Phoenixville Area School District Understanding by Design (UbD) Science Template



What are the benefits of

information in multiple

ways?

over time?

communicating scientific

How does science change

Grada Laval 9 for US Subject: 11/Chamistry Unit Name: Electrochemistry

Grade Level	&/or HS Subject: 11/Chemistry Unit Name: Electrochemistry					
	Stage 1 Desired Results					
Overarching NGSS & PA Standards: PA: Properties and Structure of Matter: 1.Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. 2.Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces	Students will be able to independently use their learning to Ask questions and/or define problems Plan and/or carry out investigations Analyze and interpret data using computational thinking Obtain, evaluate and communicate information (supported by evidence) Construct explanations and design solutions					
	Meaning-Making Students will understand that					
	 Students will understand that PS1.A: Structure and Properties of Matter: The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (Secondary to HS-PS2-6) PS2.B: Types of Interactions: Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6), (secondary to HS-PS1-1), (secondary to HS-PS1-3) SEP: Obtaining, Evaluating and Communicating Information: Scientific and technical information (e.g., about the process of development and the design and performance of a proposed process or system) in multiple formats can be communicated (including orally, graphically, textually, and mathematically). (HS-PS2-6) PS1.B: 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. (HS-PS1-2), (HS-PS1-7) Batteries are electrochemical cells, and batteries of different types are currently being 	How do models that we create in lab of electrochemical cells relate to the real world? What are the advantages and disadvantages to these models we create in lab? Why is it important to collect data about the performance of a proposed tool, object, process or system under a range of conditions? What are the benefits of				

used to replace other outdated forms of energy that are less reliable, less available,

more damaging to the environment and becoming increasingly more expensive as

human demand increases.

between

particles.

Chemical

reactions:

1. Construct and revise an a explanation for the outcome of a simple chemical reaction based on the outcome of a simple chemical reaction based on the outcomest electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. 5. Use mathematical representations support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-PS1-1. Use the periodic bable as a model to predict the relative broperties of electrons is a model to predict the relative broperties of electrons in the outermost energy level of storms. 1. For Standard cell potential cell sail bridge and skills Acquisition 1. The standard representations to the cathode and the anode, and its sign signifies the spontaneity of that redox reaction. The standard cell potential can be calculated from standard reduction potentials of the cathode and the anode, and its sign signifies the spontaneity of that redox reaction. Sept. Using a model for predict the relative properties of electrons in the outermost energy level of storms. 1. For Standard cell potential cell sail bridge anode/cathode electrolysis cathodic activity series is a table used to identify elements that are more or less easily oxidized, and it can be related to standard reduction potentials of the relative properties of electrons in the outermost energy level of storms. 2. Voltaic cells spontaneously produce energy, and electrolytic cells use energy to function. 3. The standard cell potential can be calculated from standard reduction potentials of the cathode and the anode, and its sign signifies the spontaneity of that redox reaction. 3. Electrolysis is a chemical process whereby electricity is a source of breating intramolecular bonds in order to obtain elements of the compounds they make up and is intramolecular bonds in order to obtain elements of the compounds they make up and is intramolecular bonds in order to obtain elements of the compounds they make up and is intramolecular bonds in order to obtain elemen						
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elements based on the patterns of electrons in the outermost energy level of atoms. HS-PS1-3.Plan and conduct an elements based on the patterns of electrolysis Fuel cell battery standard reduction potential voltaic cell voltaic cell standard hydrogen electrode Fuel cell standard reduction potential electrolytic cell voltaic cell standard hydrogen electrode Fuel cell standard reduction potential voltaic cell provide an explanation of phenomena and solve design problems, considering possible unanticipated effects. (HS-PS1-5) SEP. Constructing Explanations and Designing Solutions. Refining a solution to a complex real-world.		Electrode	activity series	dry cell		
on the patterns of electrons in the outermost energy level of atoms. HS-PS1-3.Plan and conduct an electrolytic cell standard hydrogen electrode Standard cell potential electrolytic cell standard hyd		Fuel cell	battery	standard reduction potential		
of electrons in the outermost energy level of atoms. HS-PS1-3.Plan and conduct an and conduct an electroplating standard hydrogen electrode Electrolysis electroplating standard hydrogen electrode standard hydrogen electrode problems, considering possible unanticipated effects. (HS-PS1-5) SEP. Constructing Explanations and Designing Solutions. Refining a solution to a complex real-world.		Standard cell potential	_	•		
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atoms. HS-PS1-3.Plan and conduct an	energy level of				unanticipated effects. (HS-PS1-5)	
and Designing Solutions. Refining					SED Constructing Evalenations	
and conduct an	HS-PS1-3.Plan					
investigation to a solution to a complex real-world	and conduct an					
invocagation to	investigation to				a solution to a complex real-world	

gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. HS-PS1-7.Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-PS2-6.Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Which branch(es) of science apply:



LS PS E&SS

problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4)

MP.2 Reason abstractly and quantitatively. (HS-PS1-5), (HS-PS1-7)

MP.4 Model with mathematics. (HS-PS1-4), (HS-PS1-8)

Stage 2 – Evidence					
Evaluative Criteria	Assessment Evidence				
Criteria	PERFORMANCE TASK(S):	Differentiation Considerations:			
Lab rubric performance points Formative checks of understanding Presentation rubric	 Students will create a lemon battery, answer some questions about its functioning, and label the parts akin to a voltaic cell. Student demonstration: redox reaction of silver "tree" using silver nitrate and copper wire, followed by discussion of activity series and relating it to half-cell potentials. Students can simulate a lead storage battery (like in cars) by making a lead cell, that they connect to a 6-V DC source that will ring a doorbell. Students will orally present in groups about the emerging trend of electric cars and discuss what obstacles still stand in the way of mass usage of these cars, or students can choose to discuss the use of fuel cells for space travel in the space shuttle and used by utility companies. In all cases, a comparison to other fuel sources should be made in terms of their impact on the environment. 	Group considerations, roles in group, variable performance tasks within labs Prior to labeling, choose some students who may do better with visual learning: Give students small, printed cards with e-printed on them in large letters. Divide students into pairs and let one student role play being the anode and the other being the cathode. The anode should have one or more cards to the anode, depending on the metal chosen. Enrichment: Challenge students to research the electrochemistry of the body's nervous system and have them report their findings in a visual display. Some topics could be the role of sodium and potassium ions, how signals are transmitted across synapses, what an EEG measures and the value of squid for nervous system research.			

Danfannaaa	OTHER EVIDENCE:	Differentiation Considerations:
Performance point values Lab report rubric Teacher formative	Cooperative Learning Drills: identifying oxidation numbers, predicting direction of reaction (voltaic or electrolytic cells) based on standard reduction potentials Formative Assessments and Homework: oxidation numbers, balancing half reactions, balancing redox reactions, labeling voltaic cells, calculating cell potentials	English learners: Review the content looking for vocabulary words and key concepts. Add drawings to these words for meaning and try to use them in various types of sentences.
checks	Laboratory Experiments: creating electrochemical cells Common Summative test: Electrochemistry	English learners or less proficient readers: Students may have difficulty remembering that oxidation occurs at the anode and that reduction occurs at the
		cathode. Tell them that the consonants go together and vowels
		Spiral some of the learning in thi unit to help students remember t patterns in chemistry: Have students look at the periodic tabl and point out that the elements of the left side of the periodic table are more easily oxidized (lose e-
		than the elements on the right sign of the periodic table. Groups 1 at 2 are the most reactive metals at are at the top of the activity series (when we studied chemical reactions). Au, Ag and Cu represent some of the most stab
		elements in nature. They are not readily oxidized and will act as the cathode (they get reduced).