

## Chemistry of Materials Study Guide

## Answer Key

### Know the Physical and Chemical Properties

#### Safety rules in a science laboratory:

Wear safety goggles at all times.

Clearly label all chemicals.

Tell your teacher immediately if a spill occurs.

Make sure the work surface and floor in your work area are clear of books, backpacks, purses, or other unnecessary materials.

Density = Mass/Volume

The Density of water =  $1\text{g/cm}^3$

1. Olive oil is less dense than water. Honey, also a liquid, is more dense than water. If Olive oil, honey, and water were mixed together, which liquid would float to the top?

- a. Honey
- b. Olive oil
- c. Water
- d. Both honey and Olive oil would float to the top

2. If you place a solid in water, you can determine:

- a. If the solid is more or less dense than water.
- b. If the solid is more or less toxic than water.
- c. The flammability of the solid.
- d. The mass of the solid.

3. James measures a piece of metal and determines it has a mass of 15 grams and a volume of  $5\text{cm}^3$ .

What is the density of the piece of metal?

- a.  $20\text{ g/cm}^3$
- b.  $10\text{ g/cm}^3$
- c.  $3\text{ g/cm}^3$
- d.  $0.2\text{ g/cm}^3$

4. Which of the following happens when the temperature of liquid water rises?

- a. kinetic energy increases
- b. kinetic energy decreases
- c. kinetic energy stays constant
- d. kinetic energy increases and then decreases

Use the following table for questions 5 & 6.

	Physical state	Density (g/cm <sup>3</sup> )	Malleability
<b>GLASS</b>	Solid	2.70(g/cm <sup>3</sup> )	non-malleable
<b>PINE WOOD</b>	Solid	0.77 g/cm <sup>3</sup>	non-malleable
<b>CARBON</b>	Solid	2.26 (g/cm <sup>3</sup> )	non-malleable

5. You must identify an unknown substance using only the information shown in the table. Which one of the following tests could help you narrow down the identity of the substance?

- a. Placing the substance in water.
- b. Carefully bend the substance.
- c. Observing that the substance is a solid.
- d. Carefully smelling the substance.

6. Your teacher holds up a solid and informs you that this non-malleable solid is less dense than Glass but more dense than water.

Based on this information, the solid could be:

- a. Carbon
- b. Glass
- c. Pine Wood
- d. None of the above

Fill In:

7. The life cycle of a product refers to the stages from when the product is made until it is disposed.

8. Plastics are members of a group of chemicals known as polymers.

9. Plastics are made from hydrogen and carbon compounds

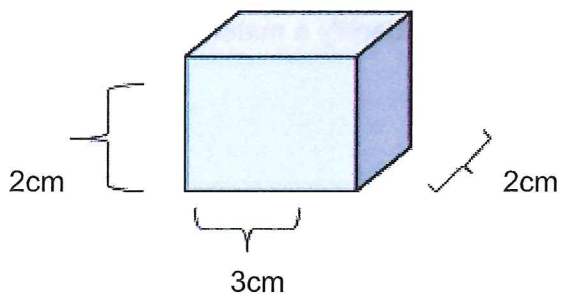
10. Most elements are a solid phase at room temperature?

11. Which of the following is a chemical property of a substance?
- solubility
  - bends easily
  - reacts with hydrochloric acid
  - melting point
12. Which of the following is a list of chemical properties?
- density, melting point, reaction with acid
  - flammability, reaction with acid, ability to rust
  - flammability, color, density
  - flexibility, color, density
13. Which of the following is **NOT** a property that can be used to identify a material?
- shape
  - color
  - luster
  - state of matter
14. Sodium Bicarbonate has a chemical formula of  $\text{NaHCO}_3$ . How many elements are in one molecule of sodium bicarbonate?
- 4
  - 12
  - 20
  - 6
15. Iron oxide has a chemical formula of  $\text{Fe}_2\text{O}_3$ . How many atoms are in this compound?
- 6
  - 7
  - 5
  - 2
16. An element contains
- two or more kinds of molecules
  - two or more kinds of atoms
  - one kind of molecule
  - one kind of atom
17. Which of the following is a compound?
- H
  - Na
  - OH
  - Fe

18. Which of the following statements is true?

- a. The particles in a gas are spread far apart from each other and rarely touch.
- b. The particles in a liquid are close together but rarely touch.
- c. The particles in a solid do not move at all.
- d. The particles in a solid are very close together and can move throughout the whole solid.

19. The wooden block has a mass of 13 grams. Will it float or sink in water? Explain.



Density equals mass  $\div$  volume.  
If the mass, which is 13g, is divided by the volume, which is  $12\text{cm}^3$ , the density will be greater than one because 12 goes into 13 at least once, it will sink.  
The density is  $1.08\text{g/cm}^3$  so it will sink.

20. If an object has a mass of 24g and a volume of 12 g/ml, what is its density?

2 g/ml.

	Polystyrene	Polyurethane	Polyamide	Low Density Polyethylene
Hardness	Soft	Soft	Firm	Soft
Flexibility	Poor	Poor	Fair	Good
Density relative to water	Sinks	Sinks	Sinks	Floats
Resistance to breaking at low temperatures	Poor	Good	Good	Fair
Resistance to softening at high temperature	Poor	Good	Good	Good
Resistance to strong acids or bases	Good	Good	Poor	Good
Resistance to solvents such as acetone	Poor	Good	Good	Good

21. A student was given a sample of one of the plastics to identify. She discovered that it was hard, would sink in water, and was not resistant to strong acids or bases. What was the name of her plastic? What is your evidence?

Her plastic sample would be Polyamide.  
 The evidence is that it is the only plastic in the table that matches the properties of hardness, sinks, and it is not resistant to strong acids or bases.

Remember:

An atom is the smallest building block of matter.

An element is composed of only **one type of atom**.

A molecule is **two or more atoms** held together by chemical bonds.

A compound is a material made from **more than one element**.

The number of atoms in 1 molecule is noted by writing the number as a subscript after the atomic symbol.  $H_2O$ .

When there is 1 atom in a molecule, such as the 1 oxygen molecule in  $H_2O$ , the 1 is not written; it is implied.

