

Physical Science

Chapter 3

Mrs. Butler's class

- Physical Science
Chapter Three-Solids, Liquids and Gases
3-1 States of Matter?

Objectives:

3.1.1. Describe the characteristics of matter

3.1.2. Describe the characteristics of a liquid

3.1.3 Describe the characteristics of a gas

Motivations:

Motivation: hand a student a rock and pour some water in their hands or blow air into it.

Ask: Which is easier to hold a rock in your hand or water? Why?

We will be learning more about how matter holds its shape in this chapter.

Aim: States of Matter

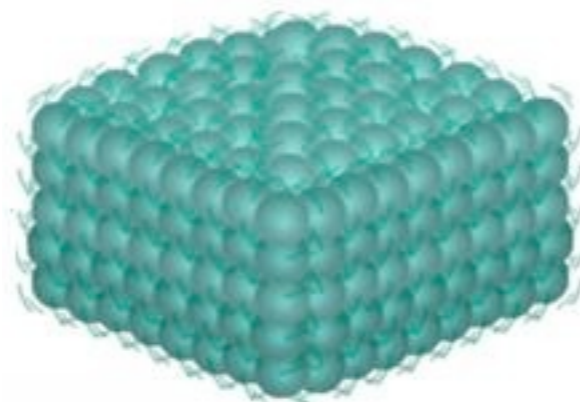
- * How do you know something is a **solid**?

Solids:

- Not easily compressed or stretched
- A solid has definite shape and a definite volume



- Because the particles are packed together tightly they stay in a fixed position



Solid



dreamstime.com

- How is a crystal different than a plastic? Rubber? Are they not both solids?

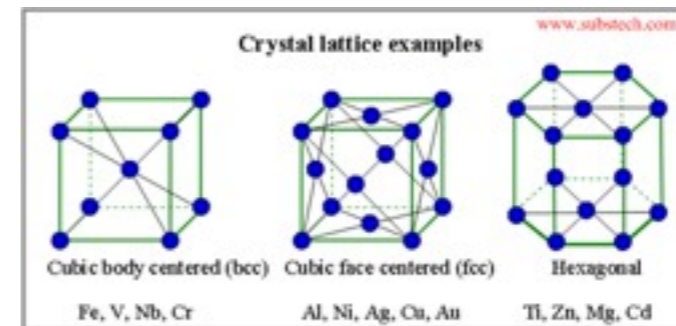


?



1. Crystalline solids: Particles form regular repeated patterns such as sugar and salt

Distinct melting point



2. Amorphous solids: particles are not arranged in a regular pattern

No distinct melting point

When heated become soft



Now look at liquids-

Liquids: No shape of its own

Takes shapes of container

How would you describe the particles compared to the solids?



- Particles are free to move,
- A liquid has no definite shape
- However, it has definite volume



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How is water different than maple syrup?

- * **Viscosity**- the resistance of a liquid to flow (see video from book)
- * **Surface tension** - inward pull that bring molecules on the surface closer together

Why are liquids called **fluids**? Can easily move around.

Is air a fluid? **YES, air is a fluid**

How are **gases** different from liquids and solids?



Gases–

- Can change its volume easily
- Will fill all of the container
- Gas particles spread apart filling all the spaces available to them.
- Gas has neither definite shape nor volume



Summary: show: <http://www.youtube.com/watch?v=s-KvoVzukHo&feature=related>

Push chairs apart have students demonstrate solid liquid and gas states

Homework Start in class Read section 3-1 answer 1-3 on page 75

Have student's push tables apart and demonstrate the phases of solid, liquids, and gases.

- State of matter
- Amorphic Solid
- Rap song

- Physical Science
Chapter Three-Solids, Liquids and Gases
3-2 States of Matter?

Objectives:

3.2.1. Explain what happens to a substance during changes between solids and liquids

3.2.2. Explain what happens to a substance during changes between liquid and gas

3.2.3 Explain what happens to a substance during changes between solid and gas

Motivations:

Motivation: What are some things you notices about the temperature during our lab? What where some of the physical changes you observed?

Aim: Changes of State

Think Energy! Melting Ice

How does a substance go from a solid to a liquid?

Absorbs energy

What happens to the substances thermal energy?

Thermal energy increases

Changes between Solids and Liquids–

How do the particles in a solid substance change when energy is added?

Vibrate faster

At what point do the particles of a solid break free from their fixed positions?

Melting point

Why do substances have different melting points?

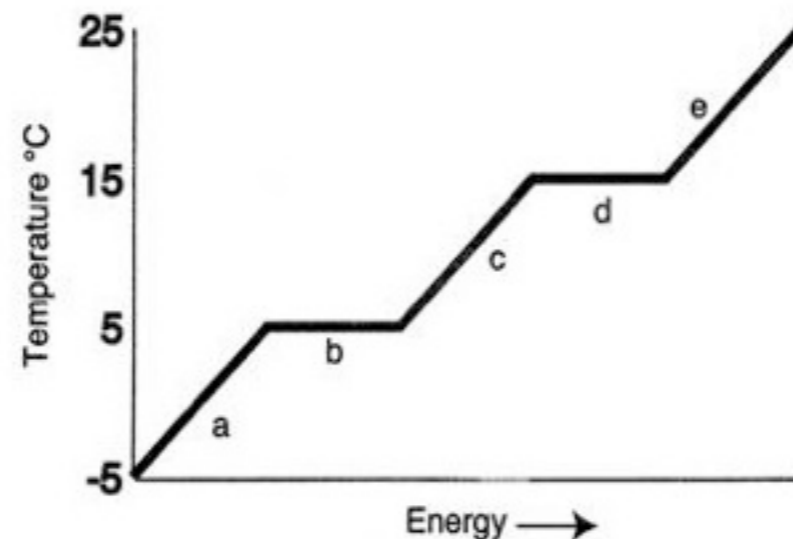
They have different arrangements of particles that respond differently to added thermal energy

How would you define Melting?

Melting is the change in state between a solid and a liquid. For most substances it occurs at a specific temperature.

How are the particles acting when a solid melts?

At Melting points the particles of a solid substance are vibrating so fast that they break free from their fixed position.



How does a substance go from a liquid state to a solid state?

Loose energy

What happens to the substances thermal energy?

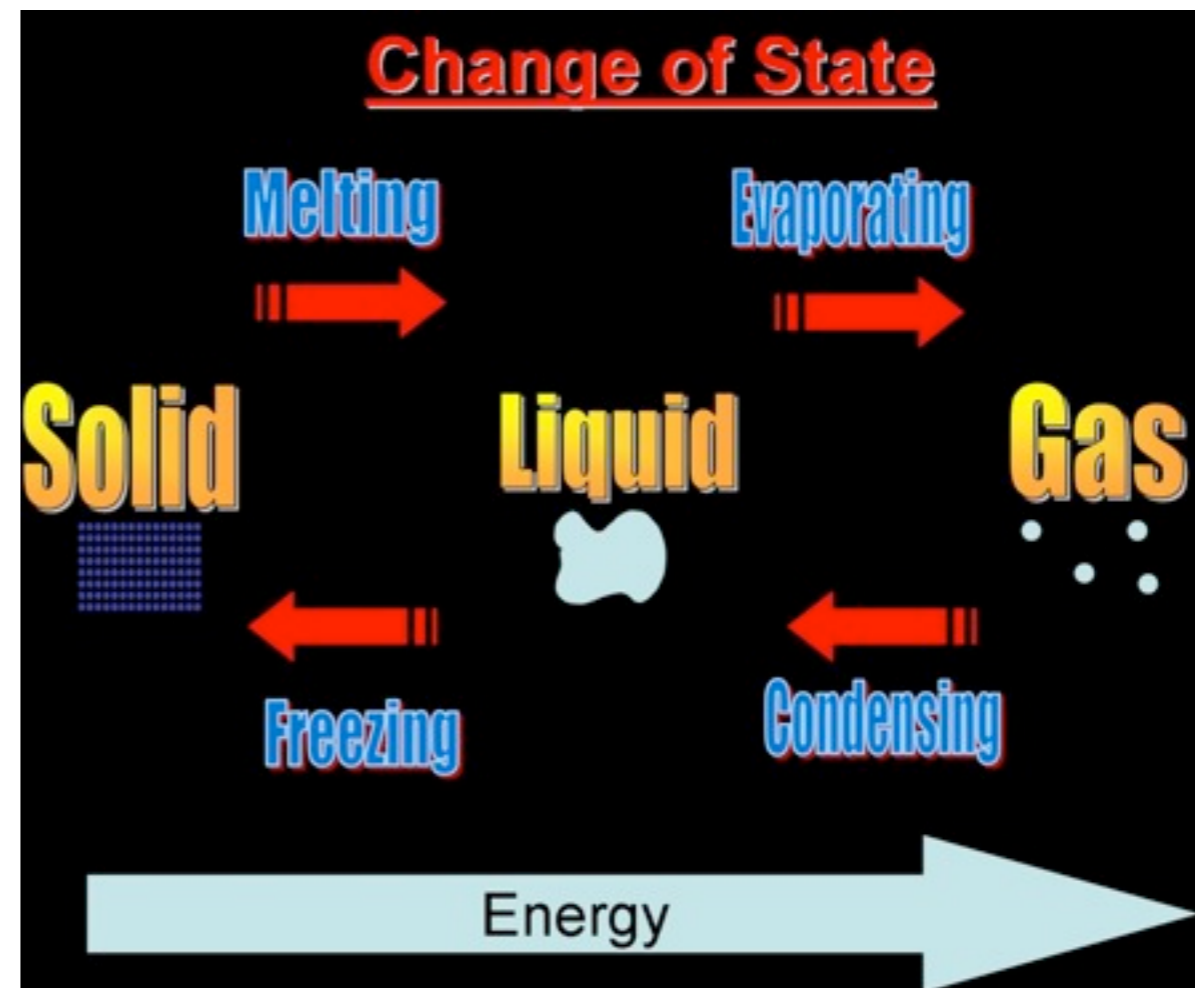
Freezing occurs when the particles of a liquid are moving so slowly they begin to form regular patterns

How would you describe the changes between a liquid and a gas?

Add heat, has more thermal energy

How are the particles of a gas different than a liquid?

Spread out more



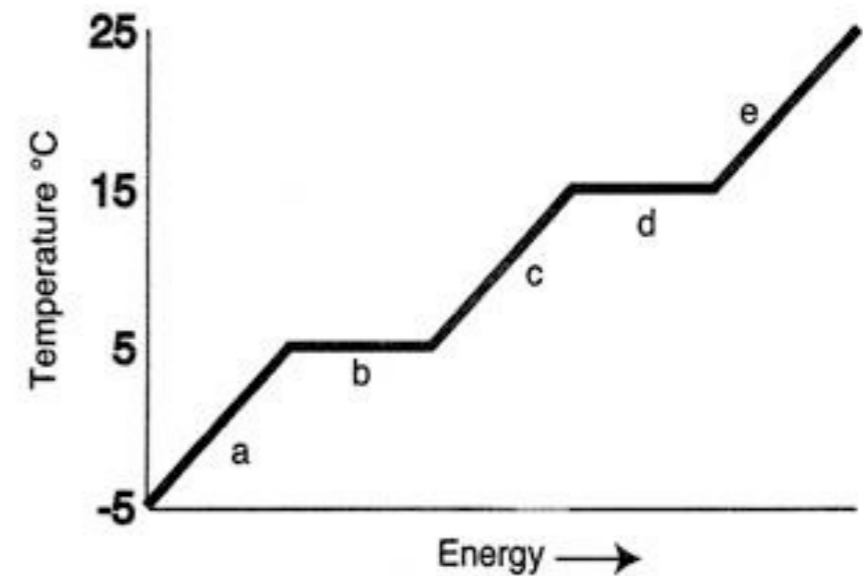
Changes between Liquids and Gas-

Vaporization takes place when the particles in a liquid gain enough energy to form a gas

Evaporation: vaporization on the surface

Boiling: vaporization below the surface

***Boiling point: temperature at which liquids boil.**



Why would air pressure affect the boiling point of a liquid?

Air pressure pushes down on the surface of the liquid not allowing the particles to escape easily

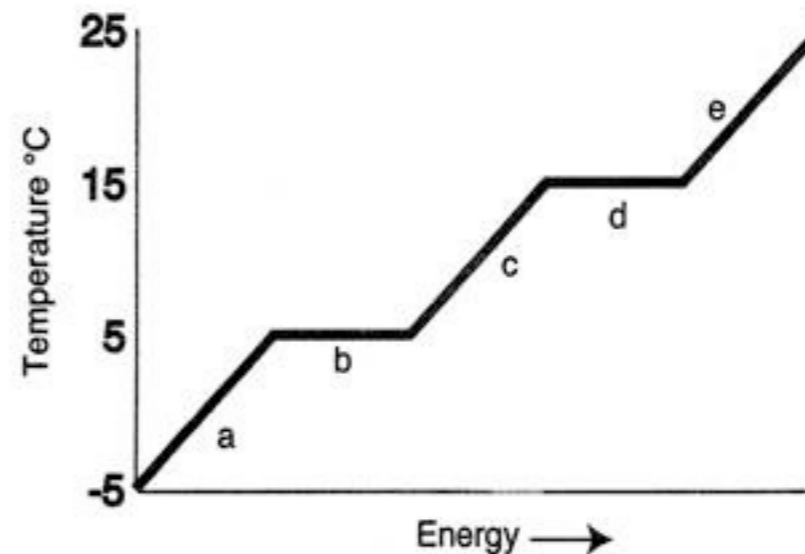
What would be the opposite of vaporization?

Condensation

Explain what is happening with the energy during condensation.

Can you think of anything that goes from a solid state to a gas state directly?

Dry Ice



Changes between Solids and Gas-

Sublimation particles in a solid go directly from a solid to a gas state without forming a liquid.

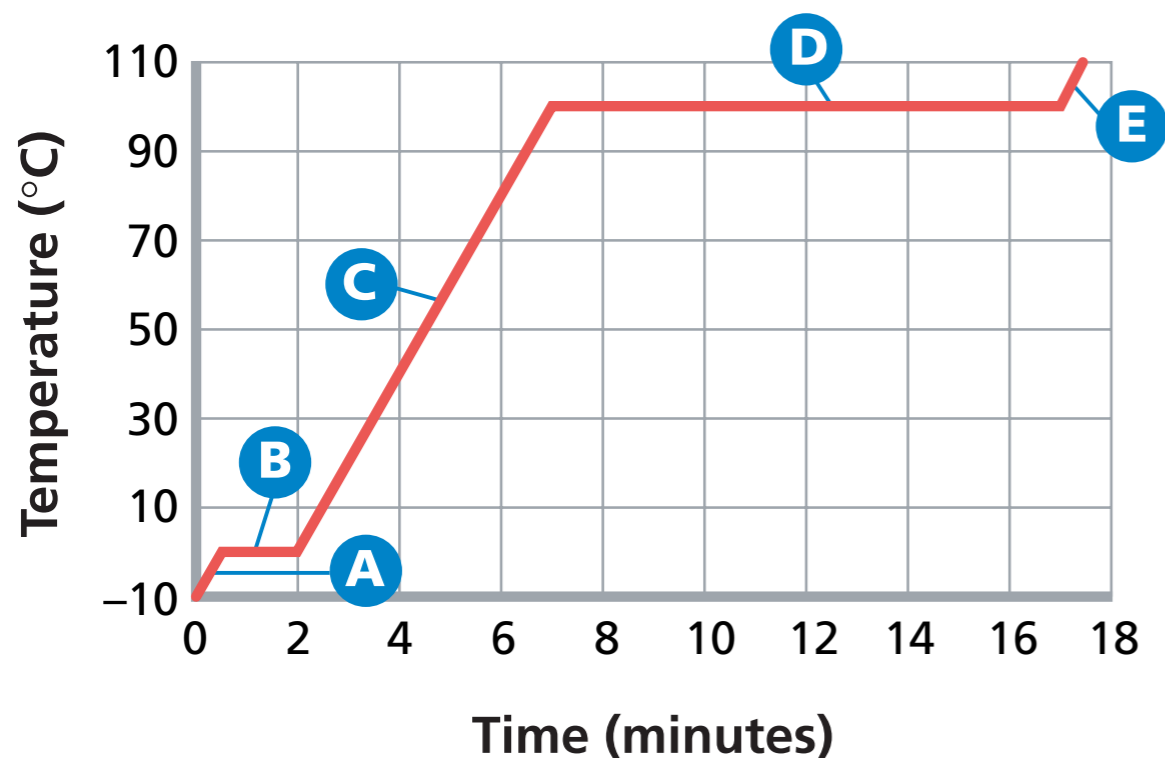
Fill in the chart for change in state

Work in groups of twos and do Analyzing Data page 80

Summary: review and reinforce worksheet

Homework read 3-2 answers 1-3 (all) page 81

Changes of State for Water



Temperature and Changes of State

d Changes of State of Water

A beaker of ice at -10°C was slowly heated to 110°C . The changes in the temperature of the water over time were recorded. The data were plotted on the graph shown here.

- (1) **Reading Graphs** What two variables are plotted on the graph?
- (2) **Reading Graphs** What is happening to the temperature of the water during segment C of the graph?
- (3) **Interpreting Data** What does the temperature value for segment B represent? For segment D?
- (4) **Drawing Conclusions** What change of state is occurring during segment B of the graph? During segment D?
- (5) **Inferring** In which segment, A or E, do the water molecules have more thermal energy? Explain your reasoning.

- Physical Science
Chapter Three-Solids, Liquids and Gases
3-3 Gas Behavior

Objectives:

3.2.1. Explain what happens to a substance during changes between solids and liquids

3.2.2. Explain what happens to a substance during changes between liquid and gas

3.2.3 Explain what happens to a substance during changes between solid and gas

Motivations:

Motivation:

Correct homework worksheet 3-2

Changes of State

Understanding Main Ideas

Complete the table by writing whether there is an gain or loss of thermal energy for each change of state and whether the movement of particles increases or decreases.

Change of State	Thermal Energy	Movement of Particles
1. Melting		
2. Freezing		
3. Vaporization		
4. Condensation		
5. Melting		

Building Vocabulary

From the list below, choose the term that best completes each sentence.

melting point

melting

sublimation

boiling point

freezing

vaporization

evaporation

boiling

condensation

6. The temperature at which a liquid boils is called its _____.
7. The change in state from gas to liquid is called _____.
8. The change in state from liquid to gas is called _____.
9. Gas bubbles forming throughout the liquid is called _____.
10. Liquid changing to gas only at the surface is called _____.
11. The change in state from solid to liquid is called _____.
12. The change in state from liquid to solid is called _____.
13. In most pure substances, melting occurs at a specific temperature, called the _____.
14. In _____, particles pass directly from solid to gas.

Aim: Gas Behavior

How much information do we know about hot air balloons?



When working with a gas, it is helpful to know its volume, temperature, and pressure. So what exactly do these measurements mean?

Review

Gas Volume:

- a. the volume of a gas is the same as the volume of its container.
- b. is measured in cubic centimeters (cm^3), milliliters (mL), liters (L)

Gas Temperature:

Temperature is a measure of the average energy of random motion of the particles of a substance. The faster the particles are moving, the greater their energy and the higher the temperature.

So what happens to a Basketball left out in the summer and then in the winter? Why?

How do you define pressure?

The pressure of the gas is the force of its outward push divided by the area of the walls of the container. Pressure is measured in units of pascals (Pa) or kilopascals (kPa). (1 kPa = 1,000 Pa.)

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

Why is temperature and pressure and volume related in gases ?

Why do you have to let air out of your cars tires in the summer and add air in the winter?

Basketball gas demo

High Pressure

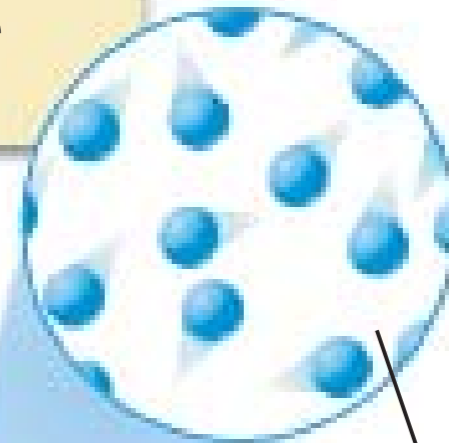
Higher gas pressure inside the ball keeps the ball inflated.



High concentration of gas particles

Low Pressure

As gas particles escape, pressure inside the ball decreases.



Low concentration of gas particles



Review:

The common unit used to measure gas pressure is

- kPa.
- cm³.
- pounds.
- kg.

Turn to the person next to you and solve this problem:

Using Formulas

Pressure can be calculated using the formula below. Force is measured in newtons (N). If area is measured in square meters (m^2), pressure is expressed in pascals (Pa).

For example, a machine exerts a force of 252 N on a piston having an area of 0.430 m^2 . What is the pressure on the piston in Pa?

Practice Problem A trash compactor exerts a force of 5,600 N over an area of 0.342 m^2 . What pressure does the compactor exert in Pa?

To people contributed to the understanding of how gases behave Boyle's and Charles

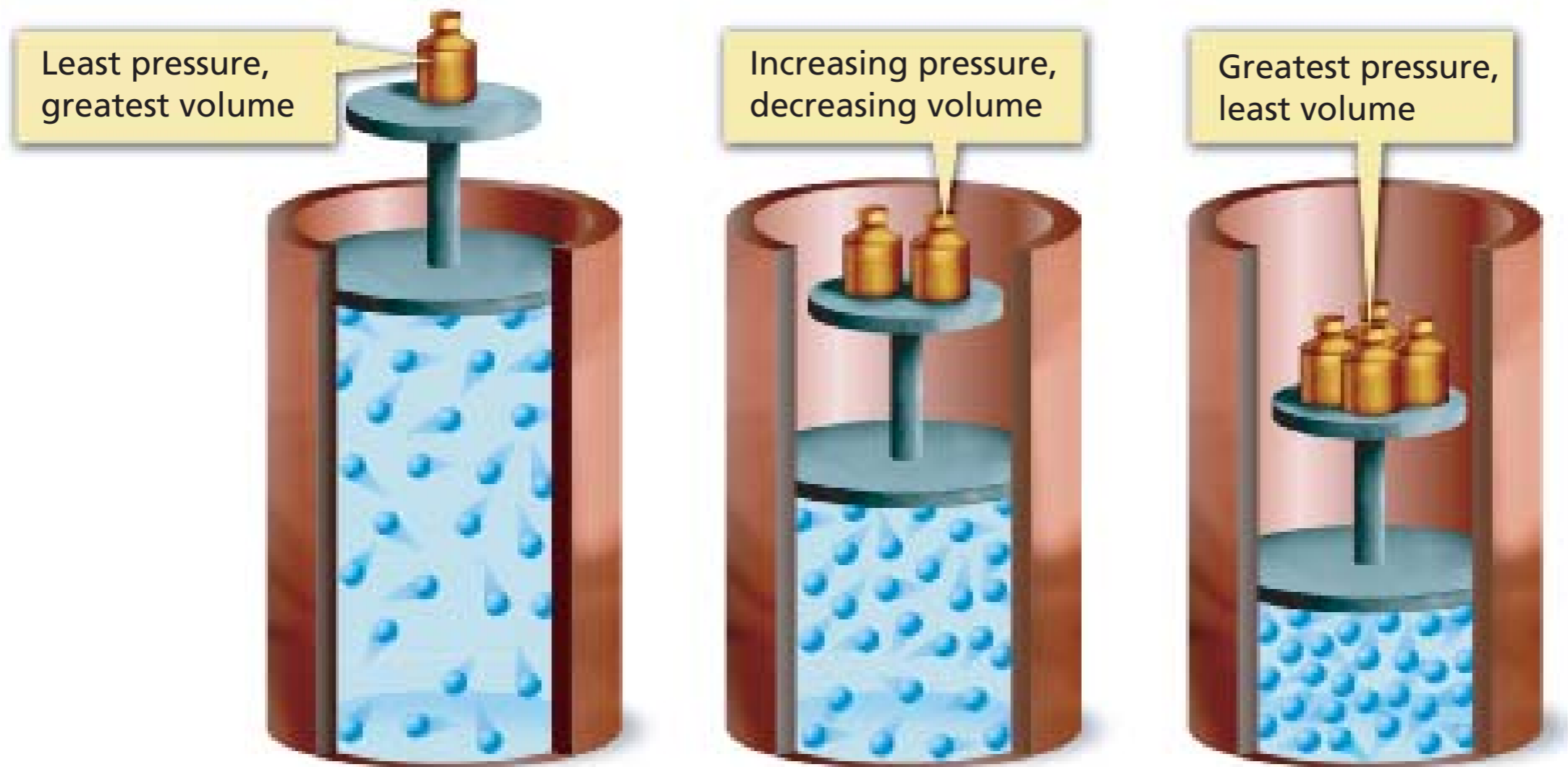
If I kept a certain gas in a balloon at a certain temperature and then increased the temperature what would happen?

Demo Ballon and Heat!

If I kept a certain gas in a balloon at a certain temperature and then decreased the temperature what would happen?

Boyle's Law

Boyle found that when the pressure of a gas at constant temperature is increased, the volume of the gas decreases. When the pressure is decreased, the volume increases.



Review:

A helium balloon bursts as it rises in the atmosphere because the

- temperature increases so the volume of helium expands.
- temperature decreases so the volume of helium expands.
- air pressure increases so the volume of helium expands.
- air pressure decreases so the volume of helium expands.

Pressure and Volume

8. What does Boyle's law say about the relationship between the pressure and volume of a gas?

9. Complete the table about the relationship between the pressure and volume of a gas, assuming temperature is held constant.

Pressure and Volume of a Gas	
Change	Increases or Decreases?
Pressure decreases	a. Volume
Pressure increases	b. Volume
Volume increases	c. Pressure
Volume decreases	d. Pressure

2. The volume of a gas is the same as the volume of its

_____.

3. What is temperature? _____

4. Is the following sentence true or false? The faster gas particles are moving, the greater their energy and the lower the temperature.

5. The force pushing on a surface divided by the area of that surface is called _____.

6. What is the formula used to calculate pressure?

7. Why does a ball leak air even when it has a tiny hole?

Pressure and Temperature

10. Suppose a gas is kept in a closed, rigid container. If the temperature of the gas is increased, what happens to its pressure on the container?

11. If the temperature of that gas in the container is decreased, what happens to its pressure?

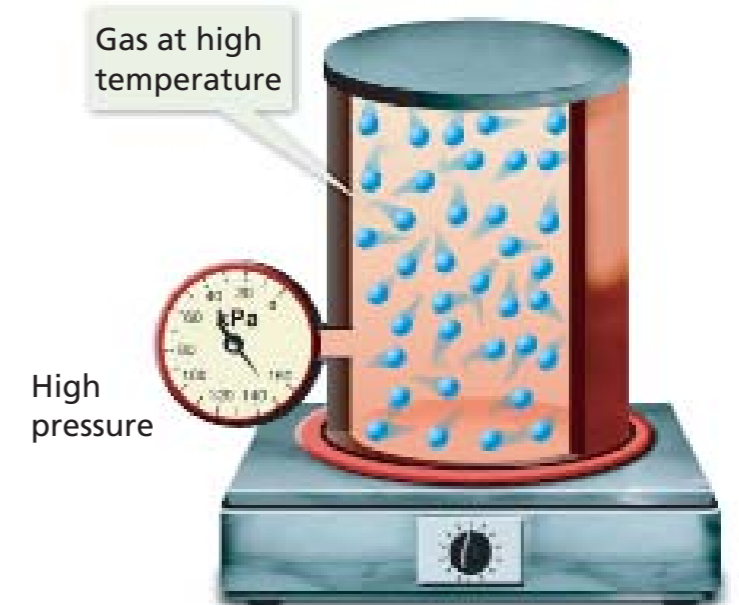
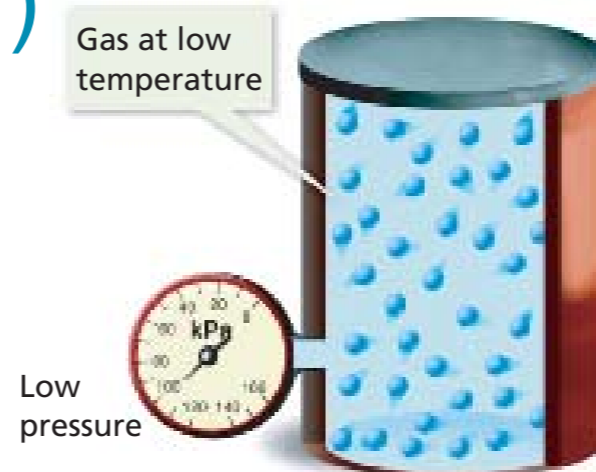
12. What can cause tires to burst on long trips in warm weather?

Now what would happen if you have a solid container and you increased the temperature?

Demo! Time!

Charles Law:

When the temperature of a gas at constant volume is increased, the pressure of the gas increases. When the temperature is decreased, the pressure of the gas decreases. (*Constant volume* means that the gas is in a closed, rigid container.)



Volume and Temperature

13. What is the principle known as Charles's law?

14. If the temperature of a gas is decreased at constant pressure, what happens to its volume?

15. Why does a hot air balloon rise when the air inside it is heated?

book review

Complete worksheet for homework 3-3 for homework

Solids, Liquids, and Gases ▪ *Review and Reinforce*

Gas Behavior

Understanding Main Ideas

Complete the following compare and contrast table.

Law	When temperature of a gas ...	If you ...	Then you observe ...
Boyle's Law	stays constant	decrease volume	1.
Boyle's Law	stays constant	increase volume	2.
Charles's Law	increases	keep pressure constant	3.

Answer the following questions in the spaces provided.

4. A gas barbecue grill uses propane gas. The propane is stored in a rigid tank. What happens to the pressure of the propane when the tank is left outside on a very hot summer day? What about on a cold winter day?

5. What is the formula relating pressure, force, and area?

6. How does the speed of the particles of a gas change when the gas is heated?

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term in the left column.

- | | | |
|-------|------------------|--|
| _____ | 7. temperature | a. explains the relationship between the pressure and volume of gas at a constant temperature |
| _____ | 8. Charles's Law | b. explains the relationship between the temperature and volume of gas kept at a constant pressure |
| _____ | 9. pressure | c. a measure of the average energy of motion of the particles of a substance |
| _____ | 10. Boyle's Law | d. a measure of the force of the outward push caused by the movement of particles of a gas |