Unit 1 : Introduction to Science

Overview

Welcome to Unit 1: Introduction to Science!

This unit is about introducing students to the principles of science and cultivating a scientific mindset that they will apply throughout the course. The Introduction to Science unit consists of the following lessons:

- 1.1 - What is Science?
- 1.2 - Scientific Literacy
- 1.3 - What is Measurement?
- 1.4 - The Laboratory
- 1.5 - Mass, Volume and Density

This teacher's guide will provide an overview of each lesson and additional resources that can be used to enhance the lessons.

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How to use Viziscience

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*Teachers can use the lessons **in class or as homework.***

- *For lessons and reflective questions, students work individually on the platform*
- *For assignments, teachers can choose to have students work on the activities in class individually or as teams, but students must submit their answers online and teachers will grade the answers manually on the platform*
- *We are not looking for correct answers, but rather to train students how to think and articulate and present their information with clarity*
- *A rubric will be provided as a guide on how to grade the assignments*

*Teachers can also use the lessons to **flip their classroom.***

- *The unit can be assigned as homework prior to teaching the topics*
- *Students will engage with all the activities and must complete all the concept check questions*
- *In class, teachers can hold discussions with their students and go through problems that they struggle with*
- *Teaches can also maximize class time with more example problems to challenge students further*

For students who are not self-starters, the flip classroom model may prove to be challenging so teachers will have to exercise discretion how often to flip their classroom.

The advantage of using the lessons in class:

- *Teachers can give individual attention to students who are struggling while the other students who are more capable can work on their own.*

Students should not have to look elsewhere for answers, as all the answers are either found on the page or they are considered prior knowledge.

- *It does not matter if students do not get answers correct, the idea is to get them actively working and learning from mistakes. This is the best way to learn science.*
- *The activities can be reattempted any number of times.*
- *The activities can also be used for credit recovery.*

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Pacing Guide

Students learn best when they have multiple days to process and apply new concepts, and we recommend spending a minimum of two days per topic. This will allow time for deeper discussions, extending activities and additional practice as you desire. Refer to the lessons in this guide for additional considerations for each lesson.

Approximately: 17 days

Unit	Lesson & Activity	Appr #days
1.1	**What is Science?** ➢ Lesson Reflection	2
1.2	**Scientific Literacy** ➢ Lesson Reflection Assignment | Design An Experiment (to find out the best brain food for breakfast)	4
1.3	**Measurement** ➢ Lesson Reflection Quiz #1	3
1.4	**The Laboratory** ➢ Lesson Reflection Assignment | Laboratory Scavenger Hunt	3

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1.5	**Mass, Volume, DensityCourse** ➢ Lesson Reflection Assignment | Density Calculations	3
	Case Study To understand the water disaster of Flint Michigan	1
	Unit Assessment	1

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Standards Alignment

NGSS[1] & Common Core State Standards Connections

ELA/Literacy

- ***RST.11-12.8*** *Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.*
- ***WHST.9-12.2*** *Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.*

Mathematics

- ***MP.2*** *Reason abstractly and quantitatively.*
- ***HSN-Q.A.1*** *Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.*
- ***HSN-Q.A.3*** *Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*

Crosscutting Concepts

- ***Systems and System Models*** ▪ *Systems in the natural and designed world have parts that work together.*
- ***Interdependence of Science, Engineering, and Technology*** ▪ *People encounter questions about the natural world every day.*
- ***Cause and Effect*** ▪ *Simple tests can be designed to gather evidence to support or refute student ideas about causes.*

[1] The Next Generation Science Standards (NGSS) is a registered trademark of WestEd. Neither WestEd nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of this product, and do not endorse it."

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Lesson Plans

➢ Lesson 1.1 | What is Science?

Overview:

Students become disengaged from getting the same exposure to “Introduction to Science” every year. We really want to help this unit stand out to students in two ways: (1) providing them with the understanding of how they think and process information, and (2) by including as many real world examples as possible.

Learning Objectives	Vocabulary
I can explain what science is and describe its process I can explain how science is related to knowledge I can provide applications & benefits of science in everyday life	• Science • Knowledge • Depth of Knowledge

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➤ Lesson 1.2 | Scientific Literacy

Overview:

Scientific Literacy is the ability to interpret scientific information. This is heavily tested by standardized tests such as the ACT, SAT and professional readiness exams such as the TEAS test for nursing and the MCAT for medicine. Many textbooks emphasize delivering information at the expense of allowing students to interpret scientific information on their own – this is where we can really stand out as teachers.

Lesson 1.2 presents opportunities to apply their scientific processes to applications which they should be highly familiar with such as cooking. In addition, the scientific method is reinforced as the process of building scientific knowledge from the previous lesson.

Learning Objectives	Vocabulary
I can explain the role of hypotheses, experiments, data and analysis in the process of science I can identify good hypotheses, and describe what makes a hypothesis weak or strong I can identify good experimental design, and describe what makes an experiment weak or strong I can analyze data and describe what makes data weak or strong	• Hypothesis • Experiment • Data
Lesson 1.2 | Scientific Literacy	

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➤ Lesson 1.3 | What is Measurement?

Overview:

Lesson 1.3 introduces students to the concept of measurement, and gives students a flavor of their origin. Additionally, students learn basic elements of measurement such as accuracy and precision, and we begin their exposure to significant digits.

Covering significant figures explicitly is challenging early in the year, as many students have a lack of experience of measurement. However, by offering adequate preparation, students will be much better equipped to master the concept later in the course.

Learning Objectives	Vocabulary
I can explain how measurements contribute to scientific knowledge I can describe key components of measurements, including accuracy and precision I can make quality measurements of length, volume, and mass	• Measurement • Standard Unit • Accuracy • Precision
Lesson 1.3 | What is Measurement	

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➤ Lesson 1.4 | The Laboratory

Overview:

Lesson 1.4 introduces students to the laboratory, including a brief overview of its history and its function. Students are exposed to essential lab equipment and their function.

Learning Objectives	Vocabulary
I can describe what a laboratory is and explain the purpose of it I can describe various equipment in a chemistry lab and explain their function	• Laboratory • Experiment
Lesson 1.4 | The Laboratory	

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Discussion

(Lesson 1.4 | The Laboratory)

“Laboratory” comes from the latin word “to labor”, which means to work.

Students have a glimpse of Leonardo Da Vinci’s secret lab and other olden day’s labs and explore the purpose of the labs.

Students are introduced to a series of common lab equipment and their use.

Students also learn some general safety rules that must be followed when in the lab.

Assignment #2 | Lab Scavenger Hunt would be a great unit following this lesson to get students acquainted with the names of the equipment.

In addition to this course, it is vital for teachers to go through lab safety procedures and also show students where the emergency equipment (such as the fire extinguisher, eye ways and shower station) are located in the school lab before doing any lab lessons.

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➤ Lesson 1.5 | Mass, Volume, and Density

Overview:

Lesson 1.5 introduces students to calculations through mass, volume and density. Students explore the concept of density through observing an orange with and without its peel. Students are guided to reason the equation of density.

Learning Objectives	Vocabulary
I can explain density and explain how it relates to mass and volume I can provide the density of water and predict if an object will float or sink I can use measurements of mass and volume to calculate density, and vice-versa	• Mass • Volume • Density • Calculation
Lesson 1.5 | Mass, Volume, and Density	

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Extensions

All the extensions provided here can be utilized either in class or as homework, with the teacher having the opportunity to review them during in-class sessions.

Category	Description
1.2 | Assignment | Design an Experiment	**Follows Lesson 1.2 - Scientific Literacy.** Students think like scientists and design an experiment to discover the most healthy breakfast. (Please see further information below.)
1.4 | Assignment | Laboratory Scavenge	**Follows Lesson 1.4 - The Laboratory**. Students identify the 15 essential pieces of lab equipment and match them with their applications.
1.5 | Assignment | Density Calculations	**Follows Lesson 1.5 - Mass, Volume and Density** This assignment allows students to gain mastery with their newly acquired understanding of density. Students are asked basic and higher-order thinking questions requiring the application of the density formula.
Case Study - There Must Be Something in the Water	**Students explore the Flint Michigan water crisis** as well as the chemistry that contributed to it. Students will read background information on the Flint water crisis, water toxins and their effects on the body and the water treatment process. Students answer comprehension questions on the background information. This assignment in the introduction to science unit is beneficial because it bridges scientific concepts to real-world issues, promotes scientific literacy, and encourages critical thinking as students

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	apply their knowledge to solve a novel water crisis scenario.
Quiz #1	Lesson 1.1, 1.2, & 1.3
Unit Assessment	Covers the entire unit / 20 multiple choice questions

1.2 | Assignment | Design an Experiment - Healthy Breakfast

Follows Lesson 1.2 - Scientific Literacy. Students think like scientists and design an experiment to discover the most healthy breakfast.

This would make a great class collaborative exercise and perhaps an excuse to have a little party at the beginning of the year to help fellow students bond. The teacher can provide breakfast for the class, or alternatively, students can bring their favorite breakfast items to share. However, it's important to set restrictions and guidelines to keep chaos and mess to a minimum.

In this group exercise, students will work collaboratively to design experiments related to breakfast nutrition and its impact on cognitive function. It's important to emphasize that this exercise is focused on "designing an experiment" and not on the practical implementation of the experiment. The goal is to encourage critical thinking and scientific literacy while fostering class interaction.

Suggestions:

1. Group Formation:

Divide the class into small groups, ensuring diversity in each group. Encourage students to introduce themselves and get to know their group members. Assign a student leader in each group with the responsibility to ensure effective communication, cooperation, organization, and that the group stays focused, follows instructions, and works together to achieve the objective of the exercise.

2. Brainstorming Session:

Start with a brainstorming session similar to the individual assignment. Each group should collectively list common breakfast foods and discuss their individual preferences and habits.

3. Formulating Hypotheses:

Have each group formulate a hypothesis related to breakfast and cognitive function. Emphasize the importance of making specific and testable predictions.

Example of a good hypothesis - Consuming a breakfast rich in nutrients such as protein and complex carbohydrates will lead to improved cognitive function, as measured by increased alertness, concentration, and problem-solving ability compared to individuals who consume a breakfast high in sugars.

4. Experimental Design:

Students will use this information given - There are 300 students who are willing to participate in this experiment over a 3-month period. How will you use these 300 students to help determine “What is the Healthiest Breakfast for the Brain? Describe how you will design the experiment, and what data/results you will look for that determines if a breakfast item is “healthy” or “not healthy”.

Instruct groups to design an experiment based on their hypothesis. Encourage creativity and practicality in their experimental approach. Groups can choose between different experimental conditions such as unhealthy breakfast, healthy breakfast, high sugar breakfast, fatty breakfast, etc.

Ask groups to consider factors like the number of participants, age, gender, and how they will collect data (e.g., surveys, cognitive tests, etc.).

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5. Survey Questions:

For groups focusing on surveys, they may want to design a set of sample questions they can use to gather data on participants' energy levels, mood, and cognitive function throughout the week. Additionally, students may choose to include a simple math test to measure accuracy and speed as part of their survey questions. Encourage them to adapt the questions to suit their experiment and gather comprehensive data on the impact of breakfast choices on cognitive function.

Students are encouraged to think creatively and are free to design any kind of test or method to gather their own data. The purpose of this exercise is to provide students with an opportunity to gain experience, be innovative, and understand the scientific process that researchers go through. Emphasize that there are no strict rules, and they should feel free to explore different approaches to gather meaningful data.

6. Presentation and Discussion:

For each group, consider conducting the presentation more informally, like a group discussion rather than a formal presentation with slides or elaborate preparations. Each group should appoint someone to speak on their behalf and briefly present their ideas, their hypothesis, and why they have designed their experiments the way they think. They can also add any additional insights or thoughts they wish to share with the class

7. Reflection and Conclusion:

Ask students to reflect on what they learned about the challenges of designing experiments for ambiguous topics and the importance of scientific literacy. Ambiguous topics are research questions that are unclear, lack precise parameters, and can be open to multiple interpretations, making them challenging to study.

Encourage them to consider how they can apply these skills in real-world scenarios. By turning this assignment into a group exercise and incorporating interactive elements like breakfast sharing and class discussions, you can create a more engaging and

enjoyable learning experience for your students while reinforcing important scientific concepts.

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