Grade Level	4	**Content Area**	**Science**
Course Title (grades 9-12 Only)			
Length of Unit	4 days	**Time of Year**	Late March - early April
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	4.1.1.1 - 4.1.2.1 Experience with following instructional steps, reading scientific measuring instruments, following safety procedures and rules, read scientific measuring instruments, willingness to analyze information and data gathered in experiments.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	Direct Instruction Mastery based instruction Ability grouping Project learning Group learning		
Standard Number and Description *List the Number* and full description for the required Standard.*	Grade: 4 Strand: 1 - Inquiry Process 4.1.3.1 Concept: 3 – Analysis and Conclusions (organize and analyze data; compare to predictions) PO: #1 - Analyze data obtained in a scientific investigation to identify trends.		
Summative Assessment *Describe a cumulative and comprehensive activity, clearly separate from instruction and guided or independent practice, which allows each student to individually demonstrate mastery of the required Standard. A copy of the summative assessment must be attached to the curriculum sample.*	Students will demonstrate mastery of the 4th grade science standard 4.1.3.1 by determining the correct answers on a 100 point test. Student will conduct a scientific experiment, gather data, analyze the data to identify trends and compare the results with their prediction to develop a conclusion. See attached Student Assessment/Rubric/Key/Student Answer Sheet		
Scoring Scale and Mastery Level *Explain how the assessment is scored, to include points per question, how points are awarded, total points possible, criteria necessary to demonstrate mastery, and grading scale. A copy of the answer key and scoring rubric (whichever applicable*	School grading scale as follows: 100 points = 100% Mastery 94% - 100% = A **<u>80 points (80) % = Mastery of standard 4.1.3.1</u>** 87% - 93% = B 80% - 86% = C 70% - 79% = D Needs remediation 69% - 0% = Needs remediation		
Materials/Resources Needed	Pressure vessel, manifold pressure gauge, electronic thermometer, manometer, white board, ice, butcher paper, heat engine, dichlorodifluromethane, rockets		

Lesson (add as needed)	Instruction	Student Activities
1	Lesson 1 Objective: **I can learn terminology used in the science of heat energy, ask questions and gather data to formulate a prediction based on what I have observed.**	
	1 - Teacher welcomes students to class and states the posted lesson objective.	Students repeat objective.
I Do	2 - Teacher instructs students to take Cornell notes as the teacher introduces scientific terminology words and their definitions and how to read scientific instruments that measure pressure and temperature.	Students are given a notebook to take Cornell notes as they practice their listening skills.
We Do	3 - Teacher introduces the inquiry process of science and explains, demonstrates, and describes one of the many inquiry process models previously selected for the instruction of standard 4.1.3.1.	Students answer questions to lesson material their teacher explained to them in #3.
	4 - Teacher leads students in an interactive discussion to verify that each student has a basic understanding of how the model is to be accomplished. (Formative Assessment)	
	5 - Teacher informs the students that mankind has benefitted from science in many ways because we ask questions, formulate predictions, test our predictions through investigations and experiments, analyze the data to identify trends and draw conclusions based on proven data.	Students practice their listening skills as they take Cornell notes.
I Do	6 - Teacher informs the students that the science subjects to be studied in this unit will be the science of heat energy and pressure energy and how they influence the behavior of water and air.	Students observe a teacher demonstration.
	7 - Teacher places a model heat engine on his/her hand. The engine begins to rotate but when placed on the desk it stops rotating. The teacher places the heat engine on a hot coffee cup and it begins spinning again.	Students continue taking Cornell notes and defining new vocabulary – Fahrenheit thermometer.
	8 - Teacher introduces the science of heat energy explaining that heat is defined as energy in motion and that it always travels in one direction, from hot to cold. Teacher explains that	

	one way to measure heat is to measure its temperature with a thermometer that measures heat in numbered degrees called Fahrenheit or F.	
We Do I Do	9 - Teacher informs students that the coldest temperature known to mankind is -459.6 degrees F and explains that anything warmer than that is considered hot because it has heat that can be measured. 10 - Teacher poses the question, " Does ice at -100F below zero have heat in it?" (Yes, ok so ice is hot right?)	Students "Think, Pair, Share" before teacher provides the correct answer Students observe that the liquid is boiling without being on a stove but it is very cold - opposite of anything they have seen before.
You Do	11 - Teacher displays a glass bottle containing a clear liquid which appears to be water but it is boiling intensely and is changing into a cloud of smoke before disappearing.	Students groups think about the boiling liquid and write questions on butcher paper.
We Do We Do	12 - Teacher divides the class into two groups and asks the students to write a list of their group's questions on blank butcher paper. Teacher reviews their questions. (Formative Assessment) 12 - Teacher takes students to the computer lab to search for data relating to the boiling liquid providing guidance as needed.	Students use the Internet to search for information pertaining to the boiling liquid. Each group write down all the data or information they gathered from the computer lab below their list of questions on their group's butcher paper.
We Do	13 – On returning to class, the teacher instructs students to write the data they obtained from the computer regarding the boiling liquid on their group's butcher paper. Teacher circulates and provides guidance as needed.	The students work with their group to organize and discuss the data and use the results to formulate a group prediction.
2	14 - Teacher asks students to discuss the information (data) on their group's butcher paper and formulate a prediction. 15 - Teacher reads the lesson objective and class is dismissed.	
You Do	Lesson 2 Objective: **I can safely conduct, organize and analyze the data in an experiment and compare the data with my prediction to identify trends.**	Students complete a quiz.
We Do	1 - Teacher welcomes students to class and reads the lesson objective. 2 - Teacher reviews Lesson 1 and administers a written quiz based on content, concepts, and terms presented in Lesson 1.	Students present their group's work to the class.

	(Formative Assessment) 3 - Teacher has each student group share their questions, data and predictions with the class.	Students practice conducting a scientific experiment, reading instruments in a safe manner.
We Do	4 - Upon completion, the teacher provides the equipment and materials necessary for each group to conduct an experiment regarding the boiling liquid. Safety concerns are reviewed.	Student groups practice using scientific instruments to take temperatures on surfaces involving the boiling liquid.
We Do	5 - Teacher asks students to use digital thermometers (designed to operate with four remote wireless sensors) to take temperature reading. Students of each group attach sensors to various surfaces of their experiment to take accurate temperature readings of the boiling liquid experiment.	Students record the experiment's data on their group's butcher paper below their questions and predictions.
I Do	6 - Upon completion, the teacher asks students to record the data collected on their group's butcher paper that now has their list of questions, researched information and their predictions. .	
We Do	7 - Teacher demonstrates how to organize, analyze and compare all of the data they have gathered and use the results to identify trends.	Students organize and analyze the data to identify trends, compare the results with their predictions and develop a conclusion.
You Do	8 - Teacher asks students to apply what they were taught in #7 by organizing, analyzing and comparing all of their data on their group's butcher paper and use the results to identify trends.	Students draft a written conclusion and submit it to the teacher.
	9 - Upon completion, teacher asks each student to draft a written report of his or her conclusions including identifying trends. (Formative Assessment) 10 - The teacher reviews the conclusions telling the class that they are correct and can be proud of their successful application of the inquiry process.	*The students identified the liquid as dichlorodifluromethane (known as refrigerant R-22) that has a boiling temperature point of -40.6 F below zero. They concluded that the refrigerant at -50F does not boil but actually behaves like water does and they concluded that the heat in the room was sufficient heat to cause the liquid to boil the jar.
3	13 - Teacher reads the lesson objective and class is dismissed.	
You Do	Lesson 3 Objective: **I can ask questions about what I observe, formulate a prediction, conduct a scientific experiment to gather actual data, organize, analyze and compare that data and use the results to identify trends.** 1 - Teacher welcomes students to class and reads the lesson	Students repeat the objective. Students complete a quiz.

I Do	objective. 2 - Teacher briefly reviews Lesson 1&2 and administers a written quiz regarding information presented. (Formative Assessment)	Students observe teacher conducting an experiment with ice.
We Do	3 - Teacher illustrates the science experiment of 1 pound of ice melting to water yet never changing temperature. 4 - Teacher asks the students to proceed using the inquiry process model presented in previous lesson.	Students work in groups to gather information in the computer lab.
We Do	5 – Teacher forms students into two new groups to write their questions on butcher paper, go to the computer lab and gather information regarding the melting of ice. 6 – Upon return to the classroom teacher instructs groups to write form a circle, discuss the gathered information and formulate a prediction to write on their butcher paper.	Students work collaboratively to use information to form a prediction they add to their butcher paper chart.
We Do	7 - Teacher circulates to verify each student has participated and is demonstrating new skills in using the inquiry process model. (Formative Assessment)	Student groups conduct an experiment.
We Do	8 - Teacher provides the student groups with the materials and scientific equipment necessary for the students to conduct an experiment. 9 - Upon completion, the teacher instructs students to gather the experiment's data and write it on their butcher paper, then form a circle to analyze the data to identify trends, compare the results with their predictions and develop their conclusions.	Student groups record the experiment's data, write it on the butcher paper, analyze the data to identify trends, compare the results with their predictions and develop conclusions.
4	10 - Teacher briefly each group's conclusions to verify each student is mastering use of the inquiry process model to acquire a higher level of knowledge and understanding of the world of science. (Formative Assessment) 11 – Teacher reads the objective and class is dismissed.	Class repeats the objective.
I Do	**Lesson 4 Objective: I can show mastery of the inquiry process by independently asking questions about what I observe, formulating a prediction, conducting a scientific experiment to gather actual data, organizing, analyzing and comparing that data to identify trends.**	Students repeat the objective. Students observe the teacher assemble and launch the

	1 - Teacher welcomes students to class and reads the lesson objective. 2 - Teacher places water in a plastic container with a wireless waterproof temperature sensor in that water. The lid, which has air holes in the top, is then sealed. Teacher places the container inside the payload section of a model rocket and takes the rocket outside. Teacher instructs students to observe	assessment demonstration model and record pre/post launch data and questions in their notebooks.
You Do	the water temperature before and after the demo launch and formulate questions to research in lab.	Students go to the computer lab to gather sufficient data to formulate a prediction independently.
You Do	3 - The teacher takes the students to the computer lab to gather sufficient data to formulate a prediction.	Each student is given a pre-assembled rocket to use in duplicating the teacher's demonstration.
You Do	4- The teacher gives each student a pre-assembled rocket and they duplicate their teacher's demonstration with the exception that they place temperature sensors and pressure gauges in the water in the rocket. They also place thermometers outside near the rocket launch pad to measure ambient temperature.	Students record requested data.
	5 - The teacher instructs students to record data in their notebooks as they conduct their experiments (with no help) by following the steps below.	
You Do	6 - **STEP 1 - Take the instrument readings 2 times** First time - **Before launch** Second time - **During flight** 7 - **STEP 2 - Return to class and complete the Summative Assessment Form.**	Students complete their summative assessments independently. Students repeat the objective.
	8 – Teacher reads the objective and class is dismissed.	

John Hancock Academy
4th Grade Science
Summative Assessment Rubric/ **Key** / Student Assessment Sheet
Inquiry Process 4.1.3.1

Write the readings you recorded from the digital thermometer, electronic thermometer, manometer, and other test equipment below. Turn in your work to your teacher when completed.

Readings:

10 points - Rocket Atmospheric pressure reading ranges	= **14.7 psi - 12.6 psi**
10 points - Mercury manometer at sea level	= **29.92 inches hg** .
10 points - Ambient temperature outside launch pad	= **75.7 degrees F**
10 points - Lowest temperature of water in the rocket	= 54.8 **degrees F**
20 points -Total temperature difference before and after launch	= 2**0.9 degrees F**. (analyzed data)

20 points - **Prediction**: Water temperature will:

A - Get warmer
X B - Get colder
C - All the above
D - None of the above

20 points - Identified Trend: The experiment data proved that:

A - Atmospheric pressure decreased as the rocket gained altitude.
B - Atmospheric pressure increased as the rocket gained altitude.
X C - Pressure and temperature have a relationship and as pressure exerted on the water decreased, the temperature decreased.
D - None of the above