

Name \_\_\_\_\_

Date \_\_\_\_\_

## States of Matter

There are five states of matter. Matter is defined as anything that takes up space. The five states of matter are solids, liquids, gases, plasmas, and Bose-Einstein condensates. Each state of matter has distinctive properties that can be used to identify it. Each of these states of matter is also known as a phase. Things can move from one phase to another phase when special forces are present. For example, temperature can cause matter to change phases. Water is a liquid but if temperatures drop low enough, water can turn to ice, which is a solid.

Solids will all have of the following three properties:

1. a definite shape
2. a definite mass
3. a definite volume

Basically, this means that a solid will always look the same, take up the same amount of space, and have the same number of molecules in it. Apples, books, and flowers are just a few examples of solids.

The following properties indicate that something is a liquid:

1. a definite mass
2. a definite volume
3. no definite shape

Basically, this means that a liquid will always take up the same amount of space and have the same number of molecules in it. Liquids, however, do not have a definite shape. Liquids take on the shape of the containers they are in. Paint and juice are just two examples of liquids.

Gases have these three main properties:

1. no definite shape
2. no definite mass
3. no definite volume

This means that gases do not always take up the same amount of space, and they do not always weigh the same amount. Like liquids, gases take the shape of their containers. Gases will fill the space that they are given, which is why they do not always take up the same amount of space. Smoke from a fire or vapor in clouds would be considered gases.

Plasmas are similar to gases, but the atoms are different because they are made up of free electrons and ions. Plasmas aren't found too often in everyday life. It takes a special environment for plasmas to exist. For example, fluorescent light bulbs involve plasmas. Fluorescent light bulbs are different from regular light bulbs. They have a gas inside of the long tube, and electricity flows through the tube when the light is on. This electricity charges the gas, which excites the atoms and creates glowing plasma inside the light bulb.

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### States of Matter (Cont'd)

Bose-Einstein condensates have atoms that are total opposites and are extremely cold and unexcited. For example, an ice cube is a solid. When temperatures near absolute zero, atoms begin to clump. The result of this clumping is the Bose-Einstein condensate. In a Bose-Einstein condensate, there are no longer thousands of separate atoms. The atoms take on the same qualities and become one blob. Bose-Einstein condensates became one of the states of matter in 1995, when two scientists named Cornell and Weiman created this new state. This state gets its name from two other scientists, Satyendra Bose and Albert Einstein. Bose and Einstein predicted this state of matter in 1920, but didn't have the equipment and facilities to make a Bose-Einstein condensate in the 1920s.

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## States of Matter Questions

### **Multiple Choice:**

1. Solids have all of the following three properties EXCEPT:
  - a. a definite shape
  - b. a definite mass
  - c. a definite color
  - d. a definite volume
2. Liquids have all of the following three properties EXCEPT:
  - a. no definite shape
  - b. a definite mass
  - c. a definite volume
  - d. a definite shape
3. The following are all properties of gases EXCEPT:
  - a. a definite volume
  - b. no definite shape
  - c. no definite volume
  - d. no definite mass

### **Fill In:**

4. \_\_\_\_\_ are similar to gases, but the atoms are different because they are made up of free electrons and ions.
5. Bose-Einstein condensates have atoms that are total \_\_\_\_\_ and are extremely cold and unexcited.
6. When temperatures near \_\_\_\_\_, atoms begin to clump.
7. A \_\_\_\_\_ will always look the same, take up the same amount of space, and have the same number of molecules in it.

### **True or False:**

- \_\_\_\_ 8. Matter is defined as anything that takes up space.
- \_\_\_\_ 9. Each of these states of matter is also known as a phase.
- \_\_\_\_ 10. Plasmas are found often in everyday life.

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## States of Matter Answers

### Multiple Choice:

1. Solids have all of the following three properties EXCEPT:

- a. a definite shape
- b. a definite mass
- c. a definite color
- d. a definite volume

2. Liquids have all of the following three properties EXCEPT:

- a. no definite shape
- b. a definite mass
- c. a definite volume
- d. a definite shape

3. The following are all properties of gases EXCEPT:

- a. a definite volume
- b. no definite shape
- c. no definite volume
- d. no definite mass

### Fill In:

4. Plasmas are similar to gases, but the atoms are different because they are made up of free electrons and ions.

5. Bose-Einstein condensates have atoms that are total opposites and are extremely cold and unexcited.

6. When temperatures near absolute zero, atoms begin to clump.

7. A solid will always look the same, take up the same amount of space, and have the same number of molecules in it.

### True or False:

T 8. Matter is defined as anything that takes up space.

T 9. Each of these states of matter is also known as a phase.

F 10. Plasmas are found often in everyday life.