Solids, Liquids, and Gases

Teacher's Guide
Middle School

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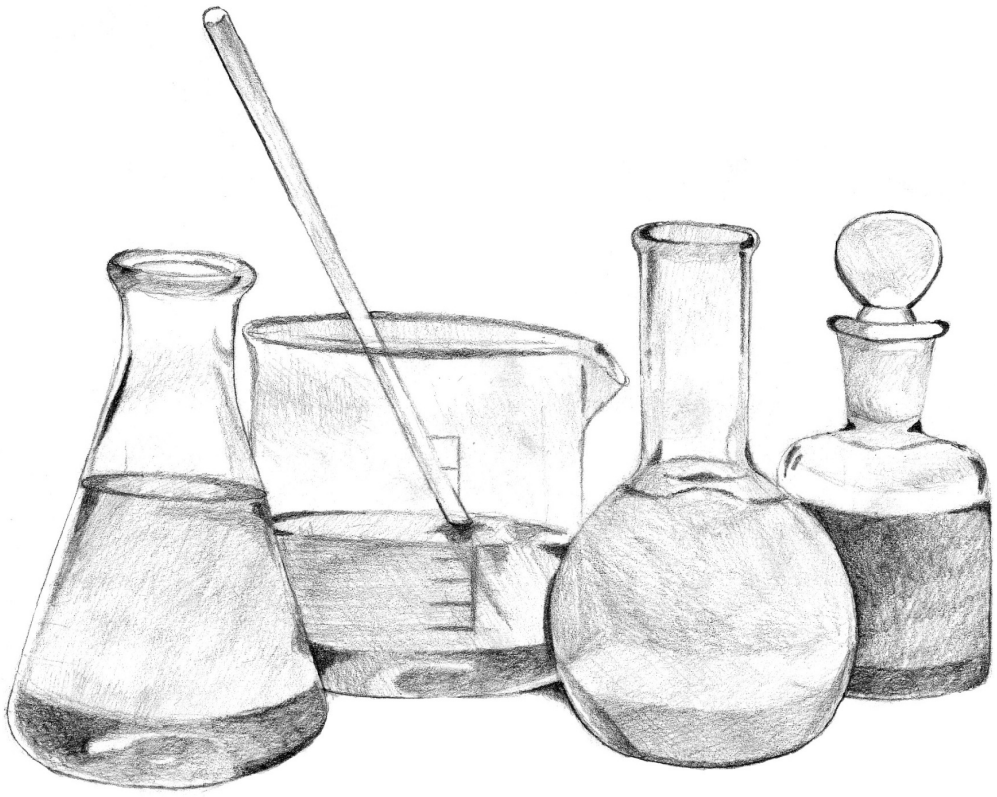

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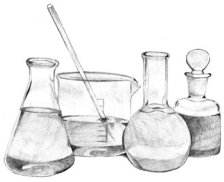

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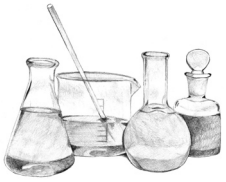

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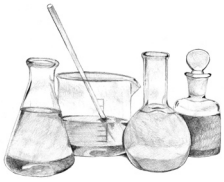

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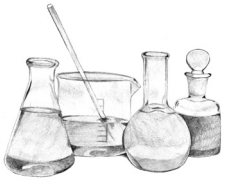


A Message from our Company . . .

Dear Educator:

Thank you for your interest in the educational videos produced by the Visual Learning Company. We are a Vermont-based, family owned and operated business specializing in the production of quality educational science videos and materials.

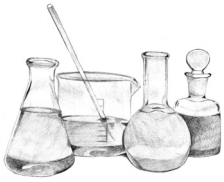
We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher, and to earn a Ph.D. in education, and led Stephanie to work on science educational programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, thus enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome



National Standards Correlations

National Science Education Standards
(Content standards: 5-8, National Academy of Sciences, c. 1996)

Physical Science - Content Standard B:

As a result of their activities in grades 5-8, all students should develop an understanding that:

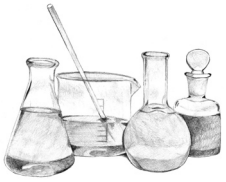
- A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances can often be separated into the original substances using one or more of the characteristic properties.
- Chemical elements do not break down during normal laboratory reactions involving such treatments as heating, exposure to electric current, or reaction with acids. There are more than 100 known elements that combine in a multitude of ways to produce compounds, which account for the living and nonliving substances we encounter.

Benchmarks for Science Literacy
(Project 2061 – AAAS, c. 1993)

The Physical Setting - Structure of Matter (4D)

By the end of 8th grade, students should know that:

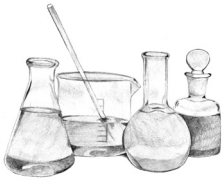
- All matter is made up of atoms, which are far too small to be seen directly through a microscope. The atoms of any element are alike but are different from atoms of other elements. Atoms may stick together in well-defined molecules or may be packed together in large arrays. Different arrangements of atoms into groups compose all substances.
- Atoms and molecules are perpetually in motion. Increased temperature means greater average energy of motion, so most substances expand when heated. In solids, the atoms are closely locked in position and can only vibrate. In liquids, the atoms or molecules have higher energy of motion, are more loosely connected, and can slide past one another; some molecules have still more energy of motion and are free of one another except during collisions.



Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students will be able to do the following:

- Describe that matter is made up of tiny particles which cannot be seen with the naked eye.
- Identify the four phases of matter: solid, liquid, gas, and plasma.
- Describe solids as having definite shape and definite volume.
- Cite some examples of solids.
- Differentiate between crystalline solids and amorphous solids.
- List examples of both crystalline solids and amorphous solids.
- Define liquids as matter with definite volume but no definite shape.
- Compare the relative viscosity of different fluids.
- Define gases as matter with no definite shape and no definite volume.
- Describe a phase change as the process of matter changing from one phase to another.
- Differentiate between melting, freezing, vaporization, and condensation.
- State the freezing point of water to be 0˚ Celsius.
- State the boiling point of water to be 100˚ Celsius.
- Describe the process of condensation and provide a common everyday example of condensation.
- Describe the difference between evaporation and vaporization.



Assessment

Preliminary Assessment:

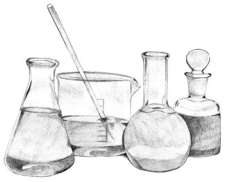
The Preliminary Assessment, provided in the Student Masters section, is an assessment tool designed to gain an understanding of students' pre-existing knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Video Review:

The Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. There are two main parts. The first part contains questions that can be answered during the video. The second series of ten questions consists of a video quiz to be answered at the conclusion of the video.

Post Assessment:

The Post Assessment, provided in the Student Masters section, can be utilized as an assessment tool following student completion of the video and student activities. The results of the Post Assessment can be compared against the results of the Preliminary Assessment to evaluate student progress.



Introducing the Video

Before showing the program, gather together the following: a glass of water, a solid such as a book or pencil, and a balloon filled with air. Place these things on a table in front of the class. Ask students to describe each of these different forms of matter. Write the observations of each on the board as the students describe them. After writing their description on the board, ask them which is a solid, liquid, and gas.

Hold up the glass of water, and ask them if this liquid form of water could exist in another form. Students will eventually conclude that it could exist as a solid or a gas. Next, ask them how they might go about changing the liquid water into a different phase. Somebody might suggest putting it into the freezer. Explain that this phase change is called freezing. Ask them how you change solid water (ice) into a liquid and ask what this process is called. Also discuss other phase changes such as evaporation, vaporization and condensation. Write these terms on the board.

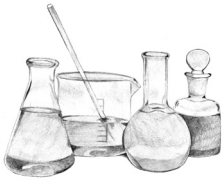
Ask students to describe where they have observed some of these phase changes. Write several of them on the board. Tell your students to pay close attention to the program to learn more about the characteristics of matter, the four phases of matter, and phase changes.

Video Viewing Suggestions

The student Master “Video Review” is provided for distribution to students. You may choose to have your students complete this Master while viewing the program or to do so upon its conclusion.

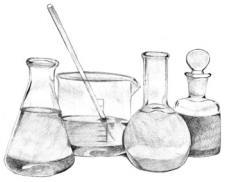
The program is approximately 20minutes in length and includes a ten question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher’s guide. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.



Video Script: Solids, Liquids, and Gases

1. Think about all the things you ate or drank today.
2. At breakfast you probably drank some type of liquid such as milk…
3. …water…
4. …or juice.
5. And you probably ate some type of solid food such as toast…
6. …eggs…
7. …or cereal.
8. And all the time without realizing it you were breathing in different types of gases your body needs from the air.
9. So, as you can see, the body needs liquids, solids, and gases to survive.
10. What are some of the characteristics of these different forms of matter?
11. What makes solids, liquids, and gases different from each other?
12. And how can solids, liquids, and gases change form?
13. During the next few minutes we are going to explore these questions and many others as we explore some of the fascinating characteristics of solids, liquids, and gases.
14. **Graphic Transition - Matter**
15. As you probably already know all living things are made up of matter.
16. Non-living things are also made up of matter.
17. Even some things we cannot see such as air are made up of matter.
18. What exactly is matter? Matter is anything that has mass and takes up space.
19. **You Decide**! What is matter made of?
20. All matter is made up of small particles.
21. These particles are too tiny to see.
22. The space between particles and the way they move determine whether matter exists as a solid, a liquid, or a gas.
23. **Graphic Transition – Phases of Matter**
24. This scene illustrates three different states of the same substance. What is the substance?
25. That is right, it is water.
26. Water is an amazing substance found here on earth in that it can exist as a solid, liquid, or gas.
27. The different forms water can take are referred to as states or phases.



Script (cont.)

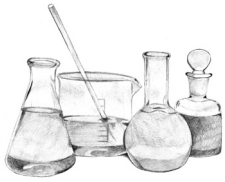
28. For example, water can exist in the solid phase as ice.
29. And it can exist in the liquid phase as liquid water.
30. And, water can also exist as a gas in the form of water vapor.
31. Matter can actually be found in four phases – solid, liquid, gas, and a fourth phase we will discuss later called plasma.

32. Graphic Transition – Solids

33. This roller coaster…
34. …these icicles…
35. …and this cliff are all solids. A solid has a definite shape and volume.
36. Volume is the amount of space that something takes up.
37. Trees are relatively rigid which gives them a well defined shape.
38. Why do solids have a definite shape and volume?
39. The answer lies in the arrangement of their particles.
40. The particles in solids are packed tightly together.
41. This is one reason why solids are relatively hard, and keep their definite shape.
42. If you could closely examine the internal structure of many solids, you would find they are made of crystals.
43. A crystal is a regular repeating pattern of particles.
44. Solids made up of crystals are called crystalline solids.
45. Common table salt is a crystalline solid that has a square shaped crystal pattern.
46. This amethyst has a definite crystalline shape.
47. As do snowflakes. While all snowflake crystals have six sides, no two snowflakes are exactly alike.
48. Not all solids are crystalline solids.
49. Some solids are called amorphous solids. Tar used to repair roads and candle wax are examples of amorphous solids.
50. Windows are also considered to be amorphous solids. A window, while it appears to be quite solid, over many years may move and reshape itself as seen in the glass of this old house.
51. Let us take a look now at liquids.

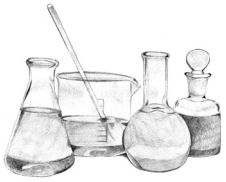
52. Graphic Transition – Liquids

53. Every time you have a drink of water…
54. …wash your hands…
55. …or go swimming, you are coming in contact with liquids.
56. Liquids are everywhere. In fact, over 60% of your body is made of liquid water.



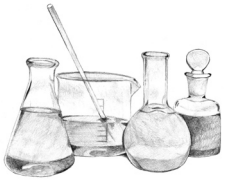
Script (cont.)

57. You Compare! How are particles in liquids packed differently than those in solids?
58. The particles in liquids are not packed as tightly together as in solids.
59. They move more freely and thus do not have a definite shape, like solids do.
60. Liquids, therefore, take the form of whatever is holding them such as this vase…
61. …or this swimming pool.
62. Even though liquids do not have a definite shape, they do have a definite volume.
63. For example, this beaker contains one liter of water.
64. And when the water is poured into this bowl…
65. …or into this square container, it still has a volume of one liter.
66. Perhaps you have noticed that some liquids flow quite readily, and others flow slowly.
67. Things such as honey and maple syrup flow slowly.
68. Viscosity refers to the resistance of a liquid to flow.
69. Fluids like motor oil have a high viscosity meaning they resist flowing.
70. Whereas, water has a relatively low viscosity, meaning it flows easily.
71. Graphic Transition – Gases
72. When you first think of gases you may think about gases coming out of a chimney.
73. …or from the exhaust of a car…
74. …or you may think of helium gas used to fill balloons.
75. But, did you realize that gas is all around us at this very moment!
76. In fact, we are breathing in several different kinds of gases including nitrogen and oxygen.
77. Without gases humans and most other living things could not survive.
78. A gas has no definite shape and no definite volume.
79. For example, this helium gas fills the shape of this balloon.
80. Not only does gas have no definite shape, but, its volume can vary.
81. This is because particles in gases can freely move about and are packed very loosely.
82. The volume of a given amount of gas can change and adjust to fill the volume of a small container. . .
83. …or a large container.
84. This balloon contains gas that has a specific volume.
85. If we squeeze the balloon it gets smaller, and the volume of the gas inside it decreases.
86. So as you can see, the volume of a given amount of gas can increase or decrease.
87. Graphic Transition – Gases in Action
88. If you have ever been outside in a strong wind, you probably felt the pressure exerted by gases against your body.



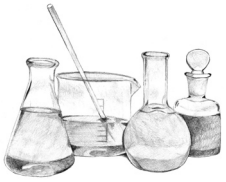
Script (cont.)

89. Pressure is the amount of force exerted per unit of area.
90. All of the air in the atmosphere exerts a downward pressure on us.
91. So, as you can see, pressure is something we live with every day.
92. Let us get back to our example of the balloon. This balloon contains gas.
93. You Predict! What do you feel when you push on the balloon?
94. The balloon pushes back. This is because the overall pressure in the balloon increased when it was squeezed.
95. Graphic Transition – Phase Changes
96. We have already discussed three of the four phases of matter – solids, liquids, and gases. In a minute we will discuss plasma, the fourth phase of matter.
97. But, first let us discuss how solids, liquids, and gases can change phases.
98. A phase change involves the change of matter from one state, or phase to another.
99. Let us take a look at water since it is commonly found in all three phases here on Earth.
100. This lake is a great place for swimming in the summer.
101. But, as the weather cools, so does the water.
102. In mid-winter the water gets so cold that it freezes.
103. Freezing is the process of a liquid changing to a solid.
104. You Decide! At what temperature does water freeze?
105. Fresh water freezes at 0^{o} Celsius, or at 32^{o} Fahrenheit.
106. The point at which a substance freezes is called the freezing point.
107. In spring, as temperatures begin to warm, ice melts when the temperature rises above 0^{o} Celsius or 32^{o} Fahrenheit.
108. This ice cream cone is also melting. Melting is a phase change in which a solid turns to a liquid.
109. If you live in a northern climate, you are probably quite familiar with the process of freezing and melting.
110. Have you ever thought about the process of a liquid changing into a gas?
111. Vaporization is the process of a substance changing from a liquid to a gas.
112. Vaporization occurs when a liquid is boiled. In the process of boiling, particles in liquid actually change to a gas.
113. You have probably seen water boil. Water boils at 100^{o} Celsius or 212^{o} Fahrenheit, at which point liquid water changes to water vapor.
114. You are probably familiar with the process of evaporation, which occurs when liquids vaporize at the surface.
115. Evaporation occurs when mud puddles dry up…



Script (cont.)

116. …when a glass of water is left on a table for several days…
117. …and it occurs at the surface of sweaty skin.
118. The last phase change we will discuss involves the changing of a gas into a liquid. This process is called condensation.
119. If you have ever noticed how a cold soda can develops beads of liquid on the sides, you have witnessed condensation in action.
120. In the process of condensation, water vapor particles in the air are cooled when they touch the cold side of the can, and they experience a phase change from a gas to a liquid.
121. Condensation is the process that forms clouds. Clouds form as water vapor changes to tiny particles of liquid water.
122. Graphic Transition - Plasma
123. Plasma is the fourth phase of matter.
124. Plasma is rare on Earth…
125. …but, it is one of the most common forms of matter found in the universe.
126. Our sun contains a great deal of plasma.
127. Plasma contains a great deal of energy, and can be quite dangerous to living things.
128. Plasma is a gas-like mixture consisting of charged particles.
139. Plasma generally exists at high temperatures…
130. …and can be observed in your home in florescent lightbulbs.
131. Graphic Transition- Summing Up
132. During the past few minutes, we have explored some of the fascinating characteristics of solids, liquids, and gases.
133. We discussed how all matter is made of particles.
134. The manner in which particles are packed together and the way they move determine whether matter exists as a solid, liquid, or gas.
135. We discussed how solids have a definite shape and definite volume.
136. Whereas liquids have no definite shape but they do have a definite volume.
137. Gases in turn have no definite shape and no definite volume.
138. We also discussed how gases react to variations in pressure and temperature.
139. We explored some different examples of phase changes including freezing, melting, vaporization, and condensation.
140. Finally, we briefly discussed the fourth phase of matter- plasma.
141. So the next time you boil some water,…
142. …see an ice cube melting,…
143. Or take a breath of air think about some of the things we just discussed. You might just think about matter a little differently.

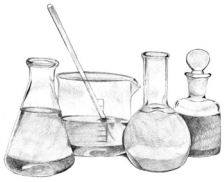


Script (cont.)

144. Graphic Transition- Video Assessment

Fill in the correct word to complete the sentence. Good luck and let's get started.

1. Matter is made up of small _____.
2. There are _____ phases of matter.
3. _____ is the amount of space something takes up.
4. A _____ is a regular repeating pattern of particles.
5. _____ have a definite volume and no definite shape.
6. _____ refers to the resistance of a liquid to flow.
7. The air above us creates a downward _____.
8. _____ involves the change of a liquid to a solid.
9. Water boils at _____° Celsius.
10. Water freezes at _____° Celsius.



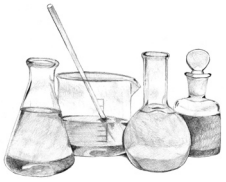
Student Assessments And Activities

Assessment Masters:

- Preliminary Assessment
- Video Review
- Post Assessment

Student Activity Masters:

- Phase Changes of Water
- Gas in Action
- Vocabulary of *Solids, Liquids, and Gases*



Answers to Student Assessments

Preliminary Assessment (pgs. 20-21)

1. particles
2. water
3. plasma
4. volume
5. crystalline
6. liquids
7. viscosity
8. gases
9. phase
10. vaporization
11. false
12. true
13. true
14. false
15. true
16. false
17. false
18. true
19. false
20. true

Video Review (pg. 22)

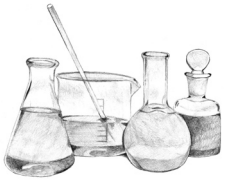
1. All matter is made up of small particles.
2. The particles in liquids are not packed as tightly together as those in solids. Particles in liquids move more freely and do not have a definite shape. Particles in solids can't move as freely and therefore have a definite shape.
3. The balloon pushes back. This is because the overall pressure in the balloon is increased when it is squeezed.
4. Water freezes at 0˚ Celsius (32˚ Fahrenheit).

Video Quiz: (pg. 22)

1. particles
2. four
3. volume
4. crystal
5. liquids
6. viscosity
7. pressure
8. freezing
9. 100°
10. 0°

Post Assessment (pgs. 23-24)

1. true
2. false
3. true
4. true
5. false
6. false
7. false
8. false
9. true
10. true
11. water
12. phase
13. particles
14. liquids
15. crystalline
16. volume
17. viscosity
18. plasma
19. gases
20. vaporization



Answers to Student Activities

Phase Changes of Water
(pgs. 25-27)

1. Water existed as a solid at or below 0˚ Celsius.
2. The temperature held at 0˚ Celsius for a while.
3. The temperature stayed at 0˚ Celsius for many minutes because the heat energy from the hot plate was being used to melt the ice. It was not until the ice melted that the temperature actually rose.
4. Bubbles were rising in the beaker at 100˚ Celsius. This is the process of boiling.
5. The first phase change involved the change from a solid to a liquid in the process of melting. The second phase change involved the change of a liquid to a gas in the process of boiling.
6. If we cooled the water vapor it would change from a gas to a liquid. This is the process called condensation. If the liquid was cooled to 0˚ Celsius it would change to ice in the process of freezing.

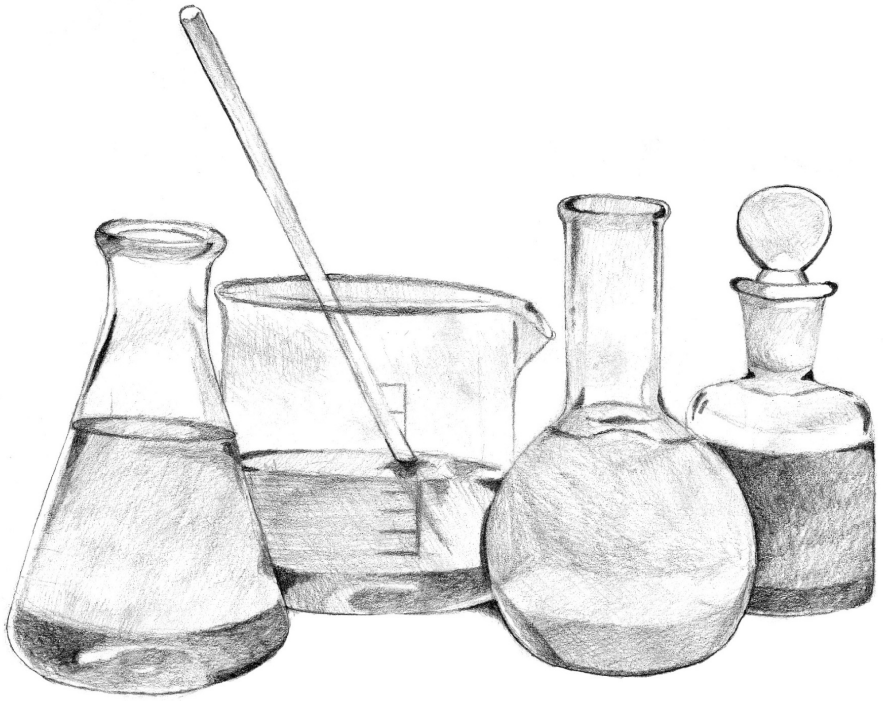
Gas in Action (pgs. 28-29)

1. The size of the balloon decreased after it was cooled.
2. The size decreased because the volume of a gas decreases when cooled.
3. The balloon's circumference increased when the balloon warmed up.
4. The size of the balloon increased because the volume of gases increases when they warm up.
5. When pressure was increased, the volume of the balloon decreased. The gas became more compact.
6. When pressure was decreased around the balloon, the volume of the balloon increased.

Vocabulary (pg. 30)

1. g - matter
2. f - liquid
3. j - gas
4. a - plasma
5. d - viscosity
6. c - melting
7. b - freezing
8. h - vaporization
9. e - condensation
10. i - phases

Assessment and Student Activity Masters



Name _____

Preliminary Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. Matter is made up of small _____.

2. _____ is found in all three phases on earth.

3. _____ is the fourth phase of matter and is common in our sun and stars.

4. Solids have a definite shape and definite _____.

5. Table salt is a _____ solid.

6. _____ have a definite volume and no definite shape.

7. The resistance of a liquid to flow is called _____.

8. Particles in _____ are packed very loosely.

9. A _____ change involves the change of matter from one state to another.

10. _____ occurs when a liquid is boiled.

crystalline	plasma
gases	vaporization
liquids	viscosity
particles	volume
phase	water

Name _____

Preliminary Assessment

Directions: Decide whether the answer is True (T) or False (F).

11. There are seven phases of matter. T F

12. All living things are made of matter. T F

13. Water exists in the gas phase as water vapor. T F

14. Volume is the amount of length an object takes up. T F

15. Plasma is found in the sun and stars. T F

16. The particles in solids are packed quite loosely. T F

17. Most liquids have a definite shape. T F

18. The volume of a given amount of gas can adjust to fill the volume of a container. T F

19. Water freezes at 20˚ Celsius. T F

20. Condensation is the process of a gas changing to a liquid. T F

Name _____

Video Review

Directions: During the course of the program, answer the questions as they are presented in the video. Answer the Video Quiz questions at the end of the video.

You Decide!

1. What is matter made of?

You Compare!

2. How are the particles in liquids packed differently than those in solids?

You Predict!

3. What do you feel when you push the balloon?

You Decide!

4. At what temperature does water freeze?

Video Quiz:

1. Matter is made up of small _____.
2. There are _____ phases of matter.
3. _____ is the amount of space something takes up.
4. A _____ is a regular repeating pattern of particles.
5. _____ have definite volume and no definite shape.
6. _____ refers to the resistance of a liquid to flow.
7. The air above us creates a downward _____.
8. _____ involves the change of a liquid to a solid.
9. Water boils at _____ degrees Celsius.
10. Water freezes _____ degrees Celsius.

Name _____

Post Assessment

Directions: Decide whether the answer is True (T) or False (F).

1. All living things are made of matter. T F

2. There are seven phases of matter. T F

3. Plasma is found in the sun and stars. T F

4. Water exists in the gas phase as water vapor. T F

5. The particles in solids are packed quite loosely. T F

6. Water freezes at 20˚ Celsius. T F

7. Most liquids have a definite shape. T F

8. Volume is the amount of length an object takes up. T F

9. The volume of a given amount of gas can adjust to fill the volume of its container. T F

10. Condensation is the process of a gas changing into a liquid. T F

Name _____

Post Assessment

Directions: Fill in the blank with the correct word. Choose from the list of possible answers at the bottom of the page.

11. _____ is found in all three phases on Earth.

12. A _____ change involves the change of matter from one state to another.

13. Matter is made up of small _____.

14. _____ have definite volume and no definite shape.

15. Table salt is a _____ solid.

16. Solids have definite shape and definite _____.

17. The resistance of a liquid to flow is called _____.

18. _____ is the fourth phase of matter and is common in our sun and stars.

19. Particles in _____ are packed very loosely.

20. _____ occurs when a liquid is boiled.

crystalline	plasma
gases	vaporization
liquids	viscosity
particles	volume
phase	water

Name _____

Phase Changes of Water

Background: Water can be found everywhere on the planet. About 70% of Earth's surface is covered with water. The oceans cover much of the surface of earth. The north and south poles are blanketed with water in the form of ice. And even the air we breathe contains water vapor. Water is the most abundant substance on Earth that is commonly found in all three phases: as a solid, liquid, and a gas!

Temperature is the main factor determining whether water exists as a solid, liquid, or gas. Liquid water freezes at 0˚ Celsius (32˚ Fahrenheit). Below that temperature fresh water exists as a solid in the form of ice. In turn ice melts at 0˚ Celsius (32˚ Fahrenheit). Water exists as a liquid between 0˚ Celsius and 100˚ Celsius. At 100˚ Celsius (212˚ Fahrenheit) liquid water boils, changing from a liquid to a gas.

In this activity you will observe and record the phase changes of water. You will record the temperature of water throughout these phase changes, and graph the temperature readings.

Materials: protective eye glasses or goggles, 250-ml beaker, hot plate, thermometer, crushed ice, stirring rod, beaker tongs

Instructions:

1. **Put on protective eye glasses or goggles. Keep this protective eyewear on during the course of the experiment.**
2. Your teacher will provide you with crushed ice. Fill the beaker up to the 150-mL mark with crushed ice.
3. Place a thermometer in the beaker of ice. Let it sit there for 1 minute. Record the temperature in the data table.
4. Carefully place the beaker on the hot plate. The thermometer should still be in it. Turn on the hot plate.
5. Record the temperature of the water every minute, and write the value in the data table. Also stir the mixture a little bit every 30 seconds. **Hold the beaker with the beaker tongs while stirring. Be very careful not to tip over the beaker!**
6. Continue to take readings every minute until the water boils. This may take 30 to 40 minutes.
7. Once the water has boiled turn off the hot plate.
8. Using the data in your table, create a line graph in the space provided.
9. Once you have completed your graph, answer the questions that follow.

Name

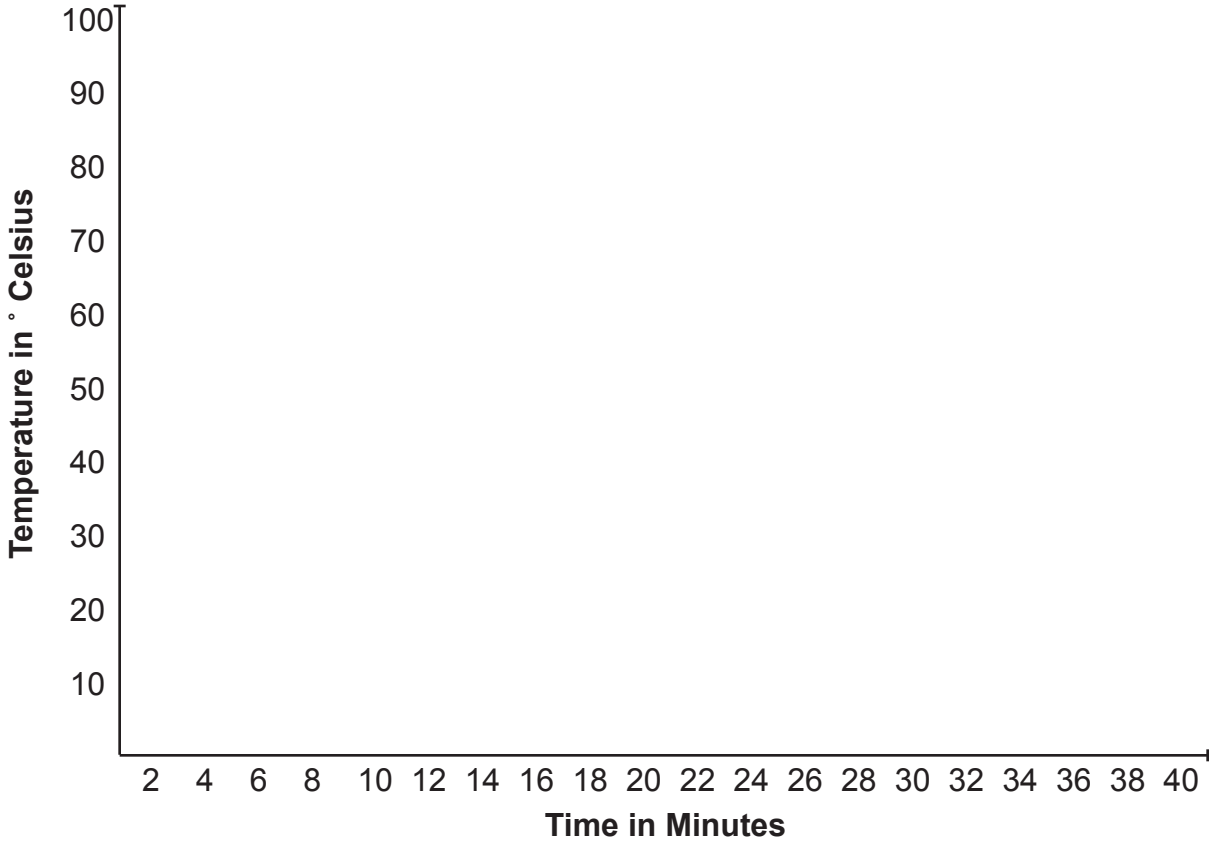
Phase Changes of Water (cont.)

Phase Change Data Table

Minutes	Temperature in ˚ Celsius	Minutes	Temperature in ˚ Celsius
1		21	
2		22	
3		23	
4		24	
5		25	
6		26	
7		27	
8		28	
9		29	
10		30	
11		31	
12		32	
13		33	
14		34	
15		35	
16		36	
17		37	
18		38	
19		39	
20		40	

Name _____

Phase Changes of Water (cont.)



Questions:

1. At what temperature did water exist as a solid?

2. At what temperature were the readings level early in your experiment?

3. Why did the temperature stay at 0˚ Celsius for many minutes?

4. What did you observe in the beaker at 100˚ Celsius?

5. Describe the two phase changes you observed in this activity.

6. Describe the phase changes that would occur if you reversed the process.

Name

Gas in Action

Background:

As you probably already know there are four phases of matter: solid, liquid, gas and plasma. The fourth phase of matter, plasma, is not very common on Earth. But it is commonly found in stars and in our sun. Solids, liquids, and gases are quite common on Earth. Water exists in all three of those phases. Solids, such as this piece of paper, have a definite shape and a definite volume. While liquids have a definite volume, they do not have a definite shape. They take on the shape of whatever container they are poured into. Gases are somewhat unique in that they do not have a definite shape and do not have a definite volume. This is what makes gases so interesting.

Gases take on the shape of their container. If you put a certain amount of a gas in a jar, it would fill the jar. When the same amount of gas is put into a box, it will take the shape of the box. What makes gases unusual is that their volume can also vary. Gases can readily expand or contract. Variations in temperature and pressure can affect the volume of a given amount of gas. In this experiment we will see how temperature and pressure can affect the volume of gas.

Materials: balloon, tape measure, light bulb or sunny windowsill, bell jar, thermometer

Instructions:

1. Obtain a balloon from your teacher. Blow up the balloon and tie it off.
2. Measure the circumference (distance around) of the balloon with a tape measure. Be sure to measure in the same place on the balloon each time this circumference is measured.
3. Measure the air temperature with a thermometer. Record the value in the data table.
4. Next, place the balloon in a freezer. Place a thermometer in the freezer at the same time.
5. Wait at least 30 minutes then open the freezer door and read the value on the thermometer. Record the temperature in the data table.
6. Next, take the balloon out of the freezer and measure its circumference with the tape measure. Work quickly so that it doesn't have time to warm up. Record the value in the data table.
7. Place the balloon under a warm light bulb or in a sunny window. Leave it there for at least 30 minutes.
8. Measure its circumference with a tape measure and record the temperature.
9. Now let's experiment how pressure can affect the volume of a gas.
10. Get a fresh balloon. Blow it up and tie it off.
11. With both hands, observe what happens when you slowly squeeze the balloon. Record your observations in the data table.
12. If a bell jar apparatus is available, place the balloon inside it. Turn on the motor and observe what happens to the balloon. Record your observations.

Name

Gas in Action (cont.)

Data Table

Circumference of balloon at start Temperature: _____˚ Celsius	
Circumference of balloon in freezer Temperature: _____˚ Celsius	
Circumference of balloon in heat Temperature _____˚ Celsius	
Observations of balloon when squeezed	
Observations of balloon in bell jar	

Questions:

1. What happened to the size of the balloon after it was cooled?

2. What accounts for this decrease in size?

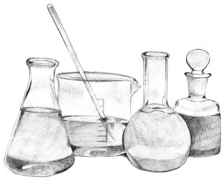
3. What happened to the balloon's circumference when it became warm?

4. What accounts for this increase in size?

5. What happened to the volume of the balloon when pressure is increased?

6. What happened to the volume of the balloon when pressure was decreased?

Name _____



Vocabulary of "Solids, Liquids, and Gases"

Directions: Unscramble the vocabulary words in the first column. Match the words to the definitions in the second column.

____ 1. tmreat _____

____ 2. diuliq _____

____ 3. sga _____

____ 4. salmpa _____

____ 5. ioysvstci _____

____ 6. neimgtl _____

____ 7. zfegrnei _____

____ 8. ziarvaonopit _____

____ 9. sdceonnitnoa _____

____ 10. hpsesa _____

a. the fourth phase of matter, found in the sun and stars

b. a phase change from a liquid to a solid

c. a phase change from a solid to a liquid

d. a measure of a liquid's resistance to flow

e. occurs when a vapor cools and changes to a liquid

f. substance that takes the shape of its container but has definite volume

g. anything that takes up space and has mass

h. a phase change that creates vapor; it occurs when a liquid is boiled

i. the different forms matter can take; there are four

j. adjusts to fill the volume of whatever container it's in and has no definite volume