School of Education & Human Development
UNIVERSITY OF COLORADO **DENVER**

LESSON PLAN 1

STANDARD(S) Discuss the standards that this lesson addresses. • Colorado Academic Standards • Common Core Standards • Next Generation Science Standards	NGSS HS-PS2-4 Motion and Stability: Forces and Interactions - **Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.** HS-PS3-2 Energy - **Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects).** HS-PS3-5 Energy - **Develop and use a model of two objects interacting through ele fields to illustrate the forces between objects and the changes in energy of the ob interaction.** Colorado Academic Standards Physics 1.The sub-atomic structural model and interactions between electric charges at the atomic scale can be used to explain the structure and interactions of matter. 5. Forces at a distance are explained by fields that can transfer energy and can be described in terms of the arrangement and properties of the interacting objects and the distance between them. 8. Force fields (gravitational, electric, and magnetic) contain energy and can transmit energy across space from one object to another.
LEARNING OBJECTIVE(S) What each learner will know and be able to do by the end of the lesson.	CT's Learning Objective for Day 1 of this unit (Lesson 1 and 2) -"I can describe the basis for gravity and electrostatic forces." Sub-Learning Objectives for this lesson plan, To support reaching the primary goal stated above and based on the unit quiz posted on google drive by my CT for this unit -Students will be able to describe the conceptual meaning of Coulomb's Law of charged particle attraction and repulsion

	-Students will understand that the charged or neutral nature of the particles of a substance affect its characteristics, and will be able to use this information to analyze the effect of a magnet on iron filings in the presence of a medium composed of an insulator (air) and medium composed of a conductor (water). -Students will be able to make predictions and explain their observations and results based on these principles.
LANGUAGE DEMANDS Identify the key language domain, function and vocabulary that students will need in order to succeed in meeting the learning objectives in this lesson. ● Language Domains (Reading, Writing, Speaking, Listening) ● Language Functions (the purpose of the language use e.g., compare/contrast, cause/effect, describe, analyze, persuade) ● Vocabulary (brick & mortar, connecting words, academic vocabulary)	Language Domains: Students will use all 4 language domains, Reading, Writing, Speaking, and Listening. Language Functions: The purpose of the language content is to understand technical scientific language, as well as a focus on cause and effect relationships, and the ability to describe physical principles. Vocabulary: Emphasis is on contextualizing technical language of physics and mathematics through hands on engagement, evidence based reasoning, and inquiry. Vocabulary Words and Terms: -Positive charge -Negative charge -Charged particle -Neutral particle -Distance between particles -Coulomb's Law -Insulator -Conductor -Electrostatic repulsion -Electrostatic attraction
COGNITIVE RIGOR Using the language of Bloom's Taxonomy of Webb's Depth of Knowledge (DOK), discuss the cognitive rigor of this lesson.	Depth of Knowledge Level 3 - Strategic thinking -Assess -Compare -Investigate -Get evidence -Draw conclusion -Formulate -Hypothesize -Explain phenomena in terms of concepts Blooms Taxonomy -Remember – Understand – Apply – Analyze -Evaluate

LESSON BREAKDOWN - In the tables below, describe the lesson with as much detail as you can. You may hyperlink resources/materials/worksheets/assignments that students will use during the lesson.

LESSON INTRODUCTION (Lesson Launch/ Hook/ Anticipatory Set/ Do-Now) (Click Here for Description & Support)		
DESCRIBE THE LEARNING EXPERIENCE/ACTIVITY		
TEACHER ACTIONS	**STUDENT ACTIONS**	**TIME REQUIRED**
(Explain) Before class starts, teacher writes learning objectives, schedule, and key terms and definitions on the board		10 minutes prior to class
(Explain and Evaluate) Ask a volunteer to pass out a lesson packet for lesson 1 and 2 (as these lessons will actually be taught as one consecutive 90 minute lesson), containing mini lab and vocab sheet, and problems set for guided, group, and independent practice (I do, We do, You do) on the electrostatic attractive and repulsive force equation (Coulomb's Law) and Newton's Universal Gravitational Force Equation, which are the foci of this unit. While student volunteer (or teacher if no student volunteers) passes out packet, teacher briefly goes over learning objectives, the vocabulary, and schedule on the board verbally. Directs students to look at the vocab sheet (first section of lesson packet), and to please fill in the areas where drawing are asked for, and where they are asked to write terms and	Student volunteer passes out packets, students look through packets, listen, and see, what the schedule and learning objectives for the day are.	2.5 minutes

definitions in their own words as we go through these three lessons. (Engage) Teacher draws a dipole water molecule, an OH- and H+ ion, and reviews the concept of charge (has been covered in previous units), electrostatic attraction and repulsion, and how positive and negative charges can be imagined as how the positive and negative end of a magnet are attracted to one another.	Students take notes and start filling out the drawing and written section of their vocab sheets. Students listen and ask questions as they come up.	5 minutes

BODY OF THE LESSON

(Click Here for Description & Support)

DESCRIBE THE LEARNING EXPERIENCES/ACTIVITIES

TEACHER ACTIONS	STUDENT ACTIONS	TIME REQUIRED
(Engage, Explore, Elaborate, Explain, and Evaluate) Iron filing activity/miniature lab Teacher explains, draws on the board, and answers questions "Metals are easily excited by magnetic fields, which you learned a little about last week. Remember that whenever there's electrical energy (movement of electrons) there's also an electric field, and magnetic field. A magnetic field can also cause the movement of electrons. When a magnet is near metal, the electrons 'want' to move, and metals easily give up their electrons and take on a positive charge. This is why we can we use the magnets to explore the electrostatic properties of easily charged substances like iron filings, inert substances like glitter, insulators like air, and conductors like water"	 Students listen, take notes, and ask question	5 minutes

"We are going to be exploring this question more in this miniature lab, that we will be completing in the next 20 minutes. Please open your packet to the first page, and start the miniature lab, 'Electrostatic Attraction and Repulsion and the Physical Properties of Iron and Water'"	Introduce mini-lab	2.5 minutes
Summative Assessment 1 – Minilab and worksheet Formative Assessment 1 – Concept Check, Student Check-In, Check-List. During lab teacher asks each student if they can explain the term charge, in their own words. Check next to name on basis of having the conversation with each student (individually or in groups), check by name not based on accuracy of response, but on participation/engagement (listening counts). The main goal of this is to ensure organized dialogic instruction is being made accessible to all students.	Students will be guided to make prediction in writing, or with a drawing, about how the magnet will affect the movement of iron filings in each condition (all in a small contained jar), such as iron filings in air (charged particle in an insulator medium), iron filings in water (charged particle in conductive medium), and iron filings and glitter in air (charged and uncharged particles in an insulator medium). They will be guided to give an evidence based argument for their prediction in the lab packet. They will then be guided to make observations in writing and drawing about what they observe in various conditions, and then will be asked to write a few sentences about why they observed what they did and whether their predictions were supported by the evidence they collected (alternative hypothesis) or if their predictions were contradicted by the evidence they collected (null hypothesis). Students will work alone or in small groups (student choice).	25 minutes

CLOSING/DEBRIEF (Click Here for Description & Support)		
DESCRIBE THE LEARNING EXPERIENCE/ACTIVITY		
TEACHER ACTIONS	**STUDENT ACTIONS**	**TIME REQUIRED**
(Elaborate, Explain, Evaluate) Formative Assessment 2 Exit Ticket – "Please write or draw your explanation for how you think the polar nature of water effected the iron filings when the electrostatic field was created by the presence of the magnet."	Students write down their name, and their response to the prompt in writing or drawing form.	5 minutes

Differentiation	
Consider the variability of learners in the classroom. Discuss the instructional strategies you have planned to support access and challenge for all learners. This includes scaffolding, grouping, and differentiation of content, processes and products.	Supports – Each student receives a vocab sheet with a space for a drawing for each term, and writing it in their own words. Images will also be provided. Graphic organizers, and explaining technical concepts in their own language is frequently recommended for students with ELL plans, and will additionally support all students in developing their own individual learning styles and independence as learners. Formative Assessment 2– Exit Ticket – Students will summarize their understanding, in their own words in writing or as graphic organizers (recommended for students with ELL plans and for many learning styles), of charge, electrostatic attractive and repulsive forces, and the conceptual applications of Coulomb's Law. Students write or draw their response to the conceptual prompt:

	"Please write or draw your explanation for how you think the polar nature of water effected the iron filings when the electrostatic field was created by the presence of the magnet." Summative Assessment 1 – Minilab: This mini lab mirrors the labs which students in my classroom do every week. Students will have the opportunity to discuss their ideas with their classmates and teachers. This lab only involves qualitative data, which will set a foundation for the related equations covered later in this unit. I think it's a valuable learning tool, not least of all because it is fun and engaging! The purpose of this mini lab is not only to get students excited about the electrostatic force, but also to provide additional scaffolding for students who are still getting used to the formal labs in class. Students will still do their regular lab this week, and will be able to reference this mini lab. The slightly different structure or format (print vs. online) of this minilab may be helpful for some students. Again this will give them the opportunity to express their understanding in more ways, which in turn will give me information about how they best learn new content, and express their understanding.
Assessment	
What formal and informal evidence of student learning will you look for, listen for, and collect as part of the lesson? The types of evidence should be varied. What will you hope to see or hear in that evidence that shows that students made progress toward or met the lesson objectives?	Formative Assessment 1 – Concept Check, Student Check-In Check-List. During lab teacher asks each student if they can explain the term charge, in their own words. Check next to name on basis of having the conversation with each student (individually or in groups), check by name not based on accuracy of response, but on participation (listening counts). The main goal of this is to ensure organized dialogic instruction is being made accessible to all students. Formative Assessment 2 – Exit Ticket – ask each student to explain how they think the polar nature of water affected the iron filings when the magnet was applied. Summative Assessment 1 – Minilab write up

Explain how the design or adaptation of your planned assessments allows students with specific needs to demonstrate their learning. This should include multiple ways for students to demonstrate their learning.	Students are given the opportunity learn and to express their understanding in all major modes of expression and language domains, listening, talking, reading, writing, seeing and drawing.
Describe what you will look for to determine whether the supports provided for the language demands were successful.	If the language supports I provide are successful, all students will be able to use technical language like charge and electrostatic attraction/repulsion to describe their reasoning, predictions, observations, and conclusions for the minilab. Students will likely need clarification on the meaning of vocab and terms throughout class and unit, and should be able to use this new vocabulary independently (possibly with some small errors) by the end of these three classes, and should be able to accurately use new vocabulary in complex contexts by the end of the unit.

Resources Selected (Please provide links to the resources if possible)	**Why did you select this resource and how will it be used?**
Only materials for packets, notecards, student chrome-books, and the minilab will be needed for this lesson.	

Checklist for including in lesson:

- ✔ Active Engagement Strategies
- ✔ Language Demands
- ✔ Cooperative learning
- ✔ Critical thinking
- ✔ Arts Integration
- ✔ Checks for understanding
- ✔ Frequent feedback
- ✔ Student voice and choice
- ✔ Scaffolding
- ✔ Strategies to support ELLs
    - Visual supports
    - Explicit vocabulary
    - Realia
    - Native language support