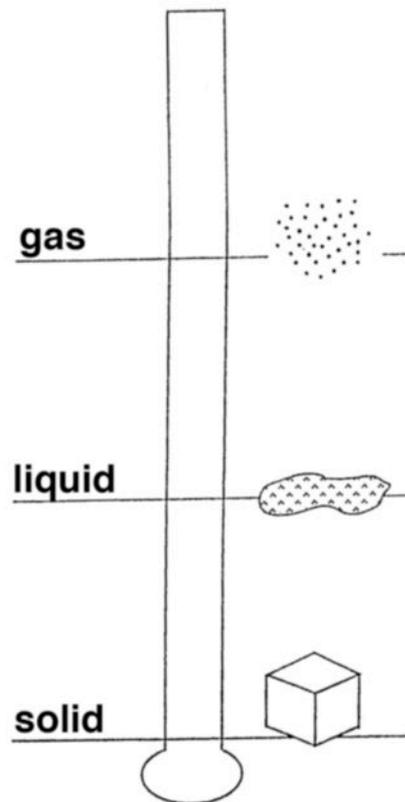


Level A Unit 4

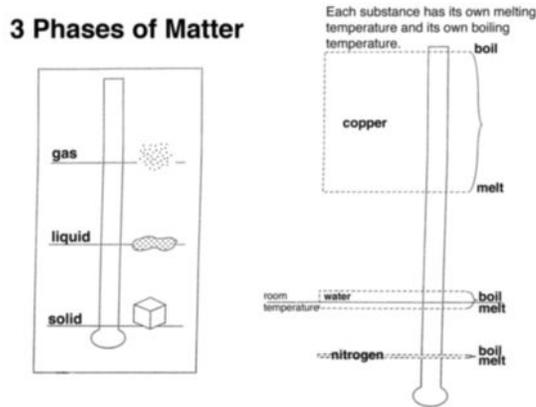
Phases of Matter: Solid, Liquid, Gas



Lesson 1

a. (Display **3 Phases of Matter** chart:)

[4:1A]



- You're going to learn about matter. All things that you can see or touch are matter. Clouds are matter, cloth is matter, dirt is matter, and trees are matter.
 - Here's a fact about matter: Matter has three phases—solid, liquid, gas.
 - Everybody, what are the three phases of matter? (Signal.) *Solid, liquid, gas.*
 - b. The solid phase is the coldest phase. (Point to the **solid block** on chart.) The solid phase of water is ice.
 - When you heat a **solid** phase of matter enough, it will turn into **liquid** matter. So **liquid** is the next hottest phase of matter. (Point to the **puddle**.)
 - If you heat a **liquid** enough, it will change into the **gas** phase of matter. That's the hottest phase of matter. The gas phase of water is steam. (Point to **gas**.) When matter is in the gas phase, it moves freely, like the air.
 - c. Remember the fact: All matter has three phases—solid, liquid, gas.
 - Your turn. How many phases of matter are there? (Signal.) **3.**
 - Say the three phases. (Signal.) *Solid, liquid, gas.*
 - What's the coldest phase? (Signal.) *Solid.*
 - What's the next hottest phase? (Signal.) *Liquid.*
 - What's the hottest phase? (Signal.) *Gas.*
- (Repeat step c until firm.)

- d. Here's a fact about the sun: The surface of the sun is 11,000 degrees Fahrenheit. How hot is the sun's surface? (Signal.) *11,000 degrees Fahrenheit.*
- The inside of the sun is even hotter. Everything inside the sun is in the gas phase. There are metals like iron and copper that are in the gas phase. There are minerals that make up rocks. They are in the gas phase. On the sun there is no liquid matter and there is no solid matter.
- e. Here's a fact about some of the planets that are far, far from the sun: The surface of those planets is so cold that everything is in the solid phase. Water is in the solid phase. Even most of the gases that are in the air on **earth** are in the solid phase on those faraway planets.
- Remember, if matter gets cold enough, it turns into a solid. If that same matter gets hot enough, it turns into a liquid and if it gets even hotter, it turns into a gas.
- f. Here's another fact about matter: Every different substance has its own melting temperature and its own boiling temperature.
- At the melting temperature, the substance changes from a solid to a liquid. What happens to a substance at the melting temperature? (Signal.) *It changes from a solid to a liquid.*
 - At the melting temperature, a liquid being cooled also changes. It changes from a liquid to a solid.
 - At the boiling temperature, the substance changes from a liquid to a gas. What happens to a substance at the boiling temperature? (Signal.) *It changes from a liquid to a gas.*
- g. Every substance has its own melting temperature and boiling temperature. You know the melting and boiling temperatures for water. (Point to **water**.) The melting temperature is the temperature at which ice turns to water.
- Listen: On the Fahrenheit scale, what's the melting temperature of water? (Signal.) *32 degrees.*
 - At the boiling temperature, liquid water turns into a gas, which is steam. What's the boiling temperature of water? (Signal.) *212 degrees Fahrenheit.*

- h. Let's try another one. Nitrogen is a gas that's in the air. (Point to **nitrogen**.)
The temperature must get to 320 degrees below zero before nitrogen turns into a liquid. The temperature must get to 346 degrees below zero before liquid nitrogen turns into solid nitrogen.
- Remember, the melting temperature is 346 degrees below zero. The boiling temperature is 320 degrees below zero.
 - What's the melting temperature for nitrogen? (Signal.) *346 degrees below zero.*
 - What's the boiling temperature? (Signal.) *320 degrees below zero.*
(Repeat step h until firm.)
- i. Copper is a metal that is used in making pennies. (Point to **copper**.) The melting temperature of copper is 1,981 degrees Fahrenheit. That's almost 2,000 degrees. The boiling temperature of copper is 4,172 degrees Fahrenheit.
- Glass has a melting point and a boiling point. The melting temperature of glass is about 2,500 degrees Fahrenheit. The boiling point is much, much higher.
- j. Remember, all matter has three phases—solid, liquid, gas. Every substance has its own melting temperature and boiling temperature. No two substances melt or boil at exactly the same temperature.
- k. Now let's review what you've learned.
- What are the three phases of matter? (Signal.) *Solid, liquid, gas.*
 - Which is the coldest phase? (Signal.) *Solid.*
 - Which is the hottest phase? (Signal.) *Gas.*
 - What do we call the solid phase of water? (Signal.) *Ice.*
 - At what temperature does water turn into ice? (Signal.) *32 degrees Fahrenheit.*
 - Is 32 degrees Fahrenheit the boiling temperature or the melting temperature of water? (Signal.) *Melting temperature.*
 - What is the boiling temperature of water? (Signal.) *212 degrees Fahrenheit.*
 - What do we call the gas phase of water? (Signal.) *Steam.*
 - At room temperature, what phase of matter is a penny? (Signal.) *Solid.*
 - If we heat a copper penny enough, it will turn into a different phase of matter. What phase will it turn into first? (Signal.) *Liquid.*
 - Yes, around 2,000 degrees Fahrenheit, it turns into a liquid.

- If we continue to heat the liquid copper, it turns into a different phase of matter. What phase is that? (Signal.) *Gas*.
 - Yes, at around 4,200 degrees Fahrenheit, it turns into a gas.
 - So, is 4,200 degrees the melting temperature or the boiling temperature of copper? (Signal.) *Boiling temperature*.
- I. Remember, at the melting temperature, matter changes from a solid to a liquid or changes from a liquid to a solid. At the boiling temperature, matter changes from a liquid to a gas or from a gas to a liquid.



Lesson 2

- a. Let's review what you learned about matter.
- How many phases of matter are there? (Signal.) *Three.*
 - Which is the coldest phase? (Signal.) *Solid.*
 - Which is the next hottest phase? (Signal.) *Liquid.*
 - What do we call the temperature at which something changes from the **solid** phase of matter to the **liquid** phase? (Signal.) *Melting temperature.*
 - If we continue to heat liquid matter, what phase of matter does it change into? (Signal.) *Gas.*
 - What do we call the temperature at which something changes from a liquid to a gas? (Signal.) *Boiling temperature.*
 - On the Fahrenheit scale, what's the melting temperature of water? (Signal.) *32 degrees.*
 - What's the boiling temperature of water? (Signal.) *212 degrees Fahrenheit.*
 - Do any other substances have the exact same melting temperature or the same boiling temperature as water? (Signal.) *No.*
 - Does copper melt at a higher temperature or at a lower temperature than water melts? (Signal.) *Higher temperature.*
 - Yes, copper melts at about 2,000 degrees Fahrenheit.
 - Nitrogen is around you right now. What phase of matter is that nitrogen? (Signal.) *Gas.*
 - If you cooled off that nitrogen enough, it would turn first to a liquid and then to a solid.

(Repeat step a until firm.)

- b. Number your paper from 1 to 11. Get ready to write answers to these items. ✓
- 1. How many phases of matter are there?
 - 2. Write the names of the phases of matter.
 - 3. Which is the coldest phase of matter?
 - 4. When a liquid is heated enough, what phase of matter does it turn into?
 - 5. What do we call the temperature at which a solid turns into a liquid?
 - 6. What's the hottest phase of matter?
 - 7. What do we call the temperature at which a liquid turns into a gas?
 - 8. What's the melting temperature of water?

- 9. What's the boiling temperature of water?
 - 10. Which has the highest melting temperature: water, copper, or nitrogen?
 - 11. Which has the lowest melting temperature: water, copper, or nitrogen?
- c. Check your work.
- Item 1. How many phases of matter are there? (Signal.) *Three.*
 - Item 2. Name the phases of matter. (Signal.) *Solid, liquid, gas.*
 - Item 3. Which is the coldest phase of matter? (Signal.) *Solid.*
 - Item 4. When a liquid is heated enough, what phase of matter does it turn into? (Signal.) *Gas.*
 - Item 5. What do we call the temperature at which a solid turns into a liquid? (Signal.) *Melting temperature.*
 - Item 6. What's the hottest phase of matter? (Signal.) *Gas.*
 - Item 7. What do we call the temperature at which a liquid turns into a gas? (Signal.) *Boiling temperature.*
 - Item 8. What's the melting temperature of water? (Signal.) *32 degrees Fahrenheit.*
 - Item 9. What's the boiling temperature of water? (Signal.) *212 degrees Fahrenheit.*
 - Item 10. Which has the highest melting temperature: water, copper, or nitrogen? (Signal.) *Copper.*
 - Item 11. Which has the lowest melting temperature: water, copper, or nitrogen? (Signal.) *Nitrogen.*

Lesson 3

REGULAR LESSON/MASTERY TEST • FRIDAY REVIEW

- a. You've learned about the three phases of matter. What are they? (Signal.)
Solid, liquid, gas.
- Which is the coldest phase? (Signal.) *Solid.*
 - What's the name of the temperature at which solids turn into another phase of matter? (Signal.) *Melting temperature.*
 - What phase of matter do solids turn into at the melting temperature? (Signal.) *Liquid.*
 - What phase of matter do liquids turn into if they are heated enough? (Signal.) *Gas.*
 - What's the name of the temperature at which liquids turn into gas? (Signal.)
Boiling temperature.
 - Do different substances have the same melting temperature or the same boiling temperature? (Signal.) *No.*
(Repeat step a until firm.)
- b. Here are some more facts about heating things.
- When solids are heated, they expand. Say that rule. (Signal.) *When solids are heated, they expand.*
 - When solids are cooled, they contract. Say that rule. (Signal.) *When solids are cooled, they contract.*
(Repeat step b until firm.)
- c. Things that expand get bigger. Things that contract get smaller. What's another way of saying **When solids are heated, they get bigger?** (Signal.)
When solids are heated, they expand.
- What's another way of saying **When solids are cooled, they get smaller?** (Signal.) *When solids are cooled, they contract.*
(Repeat step c until firm.)
- d. Let's think about that. If you had a hot bar of metal in the solid state and made the bar colder, the bar would contract. That means that it would get a little bit smaller. If you had ice that was 31 degrees and then cooled it down to 200 degrees below zero, it would contract. It would get a little smaller.

- On a really hot day, a road will expand. The road will actually get a little bigger.
- Remember the rule: When solids are heated, they expand. When solids are cooled, they contract. Say the rule. (Signal.) *When solids are heated, they expand. When solids are cooled, they contract.*
- e. Number your paper from 1 to 8. Get ready to write answers to these items. ✓
 - 1. Would a metal bar be bigger on a very **hot** day or on a very **cold** day?
 - 2. Would a piece of glass be slightly smaller on a hot day or on a cold day?
 - 3. What happens to something that expands?
 - 4. What happens to something that contracts?
 - 5. If you wanted to make a penny a little smaller, would you make it colder or make it hotter?
 - 6. Write the names of the three phases of matter from the coldest to the hottest.
 - 7. Write the Fahrenheit melting temperature and boiling temperature of water.
 - 8. Liquid nitrogen is a liquid phase of something that is normally not a liquid. What phase of matter is this substance normally?
- f. Check your work.
 - Item 1. Would a metal bar be bigger on a very hot day or on a very cold day? (Signal.) *On a very hot day.*
 - Item 2. Would a piece of glass be a little smaller on a hot day or on a cold day? (Signal.) *On a cold day.*
 - Item 3. What happens to something that expands? (Signal.) *It gets bigger.*
 - Item 4. What happens to something that contracts? (Signal.) *It gets smaller.*
 - Item 5. How could you make a penny slightly smaller? (Signal.) *Make it colder.*
 - Item 6. Name the three phases of matter from the coldest to the hottest. (Signal.) *Solid, liquid, gas.*
 - Item 7. What's the Fahrenheit melting temperature and boiling temperature of water? (Signal.) *32 degrees Fahrenheit, 212 degrees Fahrenheit.*
 - Item 8. Liquid nitrogen is a liquid phase of something that is normally not a liquid. What phase of matter is this substance normally? (Signal.) *Gas.*

Lesson 4

REGULAR LESSON/MASTERY TEST • FRIDAY REVIEW

- a. I'll name some substances. You tell me the phase of matter they are usually in.
- Cooking oil. What phase of matter? (Signal.) *Liquid.*
 - Newspaper. What phase of matter? (Signal.) *Solid.*
 - Oxygen. What phase of matter? (Signal.) *Gas.*
 - Smoke. What phase of matter? (Signal.) *Gas.*
 - Wood. What phase of matter? (Signal.) *Solid.*
 - Iron. What phase of matter? (Signal.) *Solid.*
 - Mercury. What phase of matter? (Signal.) *Liquid.*
 - Cloth. What phase of matter? (Signal.) *Solid.*
- b. You learned that solid matter changes size slightly when it is heated. Does the solid get larger or get smaller? (Signal.) *Larger.*
- What's another way of saying it gets larger? (Signal.) *It expands.*
- c. Here's the rule: When solids are heated, they expand. Say the rule. (Signal.)
When solids are heated, they expand.
- Say the rule for when solids are cooled. (Signal.) *When solids are cooled, they contract.*
- (Repeat step c until firm.)
- d. Here are some facts about objects. When you heat some solid objects in air, they won't change into a liquid. They'll burn up. That's because there is oxygen present in the air. If you remove the oxygen from the air, those objects will change into a liquid. Paper will turn into a liquid if there is no oxygen present. So will cloth. So will wood. But if oxygen is present, what will these objects do? (Signal.) *Burn up.*
- Here's another fact: Solids expand when they are heated. So do liquids, and so do gases. If air is heated, it expands a lot. That's why the pressure is greater in a hot tire than it is in a tire that is cool. Liquids also expand when they are heated, but they don't expand very much. Gases expand the most. Solids expand the next most. Liquids hardly expand or contract at all when the temperature changes.

- Here's the last fact: When we say that solids expand when they are heated, we mean that they must be solids when they start and solids after they have been heated. **But**, if we heat the solid enough to make it a liquid, we don't know whether the liquid will take up more space or less space than the solid.
- e. Here are two examples. A piece of ice is a lot larger than the liquid phase of that same substance. A piece of solid copper is smaller than the liquid phase of that copper. Solids may be bigger or smaller than they are as liquids.
- Remember, solids that are heated expand as long they stay in the solid phase. Liquids that are heated expand slightly as long as they stay in the liquid phase.
- f. The red line or silver line in a thermometer is a liquid inside a very narrow glass tube. When the thermometer gets hotter, the glass expands. The liquid expands, too, and so the liquid goes farther up the tube when it's hotter. When it's cold, the thermometer contracts, and the liquid does not go up as far.
- g. Listen: When the liquid goes higher and higher in the tube, is the day getting hotter or getting colder? (Signal.) *Getting hotter.*
 - Is the thermometer expanding or contracting? (Signal.) *Expanding.*
 - Gases expand more than liquids or solids when they are heated. And they contract more when they are cooled.
- h. Number your paper from 1 to 10. Get ready to write answers to these items. ✓
 - 1. Which is hotter, oxygen in the **liquid** phase or oxygen in the **solid** phase?
 - 2. What phase of matter is wood?
 - 3. If you heated wood that is in the air, what would happen to it?
 - 4. If you heated wood with no oxygen present, what would happen to it?
 - 5. Which is the hottest phase of any matter?
 - 6. If you heat gas that is in a balloon, what happens to the size of the gas?
 - 7. Is a copper wire slightly longer on a **hot** day or on a **cold** day?
 - 8. What happens to solid matter when it is cooled?
 - 9. The red line in a thermometer is liquid that is in a very narrow glass tube. When the thermometer gets hotter, will the liquid expand or contract?
 - 10. Will the liquid in a thermometer go up higher on a **hotter** day or on a **colder** day?

- i. Check your work.
- Item 1. Which is hotter, oxygen in the liquid phase or oxygen in the solid phase? (Signal.) *Liquid phase.*
 - Item 2. What phase of matter is wood? (Signal.) *Solid.*
 - Item 3. If you heated wood that is in the air, what would happen to it? (Signal.) *It would burn up.*
 - Item 4. If you heated wood with no oxygen present, what would happen to it? (Signal.) *It would turn to liquid.*
 - Item 5. Which is the hottest phase of any matter? (Signal.) *Gas.*
 - Item 6. If you heat gas that is in a balloon, what happens to the size of the gas? (Signal.) *It expands. (Gets bigger.)*
 - Item 7. Is a copper wire slightly longer on a hot day or on a cold day? (Signal.) *On a hot day.*
 - Item 8. What happens to solid matter when it is cooled? (Signal.) *It contracts. (Gets smaller.)*
 - Item 9. The red line in a thermometer is liquid that is in a very narrow glass tube. When the thermometer gets hotter, will the liquid expand or contract? (Signal.) *Expand.*
 - Item 10. Will the liquid in a thermometer go up higher on a hotter day or on a colder day? (Signal.) *On a hotter day.*



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