	ARTS IN MOTION CHARTER SCHOOL| 11th Grade Chemistry CURRICULUM MAP				
Projects	**Essential Questions**	**Enduring Understandings**	**Cognitive Skills**	**CCSS**	**Final Product**
Absolute Zero	• What is the coldest possible temperature? • How do scientists use experiments and models to draw conclusions?	• Matter is made of particles which behave in predictable ways.	• Argumentative Claim • Introduction and Conclusion • Justifying / Constructing an Explanation • Modeling • Multimedia in Written Production • Selection of Evidence • Style and Language (Tone, Academic Language, Syntax)	• NGSS.HS-PS1-1 • NGSS.HS-PS1-2 • NGSS.HS-PS1-3 • NGSS.HS-PS1-4 • NGSS.HS-PS1-5 • NGSS.HS-PS1-6 • NGSS.HS-PS1-7 • NGSS.HS-PS1-8 • NGSS.HS-PS3-1 • NGSS.HS-PS3-2	• Scientific Poster
Chemical Reaction Investigation	• How do chemical reactions affect the world around us?	• Understanding chemistry depends on knowing chemical reaction principles: mass (particles) is always conserved. • Answerable questions are simple, not complex, yet their answers build a complex understanding about reactions, and change.	• Asking questions • Conventions • Interpreting Data/Info • Justifying / Constructing an Explanation • Modeling • Multimedia in Written Production	• NGSS.HS-PS1-1 • NGSS.HS-PS1-2 • NGSS.HS-PS1-3 • NGSS.HS-PS1-4 • NGSS.HS-PS1-5 NGSS.HS-PS1-6 • NGSS.HS-PS1-7 • NGSS.HS-PS1-8 • NGSS.HS-PS3-1 • NGSS.HS-PS3-2	• Investigation Plan • Small Group Presentation
Biodiesel	• What does it take to make the best possible sustainable fuel? • How do scientists use literature and laboratory research to acquire new information?	• Humans alter the environment based on their actions, and the changes adds up to affect the overall global system. • With increasing awareness of the environmental impact of our actions, many have called on renewable, cleaner energy sources to replace our diminishing nonrenewable energy supplies. • Scientific research plays a critical role in solving this type of global problem. • In this project, you will engage in the same processes scientists use to learn new information, both through investigating what other people have already learned, and through designing experiments to yield information that, to this point, is unknown.	• Asking questions • Designing Processes and Procedures • Explanation of Evidence • Hypothesizing • Interpreting Data/Info • Introduction and Conclusion • Norms / Active Listening	• NGSS.HS-ETS1-1 • NGSS.HS-ETS1-2 • NGSS.HS-ETS1-3 • NGSS.HS-ETS1-4 • NGSS.HS-PS1-1 • NGSS.HS-PS1-2 • NGSS.HS-PS1-3 • NGSS.HS-PS1-4 • NGSS.HS-PS1-5 • NGSS.HS-PS1-6	• Scientific Journal Article about Biodiesel
Nuclear Technology	• Would humanity be better off without	• Nuclear technology is an issue with no easy answers; we must weigh both the benefits	• Argumentative Claim • Comparing/ Contrasting	• CCSS.ELA-LITERACY.RI.11-12.1 • CCSS.ELA-LITERACY.RI.11-12.2	• Timed in-class synthesis Essay

	radioisotopes?	and drawbacks of it to reach a conclusion.	• Counterclaims • Explanation of Evidence • Integration of Evidence • Point of View/Purpose • Precision • Synthesizing Multiple Sources	• CCSS.ELA-LITERACY.RI.11-12.3 • CCSS.ELA-LITERACY.RI.11-12.4 • CCSS.ELA-LITERACY.RI.11-12.5 • CCSS.ELA-LITERACY.RI.11-12.6 • CCSS.ELA-LITERACY.RI.11-12.8 • CCSS.ELA-LITERACY.W.11-12.1 • CCSS.ELA-LITERACY.W.11-12.5	
Adopt a Molecule	• What microscopic differences in elements and compounds create their unique properties that we experience at the macroscopic level? • How can we accurately represent these properties using different model formats?	• We use a huge variety of chemicals in our everyday lives because these chemicals have certain useful properties. • These properties are a result of the chemical's structure which in turn is a result of its atomic makeup. • In other words, chemicals in our everyday lives are governed by the same chemical laws we are learning about in class, so we can use what we learn in class to better understand the world around us.	• Comparing/ Contrasting • Modeling • Multimedia in Oral Presentation • Oral Presentation • Precision • Selecting Relevant Sources	• NGSS.HS-PS1-1 • NGSS.HS-PS1-2 • NGSS.HS-PS1-3 • NGSS.HS-PS1-4 • NGSS.HS-PS1-5 • NGSS.HS-PS1-6 • NGSS.HS-PS1-7 • NGSS.HS-PS1-8	• Performance Task
Candle in a Jar	• Why is the pressure inside the flask lower right before the water rushes in?	• Scientific knowledge is generated through the culmination of many experiments and debate.	• Counterclaims • Designing Processes and Procedures • Explanation of Evidence • Hypothesizing • Integration of Evidence • Organization (Transitions, Cohesion, Structure)	• NGSS.HS-ETS1-1 • NGSS.HS-ETS1-2 • NGSS.HS-ETS1-3 • NGSS.HS-ETS1-4 • NGSS.HS-PS1-1 • NGSS.HS-PS1-2 • NGSS.HS-PS1-3 • NGSS.HS-PS1-4 • NGSS.HS-PS1-5 • NGSS.HS-PS1-6	• Performance Task: Write an essay defending your investigation.

ARTS IN MOTION CHARTER SCHOOL| 11th Grade Chemistry UNIT PLAN	
Project	Absolute Zero
Suggested Time	● 5 Weeks
Essential Questions	● What is the coldest possible temperature? ● How do scientists use experiments and models to draw conclusions?
Enduring Understandings	● Matter is made of particles which behave in predictable ways.
Cognitive Skills	● Argumentative Claim ● Introduction and Conclusion ● Justifying / Constructing an Explanation ● Modeling ● Multimedia in Written Production ● Selection of Evidence ● Style and Language (Tone, Academic Language, Syntax)
Focus Areas	● Periodic Table ● Intramolecular Forces (Bonding) ● Intermolecular Forces
CCSS	● NGSS.HS-PS1-1 ● NGSS.HS-PS1-2 ● NGSS.HS-PS1-3 ● NGSS.HS-PS1-4 ● NGSS.HS-PS1-5 ● NGSS.HS-PS1-6 ● NGSS.HS-PS1-7 ● NGSS.HS-PS1-8 ● NGSS.HS-PS3-1 ● NGSS.HS-PS3-2

Checkpoints	• Justify and Construct Explanations using Experimental Data • Construct your Argument about Absolute Zero • Model your Argument at the Particle Level • Error Analysis and Future Work • Compile and Finish your Poster Presentation • Peer Review your Poster Presentation •
Final Product	• Scientific Poster (See attached Sample)

ARTS IN MOTION CHARTER SCHOOL|11th Grade Chemistry LESSON PLAN					
Project	Absolute Zero	**Essential Questions**	• What is the coldest possible temperature? • How do scientists use experiments and models to draw conclusions?	**Final Product**	• Scientific Poster

Checkpoint	• Justify and Construct Explanations using Experimental Data
Cognitive Skills	• Comparing/Contrasting
Objective	• Students will conduct experiments of your choice to observe relationships between particle behavior and the laws that govern gases in chemistry. "Uncovering Absolute Zero" is required.
Activities	• Ball and Ring Experiment (See attached Sample) • Expanding Balloon Experiment • Uncovering Absolute Zero Experiment • Weasel Ball Experiment •
Resources	• Smelly Balloon Experiment (linked) • Soda Bottle Experiment • Food Dye Experiment

	• Modeling Workshop
Assessment	• Performance task assessment using cognitive skills (See attached Sample)

Absolute Zero Final Product Introduction

Hypothesis: ***If*** *students are aware of what a high-quality final Absolute Zero presentation looks like,* ***then*** *they will better be able to create a high quality presentation,* ***because*** *the information gained from seeing strong examples will influence their own products.*

Background information:

The final product for our first project is a **poster presentation**.

1. The poster can be done **by hand** with poster board and various supplies.

- OR -

2. The poster can be completed digitally in **Google Slides**
   a. Check these out for ideas: Posters

Procedure:

Read through the following information before answering the questions on the last page.

Absolute Zero Final Poster Requirements

Cognitive Skills on the Absolute Zero Project	**# of Times assessed this year**	**Where is this skill assessed in Absolute Zero?**
Modeling	3	Data / Diagrams: *The particle diagrams (one for each subclaim) are accurate and clearly illustrate your reasoning.* *The pressure/temperature lab data and graph are present and an explanation is given on how the graph is used to derive the value of absolute zero.*
Justifying and Constructing an Explanation	3	Argumentative Essay: *The subclaims paragraphs and conclusion have clear explanations and adequate evidence to support the main claim.*
Argumentative Claim	2	Argumentative Essay: *Clear introduction of your main claim and sub claims.*

		There is a paragraph that explains how all of your subclaims connect together to support the main claim.
Selection of Evidence	1	Argumentative Essay: *The experiments and demos you select as evidence should share the same variables of interest as your subclaims.*
Introduction and Conclusion	1	Argumentative Essay: *The abstract and the first paragraph of your argumentative essay should clearly establish the purpose of the study.* *The last paragraph of your argumentative essay should summarize how the key points of your subclaims support your main claim.*
Style and Language	1	Argumentative Essay: *The accurate use of vocabulary and grammar of your writing and use of appropriate academic language.*
Multimedia in Written Production	2	The poster as a whole multimedia unit: *Efficient use of space, logical flow between different elements, different components build upon one another.*

The components of your final presentation must include:

Title

- Your title should give the reader some indication about what the rest of the poster is about.

Abstract

- State your major claim and a really brief summary of your report.
- Write 1-3 sentences stating:
    - What you have learned or concluded regarding Absolute Zero (i.e. main claim: The lowest possible temperature is ____ ℃).
    - A *very* short description of how you arrived at your conclusion.

Argumentative Essay:

1) Introduction

- Write one paragraph which explains:
    - The purpose / goal of the study (finding the lowest possible temperature).
    - The subclaims you will use to support your main claim and your reasoning behind these subclaims.

2) Subclaims 1, 2, & 3

Subclaim paragraphs must have a **clearly stated** subclaim and an explanation for how it relates to the main claim (Lowest possible temperature = ____ ℃). Each subclaim must be supported by at least one experiment or demo as evidence as well as reasoning to explain why the results of the experiment / demo supports the subclaim.

IMPORTANT: ONE OF THESE SUBCLAIMS **MUST** USE THE PRESSURE/TEMPERATURE LAB AS EVIDENCE

Each experiment or demo (Ball and Ring, Balloon on a Flask, Smelly Balloon, etc.) listed as evidence must have the following:

- **Procedure:** How was the experiment/demo carried out? *You shouldn't write details about every little step, instead summarize the big idea of the experiment*.
- **Results:** What happened? Observations. *You can reference the particle diagrams and data section.*
- **Discussion:** What did we learn from the experiment/demo? *Especially, what did the evidence have to do with the main claim?*

3) Conclusion

- Write one or more paragraphs which
    - Restate your main claim (Lowest possible temperature is…).
    - *Describe* the evidence in support of your claim.
    - *Explain* the reasoning of why your evidence supports your claim.
- Write one paragraph which discuss **sources of error**
    - What error is in the design of the experiment? *And* what human errors did you or your classmates make?
    - Calculation of % error
    - What assumptions did you have to make?
- Write one paragraph which discusses **new questions,** a new hypothesis, or describes experiments you would want do next.

Data and Diagrams:

- **Particle Diagrams**: A before and after diagram (one for each subclaim) that accurately and effectively communicates what happened in each discussed experiment/demo on a particle level.

- **Pressure and Temperature Lab Data**
    - Data table for Pressure/Temperature Lab.
    - Desmos Graph with four data points, x-intercept point, and best fit line.
    - Equation of best fit line.

Questions to be answered:

What type of materials will you use to make your poster? (*Will it be physical or digital?*)

Make a checklist in this document of the components that need to be in your final poster presentation

- ❑ Title
- ❑
- ❑
- ❑
- ❑
- ❑
- ❑
- ❑
- ❑

People like to think that science is all about non-stop experiments. However, it's not. Most of a scientist's job is actually writing, much like an author. Scientists have to write to receive funding from the government and must write their data in a way that other people (especially non-scientists) can understand. ***To be a scientist is to be a writer****.*

Now that you know what is required in our final poster presentation, begin putting together the pieces that you've already completed into a final poster presentation. If you need to finish any of the previous components, you now may do so now.

Name: _____ Date:_____

Pressure and Temperature

Purpose: Temperature can drastically affect the motion of particles (atoms or molecules) -- but we don't know by how much. Moving particles cause collisions that we can measure as pressure. Today, we're going to measure the effect of temperature on air pressure at four different temperatures, in order to draw conclusions about how the particles are moving at different temperatures.

Procedure (Part A) -- Set Up

1. Set up two beakers:
    a. Turn your hot plate to Medium. Place a beaker half full of water on the hot plate. (If it starts to boil, turn down the heat.)
    b. Add ice and water to a beaker. Set the ice water on the desk. It should be about half full.
1. Connect the Labquest pressure probe to the flask by securing the stopper. Close the blue valve.

Procedure (Part B) -- Gathering Data

1. Record room temperature. Record the pressure inside the flask. The pressure reading will probably change around a little; get the best estimate that you can. Record on the data table below.
2. Carefully take the hot water beaker off of the hot plate and set it on your table. Place the thermometer and flask in the hot water beaker. One person may need to hold the flask steady in the hot water. Don't let the stopper pop off!
    a. When the pressure reading stops increasing (the last digit or two might still bounce around) record the temperature of the hot water bath and the pressure of the heated flask on the data table below.
3. Remove the flask from the water and let the flask cool until it is comfortable to hold in your hand.
4. Immerse the flask and the thermometer inside the ice water. Gently stir the ice water with flask (NOT the thermometer!).
    a. When the pressure reading stops decreasing record the temperature of the ice water and the pressure of the cooled flask.
5. If available, find the dry ice and alcohol bath. Immerse your flask in this bath.
    a. When the pressure reading stops decreasing record the pressure of the very cold flask.

	Temperature (°C)	**Pressure (mmHg)**
Room Temp		
Heated		
Ice Water		
Dry Ice	–78ºC	