

# **BFSU Science Workbook**

Semester 1 | Year 1

*A Writing Revolution Workbook*

*Based on Building Foundations of Scientific Understanding by Bernard J. Nebel, Ph.D.*

## Organizing Things into Categories

### Read Aloud Passage

When scientists study the world, they sort things into groups called categories. A category is a group of two or more things that share something in common. For example, you could sort a pile of buttons, coins, and pencils by color, by size, or by what they are used for. There is no single right way to sort things. The way you sort depends on what you are trying to find out.

Sorting things into categories is not just something scientists do with objects. Our brains do it all the time. When you learn new information, your brain looks for ways to connect it to things you already know. Grouping ideas together helps you remember them better.

Categories can also be broken into smaller groups. Animals is a big category. Inside that category, you could make a smaller group called birds. Inside birds you could make an even smaller group called birds that can swim. Scientists use this kind of layered sorting to organize all of nature.

The most important thing to remember is this: when you sort things into a category, every item in that group shares something with the others. That shared thing is what holds the category together.

## Organizing Things into Categories

### Activity 1

Listen to the passage again. Write three key words or phrases that tell the most important ideas.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

### Activity 2

**Because / But / So** Complete each sentence three different ways.

*Scientists sort things into categories because*

---

---

*Scientists sort things into categories but*

---

---

*Scientists sort things into categories so*

---

---

## Solids, Liquids, and Gases

### Read Aloud Passage

Everything around us is matter, and all matter comes in one of three forms: solid, liquid, or gas. You can tell which one something is by watching how it behaves.

Solids hold their shape on their own. A rock, a book, and an apple are all solids. You do not need to put them in a container to keep their shape.

Liquids flow and take the shape of whatever container they are poured into. Water, juice, and honey are all liquids. If you pour water into a tall skinny cup, it becomes tall and skinny. Pour it into a wide bowl, and it spreads out wide. The amount of liquid stays the same, but its shape changes.

Gases spread out and fill up whatever space they are in. Air is a gas. You cannot see most gases, but they are real. When you blow up a balloon, the air inside fills every corner of the balloon.

Some things can look like they are flowing, like a pile of sand, but sand is actually a solid. Each tiny grain holds its shape on its own.

## Solids, Liquids, and Gases

### Activity 1

Fill in the blank with the correct word from the word box.

**Word Box:** *solid liquid gas shape container*

1. A \_\_\_\_\_ holds its own shape without a container.
2. A \_\_\_\_\_ takes the shape of whatever it is poured into.
3. A \_\_\_\_\_ spreads out to fill any space.
4. Liquids flow and change their \_\_\_\_\_, but not their amount.
5. Air is a type of \_\_\_\_\_.

### Activity 2

Each group of words is a fragment. Add what is missing to make a complete sentence.

1. *flows into any container*

---

---

2. *solid like a rock*

---

---

## Gravity I: The Earth's Gravity

### Read Aloud Passage

Gravity is a pulling force. It pulls things toward each other. The Earth is very large, and its gravity pulls everything toward the center of the Earth. That is why when you drop something, it falls down. It is being pulled toward the Earth.

Gravity gives things their weight. Weight is the measure of how hard gravity is pulling on something. A heavy rock has more weight than a feather because gravity is pulling harder on the rock.

Gravity works the same way on every side of the Earth. People who live in Australia are on the other side of the globe from us, but they do not fall off. Gravity pulls them toward the center of the Earth too, just from a different direction. Down always means toward the center of the Earth, no matter where you are standing.

Everything on Earth is affected by gravity, from tiny pebbles to huge boulders. Gravity also holds the air around our planet so it does not float away into space.

## Gravity I: The Earth's Gravity

### Activity 1

**Because / But / So** Complete each sentence three different ways.

*Gravity pulls things toward the Earth because*

---

---

*Gravity pulls things toward the Earth but*

---

---

*Gravity pulls things toward the Earth so*

---

---

### Activity 2

Circle True or False for each statement.

1. **True / False** Gravity pulls things toward the center of the Earth.
2. **True / False** People in Australia fall off the Earth because they are upside down.
3. **True / False** Weight is the measure of how hard gravity pulls on something.
4. **True / False** Gravity holds the air around our planet.

## Changes with Temperature and Matter

### Read Aloud Passage

Matter can change from one form to another when the temperature changes. When something gets warm enough, it can change from a solid into a liquid. This is called melting. Ice is a solid. When ice gets warm enough, it melts into liquid water.

When something gets cold enough, a liquid can change into a solid. This is called freezing. Liquid water freezes into ice when the temperature drops low enough. Butter and chocolate can melt and freeze too.

When a liquid gets hot enough, it can turn into a gas. This is called evaporation. When water boils, it turns into a gas called water vapor and floats away into the air. You can see this as steam.

All of these changes, melting, freezing, and evaporation, are changes in matter. The word matter means anything that has weight and takes up space. Solids, liquids, and gases are all forms of matter. Heat and light are not matter. They have no weight and do not take up space.

## Changes with Temperature and Matter

### Activity 1

Write three key words from the passage that name what happens when matter changes with temperature.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

### Activity 2

Fill in the blank with the correct word from the word box.

**Word Box:** *melting* *freezing* *evaporation* *matter* *weight*

1. When a solid gets warm enough and becomes a liquid, that is called \_\_\_\_\_.
2. When a liquid gets cold enough and becomes a solid, that is called \_\_\_\_\_.
3. When a liquid gets very hot and turns into a gas, that is called \_\_\_\_\_.
4. Anything that has weight and takes up space is called \_\_\_\_\_.
5. Heat and light are not matter because they have no \_\_\_\_\_.

## Horizontal, Vertical, and Orbits

### Read Aloud Passage

Two very important directions in science are vertical and horizontal. Vertical means straight up and down, in the exact direction that gravity pulls. If you tie a weight to a string and let it hang, the string points in a perfectly vertical direction. Scientists call this a plumb bob.

Horizontal means perfectly flat and level, going across rather than up or down. A flat table is horizontal. A carpenter's level is a tool that shows whether something is truly horizontal.

Vertical and horizontal are always defined by gravity. No matter where you are on Earth, vertical always points toward the center of the Earth, and horizontal is always perpendicular to that.

The Moon travels around the Earth in a path called an orbit. The Moon stays in orbit because gravity keeps pulling it toward the Earth. At the same time, the Moon is moving sideways fast enough that it keeps missing the Earth. The pull of gravity and the sideways movement balance each other out, and this keeps the Moon going around and around. Satellites work the same way.

## Horizontal, Vertical, and Orbits

### Activity 1

Fill in the blank with the correct word from the word box.

**Word Box:** *vertical horizontal gravity orbit plumb bob*

1. \_\_\_\_\_ means straight up and down in the direction gravity pulls.
2. \_\_\_\_\_ means perfectly flat and level.
3. A \_\_\_\_\_ is a weight on a string that shows a perfectly vertical line.
4. The Moon travels around the Earth in a path called an \_\_\_\_\_.
5. The Moon stays in orbit because \_\_\_\_\_ pulls it toward the Earth.

### Activity 2

Turn each fragment into a complete sentence.

1. *always points toward the center of the Earth*

---

---

2. *keeps the Moon in orbit around the Earth*

---

---

## Concepts of Energy I: Making Things Go

### Read Aloud Passage

Energy is what makes things go, move, change, or happen. Without energy, nothing would ever move or change. There are different forms of energy, but they all share one thing in common: they can make something happen.

Heat energy can make things go. When you cook food on a stove, heat energy is what changes the food. Electrical energy can make things go too. It powers lights, fans, and computers. Light energy travels from the sun and helps plants grow. Movement energy, also called kinetic energy, is the energy that moving things have.

One of the most important rules in science is that energy cannot be created and it cannot be destroyed. Energy can only change from one form into another. When you turn on a lamp, electrical energy changes into light energy and heat energy. When you ride a bike, the energy stored in your food changes into the energy of movement.

Everything that happens around us, from a ball rolling to a fire burning, involves energy changing from one form to another.

## Concepts of Energy I: Making Things Go

### Activity 1

**Because / But / So** Complete each sentence three different ways.

*Energy cannot be created or destroyed because*

---

---

*Energy cannot be created or destroyed but*

---

---

*Energy cannot be created or destroyed so*

---

---

### Activity 2

Circle True or False for each statement.

- 1. True / False** Energy makes things move, change, and happen.
- 2. True / False** Energy can be created if you have enough heat.
- 3. True / False** Electrical, heat, light, and movement are all forms of energy.
- 4. True / False** When a lamp turns on, electrical energy changes into light and heat energy.

## Air Is a Substance

### Read Aloud Passage

Air is a real thing. Even though you cannot see it, air takes up space and has weight. Scientists say that air is a substance, which means it is made of real matter.

You can prove that air takes up space. If you push an upside-down cup straight down into a bowl of water without tilting it, the inside of the cup stays dry. That is because the air trapped inside the cup is keeping the water out. The air is taking up that space and will not let the water in.

Air also has weight. If you take two identical balloons and blow one up bigger than the other, the fuller balloon will be heavier. The extra air inside adds weight. You can show this by hanging both balloons from the ends of a ruler and watching which side dips down.

We feel moving air as wind. We breathe air in and out. Air fills our tires, our basketballs, and our balloons. Even though we cannot see it, air is all around us and it is very real.

## Air Is a Substance

### Activity 1

Write three key words from the passage that help explain what air is.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

### Activity 2

**Because / But / So** Complete each sentence three different ways.

*Air takes up space and has weight because*

---

---

*Air takes up space and has weight but*

---

---

*Air takes up space and has weight so*

---

---

## Energy Transforms and Travels

### Read Aloud Passage

Energy is always on the move. It changes from one form to another, and scientists call this an energy transformation. A simple example is a wind-up toy. When you wind it up, you are storing energy in a coiled spring. When you let it go, that stored energy changes into movement energy and the toy moves.

Energy can also travel from one place to another. Light energy travels from the sun all the way to the Earth. Heat energy can travel through objects, like a metal spoon getting hot in a warm bowl of soup. Sound energy travels through the air from a speaker to your ears.

Some sources of energy can be used over and over again. The sun keeps shining. Wind keeps blowing. Moving water keeps flowing. These are called renewable energy sources. Other sources of energy, like coal and oil, took millions of years to form inside the Earth. Once we use them up, they are gone. These are called nonrenewable energy sources.

Whether energy is renewable or nonrenewable, it is always changing forms and always making things happen.

## Energy Transforms and Travels

### Activity 1

Fill in the blank with the correct word from the word box.

**Word Box:** *renewable nonrenewable transformation stored travels*

1. When energy changes from one form to another, it is called an energy \_\_\_\_\_.
2. A wound-up spring has \_\_\_\_\_ energy ready to be released.
3. Light energy \_\_\_\_\_ from the sun to the Earth.
4. The sun and wind are examples of \_\_\_\_\_ energy sources.
5. Coal and oil are \_\_\_\_\_ because once they are used, they are gone.

### Activity 2

Put the words in the correct order to make a complete sentence.

1. energy / forms / changes / one / from / to / another

---

---

2. sources / renewable / used / be / over / can / again / and / over

---

---

## The Atmosphere

### Read Aloud Passage

Earth is surrounded by a thick blanket of air called the atmosphere. The atmosphere stretches many miles above the surface of the Earth, but it is held close to the planet by gravity. Without gravity, the air would drift away into space.

The atmosphere is not the same all the way through. The air near the ground is thicker and has more substance in it. As you go higher up, there is less and less air. Very high up, there is almost no air at all.

When astronauts travel into space, they must bring their own air supply. Space suits are sealed and filled with air so astronauts can breathe. There is no air in space, which means there is no atmosphere beyond our planet.

Earth has three main layers that work together as a system. The land under our feet is called the lithosphere. The water on Earth is called the hydrosphere. The air around Earth is the atmosphere. Life on Earth depends on all three of these working together.

# The Atmosphere

## Activity 1

Circle True or False for each statement.

1. **True / False** The atmosphere is a blanket of air that surrounds the Earth.
2. **True / False** The atmosphere is the same thickness all the way through.
3. **True / False** Gravity holds the atmosphere close to the Earth.
4. **True / False** Astronauts can breathe normally in space without a space suit.

## Activity 2

**Because / But / So** Complete each sentence three different ways.

*The atmosphere is held close to the Earth by gravity because*

---

---

*The atmosphere is held close to the Earth by gravity but*

---

---

*The atmosphere is held close to the Earth by gravity so*

---

---

## Living, Natural, and Human-Made Things

### Read Aloud Passage

Everything in our world can be placed into one of three groups. The first group is living things, which scientists also call biological things. The second group is natural nonliving things, which are things that come from the Earth but are not alive. The third group is human-made things, which are things that people have built or created.

Living things grow, reproduce, need food or energy, and respond to the world around them. Dogs, trees, mushrooms, and people are all living things. Rocks, water, air, and soil are natural nonliving things. They come from the Earth, but they do not grow or reproduce on their own. Tables, cars, and plastic bags are human-made. People made them from natural materials.

Some things can be tricky to sort. A dead leaf was once living, so it used to belong in the living group. A wooden table is made from a natural material called wood, but a person built it, so it belongs in the human-made group. A bird's nest is made from natural materials by an animal, not a human, so it belongs in the natural category.

Asking good questions helps us sort things correctly. Is it alive? Did a person make it? Did it come from the Earth on its own?

## Living, Natural, and Human-Made Things

### Activity 1

Write three key words from the passage that name the three groups things can be sorted into.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

### Activity 2

Turn each fragment into a complete sentence.

1. *grows, reproduces, and needs food or energy*

---

---

2. *made by people from natural materials*

---

---

## Matter I: All Matter Is Made of Particles

### Read Aloud Passage

Here is an amazing fact about everything around you: all matter is made of incredibly tiny particles. These particles are so small that you cannot see them, even with most microscopes. But scientists know they are there because of the clues matter leaves behind.

When you spray water into the air, it breaks into tiny droplets. When you file a piece of wood, tiny bits fall off. When you dissolve salt in water, the salt seems to disappear, but it is still there as particles too small to see. All of these things give us evidence that matter is made of very small pieces.

These particles are always moving. In solids, the particles are packed tightly together and vibrate in place. They do not move past each other, which is why solids hold their shape. In liquids, the particles are still close together but can move past each other, which is why liquids flow. In gases, the particles move very fast and spread out in all directions, which is why gases fill up any space.

The idea that all matter is made of tiny moving particles helps explain almost everything we see matter do.

## Matter I: All Matter Is Made of Particles

### Activity 1

**Because / But / So** Complete each sentence three different ways.

*All matter is made of tiny particles because*

---

---

*All matter is made of tiny particles but*

---

---

*All matter is made of tiny particles so*

---

---

### Activity 2

Fill in the blank with the correct word from the word box.

**Word Box:** *particles* *vibrate* *flow* *spread* *evidence*

1. All matter is made of tiny \_\_\_\_\_ that are too small to see.
2. In solids, particles are packed tightly and \_\_\_\_\_ in place.
3. In liquids, particles can move past each other, which is why liquids \_\_\_\_\_.
4. In gases, particles move fast and \_\_\_\_\_ out to fill any space.
5. When salt disappears in water, it gives us \_\_\_\_\_ that matter is made of tiny pieces.

## What Makes Something Living?

### Read Aloud Passage

Scientists use a checklist to decide whether something is truly living. To be alive, something must do all of the following: it must grow and develop, it must reproduce or be able to reproduce, it must respond to things happening around it, and it must need energy or food to survive.

Some things can trick us. Fire grows bigger and seems to move, but fire is not alive. It cannot reproduce, and it does not need food the way living things do. Crystals can grow, but they do not reproduce or respond to their surroundings. Rivers move, but they do not grow or reproduce either.

A virus is one of the hardest cases. Scientists still debate whether viruses are living or nonliving because they can reproduce inside a living cell, but they cannot do much on their own.

The key idea is that something must meet all the criteria, not just one or two. A car moves and needs fuel, but it does not grow, reproduce, or respond to the world around it the way a living thing does. Only things that meet all the requirements can be called truly alive.

## What Makes Something Living?

### Activity 1

One detail below does NOT belong in a paragraph about what makes something living. Circle it and explain why it does not belong.

- A. Living things grow, reproduce, and need energy.
- B. Fire grows bigger but it cannot reproduce, so it is not alive.
- C. Solids hold their shape because their particles are packed tightly.
- D. Something must meet all the criteria to be considered truly living.

Why does it not belong?

---

---

### Activity 2

Circle True or False for each statement.

- 1. **True / False**    Something only needs to meet one or two of the criteria to be considered living.
- 2. **True / False**    Fire is not alive because it cannot reproduce.
- 3. **True / False**    Living things must grow, reproduce, respond to surroundings, and need energy.
- 4. **True / False**    A crystal that grows is considered a living thing.

## Particles in Solids, Liquids, and Gases

### Read Aloud Passage

Now that we know all matter is made of tiny particles, we can use that idea to explain why solids, liquids, and gases behave so differently from each other.

In a solid, the particles are packed very close together and held tightly in place. They vibrate a little, like a person shivering, but they do not move past each other. This is why a solid has a definite shape and holds it. A rock stays the shape of a rock.

In a liquid, the particles are still close together, but they can slide past each other and move around freely. This is why a liquid flows and takes the shape of its container. The particles stay connected, but they are not locked in one place.

In a gas, the particles move very fast and spread far apart from each other. There is a lot of empty space between the particles. This is why gases spread out to fill any container they are in, and why you cannot hold a gas in your hands.

When matter changes from solid to liquid or liquid to gas, the particles themselves do not change. The same particles are there, but they are moving faster and have more space between them.

## Particles in Solids, Liquids, and Gases

### Activity 1

Write three key words from the passage that describe how particles move in different states of matter.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

### Activity 2

Put the words in the correct order to make a complete sentence.

1. tightly / solids / packed / particles / in / are

---

---

2. shape / liquids / their / container / of / take / the

---

---

## Technology and Living Systems

### Read Aloud Passage

All human-made things start as something from the Earth. Plastic comes from oil. Glass comes from sand. Metal comes from rocks called ores. Paper comes from wood. Even though these things have been changed and shaped by people, they all began as natural materials from the Earth.

Machines and technology need energy from outside themselves to work. A car needs gasoline. A computer needs electricity. A toaster needs to be plugged in. Without that outside energy, machines stop working.

Living things are different. They generate their own energy by eating food. A dog finds food, eats it, and uses the energy in that food to run, grow, and live. Living systems do not need to be plugged in or filled up with fuel from outside.

Animals also build things, but those things are natural, not human-made. A bird builds a nest from sticks. A beaver builds a dam from wood and mud. A bee builds a hive from wax. These structures were not made by people, so we call them natural, even though an animal built them.

## Technology and Living Systems

### Activity 1

**Because / But / So** Complete each sentence three different ways.

*All human-made things start as natural materials from the Earth because*

---

---

*All human-made things start as natural materials from the Earth but*

---

---

*All human-made things start as natural materials from the Earth so*

---

---

### Activity 2

**Single-Paragraph Outline (SPO)** Use the details to build your outline.

**Write a topic sentence about how living things and machines get their energy differently.**

**Topic Sentence:**

---

---

**Detail 1:** Machines need energy from outside, like gasoline or electricity, to work.

**Detail 2:** Living things generate their own energy by eating food.

**Detail 3:** A dog uses the energy from its food to run, grow, and stay alive.

## Reversible and Nonreversible Changes

### Read Aloud Passage

Matter can change in two very different ways. Some changes are reversible, which means you can undo them and go back to the way things were. Other changes are nonreversible, which means you cannot undo them. Something new has been created.

Melting and freezing are reversible changes. Water can freeze into ice, and ice can melt back into water. You can go back and forth between these two forms as many times as you want. Evaporation and condensation are reversible too.

Burning is not reversible. When wood burns, it turns into ash, smoke, and gases. There is no way to put those ashes back together and get the original wood back. Cooking an egg is also nonreversible. Once an egg is cooked, it cannot be uncooked.

Scientists have a name for the nonreversible kind of change. It is called a chemical change. During a chemical change, the original substances are transformed into something new and different. Reversible changes, like melting and freezing, are called physical changes because the substance itself stays the same, just in a different form.

## Reversible and Nonreversible Changes

### Activity 1

One detail below does NOT belong in a paragraph about reversible and nonreversible changes. Circle it and explain why it does not belong.

- A. Melting and freezing are reversible changes in matter.
- B. Burning wood is a nonreversible change because you cannot get the wood back.
- C. Air is a real substance that has weight and takes up space.
- D. Cooking an egg is nonreversible because a cooked egg cannot be uncooked.

Why does it not belong?

---

---

### Activity 2

**Single-Paragraph Outline (SPO)** Use the details to build your outline.

**Write a topic sentence about the difference between reversible and nonreversible changes.**

**Topic Sentence:**

---

---

**Detail 1:** Reversible changes, like melting and freezing, can be undone.

**Detail 2:** Nonreversible changes, like burning, create something new that cannot go back.

**Detail 3:** Scientists call reversible changes physical changes and nonreversible changes chemical changes.