CHEMISTRY CAPACITY MATRIX / QUALITY LEARNING TRANSCRIPT

Learner's Name: **Alec Stilwell**

Purpose & Vision: **UNDERSTAND AND APPLY CHEMISTRY**

CAPACITY	CAPACITY BREAKDOWN	SKILLS BREAKDOWN	LEARNING PROCESS				
			INFORMATION	KNOWLEDGE	KNOW-HOW	WISDOM	PORTFOLIO
SCIENTIFIC MEASUREMENT	METRIC SYSTEM	Definitions of mass, length, volume and temp.	X				
		Prefixes.	X				
		Metric Conversions.	X				
		Conversions between metric and English.	X				
(Chapter 3)	SIGNIFICANT FIGURES	Know the five rules for significant figures.	X				
		Identify the number of Sig. Figs. in a number.	X				
		Be able to add or subtract, multiply and divide S.F.	X				
		Know the amount of certain and uncertain digits.	X				
	SCIENTIFIC NOTATION	What is it? Why do we use it?	X				
		Convert a number to scientific notation.	X				
		Convert scientific notation to a number.	X				
		Be able to add or subtract.	X				
		Be able to multiply or divide.	X				
	DIMENSIONAL ANALYSIS	Indentify the unknown.	X				
		Indentify what is known or given.	X				
		Plan a solution.	X				
		Do the calculation (using ratios equal to one)	X				
		Make sure answer has correct units.	X				
	DENSITY	Definition of density	X				
		Formula D=M/V	X				
		Calculate D, given M and V.	X				
		Calculate M, given D and V.	X				
		Calculate V, given M and D.	X				
		Compare densities of different substances.	X				

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MATTER AND CHANGE (Chapter 2) (Elements, Compounds, and Mixtures P4.p2 P4.p2A,B,C,D)	SUBSTANCES	Explain what a substance is	x				
		Elements	x				
		Compounds	x				
		Chemical Symbols	x				
	MIXTURES	Explain/define a mixture	x				
		Homogeneous mixtures	x				
		Heterogeneous mixtures	x				
	CHEMICAL REACTIONS	What is a chemical reaction?	x				
		Equations: products, reactants	x				
		Endothermic reactions	x				
		Exothermic reactions	x				
		Conservation of mass	x				
ATOMIC STRUCTURE (Chapter 4) C4.8A,B,C,D C1.1 C1.2 (C4.10A,B Netrual Atoms, Ions, Isotopes) (C4.10x C4.10c,d,e Average Atomic Mass)	3 BASIC SUBATOMIC PARTICLES	ELECTRONS: charge, location, mass	x	x			Atom Project
		PROTONS: charge, location, mass	x	x			Atom Project
		NEUTRONS: charge, location, mass	x	x			Atom Project
	ATOMIC NUMBER	Explain what it is	x	x			Atom Project
		How is the periodic table arranged	x				
	MASS NUMBER	Define mass number	x				
		How do you use it to find # of neutrons?	x				
		Average atomic mass	x				
		Define Isotopes	x				
	IONS	Define an ion (cation and anion)	x				
		Calculate # of p+, e-, and n for ions of elements	x				
	DIAGRAMS	Be able to draw a Bohr model of an atom	x	x			Atom Project
		Be able to draw a Bohr model of an ion	x				

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STATES OF MATTER (Chapter 13)	KINETIC THEORY (K.T.) AND KELVIN TEMPERATURE	Explain Kinetic Energy and the Kinetic Theory	x				
		Compare Kelvin Temperature to Celsius Scale	x				
		Explain the significance of Absolute Zero	x				
		Explain the relationship btwn absolute temperature	x				
		of a substance and the kinetic energy of its particles	x				
(Kinetic Molecular Theory C4; P4.p1A,B,C)	THE NATURE OF GASES	Describe a gas according to the kinetic theory	x				
		Interpret gas pressure in terms of kinetic energy	x				
		Convert Units of pressure: atm, kPa, mm Hg	x				
(C1.2)	THE NATURE OF LIQUIDS	Describe liquids according to the kinetic theory	x				
		Explain the vaporization of liquids accd. to K.T.	x				
		Explain dynamic equilibrium	x				
		Boiling Point of a Liquid	x				
		Normal Boiling Point of a Liquid	x				
	THE NATURE OF SOLIDS	Describe a solid according to the K.T.	x				
		Explain the melting point/freezing point	x				
		Describe crystalline solids	x				
		Describe amorphous solids	x				
		Explain allotropes	x				
	SUBLIMATION AND PHASE DIAGRAMS	Explain sublimation	x				
		Describe a phase diagram and triple point	x				
		Be able to make predictions using a phase diagram	x				
	PLASMA	Describe the formation of plasma	x				
		Describe the properties of plasma	x				
		Explain the use of plasma in a plasma arc welder	x				

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ELECTRONS IN ATOMS (Chapter 5) (C1.1 C1.2) (Electron Movement C2.4x C2.4a,b,c,d) (Electron Configuration C4.8x C4.8e,f,g,h,i)	THE DEVELOPMENT OF ATOMIC MODELS	Summarize the development of the atomic theory	x				
		Explain the significance of quantized energies and the quantum mechanical model of the atom	x				
	ATOMIC ORBITALS	Distinguish among principal energy level, energy sublevel, and atomic orbital	x	x			Atom Project
	ELECTRON CONFIGURATIONS	Apply the Aufbau principle, the Pauli exclusion principle, and Hund's rule to write the electron configurations of the elements	x	x			Atom Project
		Explain why the electron configurations of some elements like chromium and copper don't follow the Aufbau diagram	x				
	LIGHT AND ATOMIC SPECTRA	Describe relationship btwn wavelength and frequency of light ($c=\lambda\nu$)	x				
		Calculate the frequency of light	x				
		Calculate the wavelength of light	x				
		Identify the source of atomic emission spectra	x				
		Perform flame test to see pattern within groups	x				
	THE QUANTUM CONCEPT	Calculate the energy of a photon associated with a given wavelength or frequency of light ($E=h\nu$) using Planck's constant	x				

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THE PERIODIC TABLE (Chapter 6) (Electron Energy Levels C4.9x C4.9b,c)	DEVELOPMENT OF THE PERIODIC TABLE	Describe the origin of the periodic table.	x				
		Distinguish between a group and a period. Distinguish between metals, nonmetals, metalloids.	x				
	ELECTRON CONFIGURATIONS & PERIODICITY	Categorize elements as representative elements, noble gases, transitional metals or inner transitional	x				
		Notice the pattern in e- config for each category	x				
	PERIODIC TRENDS IN ATOMIC SIZE	How is atomic radius calculated?	x	x			Trends In Graphs
		Interpret the group trends.	x	x			Trends In Graphs
		Interpret the periodic trends.	x	x			Trends In Graphs
	PERIODIC TRENDS IN IONIZATION ENERGY	Define iionization energy.	x	x			Trends In Graphs
		Interpret the group trends	x	x			Trends In Graphs
		Interpret the periodic trends.	x	x			Trends In Graphs
		Explain the variation in ionization energies.	x	x			Trends In Graphs
	PERIODIC TRENDS IN IONIC SIZE	Explain ionic size of cation compared to atom	x				
		Explain ionic size of anion compared to atom	x				
		Interpret the group trends	x				
		Interpret the periodic trends.	x				
	PERIODIC TRENDS IN ELECTRONEGATIVITY	Define elecronegativity.	x				
		Interpret the group trends	x				
		Interpret the periodic trends.	x				
	COMPARISONS OF TRENDS	Graph the specific trends to show patterns.	x	x			Trends In Graphs
		Compare/contrast the trends and note relations	x	x			Trends In Graphs

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IONIC AND METALLIC BONDING (Chapter 7) (Chemical Bonds C5.5x C5.5d,e) (Solids C4.3x, C4.3c,e,h,i)	IONS	Determine the # of valence e- in an atom	x				
		Explain octet rule for metallic and nonmetallic	x				
		Describe how cations form	x				
		Explain how anions form	x				
	IONIC BONDS AND IONIC COMPOUNDS	Explain electrical charge of an ionic compound	x				
		Describe 3 properties of ionic compounds	x				
		Define formula unit	x				
	BONDING IN METALS	Model the valence e- of metal atoms	x				
		Describe the arrangement of atoms in a metal	x				
		Recognize body-centered cubic, face-centered cubic, and hexagonal close-packed arrangements	x x				
		Explain the importance of alloys	x				
		Differentiate betweeen interstitial & substitutional alloys	x				
COVALENT BONDING (Chapter 8) (Chemical Bonds C5.5x C5.5d,e) (Molecular Polarity C4.4x) (Chemical Bonds/ Trends C5.5A)	MOLECULAR COMPOUNDS	Define a molecular compound	x				
		Distinguish btwn melting points and boiling points of molecular and ionic compounds	x x				
		Describe the information a molecular compound provides	x				
		Define and identify diatomic molecules	x				
	NATURE OF COVALENT BONDING	Describe how e- are shared to from covalent bonds	x				
		Describe how atoms from double or triple covalent bonds	x				
		Describe how the strength of a covalent bond is related to its bond dissociation energy	x x				
	POLAR BONDS AND MOLECULES	Use electronegativity values to determine the type of bond	x				
		Evaluate the strength of intermolecular attractions compared to the strength of ionic and covalent bonds	x x				

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CHEMICAL NAMES AND FORMULAS (Chapter 9) (C5.5B) (Periodic Table C4.9 C4.9A) (Nomenclature C4.2A,B C4.2x,c,d) (Acids & Bases C5.7, C5.7A)	UNDERSTAND THE ORGANIZATION OF THE PERIODIC TABLE	Groups and Periods	x				
		Representative elements	x				
		Metals	x				
		Metalloids	x				
		Nonmetals	x				
	NAMING IONS	Identify charges of monatomic ions using the periodic table	x				
		Name ions: cations and anions	x				
		Define polyatomic ion	x				
		Write names & formulas of the most common polyatomic ions	x				
	NAMING & WRITING FORMULAS FOR IONIC COMPOUNDS	Apply rules for naming binary ionic compounds	x				
		Apply rules for writing formulas for binary ionic compounds	x				
		Apply rules for naming compounds with polyatomic ions	x				
		Write formulas for compounds with polyatomic ions	x				
	NAMING & WRITING FORMULAS FOR MOLECULAR COMPOUNDS	Interpret prefixes in the names of molecular compounds	x				
		Apply the rules for naming binary molecular compounds	x				
		Write formulas for binary molecular compounds	x				
	NAMING & WRITING FORMULAS FOR ACIDS AND BASES	Apply 3 rules for naming acids	x				
		Apply rules in reverse to write formulas of acids	x				
		Apply the rules for naming bases	x				
	LAWS GOVERNING FORMULAS AND NAMES	Define the Law of Definite Proportions	x				
		Define the Law of Multiple Porportions	x				

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CHEMICAL QUANTITIES (Chapter 10) (Moles C4.6x, C4.6a,b) (Molecular and Empirical Formulae C4.1x, C4.1a,b,c) (C5.2g)	THE MOLE	Define Avogadro's Number	x				
		Identify the type of Representative Particles of a substance	x				
		Convert atoms to moles/moles to atoms	x				
		Convert moles to molecules/molecules to moles	x				
	MOLAR MASS	Distinguish between atomic mass and molar mass	x				
		Calculate the mass of a mole of a compound	x				
	MOLE-MASS RELATIONSHIPS	Convert moles to grams	x				
		Convert grams to moles	x				
	MOLE-VOLUME RELATIONSHIPS	understand Molar Volume	x				
		Recognize STP conditions	x				
		Calculate the Volume of a Gas at STP	x				
		Convert Volume of a Gas to Moles	x				
	PERCENT COMPOSITION	Define Percent Composition	x				
		Calculate Percent Composition from a formula	x				
		Calculate Percent Composition from experimantal data	x				
	EMPIRICAL AND MOLECULAR FORMULAS	Interpret and empirical formula	x				
		Distinguish between Empirical & Molecular Formulas	x				
		Determine the Empirical Formula of a Cmpound	x				
		Find the Molecular Formula of a Compound	x				

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CHEMICAL REACTIONS	DESCRIBING CHEMICAL REACTIONS	Identify basic parts of a chemical equation	x				Applications of Che
		Write a word equation	x				Applications of Che
		Write a skeleton equation	x				Applications of Che
(Chapter 11)	BALANCING CHEMICAL EQUATIONS	Understand the Rules for balancing equations	x				Applications of Che
		Balance a skeleton equation	x				Applications of Che
(chemical		Write word equations as balanced chemical equations	x				Applications of Che
changes C5.2,	TYPES OF REACTIONS	Identify a Combination/synthesis reaction	x				Applications of Che
C5.2A,B,C)		Identify a Decomposition reaction	x				Applications of Che
(Balancing		Identify a Single-Replacement reaction	x				Applications of Che
Equations C5.2x)		Identify a Double-Replacement reaction	x				Applications of Che
		Identify a Combustion reaction	x				Applications of Che
(Reduction/		Predict the products of the 5 general types of reactions	x				Applications of Che
Oxidation	REACTIONS IN AQUEOUS SOLUTIONS	Use solibility rules to predict formation of precipitate	x				Applications of Che
Reactions C5.6x		Write a Complete ionic equation	x				Applications of Che
C5.6b)		Define and identify Spectator ions	x				Applications of Che
		Write a balanced Net ionic equation	x				Applications of Che
	REACTIONS IN EVERY-DAY LIFE	Research and learn about chemical reactions	x				
		used in catalytic converters, airbags, and	x	x			plications of Chemis
		oxyacetlyene torches.	x				

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STOICHIOMETRY (Chapter 12) (Balancing Equations C5.2x, C5.2d,e,f,g)	INTERPRETING EQUATIONS	Explain how balanced equations apply to both chemistry and everday life	x				
		Interpret a balanced chemical equation in terms of moles, representative particles, mass, and gas volume at STP	x				
		Use a balanced equation to model nonchemical quantities	x				
		Identify quantities always conserved in chemical reactions	x				
	CHEMICAL CALCULATIONS	Define a mole ratio	x				
		Construct mole ratios from balanced chemical reactions Apply mole ratios in stoichiometric calculations Calculate stoichiometric quantities from balanced chemical equations using units of moles, mass, representative particles, and volumes of gases at STP	x				
	LIMITING REAGENT	Define limiting reagent and excess reagent	x				
		Determine the limiting reagent in a reaction	x				
		Use limiting reagent to find the quantity of product	x				
		Determine the amount of excess reagent left over	x				
	PERCENT YIELD	Define actual yield, theoretical yield, & percent yield Calculate the theoretical yield, actual yield, or percent yield given appropriate information	x				

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ALLOYS and an INTRODUCTION to METALLURGY	MATERIAL SCIENCE CONCEPTS	Define metals and list 5 properties	x	x			Alloy Project
		Define alloys and explain their importance	x	x			Alloy Project
		Describe properties of common alloys and give applications of each	x	x			Alloy Project
(also see concepts from Chapter 7 Bonding in Metals)	IDENTIFICATION SYSTEMS	Understand the Steel alloys: AISI-SAE system	x	x			Alloy Project
		Understand the Aluminum alloys: AA system	x	x			Alloy Project
		Understand the Copper Alloys: CDA system	x	x			Alloy Project
		Understand the Unified Numbering System	x	x			Alloy Project
	PRACTICAL APPLICATIONS OF METALLURGY	Define metallurgy	x	x			Alloy Project
		Explain what a metallurgist does	x				
(Chemical Bonds C5.5x C5.5d,e)		Describe how metallurgy knowledge can be used to solve industrial problems	x	x			Alloy Project
	METALLURGICAL AND CHEMICAL TERMINOLOGY	Understand how chemistry is related to metallurgy	x	x			Alloy Project
(Solutions C4.7x)		Define chemical terms such as element, atom, compound, molecule, & solutions	x				
(Solids C4.3x C4.3e,h)	MATERIAL PROPERTIES	Explain the relationship between strength, hardness, and ductility (mechanical properties)	x	x			Alloy Project
		Compare various types of stresses	x	x			Alloy Project
(Nomenclature C4.2)		Describe stress-strain diagrams	x	x			Alloy Project
		Explain modulus of elasticity	x	x			Alloy Project
		Explain physical properties of alloys	x				
(Scientifc Reflection and Social Implications C1.2 C1.2C,D,E,f,g,j)	HEAT TREATING	Define "heat treating" and explain its importance	x				
		Annealing: describe and give application	x				
		Normalizing: describe and give application	x				
		Quenching: describe and give application	x				
		Tempering: describe and give application	x	x			Alloy Project
		Understand how heat treating changes the	x	x			Alloy Project

		mechanical properties of alloys	x	x			Alloy Project

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THE BEHAVIOR OF GASES (Chapter 14)	PROPERTIES OF GASES	Explain why gases are easier to compress than solids or liquids	x				
		Describe 3 factors that affect gas pressure	x				
		Describe the relationship among T, P, and V	x				
	BOYLE'S LAW	Calculate Pressure from the P-V relationship	x				
		Calculate Volume from the P-V relationship	x				
(C5.2f) (Ideal Gas Law	CHARLES'S LAW	Calculate the T from the T-V relationship	x				
		Calculate the V from the T-V relationship	x				
C4.5x C4.5a,b,c)	GAY - LUSSAC'S LAW	Calculate the T from the T- P relationship	x				
		Calculate the P from the T-P relationship	x				
	THE COMBINED GAS LAW	Calculate the P, V, or T from the P-V-T relationship	x				
		Be able to algebraically rearrange the equation	x				
	THE IDEAL GAS LAW	Calculate amount of gas at any conditions of P, V, T	x				
		Know the ideal gas constant & its correct units	x				
		Compare and contrast real and ideal gases	x				
		Explain van der Waals equation of state	x				
	DALTON'S LAW OF PARTIAL PRESSURE	Calculate the total P of a mixture of gases	x				
		Calculate the partial P of a gas in a mixture of gases	x				
ACIDS AND BASES (Chapter 19)	GENERAL INFORMATION	List properties of acids and bases	x				
		Describe how [H+] and [OH-] are related in aq solution	x				
(Acids and Bases C5.7 C5.7A, B, C, D)	THE pH CONCEPT	Classify a solution as neutral, acidic, or basic, given the hydrogen-ion or hydroxide-ion concentration	x				
		Calculate the pH of a solution given the hydrogen-ion concentration or the hydroxide-ion concentration	x				
		Calculate the hydrogen-ion or hydroxide-ion concentration given the pH of a solution	x				
(Bronsted-Lowry C5.7x C5.7 f,g,i)		Describe at least 2 methods used to measure pH	x				
	COMPARE AND CONTRAST THE ACIDS AND BASE THEORIES	Define and give examples of Arrhenius acids & bases	x				
		Distinguish between monoprotic, diprotic, triprotic acids	x				
		Classify substances as acids or bases, and identify conjugate acid-base pairs in reactions using the Bronsted-Lowry theory	x				
		Define amphoteric	x				

		Classify substances as either Lewis acids or bases	x				

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SOLUTIONS (Chapter 16 and Chapter 15.2)	HOMOGENEOUS SYSTEMS	Distinguish between a solvent and a solute	x				
		Describe what happens in the solution process	x				
		Explain why all ionic compounds are electrolytes	x				
	SOLUTION FORMATION	List 3 factors that determine how fast a soluble substance dissolves	x				
	SOLUBILITY	Define solubility	x				
(Solutions C4.7x C4.7a,b)		Explain the difference among saturated, unsaturated,and supersaturated solutions	x				
		Distinguish between miscible and immiscible liquids	x				
	FACTORS AFFECTING SOLUBILITY	Apply Henry's law to solve gas solubility problems	x				
		Explain how changing temperature may affect the solubility of a substnace	x				
		Explain how thermal pollution is related to solubility	x				
		Understand solubilty trend of gases in water at different temperatures	x				
	MOLARITY	Be able to define concentration and use the terms dilute solution and concentrated solution when comparing solutions	x				
		Define and work problems involving the molarity of a solution	x				
	COLLIGATIVE PROPERTIES OF SOLUTIONS	Define & identify colligative properties of solutions	x				
		Define vapor pressure & explain on why a solution has a lower vapor pressure than the pure solvent of that solution	x				
		Define boiling point elevation & explain why a solution has a higher boiling point than the pure solvent of that solution	x				
		Define freezing point depression & explain why a solution has a lower freezing point than the pure solvent of that solution	x				
	MOLALITY	Define molality and calculate the molality of a solution	x				
	CALCULATING BOILING POINT AND	Calculate the boiling point elevation of an aqueous solution	x				

	FREEZING POINT CHANGES	Calculate the freezing point depression of an aqueous solution	x				

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HYDRO-CARBON COMPOUNDS (Chapter 22) (carbon chemistry C5.8x C5.8A,B,C) (scientific reflection and social implications C1.2 C1.2B,E,g,I,j,k) (scientific inquiry C1.1 C1.1f,I)	ALIPHATIC HYDROCARBONS	Construct the electron dot structure of alkanes	x				
		Write condensed molecular structures of alkanes	x				
		Write structural formula of alkane given IUPAC name and vice versa	x				
		Write structural formula of an alkane given IUPAC name , and vice versa	x				
		Be able to name and identify simple alkenes and alkynes	x				
		Compare and contrast alkanes, alkenes, alkynes	x				
	HYDROCARBONS IN PLASTICS	Distinguish between a monomer and a polymer	x				
		Explain polymerization	x				
		Give examples of polymers used in plastics	x				
		List additives to plastics and their purpose	x				
		Compare and contrast thermosets and thermoplastics	x				
		Recognize that there are natural polymers such as proteins, starches, and latex	x				
	PLASTIC PROCESSING METHODS	Explain the basics of injection molding	x				
		Explain the basics of blow molding	x				
		Explain the basics of thermoforming	x				
		Explain the basics of extrusion	x				
	COAL, NATURAL GAS & PETROLEUM	Describe origins of coal & products it yields	x				
		Describe the formation of petroleum deposits	x				
		Describe the formation of natural gas deposits	x				
		Define petroleum refining & cracking	x				

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