation (30 spaces or less):

Course instructional methodology: Lecture

course component types: ugradcouncil.tcu.edu/forms/Course Component Types.pdf

New course number: CHEM 50242

Prerequisites for new course: *include an attachment if additional space is needed*

CHEM 30123

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Description of new course (catalog copy): *include an attachment if additional space is needed*

This course will focus on the role that chemistry has played in historical times of conflict. The scientists who made the decisions and the personal and professional conflicts they faced will be presented. Student presentations and daily class discussions will be a significant component of the course grade.

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Fully Online Courses**

All online courses, and /or distance learning offerings must meet State Compliance regulations as defined by specific state legislation. TCU Distance Learning is any for-credit instruction provided to a TCU student outside the State of Texas. This includes internships, clinical, video conferencing, online, or any other delivery format that crosses state lines. Contact the Koehler Center for Teaching Excellence for guidelines. Include a letter of support from the Koehler Center with this proposal.

Supporting evidence or justification: (For a new course, attach proposed syllabus, including course objectives, course outline, and representative bibliography.)

Describe the intended outcomes of the course and how they will be assessed: *include an attachment if additional space is needed*

Students will: (1) develop an understanding of how what they learn in the classroom can be applied to real world scenarios, (2) discuss the ethics of using scientific knowledge for intentional harm to others, and (3) learn the concepts related to military munitions, gas, nuclear warfare, and medicine of treating the related wounds.

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Additional resources required:

Faculty: Instructor (Kayla Green)

Space: Lecture Room

Equipment: Computer, projector

Library: n/a

Financial Aid: n/a

Other: n/a

Change in teaching load: none

Does this change affect any other units of the University? ☐ Yes ☑ No

If yes, submit supporting statement signed by chair of affected unit.

If cross-listed, provide evidence of approval by all curriculum committees appropriate to both the originating and the cross-listed units.

Chair of Originating Unit:

Name: Benjamin Janesko

Unit: Chemistry & Biochemistry

Signature: Benjamin G. Janesko Digitally signed by Benjamin G. Janesko
Date: 2023.10.03 15:22:07 -05'00'

CHEM 50242 - How Chemists Win Wars

INSTRUCTOR:	*Dr. Kayla N. Green* - Sid Richardson, Room 446
	PHONE: 817-257-6220 | kayla.green@tcu.edu
OFFICE HOURS:	By appointment and/or class announcements.
D2L:	Lecture notes, grades, quizzes/tests. Please login daily.

Course Information

Course Material Sourced by Dr. Green (not required for students)

- See D2L for other course reading materials
- Gas! Gas! Quick, Boys!: How Chemistry Changed the First World War, Michael Freemantle (ISBN-10 : 0752466011)
- Napoleon's Buttons: How 17 Molecules Changed History, Penny Le Couteur and Jay Burreson (ISBN-10 : 1585423319)
- The Disappearing Spoon: And Other True Tales of Madness, Love, and the History of the World from the Periodic Table of the Element, Sam Kean (ISBN-10 : 0316051632)
- Trinity: A Graphic History of the First Atomic Bomb, Jonathan Fetter-Vorm (ISBN-10 : 9780809093557)
- Man of the Hour: James B. Conant, Warrior Scientist, Jennet Conant (ISBN-10 : 1476730881)
- The Great Secret: The Classified World War II Disaster that Launched the War on Cancer, Jennet Conant (ISBN-10: 0393868435)
- American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer, Martin J. Sherwin (ISBN-10: 0375726268)
- Scientists at war: The ethics of Cold War weapons research, Sarah Bridger (ISBN-10 : 0674736826)
- Science: The Relation of War to Chemistry in America, James R. Withrow
- Making of the Atomic Bomb, Richard Rhodes
- Dark Sun: The Making of the Hydrogen Bomb, Richard Rhodes

Grading Scheme

Presentations	60 points
Ethics Discussions	40 points
Exams and Quizzes	50 points
Class Participation	25 points
Final Paper (Final Exam Grade)	25 points

CHEM 50242 - How Chemists Win Wars

Grading Scale
All grades will be posted on D2L **Undergraduate Grading scale: A (200 – 175 points); B (174 – 150 points); C (149-125 points); D (124-100 points); F (99-0 points)**
Graduate students will have an additional homework assignment (50 pts) **Undergraduate Grading scale: A (250 – 225 points); B (224 – 200 points); C (199-175 points); D (174-150 points); F (149-0 points)**
Course Description
This course will focus on the role that chemistry has played in historical times of conflict. The scientists who made the decisions and the personal and professional conflicts they faced will be presented. Student presentations and daily class discussions will be a significant component of the course grade.
COURSE DESIGN
a. This course is designed for synchronous instruction and student interaction at the T/R 9:30-10:20 a.m. **b.** The resources on the D2L site, which will include notes, assignments, class announcements, grades, and other important information will serve as the main mechanism of relaying course materials to students. **c.** Please arrive each T/Th prepared for class, ready to work and think, and open to supporting and encouraging your peers. My commitment to you is to provide a supportive and challenging environment and to give you timely and helpful feedback. I value your thoughts and opinions, and I look forward to seeing your growth this semester.

PREREQUISITES: General chemistry and Organic Chemistry.

GRADING POLICIES: The lowest quiz grade will be dropped before determining the average. Late assignments will be graded as following: Up to 24 hours late = 20% off. 24-48 hours late = 40% off. 48-72 hours late = 60% off, etc. The only exceptions are approved absences as described below and must include documentation. Absence does **not** excuse late assignments and will be subject to the conditions above. The drop policy is an allotment to account for sickness and life in general. Please let me know by Spring break if you will need to take you final exam early due to *graduation*.

Course Expectations & Policies

REGULAR ATTENDANCE

a. Lecture attendance is expected for each student and will be tracked.
b. Students are expected to be active learners during lecture time, prepared to learn.
c. Please do NOT schedule any graduate school interviews on an exam day.

COMMUNICATION

a. Please let me know if you have questions. kayla.green@tcu.edu for personal questions/concerns and *TCU Online Discussion Board* will be used for all content-related questions. Response time will be within 24 h on weekdays and 48 h on weekends.
b. I will communicate with you outside of class using D2L and/or email. You are expected to check your email in the morning (1) and at night (1).

QUIZZES AND EXAMS

a. QUIZ (10-25 min) or EXAM (50 min) assessments will take place during the scheduled lecture time (T/R 9:30 a.m.) and will be included in your course grade. Please see the course calendar on D2L for particular dates.
b. Be on time. Late arrivals *may not* be admitted to the quizzes or exams and will receive a zero.
c. Exams and quizzes will primarily cover new material since the last quiz/exam; however, cumulative problems *will* utilize prior concepts from the semester.
d. Quizzes/Exams are returned *asap* but no later than 7 days from when they are turned in.
e. The Final Exam will be a paper to be turned in.
f. No supporting resources such as notes, books, graphing calculators, websites, textbooks, cell phones, smart watches, or similar resources can be used during the exam unless noted otherwise by Dr. Green.

PREPARATION for CLASS and ASSESSMENTS

a. A schedule of topics to be addressed each class appears on the D2L Introduction page for each Unit; you are expected to have read the materials posted and studied the any assigned videos before each class, making note of any questions or troublesome topics. Individual readiness assessments may be used to validate your level of participation.
b. Most importantly, please take advantage of the office hours and ASK FOR HELP!*

SHOW ALL WORK

a. On quiz and exam quantitative questions, you must record your work, showing a logical progression of steps, including all equations, units, and sig figs. In this course, analysis of background information, political and moral affiliations, as well as historical dates may also be important.
b. On quiz and exam qualitative questions you must describe/explain/justify a chemical concept or theory. Be specific in your use of vocabulary and elaborate when appropriate.

CALCULATORS

a. Should not be necessary for this course unless indicated otherwise. In which case, you will be given ample time to obtain one.

MAKE UP POLICY

a. A Make-up Exam will be given *on a date to be announced*, for students who have documented reasons that classify as an excused absence to justify why they are unable to be present for an exam.
b. At the discretion of the instructor, the same make-up exam may be used regardless of which hour exam was missed.
c. If a second exam is missed for an accepted reason, the Final Exam percentage for that content will be substituted.
d. A missed quiz (grade = 0) for and excused absence will not count toward the average quiz score for the semester. For an unexcused absence, a score of zero will be given for that quiz and will be factored into the semester average.

ABSENCE DEFINITIONS AND POLICY

An excused absence is:

1) An official university absence. The University documents this and provides a list of affected students on a weekly basis. I expect to be notified, by the student directly, no less than two weeks prior to the expected absence and reserve the right to deny a make-up exam without proper notification;
2) Formal notice from a Dean at Dean of Students regarding any situation (medical, personal or family problem, etc.) that effects a student's ability to attend an exam. In considering the situation, I will ask the Dean if they can verify the absence through proper documentation and will consider any absence on a case by case basis. *Notice from Dean of Students does not guarantee an excused absence, and I reserve the right to permit or refuse a make-up exam based on the details of the situation.*

In the event of any excused absence, it is the responsibility of the student to ensure that written documentation is provided to TCU Dean of Students, who should contact Dr. Green promptly, upon the students' return. A grade of zero will be assessed for *any* assignment missed due to an unexcused absence.

I reserve the right to require face masks to be worn at any point during the semester to retain the health and safety of each student in the classroom. This will be communicated by email and posted on D2L prior to class.

CHEM 50242 - How Chemists Win Wars

COURSE LEARNING OBJECTIVES

- Identify the context that chemical reactivity played in the evolution of human warfare techniques dating back to ancient civilizations through WWII
- Understand how chemistry revolutionized medicine in the Civil War
- Assess and discuss the ethical consideration for the use of chemical weapons
- Create a timeline for the development of chemical gases in WWI and into WWII
- Apply your knowledge of general chemical concepts to explain the challenges faced in making the nuclear bombs deployed by the United States in WWII
- Produce a high-quality presentation focused on a person, idea, or process as it relates to the chemistry of war

Tentative Schedule

17-Jan	Course Introduction
19-Jan	From Alchemy to Fact-Based Science: A Brief History of Chemistry
24-Jan	From Alchemy to Fact-Based Science: A Brief History of Chemistry
26-Jan	Early Weapons and Warfare: Ancient History
31-Jan	Early Weapons and Warfare: Ancient History
2-Feb	Napaoleon (Quiz 1)
7-Feb	Lavoisier
9-Feb	Civil War
14-Feb	Civil War
16-Feb	Civil War
21-Feb	Civil War: Gunpowder (George, 30 min) (Quiz 2)
23-Feb	Exam 1
28-Feb	WWI: Gas, Fritz Haber & Haber Process (Caroline, 20 min)
2-Mar	WWI: Gas
7-Mar	WWI: Gas
9-Mar	WWI: Gas
21-Mar	WWI: Gas
23-Mar	WWI: Gas - P-Helmet (Caroline, 5-10 min); Harrison Tower (Alyssa, 5-10 min); British Small Box (Ana, 5-10 min) (Quiz 3)
28-Mar	Conant (Alyssa, 20-25 min), Oppenheimer (Hannah, 20-25 min)
30-Mar	Exam 2
4-Apr	Materials of War: Marie Curie (15 min, Lola); Discovery of Radium (15-20 min, Ana); Properties of Radium (15 min, Hannah)
6-Apr	Materials of War: Radium Girls (Katie)
11-Apr	The Manhattan Project
13-Apr	The Manhattan Project
18-Apr	The Manhattan Project
20-Apr	Materials of War: Rockets and Propellants I (George, 25-30 min); Military Mobile X-ray (Alyssa, 10 min) (Quiz 4)

25-Apr	WWI: Nylon, Rubber (War (Caroline, 10-15 min); WWII, Immigrant example: (Jeanne, 20 min)
27-Apr	Bioterrorism , Immigration
2-May	Ethics Discussion (Final Paper due)

TCU Policies and Resources

TCU Mission Statement

To educate individuals to think and act as ethical leaders and responsible citizens in the global community.

Sample Rubric – Class Participation

This course will focus on the role that chemistry has played in historical times of conflict. The scientists who made the decisions and the personal and professional conflicts they faced will be presented. Student presentations and daily class discussions will be a significant component of the course grade.

Performance Elements/Levels	Inadequate (1 point)	Developing (2 points)	Accomplished (3 points)	Exemplary (4 points)	Student Score
Engagement & Active Participation	Student never participates in class discussion; fails to respond to direct questions	Few contributions to class discussions; seldom volunteers but responds to direct questions	Proactively contributes to class discussion; asks questions and responds to direct questions	Proactively and regularly contributes to class discussion; initiates discussion on issues related to class topic	
Listening skills	Does not listen when others talk; interrupts or makes inappropriate comments	Does not listen carefully; comments are often nonresponsive to discussion	Listens and appropriately responds to the contributions of others	Listens without interrupting and incorporates and expands on the comments of other students	
Relevance of contribution to topic under discussion	Contributions are off-topic or distract from discussion	Contributions are sometimes off-topic or distract from discussion	Contributions are always relevant	Contributions are relevant and promote deeper analysis of the topic	
Preparation	Student is not adequately prepared; does not seem to have read the assigned material before class	Student has read the material but not closely, or has read only some of the material before class	Student has read and thought about the material before class	Student is consistently well prepared; sometimes adds relevant information beyond the assigned reading	

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How Chemists Win Wars
Presentation Rubric

General Overview

- Presentation timing based on topic assigned by Dr. Green with 3-5 minutes to answer questions.
- Topic Selection is available on the discussion board for the course on D2L.
- Scope and level are best illustrated by topics presented in the course. A focus on chemistry is key. Inclusion of the historical, ethical, and societal impacts are also a component of the score. Most of these topics will require you to carefully condense, focus, and explain the information regarding your topic in order to make your points and illustrate them in the allotted time. Remember, this is a **chemistry** seminar course, and I expect you to incorporate chemical principles into your discussions and presentation.
- A minimum of **five** resources from peer-reviewed journals, books, or reputable historical websites must be utilized. More than five resources are highly encouraged. (See scoring below, due 2 weeks from your presentation)
- **Topics cannot be repeated or closely related**, *therefore choose your topic early and carefully*. .

Scoring (100 points total):

20 points.	Topic & Sources turned in ***and*** approved 2 weeks ahead of schedule presentation, (-2 points for each day late).
20 points.	Literature, Sources: These must include peer-reviewed journals, books, or reputable historical websites (5 minimum).
60 points.	Faculty Evaluation (Rubric below). Scored by Kayla Green and adjusted to fit the 60 point value.

How Chemists Win Wars
Presentation Rubric

	Poor (1 pt)	Fair (2 pts)	Good (3 pts)	Excellent (4 pts)
Timing	50% or more too long or short	25-49% too long or short	11-24% too long or short	Within 10% of allotted
Chemistry Content: Appropriate for your audience (chemistry/biochemistry majors)	Too broad or lacking any chemistry	minimal structures or reactions	Structures & reactions present	Structures & reactions present with characteristics, data, etc.
Chemistry Content: Detailed explanations & context presented	Only surface level example	Minimal examples	Moderate number for examples presented	Consistent for each point discussed
Chemistry Content: Figures and structures	Copy/paste	Copy/paste But with high resolution	Some structures were redrawn or adapted	All structures that needed to be redrawn were redrawn (chemdraw, ACS format)
Questions provided by Dr. Green were addressed in presentation	1-50%	51-70%	71-90%	91-100%
Content focused on wartime applicability and/or gave historical context	Poor	Fair	Good	Excellent
Organization (FLOW) of Presentation	Poor	Fair	Good	Excellent
Professional Delivery of Presentation	Poor	Fair	Good	Excellent
Quality of Visual Aids (non-chemistry)	Poor	Fair	Good	Excellent
Knowledge of Subject (Answering Questions from the Audience)	Poor	Fair	Good	Excellent
		TOTAL	POINTS	

Marie Curie			
Topic	**Presentation should (at a minimum include)**	**Maximum Points for Presentation**	**Time for Presentation**
Marie Curie	Personal Life: Early years, education and career, marriages, and children. Discrimination. Personal & Financial Challenges.	25	15 min
The discovery of Radium	What was the motivation for these experiments? Was it an accidental discovery? How was it done? What were the challenges? What were the properties of radium? [Must include chemical equations and chemistry!]	30	20 min
Properties of Radium – post discovery	What were the properties of radium that were used in the general population and in the military?	25	15 min
Radium Girls (can be done with a team of up to two)	[Must read the book: The Radium Girls: The Dark Story of America's Shining Women] Company involved. Who were the radium girls? Details of their medical, financial, and legal challenges. What were the legal outcomes?	70	Up to 50 minutes
Mobile Military X-ray Units	What were they? How did they work? Who designed them?	20	10 min

World War I			
Topic	**Presentation should (at a minimum include)**	**Maximum Points for Presentation**	**Time for Presentation**
Fritz Haber – Haber Process	What was it? Why was it important? Why did it warrant a Nobel Prize? [MUST include in depth chemistry: reactions detailing importance in biology/economy, the process itself (and the catalyst!), etc.]. Economics implications of this discovery.	30	20 min
P – Helmet	What was it? How did it work (what was the chemistry)? Did it work effectively? How many were produced? Cost?	15	10 min
Harrison Tower	What was it? How did it work (what was the chemistry)? Did it work	15	10 min

	effectively? How many were produced? Cost?		
British Small Box	What was it? How did it work (what was the chemistry)? Did it work effectively? How many were produced? Cost?	15	10 min
Other	What is something we haven't covered that you would like to add	TBD	TBD

World War II			
Topic	**Presentation should (at a minimum include)**	**Maximum Points for Presentation**	**Time for Presentation**
Jim Conant	Who were they: Childhood, education, PhD and other training? Religious/Moral/Ethical beliefs Personal Challenges What role did they play in the Manhattan Project and other military projects? What did they do after the Manhattan Project?	35	25 min
Robert Oppenheimer	Who were they: Childhood, education, PhD and other training? Religious/Moral/Ethical beliefs Personal Challenges What role did they play in the Manhattan Project? What did they do after the Manhattan Project?	35	25 min
Other	What is something we haven't covered that you would like to add	TBD	TBD

Ethics Debate – Topics to Consider

With the film *Oppenheimer*, it's reasonable to assume that conversations around Oppenheimer's experiences, dilemmas, and controversy will resurface in terms of societal popularity. How do you think the social climate today will influence the way in which opinions are formed against Oppenheimer and his actions; will sentiments be relatively the same, will they be more positive, more understanding, more critical? How does the revisiting of ethical discussions across time frames reflect the subjectivity of ethicality? How does it's nature of subjectivity inform how we develop our opinions on ethicality in the first place?

Three days between the Little Boy bomb in Hiroshima (August 6) and Fat Man in Nagasaki (August 9).

QUESTIONS:

- Do you think that the atomic bomb was the best option to end the Second World War?
- Do you think a second atomic bomb was necessary for Japan to surrender?
- Do you think another type of deal could have been negotiated other than unconditional surrender?
- Do you think that Japan had enough time (three days) to know the magnitude of the damage that the bomb had caused?
- Do you think the United States should have allowed more time to see how the Japanese reacted to the news that the Soviet Union declared war on them?
- Do you think these bombs were the determining factor for the end of the war?
- Do you think that the bombs, especially the second one, were to end the war or to show the power that the US had in its hands?

Was the use of nuclear weapons against Japan justified? In a related thread....

Something that I think is important for us as scientists to consider is the message that was sent with the development and use of an atomic weapon. In essence, this weapon was developed as a means of instilling fear and obedience into the heart of any nation that dared to defy the U.S. At the same time, however, it's danger was downplayed to the people at home. An important video to note here is the "Duck and Cover" series, https://youtu.be/PWqlmow-G0U.

A historical comment on the controversies of selecting Nobel laureates

- Is a scientist responsible for the damaging ways in which their work is used?
- Does Haber's work on ammonia synthesis warrant his nobel prize, despite behavior in his personal life and contribution to the use of fertilizers?
- Is it reasonable to strip a Nobel prize laureate of their award due to their personal actions outside of the field of science?

Final Project

Your **final project** should address one of the following topics. It should be one page in length, not including figures, single spaced, with references in ACS format. [Due: May 9 @ 12 p.m. to kg by email]

1. What considerations should we scientists, as global citizens, postulate in our endeavors of curiosity. Should the timing of our curiosities be impacted if it were a time or peace vs. war?

2. What role do scientists currently play in public policy? How has this changed over time?

3. How did the Manhattan Project change the trajectory of science education in the U.S.? Support your discussion with statistics and sources.

4. How did wars (WWI & WWII) change the demographic of universities? Why did this change occur?

5. Many of those making world-changing decisions faced struggles at home. Give examples of a 'famous scientist' and their personal tragedies. How did this impact their science career and vice versa?