Academic Transfer Pathways **Massachusetts Department of Higher Education**
April 3, 2015 Convening **Massachusetts Bay Community College**

Chemistry Convening Notes

Disciplinary Sector Leaders

Community Colleges: Bill Griffin, Bunker Hill Community College
State Universities: Steven Cok, Framingham State University

Faculty Attendees:

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Foundational Courses

Chemistry I	Organic Chemistry I	Calculus I	Physics I
Chemistry II	Organic Chemistry II	Calculus II	Physics II

The goal of the meeting was to have system-wide agreement on what the foundational courses are for the first two years of study in the discipline and a commitment that our campuses will accept these courses and count them towards the baccalaureate degree. Transfer professionals also attended the meeting and provided insight on a number of issues.

Disciplinary Segmental Leaders requested that faculty submit syllabi for the foundational courses prior to the meeting in order to conduct a review that would allow them to identify core course components. During the meeting, faculty agreed with the core components for Chemistry I, Chemistry II, Organic Chemistry I, and Organic Chemistry II. The course equivalencies for Calculus and Physics courses remained the same. Attendees were encouraged to share the equivalency sheets with their colleagues in those departments.

Following this exercise, faculty engaged in a conversation regarding community college course alignment. If a course covered the topics in the core course components sheet, it would be considered appropriate for a Chemistry major. Courses that met this criteria are listed in the Community College Course Alignment sheet.

Given that different topics are introduced in different courses, faculty agreed that students would be allowed to transfer these courses if they completed the sequence (Chemistry I and Chemistry II, Organic Chemistry I and Organic Chemistry II) at the same institution.

Faculty also discussed what topics need to be covered in labs. The following statement has been slightly modified from the ACS (American Chemical Society) Guidelines for Chemistry in Two-Year College Programs (page 14). These components cover topics taught in Chemistry I, Chemistry II, Organic Chemistry I, and Organic Chemistry II.

This hands-on experience is necessary for students to understand, appreciate, and apply chemical concepts. Depending on the level and nature of the course, laboratory experiences should include the following activities:

- *Anticipating, recognizing, and responding properly to potential hazards in laboratory procedures;*
- *Keeping accurate and complete experimental records;*
- *Performing accurate quantitative measurements;*
- *Interpreting experimental results and drawing reasonable conclusions;*
- *Analyzing data statistically, assessing the reliability of experimental results, and discussing the sources of systematic and random error in experiments;*
- *Communicating effectively through oral or written reports;*
- *Preparing for and executing experiments; and*
- *Synthesizing and characterizing inorganic and organic compounds.*

Computer simulations that mimic laboratory procedures have the potential to be useful supplements, but should not be considered equivalent replacements for hands-on experiences critical to chemistry courses at any level.

American Chemical Society (ACS):

- Two-Year College Programs- http://www.acs.org/content/dam/acsorg/education/policies/twoyearcollege/acs-guidelines-for-chemistry-programs-in-two-year-colleges.pdf
- Undergraduate Professional Education in Chemistry: ACS Guidelines and Evaluation Procedures for Bachelor's Degree Programs - http://www.acs.org/content/dam/acsorg/about/governance/committees/training/acsapproved/degreeprogram/2008-acs-guidelines-for-bachelors-degree-programs.pdf

Faculty expressed an interest in sharing the syllabi used during the meeting could be shared. They have been asked to use the Yammer site to upload their syllabi. To join Yammer, please visit: https://www.yammer.com/massachusettsacademictransferpathways.

Transfer professionals were asked to notify Lois Alves (lalves@bhe.mass.edu) should any changes need to be made to the Pathways sheets.

Chemistry I – Essential Core Course Components

1	Introduction to measurement/significant figures/dimensional analysis/classification of matter
2	Atomic structure/naming ionic and covalent compounds/nuclear processes
3	Stoichiometry including molarity and balancing chemical equations
4	Ionic equations including precipitation, acid-base, and oxidation-reduction reactions
5	Gas Laws
6	Thermochemistry
7	Quantum theory/electronic configurations/periodicity
8	Chemical bonding/Lewis structures/Resonance/ Valence bond/hybridization and MO theory (introductory)
9	Molecular geometry (VSEPR)/electronegativity

Community College Course Alignment
Chemistry I

Community College	Course Number and Title	Adequately Addresses Essential Core Components	Notes
Berkshire	CHM 101 Introductory Chemistry I	✓ Yes _____ No _____ Need More Info	
Bristol	CHM 111 Gen College Chemistry I	_____ Yes ✓ No _____ Need More Info	
	CHM 113 Fund of Chemistry I	✓ Yes _____ No _____ Need More Info	
Bunker Hill	CHM 120 Prin Inorganic Chem/Lab	_____ Yes ✓ No _____ Need More Info	
	CHM 201 Gen Chemistry I and Lab	✓ Yes _____ No _____ Need More Info	
Cape Cod	CHM 109 Chemistry for Health Sci	_____ Yes ✓ No _____ Need More Info	
	CHM 151 General Chemistry I	✓ Yes _____ No _____ Need More Info	
Greenfield	CHE 105 Basic Princ of Chem	_____ Yes ✓ No _____ Need More Info	
	CHE 111 General Chemistry I	✓ Yes _____ No _____ Need More Info	
Holyoke	CHM 101 General Chemistry I	_____ Yes ✓ No _____ Need More Info	Elective.
	CHM 113 Principles of Chemistry I	_____ Yes ✓ No _____ Need More Info	
	CHM 121 Inorganic Chemistry I	✓ Yes _____ No _____ Need More Info	
MassBay	CH 110 Princ of Chemistry I/Lab	✓ Yes _____ No _____ Need More Info	
Massasoit	CHEM 151 General Chemistry I	✓ Yes _____ No _____ Need More Info	
Middlesex	CHE 151 Gen Chem/Sci & Eng I	✓ Yes _____ No _____ Need More Info	
Mt Wachusett	CHE 107 General Chemistry I	✓ Yes _____ No _____ Need More Info	
North Shore	CHE 101 Introductory Chemistry I	_____ Yes ✓ No _____ Need More Info	
	CHE 103 General Chemistry I	✓ Yes _____ No _____ Need More Info	
Northern Essex	CHM 121 General Chemistry I	✓ Yes _____ No _____ Need More Info	
Quinsigamond	CHM 105 General Chemistry I	✓ Yes _____ No _____ Need More Info	
	CHM 123 Prin of Chem for Engin I	_____ Yes _____ No _____ Need More Info	
Roxbury	SCI 121 General Chemistry I	_____ Yes ✓ No _____ Need More Info	Elective.
	SCI 123 Principles of Chemistry I	✓ Yes _____ No _____ Need More Info	Concurrent with pre-calculus.
Springfield	CHEM 101 Survey of Chemistry I	_____ Yes ✓ No _____ Need More Info	
	CHEM 103 General Chemistry I	✓ Yes _____ No _____ Need More Info	

Chemistry II – Essential Core Course Components

1	Intermolecular forces as applied to condensed phases of matter: solids and liquids
2	Solution properties including colligative properties
3	Chemical kinetics
4	Chemical Equilibrium
5	Acid-Base Theory/Bronsted-Lowry Reactions/Acid-Base Equilibria including hydrolysis and buffers
6	Thermodynamics /Enthalpy/Entropy/Gibbs Free Energy/link to equilibria
7	Electrochemistry

Community College Course Alignment
Chemistry II

Community College	Course Number and Title	Adequately Addresses Essential Core Components	Notes
Berkshire	CHM 102 Introductory Chem II	✓ Yes _____ No _____ Need More Info	
Bristol	CHM 112 Gen College Chemistry II	_____ Yes ✓ No _____ Need More Info	
	CHM 114 Fund of Chemistry II	✓ Yes _____ No _____ Need More Info	
	CHM 116 Health Science Chem II	_____ Yes ✓ No _____ Need More Info	
Bunker Hill	CHM 121 Prin Org Biochem & Lab	_____ Yes ✓ No _____ Need More Info	
	CHM 202 Gen Chemistry II and Lab	✓ Yes _____ No _____ Need More Info	
Cape Cod	CHM 152 General Chemistry II	✓ Yes _____ No _____ Need More Info	
Greenfield	CHE 112 General Chemistry II	✓ Yes _____ No _____ Need More Info	
Holyoke	CHM 102 General Chemistry II	_____ Yes ✓ No _____ Need More Info	
	CHM 114 Principles of Chemistry II	_____ Yes ✓ No _____ Need More Info	
	CHM 124 Inorganic Chemistry II	✓ Yes _____ No _____ Need More Info	
MassBay	CH 120 Princ of Chemistry II w/Lab	✓ Yes _____ No _____ Need More Info	
Massasoit	CHM 152 General Chemistry II	✓ Yes _____ No _____ Need More Info	
Middlesex	CHE 152 Gen Chem for Eng&Sci II	✓ Yes _____ No _____ Need More Info	
Mt Wachusett	CHE 108 General Chemistry II	✓ Yes _____ No _____ Need More Info	
North Shore	CHE 102 Introductory Chemistry	_____ Yes ✓ No _____ Need More Info	
	CHE 104 General Chemistry II	✓ Yes _____ No _____ Need More Info	
Northern Essex	CHM 122 General Chemistry II	✓ Yes _____ No _____ Need More Info	
Quinsigamond	CHM 106 General Chemistry II	✓ Yes _____ No _____ Need More Info	
Roxbury	SCI 122 General Chemistry II	_____ Yes ✓ No _____ Need More Info	
	SCI 124 Principles of Chemistry II	✓ Yes _____ No _____ Need More Info	
Springfield	CHM 201 Survey of Chemistry II	_____ Yes ✓ No _____ Need More Info	
	CHM 203 General Chemistry II	✓ Yes _____ No _____ Need More Info	

Organic Chemistry I – Essential Core Course Components

1	Review of bonding and resonance/Bronsted-Lowry reactions as related to organic compounds (pKa)
2	Alkanes: Nomenclature and conformational analysis of open-chain and cyclic alkanes
3	Alkenes: Nomenclature, reactions, mechanisms and physical properties including conjugated systems
4	Alkynes: Nomenclature, reactions, mechanisms and physical properties
5	Stereochemistry
6	Substitution and Elimination reactions and mechanisms
7	Spectroscopy including infrared, mass spec, nmr and UV-vis
8	Alkyl halides: Nomenclature, reactions, mechanisms and physical properties

Community College Course Alignment
Organic Chemistry I

Community College	Course Number and Title	Adequately Addresses Essential Core Components	Notes
Berkshire	CHM 201 Organic Chemistry I	✓ Yes _____ No _____ Need More Info	
Bristol			Does not offer Organic I
Bunker Hill	CHM 251 Organic Chem and Lab	✓ Yes _____ No _____ Need More Info	
Cape Cod	CHM 251 Organic Chemistry I	✓ Yes _____ No _____ Need More Info	
Greenfield	CHE 201 Organic Chemistry I	✓ Yes _____ No _____ Need More Info	
Holyoke	CHM 221 Organic Chemistry I	✓ Yes _____ No _____ Need More Info	
MassBay	CH 201 Organic Chem I w/Lab	✓ Yes _____ No _____ Need More Info	
Massasoit	CHEM 201 Organic Chemistry I	✓ Yes _____ No _____ Need More Info	
Middlesex			Does not offer Organic I
Mt Wachusett	CHE 207 Organic Chemistry I	✓ Yes _____ No _____ Need More Info	
North Shore	CHE 201 Organic Chemistry 1		Will being to offer Fall 2016
Northern Essex			Does not offer Organic I
Quinsigamond	CHM 201 Organic Chemistry I	✓ Yes _____ No _____ Need More Info	
Roxbury			Offered by Northeastern University
Springfield	CHEM 320 Organic Chemistry 1	✓ Yes _____ No _____ Need More Info	

Organic Chemistry II – Essential Core Course Components

1	Aromaticity and aromatic reactions
2	Alcohols/Ethers/Epoxides/Organometallics: Nomenclature/structure/reactions/mechanisms/physical properties
3	Carbonyl compounds: Nomenclature/structure/reactions/mechanisms/physical properties
4	Acids and acid derivatives: Nomenclature/structure/reactions/mechanisms/physical properties
5	Amines: Nomenclature/structure/reactions/mechanisms/physical properties
6	Structure and Chemistry of Macromolecules such as carbohydrates, peptides and proteins, DNA-RNA, and synthetic polymers.

Community College Course Alignment
Organic Chemistry II

Community College	Course Number and Title	Adequately Addresses Essential Core Components	Notes
Berkshire	CHM 202 Organic Chemistry II	__✓__ Yes _____ No _____ Need More Info	
Bristol			Does not offer Organic II
Bunker Hill	CHM 252 Organic Chem II and Lab	__✓__ Yes _____ No _____ Need More Info	
Cape Cod	CHM 252 Organic Chemistry II	__✓__ Yes _____ No _____ Need More Info	
Greenfield	CHE 202 Organic Chemistry II	__✓__ Yes _____ No _____ Need More Info	
Holyoke	CHM 222 Organic Chemistry II	__✓__ Yes _____ No _____ Need More Info	
MassBay	CH 202 Organic Chemistry II w/Lab	__✓__ Yes _____ No _____ Need More Info	
Massasoit	CHEM 202 Organic Chemistry II	__✓__ Yes _____ No _____ Need More Info	
Middlesex			Does not offer Organic II
Mt Wachusett	CHE 208 Organic Chemistry II	__✓__ Yes _____ No _____ Need More Info	
North Shore			Will being to offer Fall 2016
Northern Essex			Does not offer Organic II
Quinsigamond	CHM 202 Organic Chemistry II	__✓__ Yes _____ No _____ Need More Info	
Roxbury			Offered by Northeastern University.
Springfield	CHEM 420 Organic Chemistry 2	__✓__ Yes _____ No _____ Need More Info	