Overall Expectations:

A1. demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);

A2. identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields.

E1. analyse the origins and effects of water pollution, and a variety of economic, social, and environmental issues related to drinking water;

E2. investigate qualitative and quantitative properties of solutions, and solve related problems;

E3. demonstrate an understanding of qualitative and quantitative properties of solutions.

Summary:

All living things depend on water for their survival. In this unit on Solutions and Solubility, students will gain an understanding of the importance of water to humans, its unique properties and why it is referred to as the ‘universal solvent’. Students will investigate the properties of aqueous and non-aqueous solutions and the factors that affect the solubility of substances. Students will analyse the sources and impacts of water pollution and the economic and social issues relating to water.

Key Questions:

* What types of solutions exist?
* How can a property of a solution be described both qualitatively and quantitatively?
* What are the factors that affect rate of dissolving and solubility?
* How can determining the concentration of a solution help us in making better environmental decisions?

| Topic | Day | Concept/Subtopic with Learning Goals for Each Lesson | Teaching & Learning Strategies | Assessment for Learning (AfL), Assessment as Learning (AaL), Assessment of Learning (AoL) and Evaluation (E);  Learning Skills Assessment | Expectations Addressed |
| --- | --- | --- | --- | --- | --- |
| Introduction to solutions and solubility  Types of solutions | 1 | Introduction, including introduction to STSE assignment (culminating)  (E1.1 analyse origins + cumulative effects of pollutants in watersystems and explain how these pollutants affect water quality)  (E1.2 analyse economic, social and environmental issues related to the distr. Purification or use of drinking water)  By the end of the lesson students will be able to:   * Distinguish between mixtures and solutions * Provide examples of solutions in daily life * Define solvent & solute & solubility * Recognize that solutions may not be liquid (e.g. bronze); solutes may not be solid (when dissolved) | Student handout: Blank flowchart of Classification of Matter to be filled out by students  Lecture on solutions and solubility  Set up stations with solution and mixture samples for students to observe  Introduction to culminating activity  Homework, pages 290-299 of McGraw Hill Chemistry 11 and complete pre-lab in preparation for Gizmo activity | AforL: Classification of Matter flowchart | E2.1 |
| Factors that affect rate of dissolving and solubility  Plotting solubility curves | 2 | Temperature & Solubility  Solubility Curves  By the end of the lesson students will know: how temperature affects solubility, how to analyse and interpret solubility curves, communicate and understand terminology related to chapter | Whole Class learning - take up of Gizmo Warm Up Activity from homework.  In pairs students complete Activity A (15 mins)  Gizmo activity B completed in class to be prepared for handing in next class  Gizmo available at:  [http://www.explorelearning.com/index.cfm?method= cResource.dspDetail&ResourceID=384](http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=384) | AofL: student responses during class discussion (anecdotal notes)  E: Activity B (marking scheme) [KU, TI, A, C] | E2.1  E2.2  E3.3 |
| Factors that affect rate of solubility, continued | 3 | Discussion and interpretation of solubility curves  Additional factors affecting solubility (Pressure, agitation, particle size, polarity, surface area)  By the end of the lesson students will be able to interpret and analyze a solubility curve, and describe factors affecting solubility | Lecture  Discussion with PowerPoint or SMARTboard  Video and in-class demonstration of other factors (e.g. bottle of clubsoda, video: <http://www.youtube.com/watch?v=4cr9w23GcTs> “Factor Affecting Solubility”) | A for L – student responses during class discussion | E2.2  E3.3 |
| Concentration of solutions  m/m, m/v, v/v, molar | 4 | Problem Solving   * m/m * m/v * v/v   By the end of the lesson students will be able to solve concentration problems. | Real life examples and discussion on concentrations of solutions (e.g. vinegar, fruit crystal drinks, rubbing alcohol)  Modeled solving of concentration problems – gradual release to problem solving in small group /pairs on worksheet/textbook problems  Assignment handout: Solubility curve with concentration problems – to be evaluated | A for L: Observations of student work, student responses during guided examples (anecdotal notes)  E: Solubility curve assignment (marking scheme) [A, TI] | E2.2  E2.6 |
| continued | 5 | Questions & Concerns on:   * Concentration Problem solving   Molarity  By the end of this lesson students will be able to: calculate concentrations of solutions and demonstrate an understanding of Molarity. | Question and Answers; take up concentration questions  Guided lesson (using PowerPoint/SMARTboard) on moles and molarity  Assigned questions on molarity | A as L: Peer and self-evaluation of answers  A of L: observation and conversation during problem solving (anecdotal notes/checklist) | E2.2  E2.6 |
| Determining concentration of a solution | 6 | Quiz on Concentration Problems – 10 mins  Preparing solutions  By the end of this lesson students will be able to:   * Prepare sol’ns of a given concentration * Dilute a concentrated sol’n * Dissolve a solute in a solvent | Demonstration for use of equipment  Review of safety in lab  Lab – small group completion of experiment  Homework: Student to read assigned article in preparation of jigsaw activity | A of L and E – quiz  Checklist for: concentration calculations, lab safety, proper use of equipment | E2.3  E2.2 |
| Aqueous Solutions and Water Quality | 7 | The importance of water (the universal solvent)  Video for properties of water: <http://www.youtube.com/watch?v=EKHTI2ENIMg&feature=player_detailpage> Properties of water (review)  Concentration of substances in water Sources compromising quality of water  By the end of the lesson students will be able to identify sources of contamination and pollution in water sources and suggest ways to improve water quality (ties into culminating activity) | Literacy and vocabulary exercise  Video from the Canadian Nature Museum: [http://www.youtube.com/user/ canadanaturemuseum/videos](http://www.youtube.com/user/canadanaturemuseum/videos)  Jigsaw activity using variety of articles on water quality & water pollution | A for L – observation of discussions (anecdotal notes / checklist) | E2.8  E3.1 |
| Making Predictions about Solubility | 8 | Factors that affect the solubility of Ionic Substances  Solubility guidelines  Perform qualitative analysis of ions in solutions  By the end of the lesson, students will be able to summarize the rules for solubility of ionic compounds. | Solubility Rules investigation – see handout  Assignment: compose a song/rap, make a powerpoint presentation, create a YouTube video, prepare a brochure, etc. which summarizes the solubility rules. | A for L: observation during investigation (checklist of lab skills)  A of L: investigation Questions for [KU] and [C]  E: Solubility Rules Assignment (rubric) | E3.2 |
| Reactions in Aqueous Solutions | 9 | Reactions - Describe combinations of aqueous solutions that result in the formation of precipitate or a gas  By the end of the lesson, students will be able to identify the formation of precipitates in aqueous solutions | Demonstrations of reactions in aqueous solutions – eg. Alka-seltzer in water to produce gas; colour change, precipitates.  Smartboard/PowerPoint lesson on Reactions in Aqueous Solutions | A for L: observation of student responses during demonstrations and discussion. (anecdotal notes); exit ticket. | E3.4 |
| Stoichiometry in solution chemistry | 10 | Introduction to Stoichiometry  By the end of the lesson, students will be able to solve stoichiometry problems. | Anticipatory Set: Demonstration – the Oscillating Clock (see [http://www.chem.fsu.edu/outreach/ Oscillating%20Clock.pdf](http://www.chem.fsu.edu/outreach/Oscillating%20Clock.pdf))  In Class worksheets on previous lesson (pairs, small groups)  Guided lesson stoichiometry problems | A for L: observation during class discussion (anecdotal notes) | E2.5  E2.6 |
| Stoichiometry in solution Chemistry | 11 | Stoichiomety, con’t  Stoichiometry problem solving  By the end of the lesson, students will be able to solve stoichiometry problems. | GalleryWalk – solve problem in pairs and small groups – gallery walk of solutions  (Based on observations, consider doing more guided solutions to problems) | A as L, A for L: gallery walk of student solutions.  : | E2.6 |
| Work Period on Culminating Activity | 12 | Work Period on Culminating Activity  (no new learning goals) | Library / computer period for research  Small group presentations to students by librarian on research methods and sources | A for L: interviews with students on planning and progress | E1.1  E1.2 E2.8 |
| Introduction to Acids & Bases | 13 | What is an acid? What is a base?  Examples of acids and bases  Properties of Acid and Bases (Electrical conduction, Litmus test, taste, feel, reaction with metals, reaction with carbonate)  By the end of the lesson students will be able to explain the difference between an acid and a base, and identify properties of acids and bases. | Demonstration of examples of everyday acids and bases (e.g. lemon juice, soap, stomach acid)  Interactive SMARTboard lesson on Acids & Bases, including whole class discussion of acids and bases | AforL: observation during whole class discussion / anecdotal notes; exit ticket on acids & bases | E2.1 |
| Theories of Acids & Bases | 14 | Arrhenius Theory   * Acids produce H+ ions * Bases produce OH- ions (hydroxide ions)   Limitations of the theory  Bronsted Lowry Theory of Acids & Bases   * Acid is substance from which H+ (proton) can be removed * Bases can remove a H+ from a substance   By the end of the lesson, students will be able to:   1. Complete a summary note explaining the two theories of acids & bases 2. complete a T-chart which summarizes the differences between the two theories | Discrepant Event: Water into Wine into Milk (University of Manitoba:  <http://bit.ly/Ow28qP>)  Interactive Powerpoint/SMARTboard presentation on theories | A for L: note and T-chart  A as L: Students to compare T-charts with seat partner(s) and revise as necessary | E3.5  E2.1 |
| Strong & Weak | 15 | Strong and weak acids  Strong and weak bases  pH (concentration of ions in water)  By the end of the lesson, students will be able to:  Explain the difference between strong and weak acids and bases in terms of degree of ionization | Students to, in small groups, rotate through stations for investigation of:   * Strong and weak acids * Strong and weak bases * pH indicators   and complete an observation chart | A for L,: Observation and conversation as students rotate through stations (anecdotal notes)  A of L: observation of scientific inquiry skills (checklist) | E3.6  E2.2  E2.3  E2.1 |
| Concentration of Acids and Bases - Titration | 16 | Acid-Base Reactions -titration  By the end of the lesson, students will be able to:  -Determine the concentration of an acid and base in solution using titration;  -use appropriate terminology related to titration  -assemble and use titration equipment | Teacher led GIZMO on titration  ([www.explorelearning.com](http://www.explorelearning.com))  Teacher demonstration of titration equipment, including indicators  Homework: pages 399-403, prepare titration pre-lab & observation chart | A for L: GIZMO Exploration Sheet | E2.5  E2.7  E2.1 |
| Titration – con`t | 17 | Titration Laboratory  By the end of the lesson, students will be able to determine the concentration of an acid and base in solution using titration | Titration Laboratory | A for L: pre-lab  E: lab report and related questions [C, T/I, K/U, A] | 2.7  2.1  2.2  3.5 |
| Culminating Activity | 18, 19 | Culminating Activity Work Periods  Unit Review  (no new learning goals) | Student Presentations on culminating activity  Review: Q&A scramble | AasL: Peer and Self Evaluation of Culminating Activity  E: rubric for culminating activity | 1.1  1.2  2.1  2.2  2.5  2.8  3.1  3.2  3.3 |
| Unit Test | 20 | Unit Test  (no new learning goals) | Unit Test | E: unit test [C, T/I, K/U, A] | 2.1  2.3  2.5  2.6  3.1  3.3  3.4  3.5  3.6 |

**Accommodations for exceptional students and English Language Learners:**

Students identified as exceptional will be provided with accommodations and modifications as set out in their Individual Education Plans. Such accommodations may include strategic seating, strategic grouping, extra time for completion of assignments, and assistive technology. Assignments have been designed to provide choices to students as to how they wish to complete the assignment (e.g. compose a song, or prepare a multi-media presentation).

Lessons are designed to incorporate visual and graphic elements in addition to written materials. Vocabulary sheets (glossaries) may be provided to ELLs and students who would benefit. All students are encouraged to use multiple strategies (writing, diagrams, maps) to learn concepts.

**Resources:**

1. McGraw Hill Ryerson –Chemistry Text book Course code SCH3U