The Next Generation Science Standards

There is no doubt that science—and, therefore, science education—is central to the lives of all Americans. Never before has our world been so complex and science knowledge so critical to making sense of it all. When comprehending current events, choosing and using technology, or making informed decisions about one's healthcare, science understanding is key. Science is also at the heart of the United States' ability to continue to innovate, lead, and create the jobs of the future. All students—whether they become technicians in a hospital, workers in a high-tech manufacturing facility, or Ph.D. researchers—must have a solid K–12 science education.

Through a collaborative, state-led process, new K–12 science standards have been developed that are rich in content and practice and arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education. The Next Generation Science Standards are based on the *Framework for K–12 Science Education*

https://www.nextgenscience.org/get-to-know

A few details about the Next Generation Science Standards

- Every NGSS standard has three dimensions: disciplinary core ideas (content), scientific and engineering practices, and cross-cutting concepts.
- Scientific and Engineering Practices and Crosscutting Concepts are designed to be taught in context – not in a vacuum. The NGSS encourage integration with multiple core concepts throughout each year.
- The NGSS are standards, or goals, that reflect what a student should know and be able to do— they do not dictate the manner or methods by which the standards are taught.

The performance expectations are written in a way that expresses the concept and skills to be performed but still leaves curricular and instructional decisions to states, districts, school and teachers. The performance expectations do not dictate curriculum; rather, they are coherently developed to allow flexibility in the instruction of the standards. Thus, you will need to work closely with your classroom teacher(s) to choose important lessons that assist the teacher in meeting his/her educational goals.

The lesson ideas found below are merely suggestions of experiments that can be taught in a particular grade or unit of study. RESET will work closely with you, the volunteer, and the classroom teacher to choose experiments and determine the best ways to present.

Next Generation Science Standards (K-5) listed with experiments that may help teach the standard

PS – Physical Science; LS – Life Science;
ESS –Earth & Space Systems; ETS – Engineering Design, Technology and Application Science

SECOND GRADE

2-PS1-1 Matter and Its Interactions

Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Title: Mineral Detective

Subject Area: Minerals

Objective: Students will be able to classify minerals based on their properties

Summary: Students will conduct 4 tests on a variety of minerals, classifying them by characteristics and then attempt to determine the identity of each mineral.

Grade Level: 2nd Grade

Vocabulary:
Mineral- a naturally occurring substance formed through geological processes which has a characteristic chemical composition, a highly ordered atomic structure, and specific physical properties

Hardness- the strength of a mineral based on its ability to scratch another material or be scratched

Streak -The streak of a mineral is the color of the powder produced when it is dragged across an un-weathered surface.

C**lassroom Set-up:**
Students work in groups of two, tests will be conducted outside as well as inside.

Procedure:
Step 1: Print enough copies of the worksheet below so that you have one per student.

Work Sheet:

Sample	Physical Characteristics	Hardness Scratch Test	Streak Test	Carbonate Test	Observations Notes Predictions
1		**Fingernail** **Penny** **Paper clip**			
2		**Fingernail** **Penny** **Paper clip**			

3		**Fingernail** **Penny** **Paper clip**			
4		**Fingernail** **Penny** **Paper clip**			
5		**Fingernail** **Penny** **Paper clip**			

Step 2. Explain to students that minerals are classified in several ways using physical characteristics. Some of the characteristics that scientist use are: color, the shape of the crystal, the luster (if it is shiny or dull), whether the mineral leaves a streak, and how hard it is. Today we are going to test several minerals and see if we can identify them based on their characteristics.

Step 3: Pass out 5 mineral samples to each team. Ask students to observe sample #1 using their eyes, sense of smell, sense of touch. They may find hand lens helpful.
Each student should record on his/her own worksheet what the team observes in the appropriate section (first column) of the worksheet for each sample.

Step 4: Continuing to work in pairs, students will perform the *Hardness* scratch test on each of the five samples using a fingernail, a penny, and a straightened paper clip indicating which one if any make a scratch. Record whether a scratch is made by indicating YES or NO next to each of the three means of scratching. The actual geologist Hardness scale is below

HARDNESS SCALE FOR COMMON MINERALS: 1= soft. 10 = hard

Hardness	Mineral
1	Talc
2	Gypsum
3	Calcite
4	Fluorite
5	Apatite
6	K-feldspar
7	**Quartz**
8	Topaz
9	Corundum
10	Diamond

Step 5: Next, students will conduct *the streak* test: go outside and stroke each of the mineral samples across a concrete sidewalk. Does this action leave a powder on the sidewalk? What is the color of the powder the mineral produced? This color is known as "streak". A mineral will streak only if stroked across a surface harder than itself. That is why we are testing on concrete. If no streak is seen, just record "no streak"

Step 6: Finally, students will test for *the presence of carbonate*. Distribute a piece of chalk and a small cup of vinegar to each pair of students. Using an eye dropper, the students will drip a small amount of vinegar on the chalk and observe the results (a small amount of fizz). The fizz indicates that the mineral sample has carbonate. The students will repeat the procedure on each of the mineral samples and record the results on the worksheet

Step 7: Have students share some of their results. If you desire you can create a copy of the worksheet on the whiteboard and fill that in as students confirm the results.

Step 8
Create a matrix identifying the minerals you have chosen with their Hardness #, streak color and carbonate level & the observable characteristics of each sample. Post it one the board and see if students can use the matrix to identify their own samples.

Step 9.
Once all minerals have been identified, conclude class with reminding students that minerals, like other living and non -living things on Earth can often be identified by their properties. If you have extra time, you can ask students to identify what properties they might be identified by. (Eye color, height, hair color, etc.)

Materials:

Description	**Quantity**	**Can be purchased at**

Sample of different types of minerals	One set/team of two	https://www.amazon.com/Toysmith-7922-Mineral-Science-Kit/dp/B002O07JLW/ref=pd_bxgy_img_3/145-2779180-7294629?_encoding=UTF8&pd_rd_i=B002O07JLW&pd_rd_r=81c468f2-1099-4833-b8d3-bdf969836039&pd_rd_w=Usxmh&pd_rd_wg=cDdaE&pf_rd_p=4e3f7fc3-00c8-46a6-a4db-8457e6319578&pf_rd_r=F1DNPGQ8D9EJJ4TDSN8K&psc=1&refRID=F1DNPGQ8D9EJJ4TDSN8K
Vinegar and small cups	Few ounces per team	Local grocery store
Eye dropper	1 per team	https://www.containerandpackaging.com/products/13/dropper-assembly/M005B?gclid=Cj0KCQjwzZj2BRDVARIsABs3l9LEokam7ipanxlaWdxiI0BV0uxoOFckPiG8ywmZOm84zjW6bT8GyUaAnWmEALw_wcB
Worksheets	1 per student	Often times classroom teacher is willing to print the worksheets at his/her school
Penny	1 per team	Bank or local store (depending on how many you need)
Paper Clip	1 per team	Local Grocery store

2-PS1-2 Matter and Its Interactions

Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

TITLE: Everyday Bacteria

SUBJECT: Microbiology

OBJECTIVE: Bacteria or microorganisms are all around us. Washing hands is a way of preventing disease.

SUMMARY: Students will test and analyze the bacteria growth on their own hands after touching various objects and then petri dishes to determine how the property of soap and the behavior of washing hands effects the growth of bacteria.

GRADE: 2nd grade

VOCABULARY:

Petri dish: a small shallow dish of thin glass or plastic with a loose cover used for growing and studying bacteria

Bacteria: are microscopic living organisms, usually one-celled, that can be found everywhere. They can be dangerous, such as when they cause infection, or beneficial, as in the process of fermentation (such as in yeast) and that of decomposition.

Microscope: an instrument with lenses which is used to make really small objects look bigger by magnifying them. The tool used by scientists to look at really small things that they need to magnify.

Microorganism: organisms which are so small that people cannot see them with naked eye.

CLASSROOM SET UP: Typical set up for Classroom demonstration.

PROCEDURE:

PRIOR TO CLASS TIME: Prepare your petri dishes filling each with the agar medium.

Step 1: Select a student and obtain a smear from his/her hand onto a Petri dish. Set up a second petri dish that will not be touched Label one experimental and once control.
Discuss what is a control and why do we need one.

Step 2: Send first student with another child to washroom to wash hands thoroughly. The Test student is not to touch anything (door handles or other objects) after washing hands and returning to classroom. The partner will open all doors, hand the student paper towels, turn on the water in the sink, etc.

Step 3: Obtain smear of the test student's cleaned, washed hands for third Petri dish. Label.

Step 4: Explain that we are hoping to see bacteria for classmate's hand. Ask why did we need all 3 Petri dishes for this test?

#1 Before washing hand: Hope that petri dish will grow bacteria

#2 After washing hands: See what happens when there are no bacteria on the hands

#3Control Petri Dish: We set up a control in all experiments to make sure that nothing else in the environment is responsible for any change we may see; a control allows us to test the change from one variable (in our experiment cleanliness of the hands) at a time

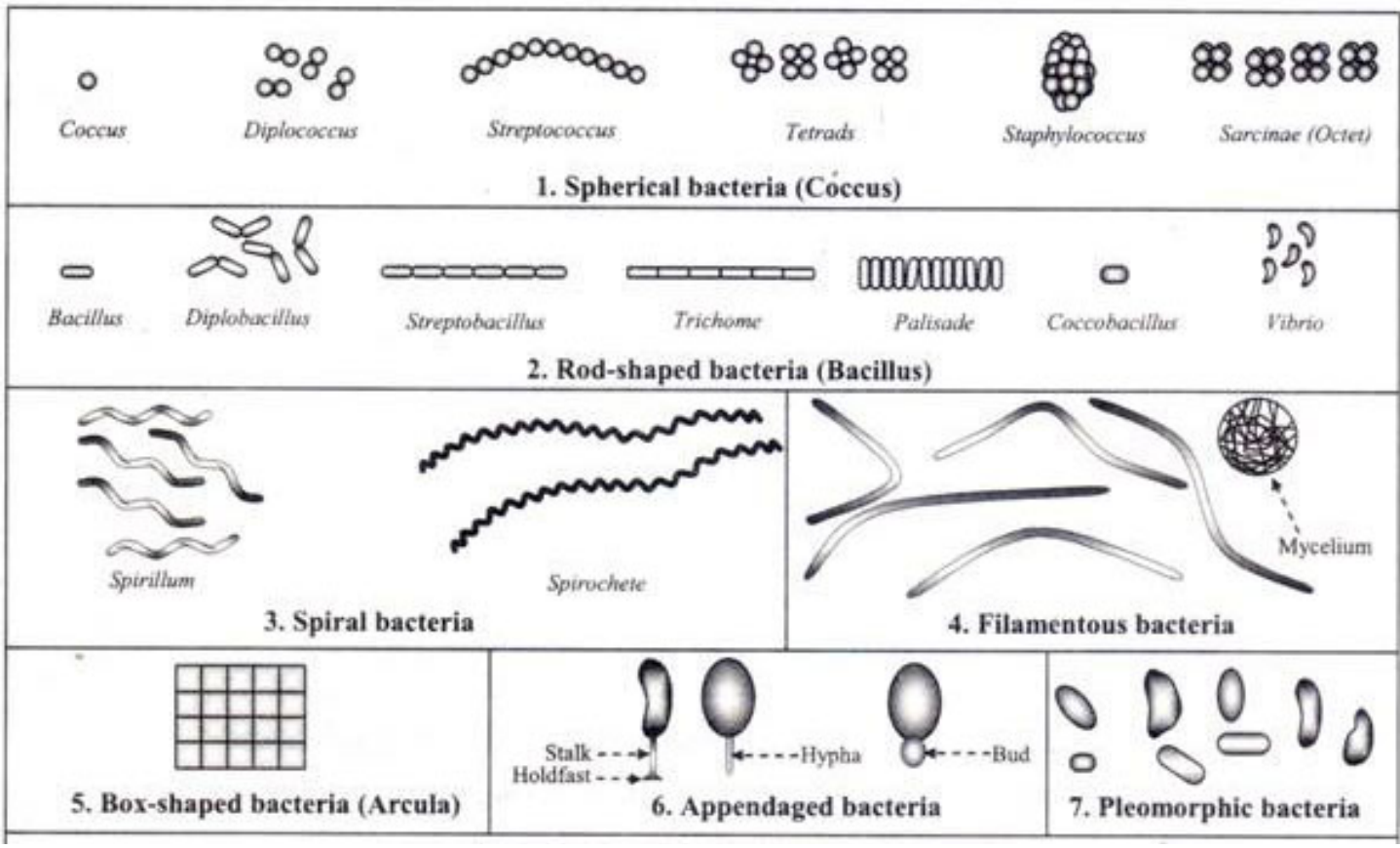
Step 5: Allow students to design their own tests. Ask them to think about one spot where they might find bacteria in the classroom?
Next, Give each student a petri dish with (student's name should be added to a label on the dish) and allow each student to choose a testing location in the classroom. Have student rub their hand all over this location and then rub hand on agar sample in petri dish. Cover the dish and add the location of where the sample was taken on the masking tape label.
ALL STUDENTS SHOULD WASH HANDS AFTER THEY HAVE SMEARED THEIR "DIRTY" HANDS ON AGAR IN PETRI DISH. NO NEED TO CREATE AN "AFTER WASHGING" HANDS TEST FO EVERYONE. Seeing results for 1 person is adequate.

Step 6: Leave Petri dishes in the class to “incubate” for a week in a warm space in the classroom.

Step 7: After one week examine Petri dishes & set up as many microscopes that are available, allowing students to examine petri dish as well as first three created. They may observe that petri dish with unwashed hand smear will have many bacteria colonies, washed hands will have less and control dish will have the least. Where else did students find bacteria in the classroom? Is this dangerous to our health? What can we do to take care of our health?

Step 8: Have students draw a picture of the bacteria in their own petri dishes.

Step 9: Bring class back together once drawings are finished and ALL HANDS ARE WASHED
Explain to students that there are three basic bacterial shapes are
coccus(spherical),
bacillus (rod-shaped)
spiral (twisted)
Draw some examples on the board



Step 10: Ask students what shape(s) did they see under the microscope. Have them label their drawing with the correct scientific name of Coccus, bacillus or spiral. Students can take pictures home.

MATERIALS:

Item	Quantity	Where to Purchase
Petri dishes	1 for every student + 2	https://www.homesciencetools.com/product/petri-dishes-polystyrene-20-pack/?nosto=nosto-page-category1
Nutrient Agar Medium	1 bottle fills 10-12 petri dishes	https://www.homesciencetools.com/product/tryptic-soy-agar-ster-125ml/

Microscopes	As many as possible	Check the school for microscopes.

2-PS1-3 Matter and Its Interactions

Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

2-PS1-4 Matter and Its Interactions

Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

2-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Plan and conduct an investigation to determine if plants need sunlight and water to grow.

Title: Seeds

Subject Area: Environmental Science

Objective: Students will be able to examine the growth of plants.

Summary: Students will dissect a seed to discover what makes a seed, and how do plants grow.

Vocabulary:
Germinate – to grow
Dissect – to look inside
Sprout – new growth
Seed – the ovule of a flowering plant that will produce a new plant
Cotyledon - the food storage part of the seed (seed food)
Embryo - the 'little plant' that will become the bean plant (seed leaves)
Micropyle - the 'weak spot' of the seed coat that allows the root to push through the protective coat (escape hatch)
Root - the first part of the young plant to push through.
Seed coat - the tough, sometimes colorful, coating of the seed that protects the embryo from fungus, rot, and insects

Classroom Setup:

Students will be working in pairs, indoors.

Procedure: Part A:

Step 1: Distribute a dry lima bean to each student. Have the students examine it using a hand lens. Have the students record their observations on the seed observation section of the lab sheet. Students should discuss their observations with their partners.

Step 2: Give each student a seed that has been soaked in water so it is easier to open. Show them how to open the seeds carefully. Ask students to see if they can find out how a seed turns into a plant. Encourage discussion with classmates. Make sure every child sees a baby plant inside the seed.

Step 3: Pass out a copy of the parts of the seed worksheet, and help students label parts.

Step 4: Discussion Questions – Ask students what they think

1. Where do plants come from?
2. How does a baby seed become a full- grown plant?

Step 5: DISCUSS:
A seed is a tiny life-support package. All seeds have three parts: a tough covering, a "baby" plant, and a food supply.

The outer covering of the seed is called the seed coat. The seed coat helps protect the inside of the seed from insects, disease, and damage.

The embryo is the tiny plant inside the seed. The embryo is the source of the root, stem and leaf structures.

Surrounding the embryo is the food supply. The food supply is the seed's only source of nourishment as it pushes up through the soil and grows into a young plant. When the food supply is gone, a green plant begins to manufacture its own food through photosynthesis. The food supply for a bean is used up in about two weeks.

Germination is the process through which the embryo inside the seed begins to grow. As the seed germinates, it develops roots, a stem, and then leaves. If a seed is not allowed to germinate within a certain length of time, the embryo inside the seed dies.

Can be conducted the same day if there is a time or at the next session.
Procedure: Part B: Students will observe 2 methods of germination.

Step 1: Each team should fold a paper towel into a strip about 4 inches wide and wrap it inside their tall plastic cup, along the bottom, creating a circle at the bottom of the cup.

Step 2: Each team should squeeze a second paper towel into a ball and place it in the circle formed by the first paper towel.

Step 3: Place a bean inside the cup between the paper towel strip and the cup about an inch from the bottom of the glass (they should have a clear view of the side of the bean)

Step 4: Pour water into the clear plastic cup until the paper towels are fully wet

Step 5: Place the plastic cup in a warm sunny spot

Step 6: Now students will prepare the second method by which they can observe germination. Have students in each team write their names on each of the 3 baggies. Put two beans in each baggie and have students create each of the three environment below, one in each baggie.

- Water (wet paper towel at bottom of baggie), light, air, seed
- no water (no wet paper towel) but light air and seed
- Baggie with 2 beans but no light (cover in black, put in closet)

Once baggies are ready, place each one in the proper location as described below.

1) Wet paper towel placed with light, and baggie open to air
2) No water but in a sunny place baggie opened to the air
3) Two seeds in a baggie with no light but open to air

(If supplies are short, you can divide the class into three of four groups and have each group prepare two bags for each of the situations)

Step 7: Ask students to make prediction about what will happen in each type of baggie. Help students create a journal in order to write their daily observations for the next 7 days when they see you again (A journal may be a section in their notebooks or 7 pieces of papers stapled together. Let students color the front page of their journal if they wish,

Seed Dissection Worksheet Sheet

Question: What is inside a seed? Write a hypothesis.

_____
_____
_____

Dry Seed Observation

1. Look carefully at the pinto bean. Examine it with a hands lens.

2. Describe what you see.

_____
_____
_____
_____
_____
_____

Soaked Seed Observation

1. Use a hand lens to examine the soaked pinto bean. Compare the soaked bean to the dry bean. What differences do you see?

_____

_____

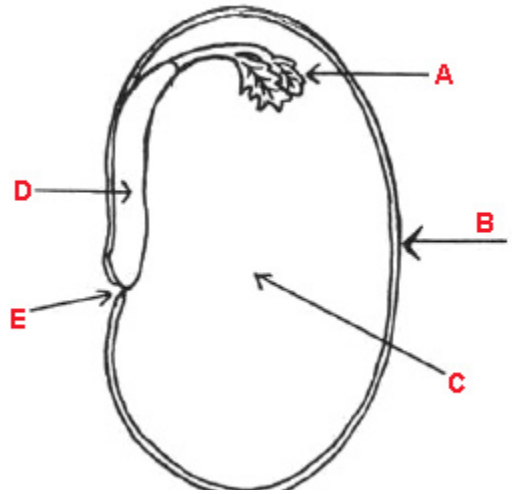
2. Carefully remove the outside covering of the soaked bean. Gently pull apart the two halves of the seed. Examine each half with a hands lens.

What do you inside the seed? _____

_____

3. Draw what you see inside the bean.

4. Label the parts of a seed: seed coat, baby plant (embryo), seed food (cotelydon), root, weak spot.



Plant Growth Lab Sheet

Question: What does a plant need to grow. Write a hypothesis.

_____
_____
_____
_____
_____

Materials:

ITEM	QUANTITY	CAN BE PUCHASED AT

Lima beans	1 per student (have extra on hand) Soaked over night	Local Grocery store
Lima beans	5 per team, Dry	Local Grocery Store
Magnifying glasses	1 per student	Amazon Link below
8 oz clear plastic cups	1 per team	Local Grocery store
Ziploc Bags	8 per team	Local Grocery Store
Paper Towels	Few sheets per team	Local Grocery Store
Masking Tape	1 roll	Local grocery store
Sharpie	1/ team	Local grocery store

https://www.amazon.com/OBTANIM-Handheld-Magnifying-Portable-Magnifier/dp/B07QS6TVQM/ref=sr_1_2?crid=30S4Y0KBMQYXF&dchild=1&keywords=hand+lens+for+kids&qid=1589383872&sprefix=hand+lens+for+%2Caps%2C140&sr=8-2

2-LS2-2 Ecosystems: Interactions, Energy, and Dynamics

Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

2-LS4-1 Biological Evolution: Unity and Diversity

Make observations of plants and animals to compare the diversity of life in different habitats.

2-ESS1-1 Earth's Place in the Universe

Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

2-ESS2-1 Earth's Systems

Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*

2-ESS2-2 Earth's Systems

Develop a model to represent the shapes and kinds of land and bodies of water in an area.

2-ESS2-3 Earth's Systems

Obtain information to identify where water is found on Earth and that it can be solid or liquid.