

Nature of Science

Nature of Science Unit includes:

- Print and digital Interactive Notebooks
- Editable Resources, including notes, PowerPoints, and test
- Instructional Videos
- Teacher-led Demos & Guided Inquiry Labs
- Task Cards & Digital Task Cards
- Study Guides



Suggested Pacing Guide

The following is a **suggested pacing guide** for my COMPLETE COURSES (Earth, Life or Physical Science) which are based on 50-minute class periods. There are three variations below. Each variation is based on the **number of sections in your SCIENCE INTERACTIVE NOTEBOOK chapter**.

Based on a **4-Section Chapter**

Day	Lesson/Activity	Engage	Explain	Explore	Elaborate	Evaluate
1	• Teacher Demo	x				
	• Section 1 Notes – INB input		x			
	• INB Activity – INB output (homework if not completed in class)			x		
2	• Mini-quiz					x
	• Section 2 Notes – use PowerPoint		x			
	• INB Activity			x		
3	• Mini-quiz					x
	• Guided Inquiry Lab – Student Led			x		
	• Section 3 Notes – use PowerPoint		x			
4	• INB Activity			x		
	• Mini-quiz					x
	• Section 4 Notes – use PowerPoint		x			
5	• INB Activity			x		
	• Mini quiz					x
	• Science Stations				x	
6	• Science Stations				x	
	• Final draft and testing for Creation Station (STEM)				x	x
	• Task Card Review (game-style, full class, partner)				x	
7	• Chapter Test					x
	• Have students complete notes for next chapter*	x				

* **Note-taking option:** Once students are done with chapter test, they get the next set of notes and work quietly on completing them while other students finish up. All notes are to be completed when they return to class. Have students glue each page of notes into the next few pages of their INB (right side only). This way, when you go over the PowerPoint each day, they have already reviewed topic and are ready for class.

5 E Model

Engage – Teacher-led demos foster wonder and classroom discussion and serve as the hook for the lesson. Videos and images of natural phenomena also foster questioning and communication. NGSS phenomena are aligned to middle school NGSS standards.

Explain – PowerPoints, instructional videos, and guided notes (input side of interactive notebooks) provide definitions, explanations, and information through mini-lecture, text, internet, and other resources which encourages students to explain concepts and definitions in their own words.

Explore – Students investigate problems, events, or situations. As a result of their mental and physical involvement in these activities, students question events, observe patterns, identify and test variables, and communicate results.

Elaborate – It is important to involve students in further experiences that apply, extend, or elaborate the concepts, processes, or skill they are learning. Elaborate activities provide time for students to apply their understanding of concepts and skills. They might apply their understanding to similar phenomena or problems.

Evaluate – Use a variety of assessment to gather evidence of student's understanding and provide opportunities for them to assess their own progress.

Student Interactive Notebook

Each concept shares:

- Actual photos of both the INPUT and OUTPUT pages of Science Interactive Notebook
- Instructions on how to create/use/complete activity for OUTPUT side
- Mini-Quizzes for each concept to check students' understanding
- Answer Keys for all mini-quizzes
- Appendix with Teacher Notes for Interactive Notebook in LARGE print.

Section 1: The Method of Science

Section 2: Standards of Measurement

Instructions:

For this section, students will be calculating Density. The displacement method of marbles and pennies activity will give them practice using a balance and graduated cylinders and walk them through how density. Attached is the activity that you can cut out and paste it into their Science Interactive Notebook. And the best part - easy set-up, easy to use.

Layered Book

Step 1: Layer 5 sheets of colored paper about an inch apart vertically. Keep edges even.

Determining Density

Volume is the amount of space taken up by something. Water displacement is one way to determine the volume of a solid. When an object is placed in water, the amount of water it displaces is the volume of the object. From the mass and volume of the object, its density can then be calculated. Density is a measure of how much mass fits a given amount of space. Note: $1 \text{ mL} = 1 \text{ cm}^3$.

Materials:
Balance
Water
100 mL graduated cylinder
5 marbles
20 pennies

Part I

- Determine the mass of 5 marbles on the balance. Mass = _____
- Fill the graduated cylinder to the 50 mL mark with water. Carefully drop the 5 marbles in the cylinder. Do not allow any water to splash out.
- Observe the new level of the water.
 - New level of water = _____ mL
 - Original level of water = _____ mL
 - Volume of the 5 marbles = _____ mL
- Density = $\frac{\text{Mass}}{\text{Volume}}$ = $\frac{\text{g}}{\text{cm}^3}$

Part II

- Repeat all steps in Part I with the 20 pennies.
 - Mass of 20 pennies = _____ g
 - New level of water = _____ mL
 - Original level of water = _____ mL
 - Volume of the 20 pennies = _____ mL
- Density = $\frac{\text{Mass}}{\text{Volume}}$ = $\frac{\text{g}}{\text{cm}^3}$

Scientific Method Labels for Layered Book

The Scientific Method	Ask a Question
Research	Form Hypothesis
Design	Gather & Analyze Data

Types of Measurement

1. A balance can measure the mass of an object. The balance is used to measure mass in grams (g).
2. A graduated cylinder can measure the volume of a liquid. The graduated cylinder is used to measure volume in milliliters (mL).
3. A ruler can measure the length of an object. The ruler is used to measure length in centimeters (cm).
4. A stopwatch can measure the time it takes for an event to occur. The stopwatch is used to measure time in seconds (s).

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Quiz: The Method of Science

Name: _____ Date: _____

Directions: Circle the correct answer.

1. Hypothesis: a. statement for comparison b. testable prediction c. factor that is adjusted by the experimenter
2. Control: d. factor that doesn't vary in experiment e. required procedure for testing hypothesis
3. Dependent variable: f. factor whose value is graphed on y axis
4. Experiment: _____
5. Constant: _____

Steps of the Scientific Method in correct order using numbers 1-7:
1. Ask a Question _____ 2. Research _____ 3. Form Hypothesis _____ 4. Design Experiment _____ 5. Gather Data _____ 6. Analyze Data _____ 7. Draw Conclusions _____

Section 3: Graphing

Instructions:

For this page in the Science Interactive Notebook, students will compare and contrast the three different types of graphs and how they are used. Students will be given three different sets of data and will need to determine what type of graph would best represent that data. Students will then need to graph the data for each table in their Science Interactive Notebook. It always make students use a minimum of three colors when doing an activity like this - realness, cause! The following is the student handout for Graphing along with a mini-quiz.

Student Digital Notebook

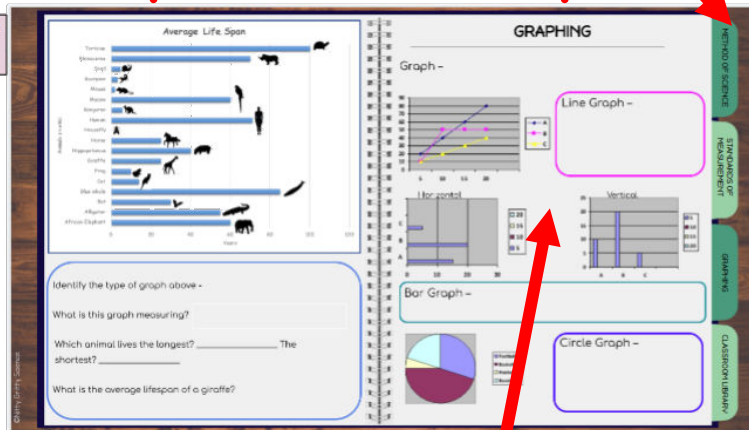
The student notebook is on Google Drive and ready for you to share with your students. Here's a quick overview of the features:

Set up like a traditional interactive notebook with input and output sides.

Hyperlinked tabs so student can easily move through chapter for review

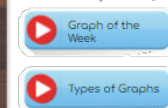
Students watch video < 6 min to complete notes.

Directions: Use the information from the graph to answer the question.



Digital Textbook

For further exploration, click button(s) below:



Encouraging independent learners. Directions for output side are here along with what they need to complete the activity.

Notes are chunked into manageable sections with large spaces for textboxes

Some pages have links so students can go deeper into the topic if they need.

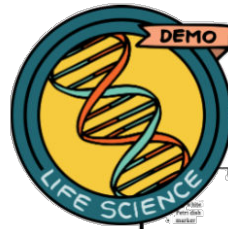
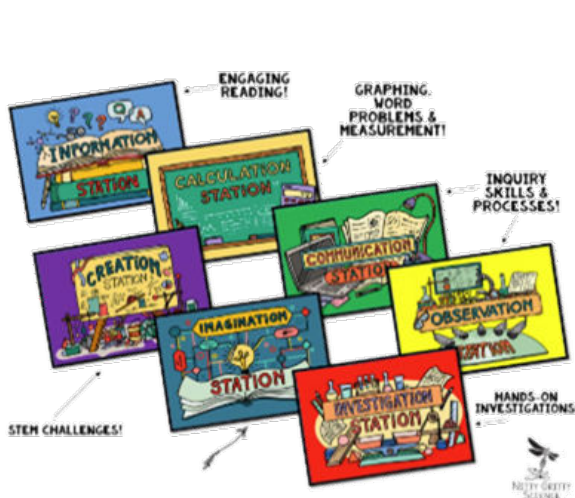
Demos, Labs, & Science Stations

Working in the lab and being engaged in science experiments is the most exciting part of science.

Demo, Labs, and Science Stations Includes:

1. **SCIENCE STATION SIGNAGE** for all 7 stations is provided in color and in black and white (see preview) and all student answer sheets have icons that correspond with each station for ease of use.
2. **DEMONSTRATION** (teacher-led) allows teachers to invite scientific discussions and can help uncover misconceptions and, most importantly, lead to heightened curiosity and interest in the topic being studied.
3. **GUIDED INQUIRY LAB** which is a traditional lab that allows students to perform an investigation in order to solve a problem. Students will hypothesize, collect and analyze data and communicate their results.
4. **TEACHER GUIDES to DEMOS & SCIENCE STATIONS** help get you started and give you background information to make your science lessons engaging.
5. **7 SCIENCE STATIONS** which are designated locations in the classroom with activities that challenge students to extend their knowledge and elaborate on their science skills by working independently of the teacher in small groups or pairs. Stations included are:
 - **INFORMATION STATION** – Group members will read an interesting and relevant science passage then complete a task to help increase science literacy and deepen their understanding of the science concept.
 - **OBSERVATION STATION** – Group members will have images, illustrations, or actual samples at this station that show applications or processes of the science topic. Using what they've learned, they will need to apply their observation skills to complete the questions attached to each.
 - **CALCULATION STATION** – Group members use their math skills to complete the station challenge. Skills may include graphing, analyzing data, using models, measurement, and calculating formulas or word problems.
 - **INVESTIGATION STATION** – Group members will work with one another to explore the concept through hands-on activities so they may practice specific inquiry process skills as they learn.
 - **COMMUNICATION STATION** – There are three different options for this station: interviews, video, group essay. Depending on the option you choose, group members will communicate what they know by answering questions in creative ways.
 - **CREATION STATION** – Group members will work together to solve a STEM (Science, Technology, Engineering, Math) challenge by creating models or designs that demonstrate their understanding of the science topic being taught.
 - **IMAGINATION STATION** – This station makes science concepts relevant for students by asking them to imagine scenarios that will bring about discussion and critical thinking.
6. **INQUIRY PROCESS SKILLS CHECKLIST** is provided with each set to show teachers and administrators the inquiry skills used by students in each activity. These skills include, but are not limited to, communicating, creating models, inferring, classifying, identifying variables, measuring, observing, predicting, gathering and organizing data, comparing and contrasting, interpreting data, and manipulating materials.

SCIENCE STATIONS



Eye Safety

SCIENCE SKILLS AND LAB SAFETY

Materials:

- projector
- yellow and black safety tape
- eye dropper
- water

Procedure:

- Place an eye on the underside of the Post-it and display for class using the projector.
- Explain the eye and the eye dropper to the eye vision only of the film clip.
- Explain that the proteins in egg whites are similar to those found in the protective layer of the eye.
- Fill three test tubes with water and then splashed with one test tube of eye "cells" (eye dropper) and to the eye whites.
- Ask students to make observations of what is happening to the egg whites.
- Try adding water to cover the droplets. Have students make observations.

What's Happening?

The proteins in the egg whites become cloudy when they are exposed to a denaturation of the proteins. This is an irreversible chemical reaction and students need to understand that a chemical reaction can cause damage to their eyes or skin if not used properly. Students must be made aware of the safety procedures involved like, such as wearing goggles, gloves and aprons. Make sure they are aware of safety equipment: eye wash station, shower, fire blanket, etc.

Discussion:

- What happened to the "eye"?
- The protective layer became cloudy and denatured the eyes.
- What type of safety equipment must be worn when doing lab?
- Explain safety, but not gloves.

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Discussion questions and teacher set-up included!

Teacher guide and answer key offered for every lab!

Easy-to-get materials!



Measure with SI Units

SCIENCE SKILLS AND LAB SAFETY

Materials:

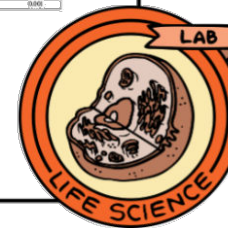
- standard system of measurement used by scientists around the world is known as the International System of Units, which is abbreviated as SI. It is very easy to use because they use basic units of measurement (m, kg, s, A, C, K, N, J, W, Pa, etc.) and they use prefixes to describe the size of the unit being used. The following table lists the prefixes and to name the unit common to use.

Prefix	Symbol	Amount
kilo-	k	1,000
hecto-	h	100
deka-	da	10
deci-	d	0.1
centi-	c	0.01
milli-	m	0.001

Materials:

- graduated cylinder
- tape
- balance
- weighing scale
- graduated cylinder (small scale)
- graduated cylinder (large scale)
- metric ruler
- 10 mL graduated cylinder
- graduated cylinder

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Drip, Drop, Splat!

How does the density of a liquid and drop height affect the size and shape of droplet splatters?

Materials:

- colored water (graduated cylinder A)
- colored syrup (graduated cylinder B)
- eye dropper
- paper
- metric ruler
- meter stick

Procedure:

- Make a hypothesis of how density of a liquid will affect splatter size on your lab sheet.
- Place the piece of paper down on the lab table in order to catch splatters.
- Measure the heights listed in the data table using a meter stick. Place meter stick with end starting at zero on paper and move up stick when increasing height of drop.
- Use the eye dropper to drop ONE drop of colored water and ONE drop of colored syrup. Make sure to drop on different places on paper.
- Measure the size of the splatter in MILLIMETERS. Record in data table on answer sheet.
- Repeat for each height.
- Use the collected data to graph the splatter size versus drop height for each liquid.

Analyze and Conclude

- Was your hypothesis correct? Explain.
- What are two controls in your experiment that helped you collect the most accurate data possible?

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USER-FRIENDLY PAGES:
Students easily recognize which answer sheet to use at each station by matching station icons located on each page!!

Investigation Station

Name _____ Date _____

Hypothesis

Drop Height (cm)

Drop Height (cm)	Water	Syrup
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Height of Drop vs. Splatter Size

Height of Drop (cm)

Size of Splatter (mm)

Legend

- Water
- Syrup

Analyze and Conclude

- _____
- _____

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TEACHERS SAVE TIME:
Laminate station pages and reuse for each class and for years to follow!
Inquiry skills used are timeless!

Instructional Videos

The Nature of Science Instructional Videos and Digital Assessments are designed to help teachers move instruction from the group learning space to the individual learning space. Not only does this give students independence in their learning, but it also allows more time for dynamic and interactive learning when teachers meet with students in a group setting.

This resource is perfect for:

- Flipped Classroom
- Absent students
- 1:1 Classrooms
- Sub Plans
- Hybrid Schedules
- Teachers who want more time to guide students as they apply concepts and engage creatively in the subject matter

Features of this resource include:

- Instructional videos which are six minutes or less to keep students focus
- Videos and assessments can be completed independently
- Auto grading and reporting in Google Forms
- Share link with students through educational platforms or email
- Quizzes are editable with 5 – 8 questions per quiz
- Information in video pairs with Nitty Gritty Science Interactive Notebooks

Task Cards & Digital Task Cards

Task cards are a great tool for concept review that can be used in a variety of ways – pairs, small groups, team games, or individually. The reason they are so effective is there is only ONE task per card, allowing students to focus on that single task until they have successfully completed it. Answers sheet and answer key for teachers are included.

The digital, self-checking task cards are hosted at Boom Learning™ and are compatible with Google Classroom. These are perfect for displaying on your interactive whiteboard and leading class games or review sessions.

Print Task Cards

DECIDE (1) A testable prediction is a _____.
a. experimental
b. variable
c. hypothesis
d. constant

DETERMINE (2) Determine the SI base unit of _____.
a. Celsius
b. Fahrenheit
c. Kelvin
d. Supernova

COMPLETE (3) An organized set of investigation procedures is called the _____.
a. line
b. circle
c. bar
d. independent

DETERMINE (4) Determine the type of variable plotted on the x-axis and the y-axis.
a. hypothesis
b. mass
c. variable
d. control

IDENTIFY (5) Identify three types of graphs.

COMPARE (6) Compare the difference between a scientific theory and a law.

IDENTIFY (7) Identify the piece of lab equipment you would use to measure 15 mL of water.

IDENTIFY (8) In an investigation you put a beaker of water in the sun and measure the temperature every 10 minutes for 1 hour. What is the dependent variable?

Digital Task Cards

Nature of Science
In a bar graph, the ____ variable is plotted on the x-axis.
independent

Nature of Science
A statement that describes what scientists expect to happen every time under a particular set of conditions is a _____.
Scientific theory
Scientific inquiry
Scientific hypothesis

Nature of Science
On what day of the week did most kids go swimming?
of kids that went swimming
Days of the Week

Study Guides: Includes **print** or **digital** options

NGS Magnified Study Guides are directly aligned to the notes and assessments offered by NGS Magnified and include a variety of review strategies that meet the needs of your learners for independent study and indirect instruction.

Each study guide provides a combination of strategies which may include:

- Graphic organizers
- Vocabulary building
- Compare and contrast
- Problem-solving
- Concept mapping
- Interpreting data
- Critical thinking
- Theme connection
- Matching
- Fill-in-the-blank
- Short answer
- Real-world application
- QR videos with accompanying questions

STUDY GUIDE

NATURE OF SCIENCE

Name: _____ Date: _____

SECTION 1

Directions: Describe how science works. Draw a picture of each of the pictures below.

Hot air balloon

SECTION 2

Directions: Define each of the factors of the scientific investigation and then use your knowledge to answer the questions.

Hypothesis: _____

Experiment: _____

SECTION 3

Directions: Using your knowledge of measurement, determine the unit you would use to measure each of the following items.

Carton of milk: _____

Bathtub: _____

Test tube: _____

Leather: _____

SECTION 4

Match the terms on the left with the definitions on the right.

SECTION 5

Directions: Use the data below to create the type of graph that best presents the information.

Temperature in Kansas City

Degrees	Day
0	1
20	2
40	3
60	4
80	5
100	6

Favorite Type of Music

People	Type of Music
20	Country
12	Pop
33	Classic Rock
8	Alternative

SECTION 6

Directions: Fill in the circle graph to best present the popularity of the type of chocolate listed.

Reese's Peanut Butter Cups 40 %

M&M's 33 %

Snickers 20 %

Butterfinger 7 %

Directions: Fill in the blank with the best term from the word bank. Not all words will be used.

independent x-axis vertical

dependent y-axis horizontal

control bar graph circle graph

1. Graphs are a way of communicating a lot of _____.

2. A variable that changes and affects another variable is called _____.

3. In a line graph, the horizontal axis can also be referred to as the _____.

4. The type of graph that shows information as parts of a circle is called a(n) _____.

5. A variable that changes as a result of another variable is called _____.

6. In a line graph, the _____ axis is referred to as the y-axis.

Assessments:

Teachers can use a variety of assessments to evaluate student progress throughout the unit. The curriculum provides mini-quizzes for each Interactive Notebook chapter and an online assessments that goes with the instructional videos. The chapter test includes multiple choice, short answer, interpreting diagrams, and an essay.

Name _____ Date _____

Quiz: The Method of Science

Matching

_____ 1. Hypothesis	a. standard for comparison
_____ 2. Control	b. testable prediction
_____ 3. Dependent variable	c. factor that is adjusted by the experimenter
_____ 4. Experiment	d. factor that doesn't vary in experiment
_____ 5. Constant	e. organized procedure for testing hypothesis
_____ 6. Independent variable	f. factor whose value is graphed on y-axis

7. Put two steps of the Scientific Method in correct order using numbers 1-7.
 _____ Gather and Analyze Data _____ Ask a Question _____ Research
 _____ Form Hypothesis _____ Design Experiment _____ Share Results

Name _____ Date _____

Quiz: The Method of Science

Matching

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