North Vancouver Online Learning

Course Plan: Chemistry 12
Teacher Name: Mr. Naresh Chand
Contact information: nchand@sd44.ca (*Remind app / website messaging preferred)

Course Description:

Science education is an activity-based process that provides an exciting method of teaching and learning.

The “blended” approach to teaching chemistry includes the vital laboratory component that is paramount to truly understanding the invisible world of atoms and molecules.

In addition to the laboratory component, students, through the use of technology, can access and learn the course material whenever they have time available which is flexibility not possible in a regular class.

Access to the teacher is not limited to only a scheduled class time as you can communicate and get help by through e-mail and virtual tutorial times.

By utilizing the learning centre time provided and the powerful tools available on-line, students will be able to get the support that will give them the best chance for success.

In Chemistry 12, many of the concepts presented in Chemistry 11 are probed at greater depth. Through theory and lab work, the following topics are investigated: thermochemistry, reaction rates, equilibrium, solubility, acids and bases, oxidation reduction and electrochemistry. Lab work and problem assignments continue the development of skills in measurement, lab report writing, analysis and chemical calculations. . For the complete Ministry curriculum Chemistry 12 document go to: https://curriculum.gov.bc.ca/sites/curriculum.gov.bc.ca/files/curriculum/science/en_science_12_chemistry.pdf

BIG IDEAS:

The Big Ideas consist of generalizations and principles and the key concepts important in an area of learning. They reflect the “Understand” component of the Know-Do-Understand model of learning. The big ideas represent what students will understand at the completion of the curriculum for their grade. They are intended to endure beyond a single grade and contribute to future understanding. Students will explore and understand the following four Big Ideas throughout the Chemistry 12 course:

Reactants must collide to react, and the **reaction rate** is dependent on the surrounding conditions.

Dynamic equilibrium can be shifted by changes to the surrounding conditions.

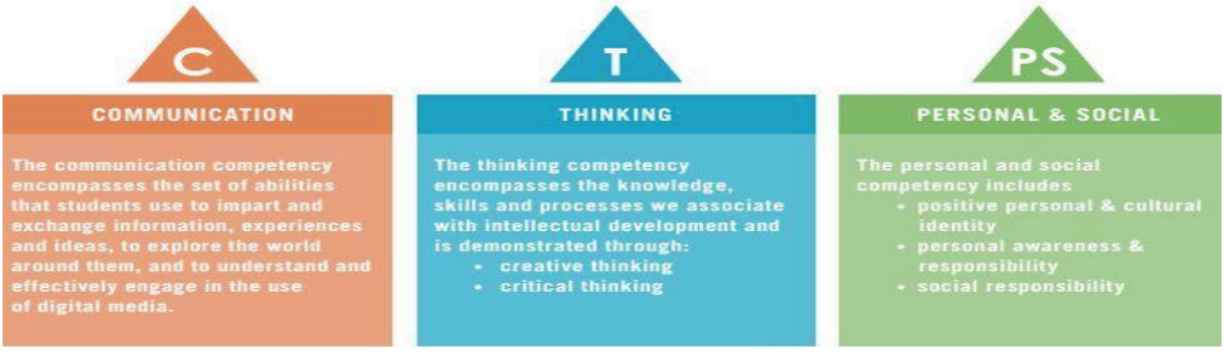
Saturated solutions are systems in equilibrium.

Acid or base strength depends on the degree of ion dissociation.

Oxidation and reduction are complementary processes that involve the gain or loss of electrons.

CORE COMPETENCIES:

A Core Competency is a skill that all learners need to have to be successful in all aspects of their life. There are 3 core competencies: Communication (Communicating & Collaborating), Thinking (Critical Thinking, Creative Thinking), and Personal & Social (Positive Personal & Cultural Identity, Personal Awareness & Responsibility, and Social Responsibility).



Course Expectations:

OPTIONAL Textbook Resource: ***(*NOT REQUIRED but discuss with Naresh if you are interested in this resource)*** HEBDEN: "Chemistry 12: A Workbook for Students"

Majority of course information is delivered online using a variety of methods (videos, interactive tutorials, text, external links to other websites). Accessing the online materials is MANDATORY.

Attendance:

You are responsible for signing up for lab sessions that will be held at Mountainside Secondary School and will happen on a weekday* from 4:00 pm to 6:30 pm (*Note: A more detailed schedule of the lab sessions will be linked in the course). You also are encouraged to come into the OL Learning Centre, if you need a place to study and for tutorial support. A schedule is posted which details when I am in the Learning Centre so that you can hopefully come during those times so that you can get the most support.

Tutorials:

There will be a booking form available to book one to one tutorial times at the Mountainside DL Centre. Also "Virtual Tutorials / Lectures" will be scheduled to give students another opportunity to access help from the teacher. Please message me if you want to arrange any tutorial support.

Lab Work (In-Class and Virtual):

If this is your first experience with a laboratory setting, some time should be spent getting you familiarized and comfortable in a laboratory setting, so please discuss any concerns or questions you may have before your first lab session. The emphasis is on SAFETY FIRST so that we can spend as much time as possible "*doing chemistry*" with hands-on activities in the safest way possible.
There may also be some virtual labs that will be completed throughout the course using different programs available on-line. (Click here for a preview)
(https://phet.colorado.edu/en/simulations/category/chemistry)

Communication:

I strongly believe that open and regular communication is an important component for student success in any online course. I encourage the use of the *Remind texting tool

and Brightspace messaging to maintain consistent contact. I will do my best to respond in a timely manner and the only “dumb question” is one that is not asked.

Exam Supervision:

****NOTE: NVDL TEST POLICY: You must show picture id whenever writing a test***
All unit exams are "closed book" and require supervision. Please make sure to use the “Test Sign Up” button to book a time for an IN PERSON test at the OL Centre in Mountainside or message Naresh to discuss the process of signing up for ONLINE assessments.

Assignments:

Before you write a unit exam, you must submit all assignments from the unit leading up to the exam. Digital copies are required to be uploaded of all completed work. (*Discuss with Naresh if there are issues with generating digital copies of work)
Assignment and lab submissions MUST be very neat and well organized. All “Learning Guide” assignments MUST be self assessed and a marking rubric attached to the front of each one before submitting.
You also need to put a check mark beside each answer indicating that you got it right and you know what you are doing. If you can't mark it right, you should be asking for help.
I assume that you will do all the required assignments. Success on the unit, and final exams depends upon exposure to a large variety of questions and lots of practice.

LEARNING STANDARDS: Curricular Competencies

Students are expected to be able to do the following:

Questioning and predicting
• Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest
• Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world
• Formulate multiple hypotheses and predict multiple outcomes

Planning and conducting
• Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)

• Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods
• Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data
• Apply the concepts of accuracy and precision to experimental procedures and data:
— significant figures
— uncertainty
— scientific notation

Processing and analyzing data and information
• Experience and interpret the local environment
• Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information
• Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies
• Construct, analyze, and interpret graphs, models, and/or diagrams
• Use knowledge of scientific concepts to draw conclusions that are consistent with evidence
• Analyze cause-and-effect relationships

Evaluating
• Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions
• Describe specific ways to improve their investigation methods and the quality of the data
• Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled
• Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and in primary and secondary sources
• Consider the changes in knowledge over time as tools and technologies have developed
• Connect scientific explorations to careers in science
• Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources
• Consider social, ethical, and environmental implications of the findings from their own and others' investigations
• Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems
• Assess risks in the context of personal safety and social responsibility

Applying and innovating

• Contribute to care for self, others, community, and world through individual or collaborative approaches
• Cooperatively design projects with local and/or global connections and applications
• Contribute to finding solutions to problems at a local and/or global level through inquiry
• Implement multiple strategies to solve problems in real-life, applied, and conceptual situations
• Consider the role of scientists in innovation

Communicating

•Formulate physical or mental theoretical models to describe a phenomenon

• Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations

• Express and reflect on a variety of experiences, perspectives, and worldviews through place

Student Substantive Activities will cover the following **Learning Outcomes (Curricular Competencies).**

- Formulate multiple hypotheses and predict multiple outcomes
- Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)
- Apply the concepts of accuracy and precision to experimental procedures and data:
    — significant figures
    — uncertainty
    — scientific notation
- Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data
- Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies
- Construct, analyze, and interpret graphs, models, and/or diagrams
- Use knowledge of scientific concepts to draw conclusions that are consistent
- with evidence

These are 8 of the 30 learning outcomes in the course curriculum, which comprises 25% of the course Learning Outcomes/Activities. (8/30 =25%)

LEARNING STANDARDS: Course Content

Students are expected to know the following:

Reaction Kinetics

• reaction rate
• factors that affect reaction rates
• collision theory:
— collision geometry
— kinetic energy
• relate PE, KE, and enthalpy (ΔH) during a reaction
• chemical equations describing energy effects
• reaction mechanism
• effect of a catalyst on a PE diagram
• applications of catalysts

Dynamic Equilibrium

• dynamic nature of chemical equilibrium
• equilibrium shifts:
— effect of enthalpy and entropy on equilibrium
— application of Le Châtelier's principle
— effect of a catalyst
• equilibrium constant, Keq
• quantitative problem solving:
— to evaluate the changes in the value of Keq and in concentrations of substances
— to determine if a system is at equilibrium and resultant shifts

Solubility Equilibrium

• saturated solutions as equilibrium systems
• equilibrium constant expression, Ksp, for a saturated solution
• quantitative problem solving involving solubility equilibrium concepts

Acids and Bases

• different types of acids and bases:
— Arrhenius acids and bases
— Brönsted-Lowry acids and bases

• relative strength of acids and bases in solution
• equilibrium in weak acid or weak base systems
• amphiprotic species
• equilibrium that exists in water and Kw
• calculate [H3O+] or [OH-] given the other, using Kw
• calculate [H3O+] or [OH-] from pH and pOH
• quantitative problem solving involving the acid-base equilibrium constants (Ka and Kb)
• titration
• write formulae, complete ionic equations, and net ionic equations for strong and weak acids and bases
• quantitative calculations involving titration, including concentration, volume, and pH
• indicators
• quantitative calculations involving the pH in a solution and Ka for an indicator
• applications of acid/base reactions
• hydrolysis of ions in salt solutions
• calculation of the pH of a salt solution from relevant data, assuming that the predominant hydrolysis reaction is the only reaction determining the pH
• buffers as equilibrium systems
• oxides in water
• general environmental problems associated with non-metal oxides reacting with water

UNIT OVERVIEWS AND LEARNING ACTIVITIES:

The course is broken down as follows:

U1 & 2: Reaction Kinetics

Big Idea:

- Reactants must collide to react.
- Conditions surrounding a reaction determine its rate.

Core Competency Focus:

Communication, Critical Thinking

Essential Questions:

How does collision theory determine whether a reaction is successful?

How do the conditions of the reactants impact the rate of reaction?

First Peoples Principle of Learning:

Learning involves recognizing the consequences of one's actions

Learning involves patience and time

Unit Overview:

The Reaction Kinetics unit will focus on learning how to experimentally determine the rate of a reaction and the factors that impact the rate. This will be done by completing the first formal in class lab and a kitchen chemistry project in the course. The student will be introduced to the overarching concept of collision theory which will be used to explain and predict the behavior of chemical reactions throughout the course. Chemical reactions will be analyzed to uncover that many involve smaller reactions or steps (reaction mechanisms) leading to the overall reaction. Also, graphically representations of energy changes in chemical processes will be discussed in detail allowing for pictorial representations of the impact of altering reaction conditions. By gaining a greater appreciation for the factors that impact chemical processes and theory to explain this behaviour, students will be able to analyze real life chemical interactions which share these same basic principles.

U3 Dynamic Equilibrium

Big Idea:

- Some chemical reactions are reversible and proceed to equilibrium.
- Dynamic equilibrium can be altered by changing the surrounding conditions

Core Competency Focus:

Communication, Critical Thinking

Essential Questions:

Are all reactions reversible and if so what factors can influence a dynamic equilibrium?

First Peoples Principle of Learning:

Learning involves recognizing the consequences of one's actions

Learning involves patience and time

Unit Overview:

The Reaction Equilibrium unit will focus on understanding the concept of chemical equilibrium with reference to reacting systems (physical / chemical). Students will be asked to analyze chemical processes and discuss the forces that interact with each other to establish an equilibrium. The theory to explain systems in equilibrium (steady / shifting) will be detailed and connections to collision theory will be made to see how they work together to explain the behaviors of a dynamic equilibrium. A virtual lab will be completed which will reinforce all the concepts introduced and emphasis the connection between collision theory and equilibrium. Students will be asked to organize and complete calculations involving the changes in the value of K_{eq} and in concentrations of substances within an equilibrium system. These calculations are paramount in the understanding the quantitative changes that occur when equilibrium processes are altered allowing for a better understanding of large scale industrial applications.

U4 Solubility Equilibria

Big Idea:

- Saturated solutions are systems in equilibrium.

Core Competency Focus:

Communication, Critical Thinking, Creative Thinking

Essential Questions:

How do the principles of equilibrium explain the behavior of saturated solutions?

What are the similarities and differences between the way salts behave when dissolved?

First Peoples Principle of Learning:

Learning involves recognizing the consequences of one's actions

Learning involves patience and time

Unit Overview:

The Solubility Equilibrium unit will continue the investigation into equilibrium systems by focusing on saturated solutions. There will be a discussion of how saturated solutions can be made and how to describe and quantify the ion properties of these systems. Quantitative equilibrium analysis will be continued by completing calculations involved with saturated solutions at equilibrium. The second in class lab will allow the opportunity to create and analyze actual systems at equilibrium. These aqueous systems will be altered and students will discuss the implications of shifting equilibrium to either produce desirable products or prevent unwanted ones.

U5 & 6: Nature of Acid and Bases

Big Idea:

- The strength of an acid or base depends on the degree of dissociation of its ions.
- Weak acids, weak bases, and buffers are systems in equilibrium.

Core Competency Focus:

Communication, Critical Thinking

Essential Questions:

What factors control the behaviour aqueous solutions of acids and bases?

How do equilibrium principles explain the creation and behaviour of many acid / base systems?

First Peoples Principle of Learning:

Learning involves recognizing the consequences of one's actions

Learning involves patience and time

Unit Overview:

The concepts introduced in the previous unit will now be focused on the family of aqueous compounds known as acids and bases. Students will be introduced to the progression of the definitions used to describe the behaviour of acidic / basic solutions. The detailed role of the water equilibrium will be explained and students will be able to discuss the applications of this equilibrium on observable properties (pH, electrical conductivity). A wide array of equilibrium calculations will introduced which will build on the calculations already completed and will allow for quantitative analysis of acid / bases systems. The concept of titrations will be studied further, by looking at patterns in graphical data and we will also introduce the chemistry of indicators. Titration graphs will also illustrate the concept of a buffer and nature of these solutions will be studied. The final in class lab will allow students the chance to observe the dual nature of H_2O in aqueous salt solutions and to perform a number of different titrations to see how this analytic tool has multiple applications utilizing primary standards.

U7 & 8: Oxidation-Reduction

Big Idea:

- Reduction and oxidation are complementary processes that involve the gain or loss of electrons.
- Redox reactions have implications for resource development and for the environment.

Core Competency Focus:

Communication, Critical Thinking

Essential Questions:

How do oxidation and reduction reactions allow for better classification of many common reactions?

How are electron transfer reactions useful in industrial / everyday applications?

First Peoples Principle of Learning:

Learning involves recognizing the consequences of one's actions

Learning involves patience and time

Unit Overview:

Redox reactions will be introduced with a focus on distinguishing them from one another and understanding the relative strengths of the species influence whether a reaction will occur or not. Complex chemical reactions will be introduced involving redox which will require new strategies to help produce complete balanced reactions.A large focus of the unit will be applications of redox processes involving electrochemical and electrolytic principles. Also titrations will be revisited and prevention of corrosion will be discussed with specific reference to large industrial applications.

Student Learning Activities and Strategies:

Students may engage in the following learning activities and strategies:

- conduct appropriate experiments (*virtual or real*)
- systematically gather and organize data from experiments
- watch video explanations and interactive tutorials
- attend virtual classroom tutorial support
- write formal lab reports based on in class experiments
- participate in forum discussions related to course content and current trends in chemistry

Keys to Success:

1. Study the Lesson and take good notes for reference when working on homework. Make sure you can do and understand the problems you are shown in the many examples given in each lesson.
2. Once you have completed the assignments for a unit (labs and worksheets) to the best of your ability, submit it to your teacher and write the end of unit assessment shortly after.
3. Make sure you understand any quiz / homework question you get wrong. If you can't figure it out - ASK!
4. **IMPORTANT SCHEDULING / DEADLINE INFORMATION: This online course is a *partially self paced course.* You have the ability to control the pace of the course but must clearly communicate your intentions.** You will have to choose a pace that the course will move forward at. Once you have chosen a pace, you will have to try and meet the unit completion deadlines based on the pace you have chosen. *You can adjust your pace as required so do not feel too pressured to meet every deadline BUT our online courses are meant to be completed within 12 months of registering.Reach out to your teacher for assistance with staying on pace as our goal is for you to be successful and finish in a timely fashion.*

Assessment:

The course will include many formative assessment opportunities where students will self assess and will have the opportunity for teacher input as needed. Summative assessment will be used on individual performance tasks throughout each unit.

Assessment of student performance will include some or all of the following strategies:

Formative

o Learning Guides and practice assignments with detailed keys provided
o Online quizzes / tests checking for completion and understanding of lessons

Summative:

o online quizzes , unit exams and a final lab exam (written and M/C)
o worksheets, assignments and virtual labs
o In-class lab experiments, formal lab reports and practical lab exams

Evaluation:

*** This weighting may change without notice**

Item	Weight
Learning Guides / Practice Quizzes / Games	**~ 10%**
Meeting Deadlines / Course Pacing*	**~ ? %**
Lab Work / Lab Final Exam	**~ 30 %**
Unit Exams	**~ 35%**
Assignments	**~ 15%**
OPTIONAL** Final Exam (covers Units 1-8) (M/C)** ***make-up marks"	**~ ?%**

(** Meeting Deadlines / Course Pacing is a percentage of your mark reserved to encourage you to move through the course at a consistent pace which will improve your chances for success. Please ask Naresh for more details)