

Academic Year	AY20/21	Semester	2
Course Coordinators	Tan Howe Siang		
Course Code	CM8004 ¹		
Course Title	From Alchemy to Chemistry (Team Project)		
Pre-requisites	Nil		
Mutually Exclusive	CM8003		
No of AUs	3		
Contact Hours	Lecture: 39 hours (3 hours per week)		
Proposal Date	5 October 2020		

Course Aims

On completing this course, you will understand and appreciate the course of historical events and intellectual progress that underlies the modern principles in Chemistry. You will be able to identify and describe the key persons and events that are important to the historical development of Chemistry.

Intended Learning Outcomes (ILO)

Upon successful completion of this course, you should be able to:

1. List and describe the main ideas in modern chemistry.
2. Describe the historical context and development of the ancient origin of alchemy (and chemistry). Identify the difference between alchemy and the science of chemistry.
3. Describe the early development of chemistry into a scientific discipline in the 17th and 18th centuries.
4. Explain the atomic hypothesis made in the early 19th century and describe the subsequent developments in inorganic chemistry.
5. Describe the development of organic chemistry and the introduction of the concept of molecular structure in the mid 19th century
6. Describe the historical development of the periodic table in the mid to late 19th century.
7. Describe and explain the concepts in physics applied to chemistry in the early 19th century. Describe the development of physical chemistry in the late 19th century.
8. Describe and explain the development of quantum mechanics and its application to the development of modern chemistry in the early 20th century.
9. Describe the development of chemistry and its applications to biology, material sciences and other fields since the early 20th century.

¹ Common Course with CM8003

Course Content

1	Introduction to the Key Ideas in Modern Chemistry
2	From Alchemy since the Ancient Times to the Dawn of Chemistry (~1600CE)
3	From the Sceptical Chemists to the Chemical Revolution. How Chemistry becomes a science
4	The Atomic Theory and the Development of Inorganic Chemistry in the 19 th Century
5	The Development of Organic Chemistry and the Concept of Molecular Structure in the 19 th Century
6	The Development of the Periodic Table
7	The Development of Physical Chemistry and the applications of Physics to Chemistry in the 19 th Century
8	Quantum Mechanics and the Rise of Modern Chemistry
9	Chemistry since the early 20 th century

Assessment (includes both continuous and summative assessment)

Component	Course ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/ Individual	Assessment rubrics
1. Midterm Test	1-6	Competence, Civic-mindedness	20%	Individual	Point-based marking (not rubrics based)
2. Group Project	1-9	Creativity, communication and character, Competence, Civic-mindedness	20%	Team	See Appendix
3. Examination	1-9	Competence, Civic-mindedness	60%	Individual	Point-based marking (not rubrics based)
Total			100%		

Formative feedback

You will be given feedback in three ways:

1. By discussions post-lecture or during consultation hours
2. By the comments provided by the instructors after midterm tests and online quizzes
3. For the group project, discussions with instructor about progress will be made

Learning and Teaching approach

Lectures	Face-to-face lectures will be employed. The lectures may be replaced by online lecture videos.
Videos	Related documentary videos will be shown to enable you to have a more immersive understanding of certain conceptual that are discussed in the lecture

Reading and References

Recommended reference book: Transforming Matter. A history of Chemistry from Alchemy to Buckyball (2001), by Trevor H. Levere, ISBN-13: 978-0801866098
Johns Hopkins University Press

Course Policies and Student Responsibilities

(1) General

You are expected to read the lecture materials prior to the lecture session in question. This will help you to learn much more efficiently as you will already have an impression on the topics to be covered.

(2) Absenteeism

If you miss a lecture, you are expected to make up for the lost learning activities. If you miss the mid-term test with approval, you will either be offered a make-up test or grading based upon the final exam score.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Tan Howe Siang	SPMS-CBC-03-06	6316 2987	howesiang@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course ILO	Readings/Activities
1	Introduction to the Key Ideas in Modern Chemistry	1	Lecture
1,2	From Alchemy since Ancient Times to the Dawn of Chemistry (~1600CE)	2	Lecture
3,4	From the Sceptical Chemists to the Chemical Revolution. How Chemistry became a Science	3	Lecture
4,5	The Atomic Theory and the Development of Inorganic Chemistry in the 19 th Century	4	Lecture
5,6	The Development of Organic Chemistry and the Concept of Molecular Structure in the 19 th Century	5	Lecture
6,7,8	The Development of the Periodic Table	6	Lecture
8,9	The Development of Physical Chemistry and the applications of Physics to Chemistry in the 19 th Century	7	Lecture, Midterms
10,11	Quantum Mechanics and the Rise of Modern Chemistry	8	Lecture
12	Chemistry since the early 20 th century	9	Lecture
13	Recapitulation and other topics	1-9	Lecture

Appendix: Assessment Criteria for Group Project Component

Group Project Work

You will carry out the project work in groups of 4 to 5 with a mixture of students from different degree programs (to be decided and/or specified by the instructor). Your group will produce a set of Powerpoint Slides and Video on a topic in History of Chemistry as determined or agreed by the instructor. In practice, you would receive the same marks as your team. However, your score may vary if there is evidence that you did not contribute to your team.

EVALUATION RUBRIC FOR POWERPOINT SLIDES & VIDEO				
	Unsatisfactory	Satisfactory	Good	Excellent
Content	Not related to topic, missing or incomplete	Contains several inaccuracies or incorrect information	Mostly accurate, and demonstrates a surface understanding of topic	Accurate, informative and thorough explanation of topic
Creativity	No attempt was made to make presentation	Majority of the information is cut and paste and shows little or no originality	Concept is original and shows clear effort of creativity in design	Concept is original, engaging and shows clear effort of creativity in design and presentation
Peer Evaluation by the rest of the class	Failed in being engaging and informative	Partially engaging and informative	Engaging and informative	Extremely engaging and informative
Preparation and Collaboration	No evidence of group collaboration or preparation	Little evidence of group collaboration and much over-dominance. Preparation appears to be minimal.	Some evidence of group collaboration, but several members contributed minimally. Some preparation is evident.	Clear attempt at group collaboration, but still some overdominance. Preparation is evident.

CBC Programme Learning Outcome

The Division of Chemistry and Biological Chemistry (CBC) offers an undergraduate degree major in Chemistry that satisfies the American Chemical Society (ACS) curricular guidelines and equips students with knowledge relevant to the industry. Graduates of the Division of Chemistry and Biological Chemistry should have the following key attributes:

1. Competence

Graduates should be well-versed in the foundational and advanced concepts of chemical science, be able to evaluate chemistry-related information critically and independently, and be able to use complex reasoning to solve emergent chemical problems.

2. Creativity

Graduates should be able to synthesize and integrate multiple ideas across the curriculum, and propose innovative solutions to emergent chemistry-related problems based on their training in chemistry.

3. Communication

Graduates should be able to demonstrate clarity of thought, independent thinking, and sound scientific analysis and reasoning through written and oral reports to audiences with varying technical backgrounds. They should also be able to effectively engage other professional chemists in collaborative endeavours.

4. Character

Graduates should be able to act in responsible ways and uphold the high ethical standards that the society expects of professional chemists.

5. Civic-mindedness

Graduates should be aware of the impact of chemistry on society, and how chemistry can be applied to benefit mankind. They should also be aware of and uphold the best chemical safety practices.