Dear Students:

This assessment is composed of classroom science teaching vignettes similar to teaching practices one can find in any classroom today. Practicing teachers contributed ideas for many of the vignettes; others are based on teacher observations, or on science curriculum standards.

As you read each vignette, think about how you might teach science in a similar situation. Respond accordingly.
Bacteria

Ms. Simon’s 8th grade class is studying bacteria. She tells her students that it is important to wash our hands before eating, even though we cannot see bacteria on them. Ms. Simon explains that, although we cannot see individual organisms, given nutrients, thousands more bacteria can grow in one place until the colony becomes visible. She demonstrates this by showing students the bacterial colonies that grew on some agar plates she had inoculated several days previously. She finishes the lesson with a reminder to wash the bacteria off your hands before eating.

Thinking about how you would teach this lesson, of the following, which one is most similar to what you would likely do?

A. I would begin by simply giving students fresh agar plates to inoculate (in any safe manner), and having them observe the plates over several days. I would end with a class discussion about what they learned from their observations and how it relates to being healthy.

B. I would begin and end the lesson the same as Ms. Simon. However, rather than showing them plates with bacteria already on them, I would allow students to touch their fingers onto their own fresh agar plates and then make observations over several days.

C. I would begin by having a class discussion on whether it is important to wash our hands before eating. Then I would have students touch their fingers onto their own fresh agar plates and make observations over several days. We would finish the lesson by relating student observations to the importance of hand-washing.

D. I would conduct this lesson in a similar way to Ms. Simon.
Frog dissection 1

Mr. Goodchild is doing a frog dissection with his 8th graders to help teach them about anatomy.

Thinking about how you would teach a lesson, of the following, which is most similar to what you believe is the best way to incorporate a dissection into a lesson?

A. It should be used as a step-by-step student activity while answering probing questions, followed up by teacher-led discussion and clarifications.

B. It should be used as a follow-up step-by-step student activity after Mr. Goodchild explains exactly what students will need to notice about the frog anatomy.

C. It should be used as a stand-alone step-by-step activity for students to explore the frog’s anatomy and raise discussion questions on their own.

D. It should be used as a step-by-step demonstration by Mr. Goodchild while he explicitly points out what students need to know about frog anatomy.
Characteristics of water

Ms. George is teaching her 2nd graders about the characteristics of water as part of a unit on the properties of matter. Her objective is that students will learn that plain water is tasteless, odorless and colorless. She has the following liquids for the students to look at, taste, and smell: vinegar, water, salt water, sugar water, apple juice, and red-colored water.

Thinking about how you would teach this lesson, of the following, which one is most similar to what you would do?

A. I would begin by stating the three characteristics of water. Then I would have the students look at, taste, and smell the various liquids based on my directions. I would use their experiences to verify the characteristics of water.

B. I would begin by having my students explore each sample. I would then conclude the lesson by having the students talk about the liquids and what they had learned about the characteristics of water.

C. The objective for this lesson is so simple as to not need a hands-on activity. I would clearly state the characteristics of water and then move on to the next part of the unit.

D. I would begin by having my students explore each sample. I would then ask for volunteers to tell the class what they saw, tasted, and smelled, and what they thought each sample was. I would use the students’ experiences as the basis for specifying the characteristics of water.
Lesson on force and motion

Ms. Brandt is preparing a lesson to introduce her 5th grade students to the relationship between force and motion, namely that a net force will cause an object to speed up or slow down (Newton’s 2nd Law). The classroom has available a loaded wagon to which a pulling force can be applied. Ms. Brandt is considering four different approaches to the lesson.

Thinking about how you would want to teach this lesson, of the following, which one is most similar to what you would do?

A. Write a clear statement of Newton’s 2nd Law on the board and explain it carefully to my students. Then I would demonstrate the law by pulling on a loaded wagon with a constant force in front of the class as they observe the motion.

B. Raise the question of what kind of motion results from a constant force. I would then guide my students to explore the question themselves by pulling on a loaded wagon and observing what happens. From the evidence they would then propose a possible law.

C. Write a clear statement of Newton’s 2nd Law on the board and explain it carefully to my students. I would then have the students verify the law by pulling on a loaded wagon themselves and confirming what type of motion results.

D. Raise the question of whether there is any relationship between force and motion. My students would then be free to explore this safely in the lab. Afterward we would have a class discussion of their findings.
Microbes

Mr. Green is introducing his 3rd grade students to the idea that tiny living microbes are found all around us. He has his students create a list of places where they think that microbes would or would not be found. The students then share their lists while Mr. Green writes their ideas on the board.

Thinking about how you would teach, of the following, which is most similar to how you would follow up on this introductory activity?

A. I would applaud the students for their participation, and then end the lesson by having them write a short paragraph on where they believe microbes can be found.

B. I’d ask the students what generalizations they might reach based on the lists they created. Then, based on the students’ ideas, I would confirm the point that microbes can be found most everywhere in daily life.

C. I would explain that microbes can be found almost everywhere in daily life. Then I would use students’ ideas from their lists for support, so that the lesson objective is clearly tied to the students’ ideas.

D. Rather than beginning the lesson this way, I would have clearly stated what students were to learn before engaging in any activities.
Comets

Ms. Thole’s 7th grade class is doing an astronomy lesson on comets. She creates a dry ice model of a comet and has the students make observations. Then, using resources in the classroom, Ms. Thole has the students search for the characteristics of real comets, and create a list of properties found in the dry ice comet model that are also properties of real comets. Students will continue the list with additional properties they find of real comets. The lesson ends with a classroom discussion of their findings.

Thinking about how you would teach, of the following, which best describes your evaluation of Ms. Thole’s lesson?

A. This is a good lesson because it allows the students to do their own investigating. However, the students would be more engaged if the teacher allowed them to design their own comet models.

B. Ms. Thole should have begun by describing the characteristics of real comets using photos and diagrams. Then she should have referred to the dry ice comet model to highlight some of the characteristics of real comets.

C. This is a good lesson because the students are able to explore a concrete model as well as using other resources to learn about the characteristics of comets.

D. Ms. Thole should have begun by describing the characteristics of real comets using photos and diagrams. Then, referring to the dry ice comet model, she should ask students to record their observations of how the model is similar to a real comet.
Properties of air 1

Ms. Kennedy wants her kindergarten students to learn that air is everywhere. She asks them where they think air might be found and they quickly respond with various answers. She then asks the students if there is anywhere in the room where there might not be air. She shows them that air can be trapped in a plastic bag, and suggests that students use bags to explore this possibility. She hands out bags and the students start hunting.

Thinking about how you would teach this lesson, of the following, how would you evaluate Ms. Kennedy’s lesson?

A. The lesson would be more effective if Ms. Kennedy had first explained that air is indeed something that is all around us. The student activity would then make more sense because they would be seeking to confirm what they had been taught about air.

B. The lesson would be more effective if Ms. Kennedy told the students that they would be learning about air, and then invited the students to come up with ways to show whether or not there was air everywhere in the room. They could use available materials, including plastic bags.

C. The lesson would be more effective if Ms. Kennedy had first explained that air is indeed something that is all around us, and concludes with a demonstration using a plastic bag. It is not necessary to have the kids hunt for air themselves.

D. This is a good lesson. Ms. Kennedy opens with a question that the students are then allowed to investigate for themselves using plastic bags.
Rain and water flow

Ms. Walters wants to start teaching her 2nd grade students about water movement and bodies of water on Earth, i.e., to understand that when rain falls on Earth the water flows downhill into bodies of water (streams, rivers, lakes, oceans), or into the ground.

Thinking of how you would design a lesson for your students, which of the following approaches would you suggest Ms. Walters take?

A. Provide a box of soil at each bench and have groups shape landscapes in it with hills and valleys. Have them suggest what might happen if they sprinkle water on it to represent rain. Then have them try it out, report their observations and relate that to what happens on Earth.

B. Project a diagram showing rain falling onto the earth, and water running downhill to form streams, rivers, lakes and oceans, with some going into the ground. Then go over each aspect carefully while pointing to it on the diagram, taking questions along the way.

C. Have student groups shape soil into hills and valleys and sprinkle water onto it, but don’t tell them in advance what it is about or what to focus attention on. Have them report what they observe happens and suggest if this is similar to anything on Earth.

D. Tell students that rain falling on the ground will flow downhill to form streams, rivers, lakes and oceans. Demonstrate this with a model: a large shallow box of soil, shaped into hills and valleys. Students watch as she sprinkles water from the spray nozzle of a watering can, and asks them to notice how it flows downhill to form streams and then ponds.
Boyle’s law

Mr. Lawton’s 8th grade class is learning about Boyle’s gas law. The volume of an enclosed gas is inversely proportional to pressure if temperature is kept constant. There is a gas law apparatus that can be used safely in the classroom. Mr. Lawton, however, is not sure in what order to do things: start by formally stating Boyle’s law first or start by having the students do a gas experiment.

Thinking about how you would teach, of the following, which sequence would you advise Mr. Lawton to use?

A. He should first state Boyle’s law so students encounter the correct science from the start, and then demonstrate it using the gas apparatus. This approach is efficient with no real need for students to repeat the experiment themselves.

B. He should first state Boyle’s law so students encounter the correct science from the start. The students can then use the gas apparatus to confirm Boyle’s Law for themselves.

C. He should first allow the students to experiment on their own to collect data on gas volume and pressure. Building on their data, he should then guide students toward Boyle’s Law as a model that accounts for their findings.

D. He should first allow the students to explore gas behavior on their own and collect data. He should ask them to create models that account for their findings and be prepared to report back to the class.
Light reflection

Ms. Baker is teaching her 8th grade students the law of reflection: when a ray of light strikes a mirrored surface, it leaves at the same angle as when it arrived. Ms. Baker has to decide how she will teach the lesson.

Thinking about your own teaching, of the following, which is most similar to how you would teach the lesson?

A. I would write the law of reflection on the board and illustrate with a diagram. Then I'd have the students verify the law using light ray sources, mirrors, and protractors. We would then discuss their findings.

B. I would first pose a question about reflection for the students to explore. The students could investigate using light ray sources, mirrors, and protractors, and then discuss their findings. I would close the lesson by giving them a summary of the law of reflection.

C. I would ask students to find out what they can about light behavior around mirrors by exploring on their own with an assortment of available items, including light ray sources, mirrors, and protractors. Then the students would report back on what they did and what they found out.

D. I would write the law of reflection on the board and illustrate with a diagram. Next I'd show them a real example, using a light ray source, mirror, and protractor. Then we would discuss any questions the students might have.
Animal classification

Mr. Clark will be teaching animal classification to his 4th grade students. Prior to any instruction, Mr. Clark asks his students to help him make a list of 25 animals. Then each student works on classifying the animals any way they choose.

Thinking about how you would teach, of the following, which is the best evaluation of this introductory lesson?

A. This introductory lesson is fine the way it is, because it gives students the opportunity to discover that there are different ways to classify.

B. Mr. Clark should have shown the students how to scientifically classify the listed animals, demonstrating the proper convention.

C. Mr. Clark should have first described how animal classification using characteristics is done, also providing an example. To verify student understanding, the students should then be asked to classify their own list of animals.

D. This introductory lesson is fine, except Mr. Clark should have provided more guidance on the kinds of characteristics students should use to group the animals.
What is an atom like?

Ms. Dalton taught her 8th grade students that matter is made of atoms. She then asked what an atom itself might be like. She wants to introduce the idea of *models* in science: though we can't see atoms we can envisage models to account for their properties. She said one clue about atoms was that scientists had discovered there are negative particles (electrons) in atoms, though atoms are neutral overall. She has available large posters of the older ‘plum pudding’ model and the subsequent ‘nuclear atom’ model.

Thinking about how you might teach, of the following, which is closest to how you would conduct the lesson? I would…

A. Begin by asking the students to suggest their own models for what an atom might be like, given that it has electrons but is neutral overall. I would then have them compare their ideas with the ‘plum pudding’ and ‘nuclear atom’ models. Drawing on their comments, I would explain how scientists arrived at the first model and why they later changed to the second model. Then I would then have the students sketch different example atoms drawing information from a Periodic Table.

B. Display the posters of both models and explain how scientists arrived at the first model and why they later changed to the second model. Referring to information from the Periodic Table, I would show how the ‘nuclear atom’ model can represent the atoms of different elements.

C. Display the posters of both models and explain how scientists arrived at the first model and why they later changed to the second model. I would then have the students sketch different example atoms drawing information from a Periodic Table.

D. Ask the students to think of as many possible models as they can of how an atom might look. I would have them report back on their ideas with sketches. Most of the lesson time would be given to students proposing and supporting their models. I would end the lesson by having the students compare and contrast their ideas with the ‘plum pudding’ and ‘nuclear atom’ models, noting that scientists now embraced the latter.
Ms. Jonas is teaching a lesson about volume to her 6th grade class. She starts by explaining that when a solid object is submerged in water, it displaces a volume of water equal to its own volume. To demonstrate, she has a variety of objects with known (calculated) volumes, as well as several graduated cylinders each containing the same measured volume of water. On the board, for each graduated cylinder, Ms. Jonas adds up the values of object volume plus water volume to predict each final combined volume. Next Ms. Jonas carefully drops each object to the bottom of its respective cylinder, reads the new volumes and writes them on the board. She concludes the lesson by pointing out that the combined volume predictions were correct, thus verifying the principle of measuring an object’s volume by submersion (which Archimedes found most useful with irregular objects whose volume is not easily calculated).

Thinking about how you would teach, of the following, which is the best evaluation of this lesson?

A. This is a good lesson because Ms. Jonas combines an appropriate demonstration with a clear explanation of how volume can be measured.

B. This is not a very good lesson. Before providing any explanations, Ms. Jonas should have asked the students how they might find out the volume of objects without measuring the objects themselves. She should have allowed her students to propose ideas, ask for equipment, experiment, record their observations and then share them with the class.

C. This is not a very good lesson. Ms. Jonas should have given the students various objects of known (calculated) volumes along with graduated cylinders of water, and asked them to find out what happens to the water levels when objects are submerged within (and why). She should have concluded the lesson by drawing on the students’ findings to explain the general principle.

D. This is a good lesson, but after the explanation of how to measure the volume of objects, Ms. Jonas should have allowed her students to try the activity on their own, with various objects of known (calculated) volume.
Light transmission

Ms. Blanchard's intended learning outcome is for her 4th grade students to understand the concepts of opacity and transparency. She starts the lesson by writing the terms transparent, translucent, and opaque on the board. She then demonstrates each concept using a variety of objects. She closes the lesson by giving her students an exercise where they are to classify additional examples.

Thinking about how you would teach, of the following, what do you think of how Ms. Blanchard conducted this lesson?

A. It would have been better if, after explaining the concepts, Ms. Blanchard had asked her students to test each of the material on their own rather than doing a demonstration.

B. Ms. Blanchard did the right thing by first clearly explaining and demonstrating the concepts to be learned.

C. It would have been better if Ms. Blanchard let the students work at their desks with a variety of materials, coming up with ideas about the different ways they interact with light.

D. Ms. Blanchard should have asked the students to work with various materials at their desks, and try to describe how much light gets through each of the materials.
Temperature and solubility

Ms. Clark’s 7th graders have learned that sugar becomes more soluble in water as the water temperature increases. Now she wants her students to learn that, unlike sugar, the solubility of salt does not increase with temperature. Graduated cylinders of hot and cold water, salt, sugar, and stir sticks are available.

Thinking about how you would teach, of the following, which one is most similar to how you would conduct this lesson?

A. I would explain that while we found that sugar is more soluble in hot water, not all solids behave the same way. I would demonstrate using salt instead of sugar in the graduated cylinders of hot and cold water.

B. I would pose the question of whether all solids might dissolve better in hot water like sugar did. I would ask them to design and do an experiment to test whether salt dissolves better in hot or cold water.

C. I would give my class sets of graduated cylinders, salt, sugar, and hot and cold water, and ask them if they could find out anything about salt versus sugar dissolving in water. I would not prescribe what they should do. Later, we would discuss what they did and what they found out.

D. I would explain that while we found that sugar is more soluble in hot water, not all solids behave the same way. I would then have them verify this in the lab using the same amount of salt in each cylinder of hot and cold water.
Chlorophyll

“Chlorophyll is a natural pigment found in green plants. It is the primary pigment that absorbs light energy from the sun for photosynthesis. This energy is then used by the plant to synthesize carbohydrates from carbon dioxide and water.” This is what Ms. Pozner’s 8th grade life science textbook says, and she is wondering how best to teach a lesson on chlorophyll and the process of photosynthesis. She has several ideas but each one has limitations.

Thinking about how you would teach, of the following ideas that Ms. Pozner is considering, which is most similar to how you would teach this lesson? I would…

A. Have the students read the textbook section on photosynthesis and chlorophyll. We would then have a classroom discussion where we draw out and clarify the important points. I would then summarize the concepts for the students.

B. Have the students read the textbook section on photosynthesis and chlorophyll. I would then explain these concepts while showing relevant slides.

C. Read aloud the textbook section on photosynthesis and chlorophyll to the class. Then I would explain these concepts while showing relevant slides.

D. Have the students use the textbook and online resources to investigate photosynthesis and the role of chlorophyll. I would then have the students summarize their findings for the class.