Helena-West Helena School District

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr>
<td rowspan="3">ESTABLISHED GOALS/ STANDARDS
What content standards and program- or mission-related goal(s) will this unit address?
NS.1.7.7 Distinguish between questions that can and cannot be answered by science
NS.1.7.9 Compare an contrast hypotheses, theories, and laws
NS.1.7.2 Analyze components of experimental design used to produce empirical evidence:
hypothesis,
replication,
sample size,
appropriate use of control,
use of standardized variable,
elimination of bias
NS.1.7.1 Interpret evidence based on observations
NS.1.7.3 Interpret scientific data using mean, median, mode, and range using SI units
NS.1.7.4 Construct and interpret scientific data using:
histograms
circle graphs
scatter plots
double line graphs
line graphs by approximating line of best fit
NS.1.7.5 Communicate results and conclusions from scientific inquiry

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<th colspan="2">Transfer</th>
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<td colspan="2">Students will be able to independently use their learning in new situations to…
What kinds of long-term, independent accomplishments are desired?
1. Design objective, unbiased experiments to appropriately collect, analyze, and interpret data
2. Identify bias in their work and the work of others, and propose alternative, unbiased explanations. Differentiate between fact and opinion.
3. Write a correct and complete lab report
4. Give and receive constructive criticism (begin to learn how to do this)
5. Failure can be a good thing. Mistakes are learning opportunities, not sins.</td>
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<td>Meaning

UNDERSTANDINGS: Students will understand that…
What specifically do you want students to understand? What important ideas do you want them to grasp? What inferences should they make?
1. They use science in everyday life, even though they haven't realized it. They use it themselves, AND they critique ("peer-review") others' scientific processes all the time… whether or not they know it.
2. Science is used to study, observe, and test the natural world.
3. There are multiple ways to interpret the same results, and not all of them may be correct.
4. Know how to properly design an experiment, record and analyze the results, draw objective conclusions, and clearly communicate the whole process</td>
<td>ESSENTIAL QUESTIONS: Students will explore & address these recurring questions:
What thought-provoking questions will foster inquiry, meaning-making, and transfer?
1. What are some instances in my daily life in which I use science?
2. Is this a scientific question?
3. Is this fact or opinion? Are there alternate explanations?
4. How do I test a question I have?
5. How do I record what I'm doing so that anyone could understand it and do it themselves?
6. How do I record the results? (including graphing)
7. What do the results mean?
8. How do I tell people about what I've done?
9. What can I learn from this mistake?
10. How do I give and receive constructive criticism?</td>
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	Acquisition	
	Students will know… *What facts and basic concepts should students know and be able to recall?* **(See below)**	*Students will be skilled at…* *What discrete skills and processes should students be able to use?* 1. Recording data and observations in an accurate, precise, organized manner (includes learning to make graphs and data tables) 2. Making inferences based on observations 3. Analyzing (looking at) data to draw conclusions 4. Communicating their inquiry process and its results in a clear and organized manner 5. Identify bias in their work and the work of others, and propose alternative, unbiased explanations. Differentiate between fact and opinion. 6. Critiquing the work of peers in a respectful manner with constructive criticism, and using constructive criticism from others to improve their own work 7. Writing a correct and complete lab report

Acquisition – Content Knowledge

Students will know…

Standard	Question	Content knowledge	Task Analysis	Labs and activities
NS.1.7.7 Distinguish between questions that can and cannot be answered by science	• Who cares? Why do I have to learn this stuff? • What is science, and what can it be used for? What can it NOT be used for? • How do I use science in my everyday life already?	• Science is used in everyday life. The devices and modern conveniences of life were all made possible by science. The study of science has advanced our understanding of the world around us (e.g. germs cause sickness, not spirits; the world is round, not flat). In addition, the skills you develop by learning and using science will help you succeed in life. • Science is a practice that tries to explain the natural world based on empirical (observable) evidence. Science can only answer questions about the natural world that can be observed. Those observations can be replicated and verified by other scientists.	• Identify and write questions that can be answered by science and questions that CANNOT be answered by science • Identify scenarios in everyday life where problem-solving skills are used	
NS.1.7.9 Compare and contrast hypotheses, theories, and laws	• What is the difference between hypotheses, theories, and laws? • Is a conversational theory the same as a scientific theory?	• A hypothesis is an "educated guess", which means that it is a suggested <u>explanation</u> for something based on some prior observations and knowledge. It is an idea that can be **tested.** • A scientific theory is a broad explanation based on verification from many lines of evidence, not just repeated testing of one hypothesis. A theory is developed over a period of time; it is based on several hypotheses that are supported by data and verified by other scientists (peer-reviewed). When something	• Compare and contrast hypotheses, theories, and laws • Give examples of valid hypotheses and invalid hypotheses • Explain why and how scientific theories can be changed • Differentiate between a scientific theory and a conversational theory, and cite examples	• Modeling theory modification: "Dogs and Turnips" activity

		becomes a theory, this means that it is now accepted as the best explanation for a phenomenon by the scientific community. But, theories may change; over time, as more evidence is gathered and new technology is invented to make more observations, theories may be modified. • A scientific theory is different from a conversational theory. A scientific theory has been scientifically tested and verified, and a conversational theory is merely an opinion, a statement that cannot be tested using science. • A law is a historical term that is used to describe a phenomenon that seems to happen the same way every time. (example: law of gravity)		
NS.1.7.2 Analyze components of experimental design used to produce empirical evidence: hypothesis, replication, sample size, appropriate use of control, use of standardized variable, dependent and independent	• How do I test a question that I have? (How do I design a good experiment?) • Why are controls important?	<u>hypothesis</u>**:** (see above) (Note: Often a prediction is a better starting point for a student's investigation, since a detailed explanation is not expected.) <u>Replication</u> is the number of times you repeat an experiment. It is important in experimental design because it leads to more reliable data. What if something went a little wrong the first time? <u>Sample size:</u> the number of repeated measurements/observations made. Usually, the larger the sample size, the more likely the data will be reliable. <u>Control:</u>is the "natural state"; a group where conditions are not changed, and what other groups are compared to. Controls are	**<u>Task Analysis:</u>** • Come up with a scientific question and create a testable hypothesis for that question • Correctly design an experiment to test the hypothesis, incorporating all elements of experimental design	**<u>Suggested labs/activities:</u>** • Princess Bride variables scenarios • Drops of water on a penny • Finger maze timing • Rope wrist tangle

variables, elimination of bias		important because they allow scientists to determine whether their independent variable had any effect. standardized variables are all the variables that you keep the same in an experiment (that is, not the independent variable). They are important to ensure that the variable being tested is really the one that causes the effect. Independent variable: This is the factor that is changed by the investigator; the thing that we are trying to determine the effect of. It is the cause. Dependent variable: The result that you measure -- the effect -- is the "dependent variable" Bias: if an experiment is biased, this means the experiment is "unfair" – it is skewed toward a particular conclusion. It is important to eliminate bias so that you can get an accurate result.		
NS.1.7.1 Interpret evidence based on observations	• What is the relationship between an observation and an inference? • How do I correctly infer a conclusion based on my data?	• An observation is something you perceive with your senses. An inference is a guess based on your observations. You do not directly observe an inference. A hypothesis is a type of inference. • Evidence is test data or observations that can be used to support or refute a scientific idea. • To make sure that observations are accurate (i.e., as close to the "real" value as possible), they need to be repeated to show that they happen time	**Task analysis:** • Compare observations and inferences • Carry out the previously designed experiment and collect data • Infer an answer to the hypothesis using the observed data	• Analyze results of above experiments

		and time again.		
NS.1.7.3 Interpret scientific data using mean, median, mode, and range using SI units	• Why do we need to consider the mean, median, mode, and range when comparing scientific data?	• "mean" is the same as average. It is important to be able to compare the collective result of our experimental measurements to another data set, in order to see if there is a difference between them. • "median" is the halfway point between two extreme data points. • "mode" is the number that occurs most often in a data set. • "range" is very important because it tells us how spread out the data is. It gives us the extreme values. The wider the spread in a data set, the less reliable the data is.	• Calculate mean, median, mode, and range of data sets	• Analyze results of above experiments
NS.1.7.4 Construct and interpret scientific data using: histograms circle graphs scatter plots double line graphs line graphs by approximating line of best fit	• How do I appropriately visually present my data?	• Graphs provide a visual representation of data and often allow us to see patterns and trends more easily. Different sets of data are often easier to interpret when using different types of charts/graphs. • <u>Bar Graph:</u> If the independent variable is categorical or discrete, and the dependent variable is continuous. • <u>Line Graph:</u> If both variables are continuous and are numbers. • <u>Scatter Plot:</u>Use when there is a large number of independent variables, resulting in a large number of dependent variables. Good for identifying correlations. • <u>Histogram:</u> Looks like a bar chart without gaps between the bars. It	**<u>Task analysis:</u>** • Correctly analyze data from my experiment and other experiments using the appropriate graphs	• Analyze results of above experiments

		should be used when the independent variable is continuous but grouped clearly to show the pattern more clearly. • Circle Graph: Use to show relative amounts or percentages. • Stem and leaf plot: Useful for showing frequency within certain ranges when the data itself has importance (rather than the pattern of data).		
NS.1.7.5 Communicate results and conclusions from scientific inquiry	• What is the best way to communicate my results?	• Often the best way to communicate results is using a chart or graph and a written description. The experiment is best communicated by **describing** the general pattern of data (shown in the graph/chart), **answering** the original question (does it support your hypothesis?), and **explaining** why this happens using scientific knowledge.	**Task analysis:** • Write a complete, correct, and precise lab report • Practice peer-reviewing others' work • Practice writing conclusions	• Communicate results of above experiments

Unit Vocabulary:

- Variable
- Dependent
- Independent
- Testable
- Cause
- Effect
- Opinion
- Fact
- Experiment
- Science
- Empirical
- Data
- Hypothesis
- Law
- Theory
- Experimental design
- Replication
- Bias
- Valid result
- Control
- Sample size
- Graph
- Observation
- Inference
- Observable
- Inference
- Interpret
- Analyze
- Pattern
- Peer Review
- Trend
- Conclusion
- Inquiry
- Sample size
- Constant

Common Core State Standards:

Reading Practices:
RST.6-8.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a scientific context.

Writing Practices:
WHST.6-8.3: Write precise descriptions of the step-by-step procedures they use in their investigations
WHST.6-8.7: Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
WHST.6-8.10: Write routinely over extended and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.

Math Practices:
CCSS.MP1: Make sense of problems and persevere in solving them
CCSS.MP2 Reason abstractly and quantitatively
CCSS.MP4 Model with mathematics
CCSS.MP5 Use appropriate tools strategically
CCSS.MP6 Attend to precision

Speaking Practices:
CCSS.SL.7.1.B: Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.
CCSS.SL.7.1.D: Acknowledge new information expressed by others and, when warranted, modify their own views.