

SCIENCE CURRICULUM

CHEMISTRY

Board Approval Date: pending May 2024

CHEMISTRY: UNIT 1 PROPERTIES OF MATTER

Overview					
Quarter(s): 1					
Pacing: 2.5 Wee	ks				
Unit Power Standard(s) Code		Unit Po	ower Standard(s) Description		
9-12.PS1.A.1	-		<u>table</u> to PREDICT the relative <u>properties</u> of <u>elements</u> In the outermost <u>energy level of atoms</u> .		
9-12.PS1.A.3	chemical propertie	<u>s of substances</u> su	ATION to GATHER EVIDENCE to COMPARE <u>physical and</u> uch as <u>melting point, boiling point, vapor pressure, surface</u> NFER the relative strength of <u>attractive forces</u> between		
Below Grade/C	ourse Connected Sta	ndard(s)	Above Grade/Course Connected Standard(s)		
Middle School Students were previously engaged with 6-8.PS1.A.1 N/A Students who took Physical Science previously engaged with 9-12.PS1.A.2 & 9-12.PS1.A.3 N/A					
Unit Supporting Standards Code		Unit Sup	porting Standards Description		
9-12.PS1.A.4		-	rystalline/molecular structure to explain the macroscopic tructural materials (i.e., metals, ionic [ceramics], and		
	l	Jnpacked	Standard(s)		
Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped		
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models • Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.		
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations • Plan and conduct an investigation individually and collaboratively to produce		

DESE Questions Examples:	2. Read t	h as pint, , ; ; ; ; es <u>les</u> distinguishes a pure su ; he following paragraph described.	decide on types, to produce relia on the precision risk, time); and r DISCIPLINARY of Matter • The the bulk scale ar and between ato bstance from a min and identify the her property. It had	quantity, an ble measure of the data efine the det CORE IDEA structure an e determine oms.	r evidence, and in the design, ad accuracy of data needed ements; consider limitations (e.g., number of trials, cost, sign accordingly. S Structure and Properties ad interactions of matter at ed by electrical forces within d extensive properties that 1 grams, a volume of 21 ed, soft, and malleable.			
	Content (<u>noun</u> leed to know)		Skills (VERBS) to be able to do OK)		rapped" Understanding nts need to understand)			
 Chemica propertie Melting p Boiling p Vapor pr Surface t Chemica Particle f Ions Atoms Molecule 	 Chemical and physical properties Melting point Boiling point Vapor pressure Surface tension Chemical reactivity Particle forces lons 		 Predict (3) Use the periodic table (2) Compare properties (2) Plan & conduct an investigation (4) 		idents will understand that tter can be scientifically ssified into different states d properties. Those operties can change based on emical or physical changes. itter is conserved			
Nev	v Academic Vo	cabulary	Scaffolde	d (Review)	Academic Vocabulary			
• pure sub homoger	stance, mixture neous, intensive	, heterogeneous,			on, electron, periodic table			
	Assessment							
	n Unit Assessme	Summative Assessmer ent to be completed in cample of summative a	the 2024-2025 S	chool Year.				
Score	4	Score 3	Score	2	Score 1			
Example	Exa	mple	Example		Example			
L					۱ا			

	Profici	ency Scale					
4		Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.					
3	Student consistently shows unders errors when asked to demonstrate	standing for most components of the standard(s) with few and apply their learning.					
2		erstanding for some of the components of the standard(s), ey are still learning and improving upon.					
1	Student rarely shows understandir needing significant teaching to app	ng for any component of the standard(s) and are still bly their learning.					
	Additiona	I Information					
Professi	ional Resource Suggestions	Instructional Resources					
 Americal offers a v chemistr activities developr National (NSTA): I specifical including developr commun Chemical (CERG): 0 resource chemistr assessme developr ChemEd commun educator activities best prace ChemCo virtual la activities resource laborato in virtual Chemistr 	n Chemical Society (ACS): The ACS wide range of resources for ry educators, including lesson plans, s, webinars, and professional nent opportunities. Science Teachers Association NSTA provides resources Ily tailored to science educators, glesson plans, articles, professional nent events, and access to a ity of fellow educators. I Education Research Group CERG offers research-based es and strategies for teaching ry, including curriculum materials, ent tools, and professional nent workshops. X: ChemEd X is an online ity and resource hub for chemistry rs. It offers lesson plans, lab s, demonstrations, and articles on ctices in chemistry teaching. Illective: ChemCollective provides bs, simulations, and interactive s for teaching chemistry. These es can supplement hands-on ry experiences and engage students experiments. ry Education Digital Library d DL): ChemEd DL is a digital library stry resources	Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources. Other Resources: • Instructional videos created by teachers • Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction • EdPuzzle • PhET Interactive Simulations • Kahoot- used as a review tool					

Curriculum Designer Notes:	 Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable. Areas incorporating math concepts and calculations are included below Chemical vs Physical Properties and Changes Extensive vs Intensive Properties States of Matter Pure Substances vs Mixtures Density - Phenomenon - density column, lab - Identify and unknown metal by measuring and calculating density
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CHEMISTRY: UNIT 2 PERIODIC TABLE AND ATOMIC STRUCTURE

	Overview				
Quarter(s): 1					
Pacing: 3 Weeks					
Unit Power Standard(s) Code		Unit	Power Standard(s) Description		
9-12.PS1.A.1	-		<u>odic table</u> to PREDICT the relative <u>properties</u> of <u>elements</u> <u>ns</u> in the outermost <u>energy level</u> of <u>atoms</u> .		
9-12.PS1.A.2		ost electron	<u>planation</u> for the products of a simple <u>chemical reaction</u> <u>state</u> s of atoms, <u>trends</u> in the periodic table, and emical properties.		
9-12.PS1.C.1			ILLUSTRATE the <u>changes</u> in the composition of the rgy released during the processes of <u>fission, fusion, and</u>		
Below Grade/Cou	irse Connected Standa	ard(s)	Above Grade/Course Connected Standard(s)		
Middle School Stu with 6-8.PS1.A.1	idents were previously	engaged	N/A		
Unit Supporting Standards Code		Unit S	upporting Standards Description		
9-12.PS1.A.5	-		It the release or absorption of energy from a chemical ne changes in total bond energy.		
	Un	packe	d Standard(s)		
Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped		
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models • Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.		
9-12.PS1.A.2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did		

	electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties Use symbolic representations to illustrate the changes in the composition of the		in the past and will continue to do so in the future. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. SCIENCE AND ENGINEERING PRACTICES Developing and Using Models • Develop a model based on evidence to illustrate the relationships between systems or between components of a system. DISCIPLINARY CORE			
9-12.PS1.C.1	nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay	3	fusion, fission, involve release of neutrons pl process.	r Processes • Nuclear processes, including and radioactive decays of unstable nuclei, e or absorption of energy. The total number us protons does not change in any nuclear		
DESE Questions Examples:	F or B 2. Draw a Bohr r You can abbre you drew. a. How r b. How r c. What	r of elements circle the one that has a larger electronegativity. Mg or Ba Cs or As model of an atom that has 13 protons, 12 electrons, and 15 neutrons. reviate the nucleus. Answer the following questions based on the mod many shielding electrons does the "atom" have? many valence electrons does the "atom" have? t element does this "atom" represent? t ionic charge would this "atom" have?				
"Unwrapped" Content (<u>nouns</u>) (students need to know)		"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)		"Unwrapped" Understanding (students need to understand)		
 Periodic table Properties Elements Patterns of electrons Outermost energy level Patterns/trends Reactivity Metals Bonds Reactions with oxygen 		• Pr • Us	edict (3) e the periodic ole (2)	 Students will understand that elements are organized on the Periodic Table based on the elements' subatomic particles Similar substances follow similar patterns in regards to properties and characteristics based on electron arrangement Periodic Table can be used to predict the properties and characteristics of those substances due to electron configurations 		
New A	cademic Vocabulary		Scaffol	ded (Review) Academic Vocabulary		

 Isotope, atomic number, atomic mass, average atomic mass, Valence Electrons, atomic radius, electronegativity, ion, ionization energy, atomic radius, fusion/fission, decay 			 metals, non-metals, metalloids, group, periods, families, atomic number, atomic mass 						
	Assessment								
6				/Demonstration of Und					
	Common Unit Assessment to be completed in the 2024-2025 School Year. Links to student example of summative assessments/demonstration of understanding								
Score 4		Score 3		Score 2	Score 1				
Example		Example		Example	Example				
	Student			ncy Scale	l(s) and makes little to no				
4				and apply their learning					
3	Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.								
2	Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.								
1		rarely shows underst significant teaching t			the standard(s) and are still				
		Additio	nal	Information					
Professiona	al Resourc	e Suggestions			nal Resources				
ACS offer for chemis	 American Chemical Society (ACS): The ACS offers a wide range of resources for chemistry educators, including 			Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. Other resources utilized within this curriculum have been					
 lesson plans, activities, webinars, and professional development opportunities. National Science Teachers Association 			designed by the teaching staff and supplemented with free online resources.						
(NSTA): NSTA provides resources specifically tailored to science			Other Resources:						
 specifically tailored to science educators, including lesson plans, articles, professional development events, and access to a community of fellow educators. Chemical Education Research Group (CERG): CERG offers research-based resources and strategies for teaching chemistry, including curriculum materials, assessment tools, and 			•		e instructional videos for tration and additional topic ulations				

-	al development workshops.				
	: ChemEd X is an online				
	y and resource hub for				
	educators. It offers lesson				
•	activities, demonstrations,				
	s on best practices in				
chemistry	•				
	ective: ChemCollective				
	irtual labs, simulations, and				
	activities for teaching				
,	These resources can				
	nt hands-on laboratory				
•	es and engage students in				
virtual exp					
	Education Digital Library				
	DL): ChemEd DL is a digital				
library of C	hemistry resources				
	Unit topic analysis includes information on the integration of phenomena for introduction				
	and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.				
	considerations for laboratory implementation where applicable.				
	Areas incorporating math concepts and calculations are included below.				
	A cas med por ating math concepts and calculations are melded below.				
Curriculum	- Basic Atomic Structure (protons, electrons, neutrons)				
Designer Notes:	- Isotopes and Average Atomic Mass				
	- Define Fusion/Fission/Decay				
	- Phenomenon - Nuclear decay in atomic reactors				
	- Periodic Table				
	 Properties of Groups Trends 				
	- Irenus				

CHEMISTRY: UNIT 3 QUANTUM ATOMIC MODEL

Overview							
Quarter(s): 2							
Pacing: 4 Weeks	Pacing: 4 Weeks						
Unit Power Standard(s) Code		Unit Pow	er Standard(s) Description				
9-12.PS1.A.2	reaction based on	the <u>outermo</u>	xplanation for the products of a simple <u>chemical</u> <u>st electron state</u> s of atoms, <u>trends</u> in the of the <u>patterns of chemical properties</u> .				
9-12.PS4.A.1			<u>ions</u> to SUPPORT a <u>claim</u> regarding ency, wavelength, and speed of waves traveling				
9-12.PS4.A.2	electromagnetic r	<u>adiation</u> can l	<u>e, and reasoning</u> behind the idea that be described either by a <u>wave mode</u> l or a he situations one model is more useful than the				
Below Grade/Co	ourse Connected St	andard(s)	Above Grade/Course Connected Standard(s)				
engaged with 6-8 Standard in Grac	Middle School Students were previously engaged with 6-8.PS1.A.2 as a Supporting Standard in Grade 8.N/A						
	ok Physical Science 12.PS1.A.2, 9-12.PS						
Unit Supporting Standards Code		Unit Suppo	rting Standards Description				
9-12.PS3.C.1	· ·	illustrate the	o objects interacting through electric or forces between objects and the changes in e interaction				
	Unp	acked S	Standard(s)				
Power Standard(s) Code	Power Standard(s) DOK(s) DESE Expectation(s) Unwrapped Description						
9-12.PS1.A.2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost electron states	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate				

	of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties		today as they did in the past and will continue to do so in the future. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
9-12.PS4.A.1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	3	SCIENCE AND ENGINEERING PRACTICES Using Mathematics and Computational Thinking • Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations. DISCIPLINARY CORE IDEAS Wave Properties • The wavelength and frequency of a wave are related to one another by the speed at which the wave travels, which depends on the type of wave and the medium through which it is passing.
9-12.PS4.A.2	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the others.	3	SCIENCE AND ENGINEERING PRACTICES Engaging in Argument from Evidence • Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. DISCIPLINARY CORE IDEAS Wave Properties • Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. Electromagnetic Radiation • Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.
DESE Questions Examples:	the freque 2. $Circle the error a. \uparrow \downarrow \uparrow \uparrow 1s = 2$ b. $\uparrow \downarrow \uparrow 1s = 1s$	For cy of this mid for s in the followin $1 \downarrow 1 \downarrow 1 _$ 2s = 2p $1 \downarrow 1 \downarrow 1 \downarrow 1$	ation with a wavelength of 3.25×10^{-2} m. What is crowave radiation? ag orbital box diagrams & identify the rule or law not followed: $4 \uparrow \uparrow 1 _$ 3s 3p

	ed" Conten nts need to k		(students n	d" Skills (VERBS) eed to be able to do DOK)		"Unwrapped" derstanding (students need to understand)
 Prop Elem Patte Oute Patte Read Meta Bond Read 	 Periodic table Properties Elements Patterns of electrons Outermost energy level Patterns/trends Reactivity Metals Bonds Reactions with oxygen 			 Predict (3) Use the periodic table (2) 		 Students will understand that elements are organized on the Periodic Table based on the elements' subatomic particles Similar substances follow similar patterns in regards to properties and characteristics based on electron arrangement Periodic Table can be used to predict the properties and characteristics of those substances due to electron configurations Academic Vocabulary
• EMR calcu	lew Academ R, energy, wa ulate proton tron configu	avelength, fr s/neutrons/	 Atomic metals, metals, atomic r ic spectra Atomic r metals, atomic r group, p 		Model, Valence Electrons, non-metals, metalloids, adius, electronegativity, ion, on energy, atomic radius, eriods, families, atomic atomic mass	
			Assess	sment		
	nmon Unit A	ssessment t	o be complet	Demonstration of ed in the 2024-20 essments/demons	25 Sc	=
Sco	re 4	Sco	ore 3	Score 2		Score 1
Example	Example Example			Example		Example
Proficiency Scale						
4	Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.					
3	Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.					

2	Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.							
1	1 Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.							
	Additional Information							
 Ame ACS for c lesse prof oppo Nati (NS spec educ artic ever fellc Che (CEF reso cher mati prof Che (CEF reso cher mati prof Che com cher plan and cher Che prov inte cher 	herican Chemical Society (ACS): The Soffers a wide range of resources chemistry educators, including son plans, activities, webinars, and ofessional development portunities. tional Science Teachers Association STA): NSTA provides resources ecifically tailored to science ucators, including lesson plans, icles, professional development ents, and access to a community of low educators. emical Education Research Group ERG): CERG offers research-based sources and strategies for teaching emistry, including curriculum	ces: ctional videos created by ers tion of YouTube instructional for phenomenon demonstration Iditional topic instruction						
Curriculum Designer Notes:	Unit topic analysis includes information on the introduction and teaching purposes, identifica	tion of topics incorporating r laboratory implementation						

 Atomic History (experiments and models - Dalton, Thompson,
Rutherford, Bohr, Quantum)
- Wave Properties and Electromagnetic Spectrum
- Phenomenon - James Webb Space Telescope
- Atomic Spectra
- Electron Configurations

CHEMISTRY: UNIT 4 COVALENT BONDING

Overview				
Quarter(s): 2	Quarter(s): 2			
Pacing: 3/4 Wee	ks			
Unit Power Standard(s) Code	Unit Power Standard(s) Description			
9-12.PS1.A.1			iodic table to PREDICT the relative <u>properties</u> ns of <u>electrons</u> in the outermost <u>energy level</u> of	
9-12.PS1.A.2	<u>reaction</u> based on t periodic table, and	he <u>outermos</u> knowledge o	<u>planation</u> for the products of a simple <u>chemical</u> <u>t electron state</u> s of atoms, <u>trends</u> in the f the <u>patterns of chemical properties</u> .	
9-12.PS1.A.3	physical and chemi point, vapor pressu relative <u>strength</u> of	cal propertie re, surface te attractive fo	igation to GATHER <u>evidence</u> to COMPARE <u>s</u> of <u>substances</u> such as <u>melting point, boiling</u> ension, and chemical reactivity to INFER the prces between <u>particles.</u>	
	ourse Connected Sta	••	Above Grade/Course Connected Standard(s)	
engaged with 6-	tudents were previou 8.PS1.A.1	isiy	N/A	
Unit Supporting Standards Code	Unit Supporting Standards Description			
9-12.ETS1.A.1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.			
	Unpa	acked S	tandard(s)	
Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped	
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models • Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.	

9-12.PS1.A.2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles.	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design, decide on types, quantity, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
DESE Questions Examples:	electron pair geometry, Nonpolar. (3pts each) 28. EG: MG:Pola	, molecular geo r No ical formula or e	asing the provided Lewis structure to determine the ometry, and molecular polarity (Circle Polar or :F: B B :F: : B :F: : :F: : : :F: : : :F: : : :

	e bonds, ion	tet rule, single/ double/ ic/ covalent, VSEPR,		
	Assessment Common Summative Assessment/Demonstration of Understanding			
Sco Example	Score 4Score 3ExampleExample		Score 2 Example	Score 1 Example
		Proficier	ncy Scale	
4		as mastered understand when asked to demonst		rd(s) and makes little to ning.
3		onsistently shows under s) with few errors when	-	
2	• Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.			
1		arely shows understandi eding significant teachi		
		Additional	Information	
Profes	ssional Reso	ource Suggestions		nal Resources
Ame ACS for c lessc profe oppc Nati (NST	rican Chem offers a wid hemistry ed on plans, act essional dev ortunities. onal Science TA): NSTA pr	ical Society (ACS): The e range of resources ucators, including ivities, webinars, and elopment e Teachers Association ovides resources	Other resources utilize curriculum have been teaching staff and sup online resources.	vities are used as als aligned with the unit. ed within this designed by the
educ artic even fello • Cher (CEF reso chen mate profe	ators, inclue les, professi its, and acce w educators mical Educa (G): CERG o urces and st nistry, inclue erials, assess	red to science ding lesson plans, onal development ss to a community of s. tion Research Group ffers research-based rategies for teaching ling curriculum sment tools, and elopment workshops. <u>nEd X is an online</u>	teachers Utilization of Y videos for pher and additional EdPuzzle PhET Interacti Kahoot- used a	ideos created by 'ouTube instructional nomenon demonstration topic instruction ve Simulations as a review tool mistry- free version

"Unwrapped" Content (<u>nouns</u>) (students need to know)	"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)	"Unwrapped" Understanding (students need to understand)
 Periodic table Properties of elements Electrons Outermost Electron Physical and chemical properties (contains examples of each) Bonding Crystalline/molecular structure Macroscopic properties Structural materials 	 Predict (2) Plan and Conduct an investigation (4) Gather evidence (2) Apply (2) Explain (1) 	 Students will understand that atoms can combine, separate or rearrange to create new substances Combinations formed depend on electrons and other properties of the atoms Bonds can be predicted based on properties Being able to predict the way atoms bond allows you to predict the substances that will form due to a reaction Chemical Names are used to describe the way in which atoms bond and are specific to the type of bonds formed. In order to properly describe the substance students must understand the proper naming rules for elements, covalent bonds and ionic bonds The ability to name chemical substances is required to effectively communicate in science
New Academic Vocabulary		eview) Academic Vocabulary
 ionic, binary, polyatomic, ion, or method, transition metal, hydr metal/nonmetal, covalent com binary acid, polyatomic acid, nonmetal/nonmetal, valence or 	e isotope pound, protops	e, atomic number, atomic mass, nergy, wavelength, frequency, atomic mass, calculate /neutrons/electrons

communi	ity and resource hub for			
	y educators. It offers lesson			
	activities, demonstrations,			
• •	les on best practices in			
	y teaching.			
	llective: ChemCollective			
	virtual labs, simulations, and			
	ve activities for teaching			
	y. These resources can			
	ent hands-on laboratory			
	ces and engage students in			
-	periments.			
Chemistr	y Education Digital Library			
	DL): ChemEd DL is a digital			
library of	chemistry resources			
	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable.			
Curriculum	Areas incorporating math concepts and calculations are included below.			
Designer	- Lewis Structures			
Notes:	- Molar Masses			
	- VSEPR			
	- Molecular Modeling Lab			
	- Polarity			
	- Phenomenon - Trying to mix polar and nonpolar substances			
	- Intermolecular Forces			

CHEMISTRY: UNIT 5 IONIC BONDING

Overview			
Quarter(s): 2-3			
Pacing: 3 Weeks	-		
Unit Power			
Standard(s)		Unit Pow	er Standard(s) Description
Code		·• • • • •	
9-12.PS1.A.1	USE the <u>organization</u> of the <u>periodic table</u> to PREDICT the relative <u>properties</u> of <u>elements</u> based on the <u>patterns</u> of <u>electrons</u> in the outermost <u>energy level</u> of <u>atoms</u> .		
9-12.PS1.A.2	chemical reaction	h based on th	<u>explanation</u> for the products of a simple e <u>outermost electron state</u> s of atoms, <u>trends</u> in edge of the <u>patterns of chemical properties</u> .
9-12.PS1.A.3	physical and chen point, vapor press	nical propert sure, surface	stigation to GATHER <u>evidence</u> to COMPARE ies of <u>substances</u> such as <u>melting point, boiling</u> tension, and chemical reactivity to INFER the forces between <u>particles</u>
Below Grade/Cou	rse Connected Sta		Above Grade/Course Connected Standard(s)
Middle School Stu engaged with 6-8.	Students were previously		
Unit Supporting Standards Code		Unit Suppo	orting Standards Description
9-12.ESS1.A.1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.		
	Unpa	acked S	tandard(s)
Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.A.1	Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	3	SCIENCE AND ENGINEERING PRACTICES Developing and Using Models • Use a model to predict the relationships between systems or between components of a system. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.

9-12.PS1.A.2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design, decide on types, quantity, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
DESE Questions Examples:	 For each of the compounds, write the chemical formula or name. 1. Cadmium hypochlorite 2. Zn(C₂H₃O₂)₂ In an ionic bond, oxygen is most likely to, making it a(n) a. Gain 2 electrons; cation b. Gain 2 electrons; anion c. Lose 6 electrons; cation 		

d. Lo	se 6 electrons; anion			
e. Br f. Ma g. Ma	f. Malleable, low melting points, strong bondsg. Malleable, high melting points, weak bonds			
"Unwrapped" Content (<u>nouns</u>) (students need to know)	"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)	"Unwrapped" Understanding (students need to understand)		
 Periodic table Properties of elements Electrons Outermost Electron Physical and chemical properties (contains examples of each) Bonding Crystalline/molecular structure Macroscopic properties Structural materials 	 Predict (2) Plan and Conduct an investigation (4) Gather evidence (2) Apply (2) Explain (1) 	 Students will understand that atoms can combine, separate or rearrange to create new substances Combinations formed depend on electrons and other properties of the atoms Bonds can be predicted based on properties Being able to predict the way atoms bond allows you to predict the substances that will form due to a reaction Chemical names are used to describe the way in which atoms bond and are specific to the type of bonds formed. In order to properly describe the substance students must understand the proper naming rules for elements, covalent bonds and ionic bonds The ability to name chemical substances is required to 		

 New Academic Vocabulary ionic, binary, polyatomic, ion, criss-cross method, transition metal, hydrates, metal/nonmetal, covalent compound, binary acid, polyatomic acid, nonmetal/nonmetal, valence electrons, cation, anion, octet rule, single/ double/ triple bonds, ionic/ covalent, VSEPR, Polarity 			 Isotope, ator EMR, energy average ator 	effectively communicate in science) Academic Vocabulary nic number, atomic mass, , wavelength, frequency, nic mass, calculate rons/electrons	
	Common	Asses Summative Assessment	sment	erstanding	
• Co		ssessment to be comple			
		ample of summative ass			
Emits		ampre of summative as			
Sc	ore 4	Score 3	Score 2	Score 1	
Example		Example	Example	Example	
		mastered understandir	-		
4	no errors w	hen asked to demonstra	te and apply their learn	ing.	
3	with few err	ors when asked to dem	onstrate and apply their		
2		sometimes show under yet there are a few asp	-	-	
1	Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.				
		Additional	Information		
Prof	essional Reso			nal Resources	
 Professional Resource Suggestions American Chemical Society (ACS): The ACS offers a wide range of resources for chemistry educators, including lesson plans, activities, webinars, and professional development opportunities. National Science Teachers Association (NSTA): NSTA provides resources specifically tailored to science 			Chemistry Process-or Learning (POGIL) activ	iented Guided Inquiry vities are used as ials aligned with the unit. ed within this designed by the	

educators	including lesson plans,	Other Resources:		
	ofessional development			
-	d access to a community of	 Instructional videos created by 		
fellow edu	-	teachers		
	Education Research Group	Utilization of YouTube instructional		
	ERG offers research-based	videos for phenomenon demonstration		
	and strategies for teaching	and additional topic instruction		
	including curriculum	EdPuzzle		
materials, a	assessment tools, and	PhET Interactive Simulations		
profession	al development workshops.	 Kahoot- used as a review tool 		
	: ChemEd X is an online			
	y and resource hub for			
	educators. It offers lesson			
-	activities, demonstrations,			
	s on best practices in			
chemistry	•			
	ective: ChemCollective			
-	irtual labs, simulations, and activities for teaching			
	These resources can			
	nt hands-on laboratory			
	es and engage students in			
virtual exp				
Chemistry	Education Digital Library			
(ChemEd E	DL): ChemEd DL is a digital			
library of c	hemistry resources			
		formation on the integration of phenomena for		
		rposes, identification of topics incorporating		
	-	considerations for laboratory implementation		
	where applicable.			
	Aroos incorporating math as	aconte and calculations are included below		
Curriculum	Areas incorporating math cor	ncepts and calculations are included below.		
Designer Notes:	Naming/Formula Writing			
	 Phenomenon - Video of sodium & chlorine reaction Electron Configuration of ions 			
	- Electron Configuratio			
	- Combined Naming			

CHEMISTRY: UNIT 6 CHEMICAL REACTIONS

Overview				
Quarter(s): 3				
Pacing: 3 Weeks				
Unit Power Standard(s) Code		Unit Power Standard(s) Description		
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to SUPPORT the claim that atoms, and therefore mass, are conserved during a chemical reaction.			
9-12.PS1.A.2	chemical reaction	based on the	<u>xplanation</u> for the <u>products</u> of a simple <u>outermost electron state</u> s of atoms, <u>trends</u> in lge of the <u>patterns of chemical properties</u> .	
9-12.PS1.B.2	REFINE the design	n of a chemica	al system by specifying a change in <u>conditions</u> of products at <u>equilibrium.</u>	
Below Grade/Co	urse Connected Sta	ndard(s)	Above Grade/Course Connected Standard(s)	
Middle School St engaged with 6-8	udents were previou B.PS1.B.1	usly	N/A	
Unit Supporting Standards Code	Unit Supporting Standards Description			
9-12.ESS1.A.2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.			
	Unpa	acked S	tandard(s)	
Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped	
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	3	SCIENCE AND ENGINEERING PRACTICES Using Mathematics and Computational Thinking • Use mathematical representations of phenomena to support claims. DISCIPLINARY CORE IDEAS Chemical Reactions • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions	
9-12.PS1.A.2	Construct and revise an explanation for	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions Construct and revise an	

	the products of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.		evidence obtain (including stude models, theories review) and the laws that descrift today as they did to do so in the fu IDEAS Structure The periodic tab horizontally by the atom's nucleus a chemical proper repeating patter patterns of oute	ed on valid and reliable ed from a variety of sources nts' own investigations, s, simulations, and peer assumption that theories and be the natural world operate d in the past and will continue iture. DISCIPLINARY CORE e and Properties of Matter • ole orders elements the number of protons in the and places those with similar rties in columns. The rns of this table reflect er electron states.
9-12.PS1.B.2	Refine the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium.	3	Constructing Ex Solutions • Refu real-world prob knowledge, stud evidence, priorit considerations. Chemical React dynamic and con between a react determines the molecules prese Solution • Crite down into simpl approached syst about the priori	ENGINEERING PRACTICES splanations and Designing ne a solution to a complex lem, based on scientific lent-generated sources of tized criteria, and trade-off DISCIPLINARY CORE IDEAS ions • In many situations, a ndition-dependent balance tion and the reverse reaction numbers of all types of ent. Optimizing the Design ria may need to be broken er ones that can be tematically, and decisions ty of certain criteria over fs) may be needed.
DESE Questions Examples:	 In balancing a chemical equation, which of the following are you allowed to do? (A) change subscripts (B) write coefficients (C) change superscripts (D) add new substances Write <i>balanced</i> equations for each of the following Combustion of propane (C₃H₈). Decomposition of water Reaction between calcium and hydrochloric acid 			
	Content (<u>nouns</u>) eed to know)	(V (students)	apped" Skills (ERBS) need to be able to do DOK)	"Unwrapped" Understanding (students need to understand)

Chemical reactions Electrons states of atoms Periodic table Chemical properties Scientific principles Temperature Concentration Atoms Mass 	Revi expl • Appl princ evid • Use supp	struct and se an anation (3) ly scientific ciples and ence (2) evidence to port a claim (3)	 Students will understand that chemical reactions occur due to outer electrons Changes in Temperature and concentration change the rate of chemical reactions Atoms/mass is conserved in a reaction 	
 New Academic Vocabulary synthesis, decomposition, single displacement, double displacement, combustion, activity series, coefficient, law of conservation, subscript, Molar mass; Avogadro's number; mole; molar ratio; molecule; formula unit; percent composition, moles, grams, liters, mole ratio, limiting reactant, excess reactant, percent yield, actual yield, theoretical yield 		 ionic, bir criss-crc hydrates compou acid, nor electron single/ d 	nary, polyatomic, ion, oss method, transition metal, s, metal/nonmetal, covalent nd, binary acid, polyatomic nmetal/nonmetal, valence s, cation, anion, octet rule, ouble/ triple bonds, ionic/ c, VSEPR, Polarity	
Common Summative	Assessment			
 Common Summative Assessment/Demonstration of Understanding Common Unit Assessment to be completed in the 2024-2025 School Year. Links to student example of summative assessments/demonstration of understanding 			25 School Year.	

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

	Proficiency Scale			
4	Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.			
	•			
3	Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.			
	•			
2	Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.			
	•			
1	Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.			
	•			

	Additional I	nformation
Profession	al Resource Suggestions	Instructional Resources
 American ACS offer for chemis lesson pla profession opportuni National S (NSTA): N specificall educators articles, p events, ar fellow edu Chemical (CERG): C resources chemistry materials, profession ChemEd D communit chemistry plans, lab and article chemistry ChemColl provides v interactiv chemistry ChemColl provides v interactiv chemistry Chemistry 	Chemical Society (ACS): The s a wide range of resources stry educators, including ns, activities, webinars, and hal development ities. Science Teachers Association STA provides resources y tailored to science s, including lesson plans, rofessional development d access to a community of ucators. Education Research Group ERG offers research-based and strategies for teaching y, including curriculum assessment tools, and hal development workshops. K: ChemEd X is an online ty and resource hub for reducators. It offers lesson activities, demonstrations, es on best practices in	Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources. Other Resources: • Instructional videos created by teachers • Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction • EdPuzzle • PhET Interactive Simulations • Kahoot- used as a review tool
Curriculum Designer Notes:	 Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable. Areas incorporating math concepts and calculations are included below. Types Lab - Types of reactions lab Balancing Equations (Law of Conservation of Mass) Phenomenon - video of balanced and unbalanced hydrogen & oxygen reaction 	

- Mole concepts
- Grams to moles to atoms using Avogadro's Number
- Mole-to-mole stoichiometry

CHEMISTRY: UNIT 7 STOICHIOMETRY

		Overv	iew
Quarter(s): 4			
Pacing: 4 weeks			
Unit Power Standard(s) Code	Unit Power Standard(s) Description		
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to SUPPORT the claim that <u>atoms</u> , and therefore mass, are conserved during a <u>chemical reaction</u> .		
9-12.PS1.A.2	CONSTRUCT and REVISE an explanation for the products of a simple <u>chemical</u> <u>reaction</u> based on the <u>outermost electron state</u> s of atoms, <u>trends</u> in the periodic table, and knowledge of the <u>patterns of chemical properties</u> .		
9-12.PS1.B.2	REFINE the <u>design of a</u> would alter the amour		<u>stem</u> by specifying a change in <u>conditions</u> that s at <u>equilibrium</u>
Below Grade/Course 6-8.PS1.A.1	Connected Standard(s)	Above Grade/Course Connected Standard(s) N/A
Unit Supporting Standards Code		Unit Suppo	rting Standards Description
9-12.ESS1.A.3	Communicate scientifice elements.	ic ideas abou	t the way stars, over their life cycle, produce
	Unpac	cked St	andard(s)
Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	3	SCIENCE AND ENGINEERING PRACTICES Using Mathematics and Computational Thinking • Use mathematical representations of phenomena to support claims. DISCIPLINARY CORE IDEAS Chemical Reactions • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions
9-12.PS1.A.2	Construct and revise an explanation for the products of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in

Chemical reactions • Electrons states of atoms • Periodic table • Chemical properties • Scientific principles • Temperature • Concentration • Atoms • Mass		 Cor 	nstruct and rise an	Students will
200. g of methane "Unwrapped" Content (<u>nouns</u>) (students need to know) Chemical reactions		e 80.0 grams ow many gra (CH ₄)? CH ₄ "Unwra (V (students & • Cor Rev	ams of water are + $2O_2 \rightarrow CO_2 + 2$ apped" Skills (ERBS) need to be able to do DOK) astruct and	e? produced from the combustion of 2H ₂ O, "Unwrapped" Understanding (students need to understand)
9-12.PS1.B.2	Refine the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium.	3	reflect patterns SCIENCE AND I Constructing Ex Solutions • Refu real-world prob knowledge, stuc evidence, priorit considerations. I Chemical Reacti dynamic and cor between a react determines the present. Optimiz Criteria may nee ones that can be decisions about over others (trac	peating patterns of this table of outer electron states. ENGINEERING PRACTICES splanations and Designing ne a solution to a complex lem, based on scientific lent-generated sources of tized criteria, and trade-off DISCIPLINARY CORE IDEAS ions • In many situations, a ndition-dependent balance ion and the reverse reaction numbers of all types of molecules zing the Design Solution • ed to be broken down into simpler e approached systematically, and the priority of certain criteria de-offs) may be needed.

Assessment

Common Summative Assessment/Demonstration of Understanding

Common Unit Assessment to be completed in the 2024-2025 School Year.

•

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale		
4	Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.	
3	Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.	
	•	
2	Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.	
	•	
1	Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.	
	•	

Additional Information

Professional Resource Suggestions	Instructional Resources
 American Chemical Society (ACS): The ACS offers a wide range of resources for chemistry educators, including lesson plans, activities, webinars, and professional development opportunities. National Science Teachers Association (NSTA): NSTA provides resources specifically tailored to science educators, including lesson plans, articles, professional development events, and access to a community of fellow educators. Chemical Education Research Group (CERG): CERG offers research-based resources and strategies for teaching chemistry, including curriculum materials, assessment tools, and professional development workshops. ChemEd X: ChemEd X is an online community and resource hub for chemistry educators. It offers lesson plans, lab activities, demonstrations, and articles on best practices in chemistry teaching. ChemCollective: ChemCollective provides 	 Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources. Other Resources: Instructional videos created by teachers Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction EdPuzzle PhET Interactive Simulations Kahoot- used as a review tool

 activities for tresources can experiences a experiments. Chemistry Ed 	mulations, and interactive ceaching chemistry. These a supplement hands-on laboratory and engage students in virtual ucation Digital Library (ChemEd DL is a digital library of chemistry
Curriculum Designer Notes:	 Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable. Areas incorporating math concepts and calculations are included below: Percent composition of compounds Empirical/Molecular Formulas Mole to gram, gram to mole, gram to gram Phenomenon - Breakfast Equations Limiting Reactants & Percent Yield Lab - Limiting Reactant Lab

CHEMISTRY: UNIT 8 SOLUTIONS

	Overview			
Quarter(s): 4				
Pacing: 3 Weeks	5			
Unit Power Standard(s) Code	Unit Power Standard(s) Description			
9-12.PS1.A.3	PLAN and CONDUCT an INVESTIGATION to GATHER EVIDENCE to COMPARE <u>physical</u> <u>and chemical properties</u> of <u>substances</u> such as <u>melting point</u> , <u>boiling point</u> , <u>vapor pressure</u> , <u>surface tension</u> , <u>and chemical reactivity</u> to INFER the relative strength of <u>attractive forces</u> between <u>particles</u> .			
9-12.PS1.B.2	REFINE the <u>design of</u> alter the amount of pr		em by specifying a change in <u>conditions</u> that would <u>brium.</u>	
9-12.PS1.B.3			athematical calculations to SUPPORT the claim that rved during a <u>chemical reaction.</u>	
	ourse Connected Stand	ard(s)	Above Grade/Course Connected Standard(s)	
6-8.PS1.A.1			N/A	
Unit Supporting Standards Code	Unit Supporting Standards Description			
9-12.PS1.A.4	Apply the concepts of bonding and crystalline/molecular structure to explain the macroscopic properties of various categories of structural materials (i.e., metals, ionic [ceramics], and polymers).			
	Un	packed S	Standard(s)	
Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped	
9-12.PS1.A.3	Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point,boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles	3	SCIENCE AND ENGINEERING PRACTICES Planning and Carrying Out Investigations • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design, decide on types, quantity, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly. DISCIPLINARY CORE IDEAS Structure and Properties of Matter • The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.	
9-12.PS1.B.2	Refine the design of a chemical system	3	SCIENCE AND ENGINEERING PRACTICES Constructing Explanations and Designing Solutions	

	by specifying a change in conditions that would alter the amount of products at equilibrium		based on scie sources of evi trade-off cons IDEAS Chemi dynamic and a reaction and numbers of al Optimizing th to be broken approached s	ution to a complex real-world problem, ntific knowledge, student-generated idence, prioritized criteria, and siderations. DISCIPLINARY CORE ical Reactions • In many situations, a condition-dependent balance between d the reverse reaction determines the II types of molecules present. ne Design Solution • Criteria may need down into simpler ones that can be systematically, and decisions about the rtain criteria over others (trade-offs)
9-12.PS1.B.3	Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	3 centrated 16 M s	SCIENCE AN Mathematics mathematica support claim Chemical Rea conserved, to properties of describe and	D ENGINEERING PRACTICES Using and Computational Thinking • Use I representations of phenomena to as. DISCIPLINARY CORE IDEAS actions • The fact that atoms are ogether with knowledge of the chemical the elements involved, can be used to predict chemical reactions.
DESE Questions Examples:	 32 mL of concentrated 16 M sulfuric acid are diluted to create a 1.2 M sulfuric acid solution. What is the volume of the diluted solution? (5pts, 5 step method) 0.45 L of 18 M Sulfuric acid (H₂SO₄) and excess Aluminum hydroxide solution (Al(OH)₃) react to form solid aluminum sulfate (Al₂(SO₄)₃) and water. Theoretically what mass of solid aluminum sulfate would be created? (6 points) H₂SO₄(aq) +Al(OH)₃ (aq) →Al₂(SO₄)₃ (s) +H₂O (l) 			
"Unwrapped" Content (<u>nouns</u>) (students need to know)				"Unwrapped" Understanding (students need to understand)
 Technological solutions Impacts of human activities Natural systems Stability Biodiversity Ecosystems 		• Evalua techno solutio	-	 Students will understand solubility of substance is dependent on type of substance Substances are classified based on properties and characteristics Solubility is also affected by temperature, agitation, and surface area

	 Reactions in solutions can be classified as acid/base, redox and precipitation Solutions and solubilities have environmental and human impacts including ocean acidification, acid rain, pollution, body functions/ health, and more. 			
New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary			
 Solubility, electrolyte, non-electrolyte, acid/base reactions, redox reactions, pH, molarity 	 synthesis, decomposition, single displacement, double displacement, combustion, activity series, coefficient, law of conservation, subscript, Molar mass; Avogadro's number; mole; molar ratio; molecule; formula unit; percent composition, moles, grams, liters, mole ratio, limiting reactant, excess reactant, percent yield, actual yield, theoretical yield 			
Assessment				
Common Summative Assessment/Demonstration of Understanding Common Unit Assessment to be completed in the 2024-2025 School Year. 				
Links to student example of summative asse	essments/demonstration of understanding			

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale				
4		Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.		
	•			
Student consistently shows understanding for most components of the standard few errors when asked to demonstrate and apply their learning.				
	•			
2		Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.		
•				
1	Student rarely shows understanding for any component of the standard(s) and are stil needing significant teaching to apply their learning.			
	•			
	Additiona	al Information		
Professional Resource Suggestions Instructional Resources				
 American Chemical Society (ACS): The ACS offers a wide range of resources for chemistry educators, including lesson Chemistry Process-oriented Guided Inquiry Learning (POGIL) activities are used as supplementary materials aligned with the unit. 				

 profession National (NSTA): I specification profession access to access to Chemication Chemication Chemication Chemistric assessment ChemEdic Communication ChemEdic Communication ChemConvirtual la activities resource Iaboratois Chemistrication 	tivities, webinars, and onal development opportunities. Science Teachers Association NSTA provides resources Ily tailored to science educators, glesson plans, articles, onal development events, and a community of fellow educators. I Education Research Group CERG offers research-based s and strategies for teaching y, including curriculum materials, ent tools, and professional nent workshops. X: ChemEd X is an online ity and resource hub for y educators. It offers lesson plans, ties, demonstrations, and articles practices in chemistry teaching. Ilective: ChemCollective provides bs, simulations, and interactive of or teaching chemistry. These s can supplement hands-on ry experiences and engage in virtual experiments. ry Education Digital Library I DL): ChemEd DL is a digital chemistry resources	 Other resources utilized within this curriculum have been designed by the teaching staff and supplemented with free online resources. Other Resources: Instructional videos created by teachers Utilization of YouTube instructional videos for phenomenon demonstration and additional topic instruction EdPuzzle PhET Interactive Simulations Kahoot- used as a review tool 		
• Curriculum Designer Notes:	Unit topic analysis includes information on the integration of phenomena for introduction and teaching purposes, identification of topics incorporating mathematical concepts, and considerations for laboratory implementation where applicable. Areas incorporating math concepts and calculations are included below.			

CHEMISTRY: UNIT 9 NUCLEAR CHEMISTRY

Overview				
Quarter(s): 4				
Pacing: 2 Weeks	;			
Unit Power				
Standard(s)		Unit Powe	er Standard(s) Description	
Code				
	USE <u>symbolic re</u>	oresentations to	o ILLUSTRATE the <u>changes</u> in the <u>composition</u>	
9-12.PS1.C.1	of the <u>nucleus of the atom</u> and the <u>energy</u> released during the <u>processes</u> of			
	fission, fusion, ar			
	ourse Connected S	Standard(s)	Above Grade/Course Connected Standard(s)	
6-8.PS1.A.1			N/A	
Unit				
Supporting		Unit Suppor	ting Standards Description	
Standards				
Code				
9-12.ESS1.A.1		• •	e to specify qualitative and quantitative criteria at account for societal needs and wants.	
9-12.ESS1.A.3	elements.	ientine lueas ab	oout the way stars, over their life cycle, produce	
	Unj	backed S	tandard(s)	
Power	Power			
Standard(s)	Standard(s)	DOK(s)	DESE Expectation(s) Unwrapped	
Code	Description			
	Use symbolic		SCIENCE AND ENGINEERING PRACTICES	
	representation		Developing and Using Models • Develop a	
	s to illustrate		model based on evidence to illustrate the	
	the changes in		relationships between systems or between	
	the		components of a system. DISCIPLINARY	
	composition of		CORE IDEAS Nuclear Processes • Nuclear	
	the nucleus of		processes, including fusion, fission, and	
9-12.PS1.C.1	the atom and	3		
, 12.1 0 1.0.1	the energy	Ũ	radioactive decays of unstable nuclei, involve	
	released		release or absorption of energy. The total	
	during the		number of neutrons plus protons does not	
	processes of		change in any nuclear process.	
	fission, fusion,			
	and			
	radioactive			
	decay 1. Which typ	be of		
	decay is	198	198 0	
DESE			Au — Hg + e	
Questions	nuclear eo	quation to		
Examples:	the right?		80 -1	
		lpha		
	d	ecay		

 b. Beta decay c. Gamma decay d. Delta decay 2. Paper would be strong enough to stop a(n) a. Alpha particle b. Beta particle c. Gamma ray d. All of the above e. 1. Write the nuclear equation for gold-198 when it undergoes beta decay. 					
"Unwrapped" Content (students need to kr	· · · · · · · · · · · · · · · · · · ·	(students ne	" Skills (VERBS) ed to be able to do DOK)		"Unwrapped" erstanding (students eed to understand)
 Symbolic represe Composition of r Atom Energy Fission Fusion Radioactive deca Qualitative mode Nuclear process Transformations 	nucleus ny els		nd illustrate (2)	•	The nucleus of an atom can change Changes must be of a specific type (alpha, beta, gamma) Changes release energy of a specific wavelength, frequency, and energy Nucleus splits in fission and combines in fusion Understand the applications of fission/fusion/ radioactive decay. These reactions are essential to their daily lives- the sun, power plants
New Academic VocabularyScaffolded (Review) Academic Vocabulary• Alpha, beta, gamma, EMR radio-gamma; frequency, wavelength, nuclear equations; fission, fusion• Isotope, atomic number, atomic mass, EMR, energy, wavelength, frequency, average atomic mass, calculate protons/neutrons/electrons					
Common Unit As	Assessment Common Summative Assessment/Demonstration of Understanding • Common Unit Assessment to be completed in the 2024-2025 School Year. Links to student example of summative assessments/demonstration of understanding				
Score 4	Sco	ore 3	Score 2		Score 1

Example	e Example		Example	Example		
	Proficiency Scale					
4	Student has mastered understanding of the entire standard(s) and makes little to					
3		Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.				
2		• Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.				
1		ely shows understandir g significant teaching to		the standard(s) and are		
	L	Additional	Information			
AC: for less pro opp Nat (NS spe edu arti eve fell • Che (CE res che mai pro • Che con che plai anc che pro	S offers a wid chemistry ed son plans, action ofessional dev portunities. tional Science STA): NSTA pre- cifically tailor ucators, includ icles, profession ents, and accession ow educators emical Educat ERG): CERG of ources and st emistry, includ terials, assess ofessional dev emEd X: Chen munity and re- emistry educators of articles on bre- emistry teachion emistry teachion emistry teachion emistry teachion emistry activition districtes on bre- emistry teachion emistry teachion emistry teachion emistry teachion emistry teachion emistry teachion emistry teachion emistry activition districtes on bre- emistry teachion emistry tea	Teachers Association ovides resources red to science ling lesson plans, onal development ss to a community of	Learning (POGIL) activisupplementary mater Other resources utilizicurriculum have been teaching staff and sup online resources. Other Resources: Instructional wite teachers Utilization of Nivideos for phe and additional EdPuzzle PhET Interaction	ials aligned with the unit. ed within this designed by the		

experien virtual ex • Chemist (ChemEo	ent hands-on laboratory nces and engage students in xperiments. ry Education Digital Library d DL): ChemEd DL is a digital f chemistry resources	
Curriculum Designer Notes:	introduction and teaching purpor mathematical concepts, and con- where applicable. Areas incorporating math conce - Alpha, beta, gamma deca - Nuclear Equations - Fission vs fusion - Phenomenon - fis - Radioactivity	rmation on the integration of phenomena for oses, identification of topics incorporating isiderations for laboratory implementation opts and calculations are included below. ay ssion and fusion reactions adium Girls Article