Coeur d'Alene Public Schools
DIVISION OF TEACHING AND LEARNING
INVEST | INSPIRE | INNOVATE

COURSE PACING GUIDE
3530- CHEMISTRY
Date of Last Update: 26-April, 2017

Course Title:	Chemistry	**Course Number:**	3530
Department / Grade Level:	Science High School	**Date:**	April 5, 2019

PHILOSOPHY OF INSTRUCTION:

The Coeur d'Alene School District recognizes the importance of science as an essential part of each student's educational experience. More than a body of knowledge, our district recognizes that scientific ways of thinking are central to our personal, cultural, and societal needs.
If our students are to live successfully in the future, they must become scientifically literate. Scientific literacy enables people to use scientific principles and processes in making personal and public decisions and to participate in discussions of scientific issues that affect society. A sound grounding in science strengthens many of the skills that people use every day such as solving problems creatively, thinking critically, working cooperatively in teams, using technology effectively, and valuing lifelong learning. To accomplish scientific literacy in every course offered, instruction will reflect the following:

- Develop inquiry-based, scientific reasoning, and critical thinking skills.
- Extend problem-solving skills using scientific methods.
- Include lab-based experiences.
- Strengthen positive attitudes about science.
- Incorporate the use of new technologies.
- Follow a logical progression with an opportunity for all students to follow special interest areas.
- Provide relevant connections to personal and societal issues and events.
- Design and evaluate engineering solutions to real-world problems

COURSE DESCRIPTION:

This course is designed for the student who does not plan on pursuing a science or technology related career. This course has less mathematical and highly abstract material than a traditional chemistry class. The main emphasis is on practical, real-life applications of chemistry in our society. Societal problems and issues like air and water pollution, waste disposal, resource management, nutrition and hunger, energy supply and nuclear issues are discussed. These controversial issues are examined from social, economic and political as well as scientific viewpoints.

SCOPE AND SEQUENCE:

First Semester (September - January)	Second Semester (February - June)
• Measurement • Properties of Matters • Atomic Structures • Electrons in Atoms • The Periodic Table • Ionic and Metallic Bonds • Molecular Compounds • Chemical Names and Formulas • Chemical Quantities • Chemical Reactions	• Stoichiometry • States of Matter • Behavior of gasses • Water and Aqueous Systems • Solutions • Thermochemistry • Reaction Rates • Acids, Bases, and Salts • Nuclear Chemistry

UNIT 1: MEASUREMENT

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Estimated Time Frame:	**5 hours**	**Thinking Strategies**	**Background knowledge Monitoring for Meaning**	
Enduring Understandings:	**Numbers have meaning.**			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-4.	Why are accurate and precise measurements important in science?	Significant figures Accuracy and precision Density	Rulers Mass Balances Protractors Graduated Cylinders	Lab Practical on Measurement
PSC1-HS-4.	How is the degree of uncertainty expressed in measurement?	Significant figures		
PSC1-HS-4.	How is dimensional analysis used to solve problems?	Metric conversions Scientific Notation		
PSC1-HS-4.	How is the density of matter determined in solids liquids and gases?	Mass Volume	Regular & irregular solids Carbon dioxide (Alka Seltzer)	Lab practical on Density

UNIT 2 : PROPERTIES OF MATTER				
Estimated Time Frame:	10 hrs	**Thinking Strategies**	**Sensory Imagery Asking questions**	
Enduring Understandings:	Matter is made of pure substance and mixtures of pure substances. All matter is made of atoms.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-2.	What properties are used to describe matter? ● Every sample of a given substance has identical intensive properties because every sample has the same composition ● Three states of matter are solid, liquid, and gas ● Physical changes can be classified as reversible or irreversible	Extensive property Intensive property Physical properties States of Matter physical changes	Clay Wax Isopropanol	Density , mass, color, volume, boiling point, and conductivity test of two amounts of the same substance lab practical
PSC1-HS-2.	What is a mixture? ● Mixtures can be classified as heterogeneous or homogeneous based on the distribution of their components ● Differences in physical properties can be used to separate mixtures	Mixture Heterogeneous Homogeneous Solution Phase Filtration Distillation	Funnels Filter paper Hot plates Beakers	Separated a mixture and find percent composition by mass lab practical.
PSC1-HS-2.	What are elements and compounds ● Compounds can be broken down into simpler substances by chemical means, but elements cannot ● If the composition of a material is fixed, the material is a substance. If the composition may vary, the material is a mixture ● Chemists use chemical symbols to represent elements, and chemical formulas to represent compounds	Element Compound Chemical change Chemical symbol Periodic table Period group		

	• The periodic table allows you to easily compress the properties of one element (or a group of elements) to another element (or group of elements)			
PSC1-HS-2.	What are chemical reactions? • During a chemical change, the composition (arrangement of atoms) of matter always changes • Four possible clues of chemical change include a transfer of energy, a change in color, the production of a gas, or the formation of a precipitate	Chemical property Chemical reaction Reactant Product Precipitate Law of conservation of mass	Tubing Gas collection flasks Alka seltzer balances	Conservation of mass lab practical (alka seltzer in water)

UNIT 3: ATOMIC STRUCTURE				
Estimated Time Frame:	10 hours	**Thinking Strategies**	**Sensory imagery Synthesizing**	
Enduring Understandings:	All matter is made of atoms. Atoms bond to form new substances. The atomic model is evolving.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-1.	Is our current model of an atom correct? ● How did the concept of the atom change over time? What is an atom? ● Democritus reasoned that atoms were indivisible and indestructible. By using experimental methods, Dalton transformed Democritus's ideas on atoms into a scientific theory. ● Scientists can observe individual atoms by using instruments such as scanning electron microscopes. ● Many scientists have contributed to our present understanding of atomic structure.	Dalton's atomic theory		Atomic model timeline
PSC1-HS-1.	What is the structure of an atom? ● Three kinds of subatomic particles are electrons, protons, and neutrons. ● In the nuclear atom, the protons and neutrons are located in the nucleus. The electrons are distributed around the nucleus and occupy almost all the volume of the atom.	Proton Neutron Electron Nucleus Cathode ray		Model of the atom activity
PSC1-HS-1.	How do you distinguish among atoms? ● Elements contain different number of protons	Atomic number Mass number Isotope	Lab: Isotopes(using beans)\ Lab:Flame Test	"Who am I?" atom quiz

	• Isotopes have different number of neutrons • Atomic mass is calculated using natural abundance	Atomic mass unit Atomic mass	Lab:Atomic Mass (using candy)	Flame test unknown lab practical

UNIT 4 : THE PERIODIC TABLE				
Estimated Time Frame:	9 hrs	**Thinking Strategies**	**Asking Questions** **Determining importance** **Monitory for meaning**	
Enduring Understandings:	How are elements organized on the periodic table?			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-1.	How are elements organized on the periodic table? ● Early chemists used properties of elements to sort them into groups ● Mendeleev arranged elements in order of increasing atomic mass ● Element in the modern periodic table are arranged in order of increasing atomic number ● The 3 main classes of elements are metals, nonmetals, and metalloids	Periodic law Metal Nonmetal metalloid		Alien periodic table
PSC1-HS-1.	How are elements classified? ● The periodic table displays the symbols and names of elements, along with information about the structure their atoms ● Elements can be sorted into noble gases, representative elements, transition metals or inner transition metal	Alkali metal Alkaline earth metal Halogen Noble gas Representative element Transition metal Inner transition metal	Na K Li	Build a Periodic table "cheat sheet" quiz
PSC1-HS-1.	What are some trends in the periodic table? ● Atomic radius ● Density ● Reactivity	Lab: atomic radius Lab: density Demo: reactivity of Group 1 metals		Periodic trends quiz

UNIT 5:IONIC AND METALLIC BONDS				
Estimated Time Frame:	8 hours	**Thinking Strategies**	**Sensory imagery** **Background knowledge**	
Enduring Understandings:	How do atoms form ionic and metallic bonds? Atoms can lose, gain, or share electrons.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-3.	What is an ion? ● To find the number of valence electrons in an atom of a representative element, simply look at its group number (for A group elements) ● A positively charged ion, or a cation, is produced when an atom loses one or more valence electrons. ● An anion is produced when an atom gains one or more valence electrons.	Valence electron Electron dot structure Octet rule Halide ion		Predicting charges of ions quiz.
PSC1-HS-3.	What is ionic bonding? ● Although they are composed of ions, ionic compounds are electrically neutral ● Most ionic compounds are crystalline solids at room temperature. ● Ionic compounds generally have high melting points. ● Ionic compounds can conduct an electric current when melted or dissolved in water.	Ionic compound Ionic bond Chemical formula Formula unit Coordination unit		Bond ratio/formula quiz.
PSC1-HS-3.	How do metals bond? ● The valence electrons of atoms in a pure metal can be modeled as a sea of electrons ● Alloys are important because their properties are often different from those of their component elements.	Metallic bond Alloy		Metallic or nonmetallic lab practical

UNIT 6:MOLECULAR COMPOUNDS				
Estimated Time Frame:	8 hrs	**Thinking Strategies**	**Sensory imagery Background knowledge**	
Enduring Understandings:	How does bonding occur in molecular compounds? Bond types affect bulk properties.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-3.	What is a molecular compound? ● Molecular formulas show how many atoms of each element a substance contains ● The representative unit of a molecular compound is a molecule	Covalent bond Molecule Diatomic molecule Molecular compound Molecular formula		Covalent compounds and octet rule quiz
PSC1-HS-3.	How are covalent bonds formed? ● Electrons are shared so atoms attain the configuration of a noble gas	Octet rule Single bond Unshared pair Double bond Triple bond Polyatomic ion		Multiple bond quiz
PSC1-HS-3.	How is VSEPR theory used? ● The 3-D shape of a molecule can be determined	Linear Bent Trigonal planar Trigonal pyramidal tetrahedral	Lab: Molecular model kit	
PSC1-HS-3.	How are polar bonds and polar molecules identified? ● Electrons are shared unequally in a polar bond ● Polar molecules have slightly negative and positive ends	Nonpolar covalent bond Polar covalent bond Polar molecule dipole	oil/water Petroleum ether Food die	VSEPR "build a model shape" Molecular shape Electrical Shape Polar or non polar
PSC1-HS-3.	How are molecules attracted to one another? ● 3 Intermolecular forces can occur between molecules ● Intermolecular attractions determine physical properties of compounds	Van der Waals forces Dipole Dispersion Hydrogen bonding		IMF model lab

UNIT 7:CHEMICAL NAMES AND FORMULAS				
Estimated Time Frame:	9 hrs	**Thinking Strategies**	**Monitoring for meaning** **Determining importance**	
Enduring Understandings:	How do we assign names to compounds?			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC2-HS-1	How are ions named?	Monatomic ion Polyatomic ion		
PSC2-HS-1	How are ionic compounds named?	Binary compound		
PSC2-HS-1	How are molecular compounds named?	Molecular compound		
PSC2-HS-1	How are acids and bases named?	Acid Base	Universal indicator	
PSC2-HS-1	What laws govern the formation of compounds? ● If the ratio of atoms of each element in a compound is fixed, then the ratio of their masses is also fixed.	Law of definite proportions Law of multiple proportions		Build a naming "cheat sheet" quiz Naming compounds exam

UNIT 8: CHEMICAL QUANTITIES				
Estimated Time Frame:	8 hrs	**Thinking Strategies**	**Drawing inferences Synthesizing**	
Enduring Understandings:	How is matter quantified?			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC2-HS-4.	What is a mole? ● Knowing how the count, mass, and volume of an item relate to a common unit allows you to convert among these units. ● The mle allows chemists to count the number of representative particles in a substance. ● The atomic mass of an element expressed in grams is the mass of a mole of the element. ● To calculate the molar mass of a compound, find the number of grams of each element in one mole of the compound. Then add the masses of the elements in the compound. ●	Mole Avogadro's number Representative particle Molar mass		"Mole Road-Map" assessment
PSC2-HS-4.	How can the mole be related to mass and volume? ● Use the molar mass of an element or compound to convert between the mass of a substance and the moles of a substance. ● The molar volume is used to convert between the number of moles of gas and the volume of the gas at STP.	Avagadro's hypothesis Standard temperature and pressure (STP) Molar volume		
PSC2-HS-4.	How are percent composition and chemical formulas calculated? ● The percent by mass of an element in a compound is the number of grams of the element divided by the mass in grams of	Percent composition Empirical formula Molecular formula		Percent composition analogy 1 page flyer

	the compound, multiplied by 100% ● The percent composition of a compound can be used to calculate the emprical formula of that compound. ● The molecular formula of a compound is either the same as its experimentally determined empirical formula, or it is a simple whole-number multiple of its empirical formula.			

UNIT 9: CHEMICAL REACTIONS				
Estimated Time Frame:	8 hrs	**Thinking Strategies**	**Synthesizing Asking Questions**	
Enduring Understandings:	Chemical reactions obey the law of conservation of mass. Products of chemical reactions can be predicted.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC2-HS-4. PSC2-HS-1	How do you write a balanced chemical equation?	Coefficient Reactant product		Balanc ing equations in picture form
PSC2-HS-4. **PSC2-HS-1**	What are the 5 general types of reaction? ● In a combination reaction, there is a single product ● A decomposition reaction involves the breakdown of a single compound into 2 or more simpler substances ● In a single-replacement reaction, both reactants and products are and element and a compound ● A double-replacement reaction takes place between 2 ionic compounds in aqueous solution ● A combustion reaction always involves oxygen as a reactant	Activity series	Labs for each type of reaction	Reaction type analogy hand-out (Students build the and-out)
PSC2-HS-4. **PSC2-HS-1**	How can you predict the formation of a precipitate in a double-replacement reaction? ● A net ionic equation shows only the particles involved in the reaction	Complete ionic equation Spectator ion Net ionic equation Solubility rules		Find the precipitate name lab practical

UNIT 10: STOICHIOMETRY				
Estimated Time Frame:	10 hrs	**Thinking Strategies**	**Drawing Inferences Monitoring for meaning**	
Enduring Understandings:	How are stoichiometric calculations performed?			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC2-HS-4.	How do chemists balance and use balanced chemical equations? ● Chemists use balanced chemical equations as a basis to calculate how much reactant is needed or product is formed in a reaction. ● A balanced chemical equation can be interpreted in terms of different quantities, including numbers of atoms, molecules, or moles; mass; and volume.	Stoichiometry		
PSC2-HS-4.	How do chemical calculations utilize mole ratios? ● In chemical calculations, mole ratios are used to convert between a given number of moles of a reactant or product to moles of a different reactant or product. ● In a typical stoichiometric problem, the given quantity is first converted to moles. Then, the mole ration from the balanced equation is used to calculate the moles of the wanted substance. Finally, the moles are converted to any other unit of measurement related to the unit mole.	Mole ratio		Favorite recipe to stoichiometry analogy Slide (students show how a recipe is similar to stoichiometry)
PSC2-HS-4.	How do limiting reagents affect a reaction? ● In a chemical reaction, an insufficient quantity of any of the reactants will limit the amount of product that forms.	Limiting reagent Excess reagent	Zn in HCl demonstration (more does not equal more gas)	
PSC2-HS-4.	What is the percent yield of a reaction and how is one calculated? ● The percent yield is a measure of the efficiency of a reaction performed in the laboratory.	Theoretical yield Actual yield Percentage yield		Percent yield lab practical

UNIT 11: STATES OF MATTER				
Estimated Time Frame:	8 hrs	**Thinking Strategies**	**Sensory Imagery Background knowledge**	
Enduring Understandings:	How are the states of matter different?			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC3-HS-3. PSC1-HS-5.	What is the nature of gases? ● Particles in a gas are considered (modeled) to be small, hard spheres, with an insignificant volume. The motion of the particles in a gas is rapid, constant, and random. All collisions between particles in a gas are perfectly elastic. ● Gas pressure is the result of billions of rapidly moving particles in a gas simultaneously colliding with an object. ● The Kelvin temperature of a substance is directly proportional to the average kinetic energy of the particles of the substance.	Kinetic energy Kinetic theory Gas pressure Vaccum Atmospheric pressure Barometer Pascal (Pa) Standard atmosphere (atm)		Use KMT to explain the different particles in a hot cup of coffee.
PSC3-HS-3. **PSC1-HS-5.**	What is the nature of liquids? ● The interplay between the disruptive motions of particles in a liquid and the attractions among the particles determines the physical properties of liquids. ● During evaporation, only those molecules with a certain minimum kinetic energy can escape from the surface of the liquid. ● In a system at constant vapor pressure, a dynamic equilibrium exists between the vapor and the liquid. The rate of evaporation and condensation are equal. ● At a temperature at which paraticles throughout a liquid have enough kinetic energy to vaporize, the liquid begins to boil.	Vaporization Evaporation Vapor pressure Boiling point Normal boiling point	Vacuum pump	

PSC3-HS-3. **PSC1-HS-5.**	What is the nature of solids? ● The general properties of solids reflect the orderly arrangement and the fixed locations of their particles. ● The shape of a crystal reflects the arrangement of the particles within the solid.	Melting point Freezing point Crystal Unit cell Allotropes Amorphous solid Glass		
PSC3-HS-3.	What occurs during changes of state? ● Sublimation occurs in solids with vapor pressures that exceed atmospheric pressure at or near room temperature. ● The conditions of pressure and temperature at which two phases exist in equilibrium are indicated on a phase diagram by a line separating two regions representing the phases.	Sublimation Phase diagram Triple point	Dry ice Disposable pipets Liquid dry ice demo	Develope a heating curve lab practical

UNIT 12:BEHAVIOR OF GASES				
Estimated Time Frame:	8 hrs	**Thinking Strategies**	**Sensory Imagery Drawing Inferences**	
Enduring Understandings:	Volume, temperature, pressure, and amount of gas can pre predicted.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC3-HS-3.	What are the properties of gases? ● Gases are easily compressible because of the space between particles ● The amount of gas(n), volume(V), and temperature(T) affect pressure(P)			
PSC3-HS-3.	How do gas laws govern how gases respond to temperature and pressure?	Laws: Boyle's Charle's Gay-Lussac's combined	Boyle's law apparatus	
PSC3-HS-3.	How is the ideal gas law used? ● Real gases differ from ideal gases ● The ideal gas law can be used to calculate the number of moles of a gas	Ideal gas constant Ideal gas law		Determining the ideal gas constant lab practical
PSC3-HS-3.	How is the total pressure of a gas mixture related to the partial pressures of the component gases?	Dalton's law Partial pressure		
PSC3-HS-3.	How does the molar mass of a gas affect the rate at which the gas diffuses or effuses?	Diffusion Effusion Graham's law	Gas diffusion tubes (NH3 with HCl)	

UNIT 13: WATER AND AQUEOUS SYSTEMS				
Estimated Time Frame:	5 hrs	**Thinking Strategies**	**Background Knowledge Asking Questions**	
Enduring Understandings:	Water is a very special compound that makes life on earth possible.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-3. PSC1-HS-5.	What are the properties of water and how do they affect the behavior of water?	Surface tension surfactant	Lab: Properties of Water	
PSC1-HS-3. **PSC1-HS-5.**	What type of substances dissolve most readily in water?	Aqueous solution Solvent Solute Electrolyte	Lab: Conductivity	
PSC1-HS-3.	What distinguishes between a solution, suspension, and colloid?	Tyndall effect	Lab: solution, suspension, colloid Laser pointers	Properties of water narrative

UNIT 14: SOLUTIONS				
Estimated Time Frame:	6 hrs	**Thinking Strategies**	**Monitoring for meaning Synthesizing**	
Enduring Understandings:	Solutions are all around us. Their properties are measurable and affect everything from our foods/drinks to our lakes and air quality.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-3.	What are the properties of solutions? ● Factors that determine how fast a substance dissolves are stirring, temperature, and surface area. ● In a saturated solution, a state of dynamic equilibrium exists between the solution and any undissolved solute, provided that the temperature remains constant. ● Temperature affects the solubility of solid, liquid, and gaseous solutes, provided that the temperature remains constant.	Saturated solution Solubility Unsaturated solution Miscible Immiscible Supersaturated solution Henry's law	Sodium Acetate supersaturated demo oil/water	
PSC2-HS-4.	How are the concentrations of solutions calculated? ● To calculate the molarity of a solution, divide the moles of solute by the volume of the solution in liters. ● Diluting a solution reduces the number of moles of solute per unit volume, but the total number of moles of solute in solution does not change. ● Percent by volume is the ratio of the volume of solute to the volume of solution. Percent by mass is the ratio of the mass of the solute to the mass of the solution.	Concentration Dilute solution Concentrated solution Molarity	Volumetric flasks balances	
PSC1-HS-3.	What is a colligative property of a solution? ● Colligative properties of solutions include vapor pressure lowering, freezing point depression, and boiling point elevation.	Colligative property Freezing point depression Boiling point elevation		

UNIT 15: THERMOCHEMISTRY				
Estimated Time Frame:	8 hrs	**Thinking Strategies**	**Determining Importance Background Knowledge**	
Enduring Understandings:	Heat transfer is involved in every chemical reaction from our bodies to our cars.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC3-HS-2 PSC3-HS-5.	How can the amount of energy absorbed or released be determined?	Thermochemistry Chemical potential energy System Surrounding Law of conservation of energy Endothermic Exothermic Heat capacity Specific heat	Lab:determine specific heat of a metal	
PSC3-HS-5. **PSC3-HS-2**	How can the enthalpy change of a reaction be measured?	Calorimetry Calorimeter Enthalpy Thermochemical equation	Lab: chip calorimetry	
PSC3-HS-5. **PSC3-HS-2**	How can heat of reaction be calculated when it cannot be measured directly?	Hess's law	Lab: Hess's law	

UNIT 16: REACTION RATES				
Estimated Time Frame:	6 hrs	**Thinking Strategies**	**Sensory Imagery Monitoring for meaning**	
Enduring Understandings:	Chemical reactions in our world can be sped up or slowed down.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC2-HS-3.	How is the rate of a chemical reaction expressed?	Rate Collision theory Activation energy		
PSC2-HS-3.	What factors influence the rate of a reaction?	Temperature Pressure Concentration Particle size Catalyst Inhibitor Le Chatelier's principle		
PSC2-HS-3.	What happens at the molecular level in a chemical system at equilibrium?	Reversible reaction Chemical equilibrium		Equilibrium assessment

UNIT 17: ACIDS, BASES AND SALTS				
Estimated Time Frame:	8 hrs	**Thinking Strategies**	**Background Knowledge Drawing Inferences**	
Enduring Understandings:	Acids and bases are all around us and have very common uses.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC2-HS-2.	What are acid-base theories?	Hydronium ion		
PSC2-HS-2.	How do hydrogen ions relate to acidity? ● For aqueous solutions, the product of the hydrogen-ion concentration and the hydroxide ion concentration equals 1 x 10-14 ● A solution with a pH less than 7.0 is acidic. A solution with a pH of 7 is neutral. A solution with a pH greater than 7.0 is basic. ● Either acid-base indicators or pH meters can be used to measure pH.	Neutral solution Acidic solution Basic solution pH	pH paper pH detector	Build an use a pH square to determine pH, pOH, [H+], [OH-] assessment
PSC2-HS-3.	What determines the strength of acids and bases? ● Acids and bases are classified as strong or weak based upon the degree to which they ionize water.	Strong acid Weak acid Strong base Weak base		
PSC2-HS-3.	What is neutralization? ● In general, acids and bases react to produce a salt and water. ● Neutralization occurs when the number of moles of hydrogen ions is equal to the number of moles of hydroxide ions.	Neutralization reaction Titration Standard solution Equivalence point End point	Burets Phenolphthalein	Hot tub chemistry guide, "What do the chemicals is a hot tub change and why"
PSC1-HS-2.	What are salts in solution? ● Salts that produce acidic solutions have positive ions that release hydrogen to water. Salts that produce basic solutions have negative ions that attract hydrogen ions from water.	Salt		

UNIT 18: NUCLEAR CHEMISTRY				
Estimated Time Frame:	6 hrs	**Thinking Strategies**	**Determining importance** **Asking Questions** **Synthesizing**	
Enduring Understandings:	Nuclear energy is being used all over the world.			
Idaho Content Standard	**Essential Questions**	**Key Terms**	**Resources Needed**	**Assessment** (Tie to Enduring Understandings)
PSC1-HS-4.	Who has the right to nuclear energy? What are nuclear reactions? ● Unlike chemical reactions, nuclear reactions are not affected by changes in temperature, pressure, or the presence of catalysts. Also, nuclear reactions of a given radioisotope cannot be slowed down, speeded up, or stopped. ● Three types of radiation are alha, beta, and gamma.	Radioactivity Nuclear radiation Radioisotope Alpha particle Beta particle Gamma ray		
PSC1-HS-4.	What happens when an unstable nucleus decays? ● The neutron-to-proton ratio in a radioisotope determines the type of decay that occurs. ● After each half-life, half of the original radioactive atoms have decayed into atoms of a new element. ● Transmutation can occur by radioactive decay, or when particles bombard the nucleus of an atom.	Nuclear force Band of stability Positron Half-life Transmutation Transuranium elements	Phet Isotopes	Transmutation sequence poster.
PSC1-HS-4.	How is the structure of atoms altered during fission and fusion? ● In a chain reaction, some of the emitted neutrons react with other fissionable atoms, which emit neutrons that react with still more fissionable atoms.	Fission Fusion Neutron moderation Neutron adsorption		Fission v Fusion hand-out (students build the hand-out)

	• Fusion reactions, in which small nuclei combine, release much more energy than fission reactions, in which large nuclei split apart to form smaller nuclei.			
PSC1-HS-4.	How does nuclear chemistry affect your life? • Geiger counters, scintillation counters, and film badges are commonly used to detect radiation. • Radioisotopes are used to analyze the composition of matter, study plant growth, diagnose medical problems, and treat diseases. • Fission is used to create power. • Nuclear waste is difficult to dispose of.	ionizing/non-ionizing radiation Nuclear power	Geiger Counters Radioactive Sources	Nuclear power pros and cons slides