Summary of 2024 Chemistry Recommendation Report

The following provides a summary of the 2024 CCN Chemistry Recommendation Report.

Recommendation

Course Number and Prefix: CH/CHE/CHEM 221Z

Course Title: General Chemistry I

Course Credits: 5 for lecture and lab. (Institutions will divide these credits between lecture and lab so that the total credits for both courses equals 5 credits.)

Course Description:

Explores and applies principles and applications of chemistry. Emphasis on measurement, components of matter, atomic and molecular structure, quantitative relationships including foundational stoichiometry, and major classes of chemical reactions. CH/CHE/CHEM 221Z is a lecture course; CH/CHE/CHEM 227Z is the laboratory component.

Course Learning Outcomes:

Students will be able to

1. Describe the phases and classifications of matter and differentiate between physical and chemical properties.
2. Represent physical measurements using SI and derived units and demonstrate systematic problem-solving including unit conversion.
3. Use the periodic table to solve problems in chemistry.
4. Describe the principles of electromagnetic energy, the Bohr model and quantum theory, and use electron configurations to identify periodic variations in chemical properties.
5. Interpret and apply ionic and covalent bonding theories including Lewis structures, formal charges, resonance, molecular structure, and polarity.
6. Quantify the composition of substances and solutions.
7. Identify and name a variety of elements, ions, ionic compounds, and covalent compounds.
8. Write, balance, and classify chemical reactions and solve foundational stoichiometry calculations.

Course Number and Prefix: CH/CHE/CHEM 222Z

Course Title: General Chemistry II

Course Credits: 5 for lecture and lab. (Institutions will divide these credits between lecture

and lab so that the total credits for both courses equals 5 credits.)

Course Description:

Explores and applies principles presented in CH/CHE/CHEM 221Z to the study of the solid, liquid, and gaseous states of matter. Principles of stoichiometry, thermochemistry, kinetics, and foundational equilibrium are explored and applied to the study of aqueous and gas-phase chemical reactions. CH/CHE/CHEM 222Z is a lecture course; CH/CHE/CHEM 228Z is the laboratory component.

Course Learning Outcomes:

Students will be able to

1. Apply stoichiometry to a variety of problems involving reactions, gases, liquids, solutions, thermochemistry, kinetics, and equilibrium expressions.
2. Apply kinetic molecular theory and gas laws to predict the behavior of gases at various conditions.
3. Identify types of intermolecular forces and apply them to physical properties of solids, liquids, and solutions.
4. Describe solution concepts and factors affecting solution properties.
5. Determine the effects of different factors on chemical reaction rates and examine the role of catalysis in modifying these rates.
6. Apply concepts of thermochemistry to explain thermal energy transfer and the energy changes that accompany chemical and physical changes.
7. Identify and apply appropriate equations related to gas laws, solutions, colligative properties, thermochemistry, kinetics, and equilibrium expressions.

Course Number and Prefix: CH/CHE/CHEM 223Z

Course Title: General Chemistry III

Course Credits: 5 for lecture and lab. (Institutions will divide these credits between lecture and lab so that the total credits for both courses equals 5 credits.)

Course Description:

Builds upon the principles presented in CH/CHE/CHEM 222Z, explores thermodynamics and chemical equilibrium, and applies them to the study of aqueous acid-base reactions, solubility, and electrochemistry. CH/CHE/CHEM 223Z is a lecture course; CH/CHE/CHEM 229Z is the laboratory component.

Course Learning Outcomes:

Students will be able to

1. Apply concepts of thermodynamics to explain the favorability of chemical reactions.

2. Apply the principles of spontaneity, entropy, free energy, and the laws of thermodynamics to predict and rationalize the behavior of chemical reactions.
3. Interpret the behavior and relative strengths of acids and bases, buffers, and the hydrolysis of salts.
4. Analyze and evaluate equilibrium reactions including solubility, acids and bases, and other equilibria.
5. Predict responses of various chemical systems to changing conditions using equilibrium calculations and Le Chatelier's Principle.
6. Use redox reactions and electrochemical principles to determine cell potentials and to analyze the relationship between voltage, free energy, and equilibrium.
7. Identify or formulate and apply the appropriate equations related to electrochemistry, thermodynamics, equilibrium reactions, acids, bases, and buffers.

Course Number and Prefix: CH/CHE/CHEM 227Z

Course Title: General Chemistry I Laboratory

Course Credits: 5 for lecture and lab. (Institutions will divide these credits between lecture and lab so that the total credits for both courses equals 5 credits.)

Course Description:

Experiments correspond to the topics covered in CH/CHE/CHEM 221Z including the fundamentals of chemical measurements, quantitative relationships in chemical analysis, and understanding atomic and molecular structure. CH/CHE/CHEM 227Z is the laboratory component; CH/CHE/CHEM 221Z is the lecture course.

Course Learning Outcomes:

Students will be able to

1. Follow standard safety procedures while working with chemicals and equipment in a laboratory setting.

2. Keep an accurate and detailed laboratory record.

3. Measure, calculate, and report data and results using proper units and appropriate measures of uncertainty.

4. Analyze experimental results qualitatively and quantitatively with measures of accuracy and precision.

5. Interpret and communicate the results of experiments applying chemical concepts in CH/CHE/CHEM 221Z in a clear and concise manner.

6. Investigate chemical concepts in CH/CHE/CHEM 221Z qualitatively and quantitatively using scientific methods.

Course Number and Prefix: CH/CHE/CHEM 228Z

Course Title: General Chemistry II Laboratory

Course Credits: 5 for lecture and lab. (Institutions will divide these credits between lecture and lab so that the total credits for both courses equals 5 credits.)

Course Description:

Experiments correspond to the topics covered in CH/CHE/CHEM 222Z including the fundamentals of intermolecular interactions, stoichiometric relationships, chemical equilibria and their application to the synthesis, identification, and analysis of chemical compounds. CH/CHE/CHEM 228Z is the laboratory component; CH/CHE/CHEM 222Z is the lecture course.

Course Learning Outcomes:

Students will be able to

1. Follow standard safety procedures while working with chemicals and equipment in a laboratory setting.

2. Keep an accurate and detailed laboratory record.

3. Measure, calculate, and report data and results using proper units and appropriate measures of uncertainty.

4. Analyze experimental results qualitatively and quantitatively with measures of accuracy and precision.

5. Interpret and communicate the results of experiments applying chemical concepts in CH/CHE/CHEM 222Z in a clear and concise manner.

6. Investigate chemical concepts in CH/CHE/CHEM 222Z qualitatively and quantitatively using scientific methods.

Course Number and Prefix: CH/CHE/CHEM 229Z

Course Title: General Chemistry III Laboratory

Course Credits: 5 for lecture and lab. (Institutions will divide these credits between lecture and lab so that the total credits for both courses equals 5 credits.)

Course Description:

Experiments correspond to the topics covered in CH/CHE/CHEM 223Z including the principles of chemical equilibria and their application to chemical analysis using volumetric and electrochemical methods. CH/CHE/CHEM 229Z is the laboratory component; CH/CHE/CHEM 223Z is the lecture course.

Course Learning Outcomes:

Students will be able to

1. Follow standard safety procedures while working with chemicals and equipment in a laboratory setting.

2. Keep an accurate and detailed laboratory record.

3. Measure, calculate, and report data and results using proper units and appropriate measures of uncertainty.

4. Analyze experimental results qualitatively and quantitatively with measures of accuracy and precision.

5. Interpret and communicate the results of experiments applying chemical concepts in CH/CHE/CHEM 223Z in a clear and concise manner.

6. Investigate chemical concepts in CH/CHE/CHEM 223Z qualitatively and quantitatively using scientific methods.

Teachout Recommendation:

The committee recommends that the 2025-2026 academic year be designated as a teachout year for students that began the general chemistry series prior to Fall 2025. As the topics in the newly aligned CH/CHE/CHEM 221Z/227Z, 222Z/228Z, 223Z/229Z differ from those taught in the unaligned courses, students could miss topics by switching mid series. Several institutions currently offer delayed "trailer" sections of each course. This proposed teachout would facilitate completion of the sequence by students already on that schedule.

- All schools should be allowed to offer the pre-Z CH 222 and CH 223 alongside the CCN aligned courses for the **first** academic year of offering the newly aligned courses. This minimizes the negative impact on students who need to finish the series if they completed CH 221 before Fall 2025. CH 221 (pre-Z) does not need to be included in the teachout plan as students entering the series would begin in CH/CHE/CHEM 221Z and CH/CHE/CHEM 227Z in the Fall of 2025.

Review Cycle:

There will be an annual review cycle of these courses beginning 2027. The annual review will have a twofold purpose: (1) to review the transfer effectiveness of the courses and (2) to gather information about challenges, concerns, or changes needed from the OPUs and CCs. These reviews are to take place in winter term 2027.

Every third year beginning 2030, the subcommittee will conduct a deeper review of the alignment of these courses; this is the only time that the subcommittee will consider a vote to modify the aligned content of the course, using the previous two years of data. The choice in these third-year reviews will be to either affirm our existing alignment decisions or to revise a particular aspect to keep our curriculum based on the data gathered from the previous two years.

We would like as many members as possible of the original subcommittee to be invited to

participate in these discussions. Historical memory and original context will be useful in informing future decisions.

Chart approved by CCN Chemistry Co-chairs Kenneth Friedrich and Christopher Walsh, November 21, 2024.

CCN Chemistry Subcommittee Recommendation Report

CH/CHE/CHEM 221Z/227Z, 222Z/228Z, 223Z/229Z

General Chemistry

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Nov 11, 2024

Date of last meeting

Nov 8, 2024

Plans for next meeting

This subcommittee plans to continue meeting biweekly to work on aligning the next chemistry series CH/CHE/CHEM 104, 105, 106 in 2025.

This Subcommittee recommends the following schedule, structure, and goals for the reflection, maintenance, and enhancement of the recommendations made in this report:

1. Annual CCN Chemistry Subcommittee check-ins beginning in Winter 2027 to gather qualitative and/or quantitative data on faculty and student experiences, make requests for institutional and statewide data, discuss challenges, and raise concerns to review the transfer effectiveness of the CCN CH/CHE/CHEM 221Z/227Z, CH/CHE/CHEM 222Z/228Z & CH/CHE/CHEM 223Z/229Z aligned courses. The scope of annual check-ins will focus on the statewide and collaborative nature of this work to facilitate inclusive and equitable conversations and to identify potential issues that may require future modifications of the CCN recommendations or framework every third year, starting in 2030.
2. Triennial CCN Chemistry Subcommittee meetings beginning in Winter 2030 with the purpose of analyzing qualitative and quantitative data, drafting and approving modifications to the CCN Chemistry Recommendations, and problem-solving implementation issues to strive to improve the effectiveness, inclusiveness, equity, and implementation of the recommendations and framework.

Overview

The following information represents the alignment work and discussions that focused on CH/CHE/CHEM 221Z, 222Z, and 223Z known as General Chemistry 1, 2, and 3 respectively.

Atoms First Approach: There was early subcommittee consensus on course numbers, subject codes, and course titles, thus we were able to vote on these items without much deliberation.

However, there are two basic approaches to the ordering of topics in a General Chemistry sequence. Our subcommittee chose to align using the "Atoms First" approach, which is currently used by the majority of institutions represented in our subcommittee. This choice will result in significant realignment of the topics covered in each quarter of the general chemistry series for institutions that are currently using a "Traditional" approach to sequencing/covering the material.

The groups assigned to each course worked asynchronously on building a draft that was then brought to the subcommittee for consideration. The draft was populated by considering the topics within current offerings of these courses that follow an "Atoms First" approach. Once a draft was agreed upon by the subcommittee, it was shared by the subcommittee members with their respective, relevant faculty members so they could provide feedback. It was also shared by the subcommittee members with relevant faculty at community colleges that were not represented on the subcommittee. Non-voting institutions were also invited to attend meetings so they could participate in discussions. Discussions on outcomes were extensive for all six courses.

Feedback on the topic order and proposed learning outcomes for each course was collected and incorporated into the final versions of the course descriptions and learning outcomes. These learning outcomes were voted on at the subcommittee's last meeting in Fall of 2024.

The general chemistry series is a content heavy series. In addition to deciding on an "Atoms first" topic order, the committee had to make tough decisions about the breakpoints between the three courses. To reach the highest level of consensus possible, the committee compromised and recommended splitting the topic of *stoichiometry* between CH/CHE/CHEM 221Z and CH/CHE/CHEM 222Z as a linking topic and splitting the topic of *equilibrium* between CH/CHE/CHEM 222Z and CH/CHE/CHEM 223Z as a linking topic. In both cases, the word "foundational" was added before stoichiometry and equilibrium to differentiate between the stoichiometry and equilibrium covered in the first of the respective courses and the same topics covered in the second of the courses. Covering only foundational equilibrium in CH/CHE/CHEM 222Z was the decision that was most contentious in our committee. The three subcommittee members that voted "no" or "abstained" on this vote wanted to cover the topic of equilibrium at more than a foundational level.

Credits: Lab experience, experimentation, and activities are essential to learning chemistry. That being said, chemistry can be taught with various levels of lecture and lab integration. To account for different levels of integration in the teaching of chemistry, the subcommittee decided to recommend flexibility in the split of 5 credits between lecture and lab credits. The most common split would be 4 lecture credits and 1 lab credit, but some schools may decide 3 lecture credits and 2 lab

credits.

Lecture and Lab: These courses have a lecture and lab portion. The decision was made to recommend the separation of the lecture and lab portions of these three courses into separate courses with separate course numbers. The lecture courses will remain as CH/CHE/CHEM 221Z, 222Z, and 223Z. The respective lab courses will be known as CH/CHE/CHEM 227Z, 228Z, and 229Z. The rationale for this split was to provide students the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course, as is currently the case at most institutions.

The committee recommends that the three courses of General Chemistry each be offered as 5 total credits of lecture and lab across the state. The following is the rationale for this recommendation:

- 22 of 24 Oregon Community Colleges and Public Universities currently have the lecture and lab with a combined total of 5 credits.
- 20 institutions have a split of 4 lecture credits and 1 lab credit. One school has a split of 3 lecture credits and 2 lab credits. One school has a split of 3 lecture credits, 1 recitation credit and 1 lab credit. The other two schools have 6 credits with a split of 4 lecture credits and 2 lab credits.
- Institutions that currently offer a total of 6 credits per term should be permitted to add an additional required 1-credit corequisite for each quarter, though the corequisite should not be an additional requirement for incoming transfer students who have completed CH/CHE/CHEM 221Z/227Z, 222Z/228Z or 223Z/229Z elsewhere.
- Seven of the colleges and institutions, including our largest institutions, currently have the lecture and lab split into separate courses. The subcommittee decided to recommend that all schools split the lecture and lab to provide students maximum flexibility and the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course. Several members from smaller institutions with a single catalog number for both lecture and lab shared that they already allow this flexibility through an informal case-by-case basis.

Teachout Recommendation: The committee also strongly recommends that the 2025-2026 academic year be designated as a teachout year for students that began the general chemistry series prior to Fall 2025. As the topics in the newly aligned CH/CHE/CHEM 221Z/227Z, 222Z/228Z, 223Z/229Z differ from those taught in the unaligned courses, students could miss topics by switching mid series. Several of our institutions currently offer delayed “trailer” sections of each course. This

proposed teach-out would facilitate completion by students already on that schedule.

- All schools should be allowed to offer the Pre-Z CH 222 and CH 223 alongside the CCN aligned courses for the **first** academic year of offering the newly aligned courses. This minimizes the negative impact on students who need to finish the series if they completed CH 221 before Fall 2025. CH 221 (pre-Z) does not need to be included in the teachout plan as students entering the series would begin in CH/CHE/CHEM 221Z and CH/CHE/CHEM 227Z in the Fall of 2025.
- Beginning Fall 2026, only CH/CHE/CHEM 221Z/227Z, 222Z/228Z, 223Z/229Z should be offered.

Action Items Completed

RECOMMENDATION	**STATUS**
CH/CHE/CHEM 221Z	
Course Number and Subject Code: CH/CHE/CHEM 221Z **Rationale:** All Oregon Community Colleges and public Universities use one of these subject codes with CH being the most common. All but two of these schools currently use 221 for this course. The "Z" is used to indicate the course complies with the CCN framework.	Yes 16 No 0 Abstain 0 **Passed**
Course Title: General Chemistry I **Rationale:** 23 of 24 schools currently use General Chemistry as the course title. Most of the schools have a "I" or "1" in the course title. Both are acceptable as per the CCN Framework.	Yes 16 No 0 Abstain 0 **Passed**
Course Credits: 5 for lecture and lab **Rationale:** 22 of 24 Oregon Community Colleges and Public Universities currently have the lecture and lab with a combined total of 5 credits. The vast majority of these, 20	Yes 10 No 0 Abstain 0 **Passed**

institutions, have a split of 4 lecture credits and 1 lab credit. Seven of the schools, including our largest institutions, currently have the lecture and lab split into separate courses. The committee decided to recommend that all schools split the lecture and lab to provide students maximum flexibility and the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course. Lab experience, experimentation, and activities are essential to learning chemistry. That being said, chemistry can be taught with various levels of lecture and lab integration. To account for different levels of integration in the teaching of chemistry, the committee decided to recommend flexibility in the split of the 5 credits between lecture and lab credits. The most common split would be 4 lecture credits and 1 lab credit, but some schools may decide 3 lecture credits and 2 lab credits. **Course Description:** Explores and applies principles and applications of chemistry. Emphasis on measurement, components of matter, atomic and molecular structure, quantitative relationships including foundational stoichiometry, and major classes of chemical reactions. CH/CHE/CHEM 221Z is a lecture course; CH/CHE/CHEM 227Z is the laboratory component. **Rationale:** This description aligns with an "Atoms First" approach to general chemistry currently used by the majority of schools in Oregon. The broad topics that are covered in this course are mentioned. After much discussion, the topic of stoichiometry was divided between CH/CHE/CHEM 221Z and 222Z as a linking topic. The word "foundational" was added before "stoichiometry" to differentiate between the stoichiometry covered in this course and the stoichiometry covered in CH/CHE/CHEM 222Z. This was a	Yes 11 No 1 Abstain 2 **Passed**

compromise proposed and accepted by the committee. NOTE: Course descriptions of CH/CHE/CHEM 221Z, CH222Z and CH223Z were voted on as a group. After much discussion with the members that voted "no" or "abstained," it should be mentioned that these votes have to do with disagreement with the course descriptions of CH/CHE/CHEM 222Z and CH223Z, not CH221Z. **Course Learning Outcomes:** Students will be able to 1. Describe the phases and classifications of matter and differentiate between physical and chemical properties. 2. Represent physical measurements using SI and derived units and demonstrate systematic problem-solving including unit conversion. 3. Use the periodic table to solve problems in chemistry. 4. Describe the principles of electromagnetic energy, the Bohr model and quantum theory, and use electron configurations to identify periodic variations in chemical properties. 5. Interpret and apply ionic and covalent bonding theories including Lewis structures, formal charges, resonance, molecular structure, and polarity. 6. Quantify the composition of substances and solutions. 7. Identify and name a variety of elements, ions, ionic compounds, and covalent compounds. 8. Write, balance, and classify chemical reactions and solve foundational stoichiometry calculations. **Rationale:** These outcomes align with an "Atoms First" approach to general chemistry currently used by the majority of schools in Oregon. After much discussion the topic of stoichiometry was divided between CH/CHE/CHEM 221Z and 222Z as a linking topic. The word "foundational" was added to outcome #8 to differentiate between the	Yes 10 No 3 Abstain 0 **Passed**

stoichiometry covered in this course and the stoichiometry covered in CH/CHE/CHEM 222Z. This was a compromise proposed and accepted by the committee. NOTE: Course descriptions of CH/CHE/CHEM 221Z, 222Z and 223Z were voted all as a group. After much discussion with the members that voted "no" or "abstained," it should be mentioned that these votes have to do with the course descriptions of CH/CHE/CHEM 222Z and 223Z, not CH/CHE/CHEM 221Z. A liaison from the Outcomes Assessment attended most of our meetings and gave feedback and advice on these outcomes.	
CH/CHE/CHEM 222Z	
Course Number and Subject Code: CH/CHE/CHEM 222Z **Rationale:** All Oregon Community Colleges and public Universities use one of these subject codes with CH being the most common. All but two of these schools currently use 222 for this course. The "Z" is used to indicate the course complies with the CCN framework.	Yes 16 No 0 Abstain 0 **Passed**
Course Title: General Chemistry II **Rationale:** 23 of 24 schools currently use General Chemistry as the course title. Most of the schools have a "II" or "2" in the course title. Both are acceptable as per the CCN Framework.	Yes 16 No 0 Abstain 0 **Passed**
Course Credits: 5 for lecture and lab **Rationale:** 22 of 24 Oregon Community Colleges and Public Universities currently have the lecture and lab with a combined total of 5 credits. The vast majority of these, 20 institutions, have a split of 4 lecture credits and 1 lab credit. Seven of the schools, including our largest institutions,	Yes 10 No 0 Abstain 0 **Passed**

currently have the lecture and lab split into separate courses. The committee decided to recommend that all schools split the lecture and lab to provide students maximum flexibility and the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course. Lab experience, experimentation, and activities are essential to learning chemistry. That being said, chemistry can be taught with various levels of lecture and lab integration. To account for different levels of integration in the teaching of chemistry, the committee decided to recommend flexibility in the split of the 5 credits between lecture and lab credits. The most common split would be 4 lecture credits and 1 lab credit, but some schools may decide 3 lecture credits and 2 lab credits. **Course Description:** Explores and applies principles presented in CH/CHE/CHEM 221Z to the study of the solid, liquid, and gaseous states of matter. Principles of stoichiometry, thermochemistry, kinetics, and foundational equilibrium are explored and applied to the study of aqueous and gas-phase chemical reactions. CH/CHE/CHEM 222Z is a lecture course; CH/CHE/CHEM 228Z is the laboratory component. **Rationale:** This description aligns with an "Atoms First" approach to general chemistry currently used by the majority of schools in Oregon. The broad topics that are covered in this course are mentioned. After much discussion, the topic of stoichiometry was divided between CH/CHE/CHEM 221Z and 222Z as a linking topic. The word "foundational" was added before "stoichiometry" to differentiate between the stoichiometry covered in this course and the stoichiometry covered in CH/CHE/CHEM 222Z. This was a compromise proposed and accepted by the committee. After further discussion the topic of equilibrium was	Yes 11 No 1 Abstain 2 **Passed**

divided between CH/CHE/CHEM 222Z and 223Z as a linking topic. The word “foundational” was added before “equilibrium” to differentiate between the equilibrium covered in this course and the equilibrium covered in CH/CHE/CHEM 223Z. This was a compromise proposed and accepted by the committee. Covering only foundational equilibrium in CH/CHE/CHEM 222Z was the decision that was most contentious in our committee. The three subcommittee members that voted “no” or “abstained” on this vote wanted to cover the topic of equilibrium at more than a foundational level. **Course Learning Outcomes:** Students will be able to 1. Apply stoichiometry to a variety of problems involving reactions, gases, liquids, solutions, thermochemistry, kinetics, and equilibrium expressions. 2. Apply kinetic molecular theory and gas laws to predict the behavior of gases at various conditions. 3. Identify types of intermolecular forces and apply them to physical properties of solids, liquids, and solutions. 4. Describe solution concepts and factors affecting solution properties. 5. Determine the effects of different factors on chemical reaction rates and examine the role of catalysis in modifying these rates. 6. Apply concepts of thermochemistry to explain thermal energy transfer and the energy changes that accompany chemical and physical changes 7. Identify and apply appropriate equations related to gas laws, solutions, colligative properties, thermochemistry, kinetics, and equilibrium expressions. **Rationale:** These outcomes align with an “Atoms First” approach to general chemistry currently used by the majority of	Yes 10 No 3 Abstain 0 **Passed**

schools in Oregon. After much discussion the topic of stoichiometry was divided between CH/CHE/CHEM 221Z and 222Z as a linking topic. The word foundational was added before stoichiometry to differentiate between the stoichiometry covered in this course and the stoichiometry covered in CH/CHE/CHEM 222Z. This was a compromise proposed and accepted by the committee. After further discussion the topic of equilibrium was divided between CH/CHE/CHEM 222Z and 223Z as a linking topic. The word foundational was added before equilibrium to differentiate between the equilibrium covered in this course and the equilibrium covered in CH/CHE/CHEM 223Z. This was a compromise proposed and accepted by the committee. Covering only foundational equilibrium in CH/CHE/CHEM 222Z was the decision that was most contentious in our committee. The three members that voted "no" or "abstained" on this vote wanted to cover the topic of equilibrium at more than a foundational level.	
CH/CHE/CHEM 223Z	
Course Number and Subject Code: CH/CHE/CHEM 223Z **Rationale:** All Oregon Community Colleges and public Universities use one of these subject codes with CH being the most common. All but two of these schools currently use 223 for this course. The "Z" is used to indicate the course complies with the CCN framework.	Yes 16 No 0 Abstain 0 **Passed**
Course Title: General Chemistry III **Rationale:** 23 of 24 schools currently use General Chemistry as the course title. Most of the schools have a "III" or "3" in the course title. Both are acceptable as per the CCN Framework.	Yes 16 No 0 Abstain 0 **Passed**

Course Credits: 5 for lecture and lab **Rationale:** 22 of 24 Oregon Community Colleges and Public Universities currently have the lecture and lab with a combined total of 5 credits. The vast majority of these, 20 institutions, have a split of 4 lecture credits and 1 lab credit. Seven of the schools, including our largest institutions, currently have the lecture and lab split into separate courses. The committee decided to recommend that all schools split the lecture and lab to provide students maximum flexibility and the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course Lab experience, experimentation, and activities are essential to learning chemistry. That being said, chemistry can be taught with various levels of lecture and lab integration. To account for different levels of integration in the teaching of chemistry, the committee decided to recommend flexibility in the split of the 5 credits between lecture and lab credits. The most common split would be 4 lecture credits and 1 lab credit, but some schools may decide 3 lecture credits and 2 lab credits.	Yes 10 No 0 Abstain 0 **Passed**
Course Description: Builds upon the principles presented in CH/CHE/CHEM 222Z, explores thermodynamics and chemical equilibrium, and applies them to the study of aqueous acid-base reactions, solubility, and electrochemistry. CH/CHE/CHEM 223Z is a lecture course; CH/CHE/CHEM 229Z is the laboratory component. **Rationale:** This description aligns with an “Atoms First” approach to general chemistry currently used by the majority of schools in Oregon. The broad topics that are covered in this course are mentioned. After much discussion the topic of equilibrium was	Yes 11 No 1 Abstain 2 **Passed**

divided between CH/CHE/CHEM 222Z and 223Z as a linking topic. The word foundational was added before equilibrium to differentiate between the equilibrium covered in this course and the equilibrium covered in CH/CHE/CHEM 223Z. This was a compromise proposed and accepted by the committee. Covering only foundational equilibrium in CH/CHE/CHEM 222Z was the decision that was most contentious in our committee. The three members that voted no or abstained on this vote wanted to cover the topic of equilibrium at more than a foundational level. **Course Learning Outcomes:** Students will be able to 1. Apply concepts of thermodynamics to explain the favorability of chemical reactions. 2. Apply the principles of spontaneity, entropy, free energy, and the laws of thermodynamics to predict and rationalize the behavior of chemical reactions. 3. Interpret the behavior and relative strengths of acids and bases, buffers, and the hydrolysis of salts. 4. Analyze and evaluate equilibrium reactions, including solubility, acids and bases, and other equilibria. 5. Predict responses of various chemical systems to changing conditions using equilibrium calculations and Le Chatelier's Principle. 6. Use redox reactions and electrochemical principles to determine cell potentials and to analyze the relationship between voltage, free energy, and equilibrium. 7. Identify or formulate and apply the appropriate equations related to electrochemistry, thermodynamics, equilibrium reactions, acids, bases, and buffers. **Rationale:** These outcomes align with an "Atoms First" approach to general chemistry currently used by the majority of schools in Oregon.	Yes 10 No 3 Abstain 0 **Passed**

After further discussion the topic of equilibrium was divided between CH/CHE/CHEM 222Z and 223Z as a linking topic. The word foundational was added before equilibrium to differentiate between the equilibrium covered in this course and the equilibrium covered in CH/CHE/CHEM 223Z. This was a compromise proposed and accepted by the committee. Covering only foundational equilibrium in CH/CHE/CHEM 222Z was the decision that was most contentious in our committee. The three members that voted no or abstained on this vote wanted to cover the topic of equilibrium at more than a foundational level.	
CH/CHE/CHEM 227Z	
Course Number: 227Z **Rationale:** Three of the seven schools that currently have split lecture and lab use 227, including U of O, PSU, and Lane Community College. The "Z" is used to indicate the course complies with the CCN framework.	Yes 9 No 1 Abstain 0 **Passed**
Subject Code: CH/CHE/CHEM **Rationale:** All Oregon Community Colleges and public Universities use one of these subject codes with CH being the most common.	Yes 14 No 0 Abstain 0 **Passed**
Course Title: General Chemistry I Laboratory **Rationale:** Adding the word "laboratory" to the name of the corresponding lecture course, General Chemistry I, was chosen to ensure that the lecture and laboratory course are linked.	Yes 14 No 0 Abstain 0 **Passed**
Course Credits: 5 for lecture and lab **Rationale:** 22 of 24 Oregon Community Colleges and Public Universities currently have the lecture and lab with a combined total of 5 credits. The vast majority of these, 20	Yes 10 No 0 Abstain 0 **Passed**

institutions, have a split of 4 lecture credits and 1 lab credit. Seven of the schools, including our largest institutions, currently have the lecture and lab split into separate courses. The committee decided to recommend that all schools split the lecture and lab to provide students maximum flexibility and the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course Lab experience, experimentation and activities are essential to learning chemistry. That being said, chemistry can be taught with various levels of lecture and lab integration. To account for different levels of integration in the teaching of chemistry the committee decided to recommend flexibility in the split of the 5 credits between lecture and lab credits. The most common split would be 4 lecture credits and 1 lab credit, but some schools may decide 3 lecture credits and 2 lab credits.	
Course Description: Experiments correspond to the topics covered in CH/CHE/CHEM 221Z including the fundamentals of chemical measurements, quantitative relationships in chemical analysis, and understanding atomic and molecular structure. CH/CHE/CHEM 227Z is the laboratory component; CH/CHE/CHEM 221Z is the lecture course. **Rationale:** This description aligns with the linked CH/CHE/CHEM 221Z and the topics covered within. The broad topics that are covered in this lab course are mentioned.	Yes 14 No 0 Abstain 0 **Passed**
Course Learning Outcomes: Students will be able to 1. Follow standard safety procedures while working with chemicals and equipment in a laboratory setting. 2. Keep an accurate and detailed laboratory record. 3. Measure, calculate, and report data and results using	Yes 13 No 0 Abstain 0 **Passed**

proper units and appropriate measures of uncertainty. 4. Analyze experimental results qualitatively and quantitatively with measures of accuracy and precision. 5. Interpret and communicate the results of experiments applying chemical concepts in CH/CHE/CHEM 222Z in a clear and concise manner. 6. Investigate chemical concepts in CH/CHE/CHEM 222Z qualitatively and quantitatively using scientific methods. **Rationale:** The rationale for these lab course outcomes is rooted in the goal of providing students with both practical laboratory skills and critical thinking abilities necessary for success in a chemistry laboratory setting. The outcomes are designed to help students develop a deep understanding of chemical principles, gain hands-on experience, and prepare them for real-world scientific challenges.	
CH/CHE/CHEM 228Z	
Course Number: 228Z **Rationale:** Three of the seven schools that currently have split lecture and lab use 227, including U of O, PSU, and Lane Community College. The "Z" is used to indicate the course complies with the CCN framework.	Yes 9 No 1 Abstain 0 **Passed**
Subject Code: CH/CHE/CHEM **Rationale:** All Oregon Community Colleges and public Universities use one of these subject codes with CH being the most common.	Yes 14 No 0 Abstain 0 **Passed**
Course Title: General Chemistry II Laboratory **Rationale:** Adding the word "laboratory" to the name of the corresponding lecture course, General Chemistry II, was chosen to ensure that the lecture and laboratory course	Yes 14 No 0 Abstain 0 **Passed**

are linked. **Course Credits:** 5 for lecture and lab **Rationale:** 22 of 24 Oregon Community Colleges and Public Universities currently have the lecture and lab with a combined total of 5 credits. The vast majority of these, 20 institutions, have a split of 4 lecture credits and 1 lab credit. Seven of the schools, including our largest institutions, currently have the lecture and lab split into separate courses. The committee decided to recommend that all schools split the lecture and lab to provide students maximum flexibility and the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course. Lab experience, experimentation and activities are essential to learning chemistry. That being said, chemistry can be taught with various levels of lecture and lab integration. To account for different levels of integration in the teaching of chemistry the committee decided to recommend flexibility in the split of the 5 credits between lecture and lab credits. The most common split would be 4 lecture credits and 1 lab credit, but some schools may decide 3 lecture credits and 2 lab credits.	Yes 10 No 0 Abstain 0 **Passed**
Course Description: Experiments correspond to the topics covered in CH/CHE/CHEM 222Z, including the fundamentals of intermolecular interactions, stoichiometric relationships, chemical equilibria, and their application to the synthesis, identification, and analysis of chemical compounds. CH/CHE/CHEM 228Z is the laboratory component; CH/CHE/CHEM 222Z is the lecture course. **Rationale:** This description aligns with the linked CH/CHE/CHEM 222Z and the topics covered within. The broad topics that are covered in this lab course are mentioned.	Yes 14 No 0 Abstain 0 **Passed**

Course Learning Outcomes: Students will be able to 1. Follow standard safety procedures while working with chemicals and equipment in a laboratory setting. 2. Keep an accurate and detailed laboratory record. 3. Measure, calculate, and report data and results using proper units and appropriate measures of uncertainty. 4. Analyze experimental results qualitatively and quantitatively with measures of accuracy and precision. 5. Interpret and communicate the results of experiments applying chemical concepts in CH/CHE/CHEM 222Z in a clear and concise manner. 6. Investigate chemical concepts in CH/CHE/CHEM 222Z qualitatively and quantitatively using scientific methods. **Rationale:** The rationale for these lab course outcomes is rooted in the goal of providing students with both practical laboratory skills and critical thinking abilities necessary for success in a chemistry laboratory setting. The outcomes are designed to help students develop a deep understanding of chemical principles, gain hands-on experience, and prepare them for real-world scientific challenges.	Yes 13 No 0 Abstain 0 **Passed**
CH/CHE/CHEM 229Z	
Course Number: 229Z **Rationale:** Three of the seven schools that currently have split lecture and lab use 227 currently, including U of O, PSU and Lane Community College. The "Z" is used to indicate the course complies with the CCN framework. **Subject Code:** CH/CHE/CHEM **Rationale:** All Oregon Community Colleges and public Universities	Yes 9 No 1 Abstain 0 **Passed** Yes 14 No 0 Abstain 0 **Passed**

use one of these subject codes with CH being the most common. **Course Title:** General Chemistry III Laboratory **Rationale:** Adding the word “laboratory” to the name of the corresponding lecture course, General Chemistry III, was chosen to ensure that the lecture and laboratory course are linked.	Yes 14 No 0 Abstain 0 **Passed**
Course Credits: 5 for lecture and lab **Rationale:** 22 of 24 Oregon Community Colleges and Public Universities currently have the lecture and lab with a combined total of 5 credits. The vast majority of these, 20 institutions, have a split of 4 lecture credits and 1 lab credit. Seven of the schools, including our largest institutions, currently have the lecture and lab split into separate courses. The committee decided to recommend that all schools split the lecture and lab to provide students maximum flexibility and the ability to retake the lecture or the lab without paying for the full number of credits in a combined lecture/lab course. Lab experience, experimentation and activities are essential to learning chemistry. That being said, chemistry can be taught with various levels of lecture and lab integration. To account for different levels of integration in the teaching of chemistry the committee decided to recommend flexibility in the split of the 5 credits between lecture and lab credits. The most common split would be 4 lecture credits and 1 lab credit, but some schools may decide 3 lecture credits and 2 lab credits.	Yes 10 No 0 Abstain 0 **Passed**
Course Description: Experiments correspond to the topics covered in CH/CHE/CHEM 223Z, including the principles of chemical equilibria and their application to chemical analysis using volumetric and electrochemical methods. CH/CHE/CHEM	Yes 14 No 0 Abstain 0 **Passed**

229Z is the laboratory component; CH/CHE/CHEM 223Z is the lecture course. **Rationale:** This description aligns with the linked CH/CHE/CHEM 223Z and the topics covered within. The broad topics that are covered in this lab course are mentioned. **Course Learning Outcomes:** Students will be able to 1. Follow standard safety procedures while working with chemicals and equipment in a laboratory setting. 2. Keep an accurate and detailed laboratory record. 3. Measure, calculate, and report data and results using proper units and appropriate measures of uncertainty. 4. Analyze experimental results qualitatively and quantitatively with measures of accuracy and precision. 5. Interpret and communicate the results of experiments applying chemical concepts in CH/CHE/CHEM 223Z in a clear and concise manner. 6. Investigate chemical concepts in CH/CHE/CHEM 223Z qualitatively and quantitatively using scientific methods. **Rationale:** The rationale for these lab course outcomes is rooted in the goal of providing students with both practical laboratory skills and critical thinking abilities necessary for success in a chemistry laboratory setting. The outcomes are designed to help students develop a deep understanding of chemical principles, gain hands-on experience, and prepare them for real-world scientific challenges.	Yes 13 No 0 Abstain 0 **Passed**
Teachout Recommendation	
The committee recommends that the 2025-2026 academic year be designated as a teachout year for students that began the general chemistry series prior to Fall 2025. As the topics in the newly aligned	Yes 13 No 0 Abstain 0 **Passed**

CH/CHE/CHEM 221Z/227Z, 222Z/228Z, 223Z/229Z differ from those taught in the unaligned courses, students could miss topics by switching mid series. Several institutions currently offer delayed "trailer" sections of each course. This proposed teach-out would facilitate completion by students already on that schedule. ● All schools should be allowed to offer the pre-Z CH 222 and CH 223 alongside the CCN aligned courses for the **first** academic year of offering the newly aligned courses. This minimizes the negative impact on students who need to finish the series if they completed CH 221 before Fall 2025. CH 221 (pre-Z) does not need to be included in the teachout plan as students entering the series would begin in CH/CHE/CHEM 221Z and CH/CHE/CHEM 227Z in the Fall of 2025. ● Beginning Fall 2026, only CH/CHE/CHEM 221Z/227Z, 222Z/228Z, 223Z/229Z should be offered.	
Review Cycle Recommendation	
There will be an annual review cycle of these courses beginning Winter 2027. The annual review will have a twofold purpose: (1) to review the transfer effectiveness of the courses and (2) to gather information about challenges, concerns, or changes needed from the OPUs and CCs. These reviews are to take place in winter term. Every third year beginning 2030, the subcommittee will conduct a deeper review of the alignment of these courses; this is the only time that the subcommittee will consider a vote to modify the aligned content of the course, using the previous two years of data. The choice in these third-year reviews will be to either affirm our existing alignment decisions or to revise a particular aspect to keep our curriculum based on the data gathered from the previous two years. We would like as many members as possible of the original subcommittee to be invited to participate in these discussions. Historical memory and original context	Yes 14 No 0 Abstain 0 **Passed**

will be useful in informing future decisions.	

Action Items In-progress/Pending

ACTIVITY	STATUS
NA	NA

Questions for Transfer Council

- NA

Other Notes

Regarding the Minority Report: The number of topics covered in CH/CHE/CHEM 222Z and in CH/CH/CHEM 223Z is at the heart of the concern expressed in the Minority Report. Dividing topics in these two courses was discussed at great length by the subcommittee. 10 of 13 members present felt that covering more than foundational equilibrium as a topic in CH/CHE/CHEM 222Z would make it very difficult to cover all the recommended outcomes for the course. As unanimous consensus was not found, a vote was called and 10 of 13 members present voted to only cover foundational equilibrium in CH/CHE/CHEM 222Z. Individual schools could add an additional outcome for CH/CHE/CHEM 222Z if needed, allowing them to cover this topic in greater depth. This concession allows for the greatest flexibility for all institutions, and it is allowed under the CCN framework.

Signed by: Kenneth Friedrich (PCC) and Christopher Walsh (EOU)

Name Kenneth Friedrich Signature Kenneth Friedrich

Name Christopher Walsh Signature Christopher D Walsh

Date: November 12, 2024

Provide copies to:

CCN Chemistry Co-chairs	Kenneth Friedrich (PCC) Christopher Walsh (EOU)
CCN Chemistry Subcommittee Members	Anna Olivieri (SOU) Beth Manhat Hall (LBCC) Carol Higginbotham (COCC) Eden Francis (Clackamas) Eric Sheagley (PSU) Jessica Wittman (MHCC) Joseph Villa (UCC) Ken Usher (OIT) Margaret Haak (OSU) Michael Koscho (U of O) Patricia Flatt (WOU) Paula Weiss (OSU) Sekhar Kunapareddy (RCC) Chris Nelson (Chemeketa)
Transfer Council Co-chairs	Jose Coll and David Plotkin
HECC	Donna Lewelling, Director of Community Colleges and Workforce Development, HECC Veronica Dujon, Director of Academic Policy and Authorization, HECC

— END OF REPORT–