

Clackamas Community College

Online Course/Outline Submission System

 Show changes since last approval in red**Section #1 General Course Information****Department:** Sciences**Submitter**First Name: **Eden**Last Name: **Francis**Phone: **3352**Email: **edenf**

Course Prefix and Number: CH - 104

Credits: 5**Contact hours**

Lecture (# of hours): 44

Lec/lab (# of hours):

Lab (# of hours): 33

Total course hours: 77

For each credit, the student will be expected to spend, on average, 3 hours per week in combination of in-class and out-of-class activity.

Course Title: Introductory Chemistry**Course Description:**

A lab transfer course for students in nursing, allied health fields and liberal arts. Topics include: observation, measurement, composition, stoichiometry, atomic structure, periodic table, bonding and nomenclature.

Type of Course: Lower Division Collegiate

Is this class challengeable?

Yes

Can this course be repeated for credit in a degree?

No

Is general education certification being sought at this time?

Yes

Check which General Education requirement:

✓ Science & Computer Science

Is this course part of an AAS or related certificate of completion?

No

Are there prerequisites to this course?

Yes

Pre-reqs: Pass MTH-065 with a C or better or placement in MTH-095, pass RD-090 or placement in RD-115

Have you consulted with the appropriate chair if the pre-req is in another program?

No

Are there corequisites to this course?

No

Are there any requirements or recommendations for students taken this course?

No

Are there similar courses existing in other programs or disciplines at CCC?

No

Will this class use library resources?

Yes

Have you talked with a librarian regarding that impact?

No

Is there any other potential impact on another department?

No

Does this course belong on the Related Instruction list?

No

GRADING METHOD:

A-F or Pass/No Pass

Audit: Yes

When do you plan to offer this course?

- ✓ **Summer**
- ✓ **Fall**
- ✓ **Winter**
- ✓ **Spring**

Is this course equivalent to another?

If yes, they must have the same description and outcomes.

No

Will this course appear in the college catalog?

Yes

Will this course appear in the schedule?

Yes**Student Learning Outcomes:**

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

1. describe the scientific method and the procedures used in generating hypotheses and solving scientific questions in the context of chemistry, (SC1) (SC2) (SC3)
 2. analyze problems and apply appropriate problem-solving methods, including the correct use of experimental data, units and significant figures, (SC1) (SC2)
 3. illustrate the current and historical models of atomic structure and relate atomic structure to the principles of bonding between atoms, (SC1) (SC2)
 4. describe the relationship between chemical structure at the atomic- and molecular-level and observable physical properties, (SC1) (SC2)
 5. clearly communicate and comprehend basic scientific principles and concepts important to an understanding of major topics in introductory chemistry, (SC1)
 6. demonstrate understanding of fundamental concepts of chemistry by definition, explanation, and use of these ideas in examinations and laboratory exercises; (SC1) (SC2)
 7. critically examine the fundamentals of chemistry in their role as applied to human biology, medicine, and environmental issues. (SC3)
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**AAOT/ASOT GENERAL EDUCATION OUTCOMES
COURSE OUTLINE MAPPING CHART**

Mark outcomes addressed by the course:

- Mark "C" if this course completely addresses the outcome. Students who successfully complete this course are likely to have attained this learning outcome.
- Mark "S" if this course substantially addresses the outcome. More than one course is required for the outcome to be completely addressed. Students who successfully complete all of the required courses are likely to have attained this learning outcome.
- Mark "P" if this course partially addresses the outcome. Students will have been exposed to the outcome as part of the class, but the class is not a primary means for attaining the outcome and assessment for general education purposes may not be necessary.

As a result of completing the AAOT/ASOT general education requirements, students will be able to:

WR: Writing Outcomes

1. Read actively, think critically, and write purposefully and capably for academic and, in some cases, professional audiences.
2. Locate, evaluate, and ethically utilize information to communicate effectively.
3. Demonstrate appropriate reasoning in response to complex issues.

SP: Speech/Oral Communication Outcomes

1. Engage in ethical communication processes that accomplish goals.
2. Respond to the needs of diverse audiences and contexts.
3. Build and manage relationships.

MA: Mathematics Outcomes:

- P** 1. Use appropriate mathematics to solve problems.
- P** 2. Recognize which mathematical concepts are applicable to a scenario, apply appropriate mathematics and technology in its analysis, and then accurately interpret, validate, and communicate the results.

AL: Arts and Letters Outcomes

1. Interpret and engage in the Arts & Letters, making use of the creative process to enrich the quality of life.
2. Critically analyze values and ethics within range of human experience and expression to engage more fully in local and global issues.

SS: Social Science Outcomes

1. Apply analytical skills to social phenomena in order to understand human behavior.
2. Apply knowledge and experience to foster personal growth and better appreciate the diverse social world in which we live.

SC: Science or Computer Science Outcomes

- S** 1. Gather, comprehend, and communicate scientific and technical information in order to explore ideas, models, and solutions and generate further questions.
- S** 2. Apply scientific and technical modes of inquiry, individually, and collaboratively, to critically examine the influence of scientific and technical knowledge on human society and the environment.

S

3. Assess the strengths and weaknesses of scientific studies and critically examine the influence of scientific and technical knowledge on human society and the environment.

CL: Cultural Literacy Outcome

1. Identify and analyze complex practices, values, and beliefs and the culturally and historically defined meanings of difference.

Outcomes Assessment Strategies:

✓ **General Examination**

✓ **Multiple Choice Test**

✓ **Other Assessment Tools:** lab reports

Major Topic Outline:

1. Observation and description.
 - a. Make and record careful observations of materials and objects.
 - b. Use observations to distinguish between chemical and physical changes.
2. Measurements and calculations.
 - a. Distinguish between accuracy and precision.
 - b. Keep track of significant digits and units in calculations.
 - c. Make reliable measurements showing appropriate precision and units.
 - d. Calculate the density of a material given the necessary data about mass and volume. Calculate either the mass or volume of a sample given the other and the density of the material.
 - e. Convert between units given a relationship between the units that can serve as a conversion factor.
3. Composition and weight relationships.
 - a. State or recognize statements of the Law of Conservation of Mass and apply the law where appropriate.
 - b. Balance and categorize chemical equations.
 - c. Calculate the amount of a chemical that will react with (or produce or be produced by) a specified amount of another chemical.
 - d. Identify the limiting reagent (and the excess reagent) in a chemical reaction.
 - e. Calculate the amount of a chemical that will react with (or be produced by) a limiting reagent.
 - f. Calculate the composition (in weight percent) of a compound.
 - g. Explain what is meant by the Law of Constant Composition, as well as stating it, recognizing it, or identifying examples of it. Use it to distinguish between compounds and other classes of materials.
 - h. Explain how scientific knowledge is obtained using the Scientific Method.
4. Elements and atoms and compounds.
 - a. Relate (equate, memorize) the names and symbols for selected elements.
 - b. State and recognize the basic points of Dalton's Atomic Theory, describe Dalton's model of atoms.
 - c. Define "mole" and describe the relationship between the mole and the atomic weight (and also the formula or molecular weight).
 - d. Convert from grams to moles and from moles to grams.
 - e. State Avogadro's Law and explain how it relates to molecules and compounds and elements, describe the differences between Avogadro's "molecule" and Dalton's "compound atom."
 - f. Define and distinguish between empirical and molecular formulas.
 - g. Define and calculate formula weights.
 - h. Determine the empirical formula of a compound from its composition or similar data.
 - i. Experimentally determine the molecular weight of gases.
 - j. Determine the molecular formula of a compound given its empirical formula and its molecular weight.
5. Chemical equations.
 - a. Define "reagent", "reactant" and "product" and identify them in chemical equations.
 - b. Distinguish between reactions and equations.

- c. Write and interpret word equations.
 - d. Write and interpret skeleton (unbalanced) equations.
 - e. Describe what is meant by a balanced equation.
 - f. Balance simple chemical equations.
 - g. Use a balanced equation to calculate the amount of one chemical that corresponds to a specified amount of another chemical.
 - h. Given the amounts of two reactants, use a balanced equation to identify the limiting reagent, calculate the amount of product(s) formed along with the amount of excess reagent used and left over.
 - i. Categorize chemical reactions on the basis of chemical equations.
6. Atomic and electronic structure.
- a. Define "atomic mass units" (amu) and relate them to isotopic weights, atomic weights, and formula weights.
 - b. Conceptually define Avogadro's Number, distinguish between its definition and its measurement.
 - c. Use Avogadro's Number to calculate the number of atoms or molecules from mass or moles (and vice versa).
 - d. In general, relate how various studies and discoveries having to do with light, electricity and radioactivity challenged Dalton's model of atoms and converged to give us our current model of atomic structure.
 - e. Describe the internal composition and structure of various atoms, ions and isotopes including the variations that relate atoms to ions and isotopes.
 - f. Describe the size, mass and charge of protons, neutrons and electrons.
 - g. Describe the arrangement of protons, neutrons and electrons in atoms and ions.
 - h. Write and interpret formulas for ions.
 - i. Write and interpret isotopic symbols.
 - j. Describe how atomic spectra gave evidence of energy levels in atoms.
 - k. Describe the Bohr model of atoms and how it explains atomic spectra.
 - l. Describe the arrangement of electrons in atoms using the Bohr model.
 - m. Describe the arrangement of electrons in atoms using the "orbital model", which is also called the "wave mechanical model."
 - n. State the number of valence electrons for any representative element.
 - o. Draw Lewis (electron dot) diagrams for any representative element.
7. Periodic table and atomic properties.
- a. Describe how the periodic table is arranged with respect to atomic numbers and similarities of chemical properties.
 - b. Identify the various groups (families), periods and other sections of the periodic table.
 - c. Locate an element on the periodic table and determine which group and which period it is in.
 - d. Classify an element as either a metal or a nonmetal (or an inert gas) from its position on the periodic table.
 - e. Describe how the periodic table is arranged with respect to the electron configurations of the elements.
 - f. Use the periodic table or the electron configuration to determine the number of valence electrons for elements from their position on the periodic table.
 - g. Describe what each of the following is and how each varies within the periods and groups of the periodic table: nuclear charge, number of main electron energy levels, shielding electrons, valence electrons, effective nuclear charge (kernel charge).
 - h. Describe what atomic size is, how it varies within the groups and periods, and explain why it varies the way it does.
 - i. Describe what ionization energy is, how it varies within the groups and periods, and explain why it varies the way it does.
 - j. Describe how the tendency of atoms to gain electrons varies within the groups and periods, and explain why it varies the way it does.
 - k. Describe what electron affinity is.
 - l. Describe how the sizes of cations and anions compare to one another and to their parent atoms.
 - m. For both metals and nonmetals, describe what chemical reactivity is, how it varies within the groups and periods, and explain why it varies the way it does.
8. Ionic, covalent and metallic bonding.
- a. Given any collection of atoms determine what type of bonding will hold them together, whether they bond as molecules or networks, and whether they will bond together as an element, an alloy or a compound.
 - b. Explain what happens to the electrons of individual, isolated atoms when they come in contact with and fall under the influence of other atoms.
 - c. Describe the nature of ionic bonding and explain why it results in the formation of networks and compounds, but not elements and not molecules.
 - d. Use the periodic table, our current atomic model, and the octet rule to determine the charges (oxidation states) of ions formed by the representative metals and nonmetals.
 - e. Use the charges of cations and anions to determine the formulas of ionic compounds.
 - f. Describe the basic model of covalent bonding, describe and identify the variations that occur with respect to numbers of electrons (multiple bonds), origin of electrons (coordinate covalent bonds), and polarization of bonds.
 - g. Explain how covalent bonding can result in both network and molecular materials, in both elements and

compounds, and in polyatomic ions.

h. Use our current atomic model, the periodic table, the octet rule, and Lewis diagrams to depict, predict and explain the covalent bonding patterns in many of the covalent molecules, networks, elements and compounds that exist.

i. Describe the nature of free radicals and relate their degree of reactivity to the arrangement of their electrons.

j. Define and describe electronegativity, relate its magnitude to the position of an element on the periodic table, describe its application to determining bond type.

k. Describe the nature of metallic bonding, relate it to the observed properties of metals, our current model of atoms and to the position of elements on the periodic table.

l. Explain how metallic bonding results in networks and why it is associated with elements and alloys but not compounds.

m. Describe how ionic, covalent and metallic bonding are different from one another and in what ways they are similar to or blend into one another.

9. Molecular shapes, polarity, intermolecular bonding.

a. Describe the relationship between the bond type for a particular chemical and its physical properties such as state of matter at room temperature, melting point, boiling point, and compatibility with other chemicals (e.g. miscibility water).

b. Describe the nature of dipole-dipole bonding and explain why it is associated with polar molecules.

c. Describe the nature of hydrogen bonding and explain what conditions must exist within a molecule for it to occur.

d. Describe the nature of van der Waals bonding and explain why it is associated with nonpolar molecules.

e. Compare the strengths of intermolecular bond types to one another and to interatomic bonds, compare specific chemicals to one another based on bond strength.

f. For simple molecular elements and compounds, determine the shape of the molecules.

g. Distinguish between bond polarity and molecular polarity.

h. For molecular elements and compounds, which are simple or moderately complex in shape, determine whether the molecules are polar or nonpolar and which type of intermolecular bonding (if any) is used by the chemicals.

i. Given a particular chemical, determine what type of bonding is responsible for its state at room temperature, melting point, boiling point, and miscibility with other chemicals.

j. Describe the nature of ion-dipole bonding and the conditions under which it occurs.

10. Review based on nomenclature.

a. Name cations, anions and ionic compounds using simple, Latin and Stock names as appropriate.

b. Name and write formulas for common polyatomic ions and compounds that include them.

c. Name covalent compounds using prefix and Stock names as appropriate.

d. From the name of a chemical, determine whether it is an element or compound.

e. From the name of an element, determine: the formula; whether it is a metal, a nonmetal or an inert gas; its type of bonding; and whether it is a network or molecular material.

f. From the name of a compound, determine: whether it is ionic or covalent; whether it is network or molecular; the formula and formula weight; the composition; write the balanced equation for its synthesis or decomposition; and use those balanced equations to determine stoichiometric amounts of reactants and/or products.

g. From the name of a molecular chemical, determine: the Lewis (electron dot) diagram for it; the shape and polarity of the molecule; and the type of intermolecular bonding.

Does the content of this class relate to job skills in any of the following areas:

- | | |
|--------------------------------------|-----------|
| 1. Increased energy efficiency | No |
| 2. Produce renewable energy | No |
| 3. Prevent environmental degradation | No |
| 4. Clean up natural environment | No |
| 5. Supports green services | No |

Percent of course: 0%

Section #2 Course Transferability

Concern over students taking many courses that do not have a high transfer value has led to increasing attention to the transferability of LDC courses. The state currently requires us to certify that at least one OUS school will accept a new LDC course in transfer. Faculty should communicate with colleagues at one or more OUS schools to ascertain how the course will transfer by answering these questions.

1. Is there an equivalent lower division course at the University?
2. Will a department accept the course for its major or minor requirements?
3. Will the course be accepted as part of the University's distribution requirements?

If a course transfers as an elective only, it may still be accepted or approved as an LDC course, depending on the nature of the course, though it will likely not be eligible for Gen Ed status.

Which OUS schools will the course transfer to? (Check all that apply)

PSU (Portland State University)

OSU (Oregon State University) UO (University of Oregon)

Identify comparable course(s) at OUS school(s)

CH LDT Introductory Chemistry (OSU)
CH 104, CH 107 (PSU)
CH 120T (UO)

How does it transfer? (Check all that apply)

general education or distribution requirement

general elective

:

Provide evidence of transferability: (minimum one, more preferred)

Other. Please explain.

OSU Course Equivalencies list (online)
Transferology website (PSU, UO)

First term to be offered:

Next available term after approval

:
