

Practice Test- Properties of Matter

Physical & Chemical Properties

1. Water is a very unique substance because it can exist in all three phases of matter (solid, liquid, gas) within the normal temperature ranges found on Earth.

When one observes the phase of matter of water, one observes a _____ property of matter.

- A. chemical
 - B. geological
 - C. physical
 - D. biological
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2. Which of the following statements describes a physical property?

- A. The substance is highly reactive.
 - B. The substance forms a solid when reacted with silver nitrate.
 - C. The substance produces an acid when dissolved in water.
 - D. The substance has a higher density than water.
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3. Which of the following is a chemical property?

- A. combustibility
 - B. melting point
 - C. boiling point
 - D. density
-

4. Adam is trying to identify a solid. He places a small amount of the substance in an acid solution and observes whether or not a reaction takes place. This test is based on a _____ property.

- A. physical
- B. chemical
- C. radical
- D. biological

5. Chemical and physical properties are used to help identify substances. A substance's chemical properties identify whether or not that substance reacts with another substance.

What chemical property is present in substances that react slowly to oxygen?

- A. the ability to rust
- B. the ability to burn
- C. color
- D. melting point

6. Mr. Watson's students brought him a cake on his birthday because he was their favorite teacher. Before he blew out the candles, however, he asked his class to name physical properties of the candles. All of the following responses are correct except one. Which of the following is NOT a physical property of the candles?

- A. The candles are blue.
- B. The candles are 10 cm tall.
- C. The candles are thin.
- D. The candles are able to burn.

7. Which of the following are physical properties of matter?

- A. phase of matter and temperature
- B. density, solubility, and hardness
- C. size, shape, and color
- D. all of these

8. The table below shows properties of the element gold (Au).

Property	Gold's Characteristics
Color	yellow
Density	19.32 g/mL
Electronegativity	2.54

Ionization Potential	9.225
Boiling Point	2807°C
Melting Point	1064.58°C

A physical property of gold is _____.

- A. boiling point of 2807°C
- B. density of 19.32 g/mL
- C. melting point of 1064.58°C
- D. all of these

9. Water can be described in a variety of ways. Which of the following statements describes a chemical property of water?

- A. Liquid water vaporizes into steam at a temperature of 100 degrees Celsius.
- B. Ice melts into liquid water at a temperature of 0 degrees Celsius.
- C. Water is a generally unreactive compound.
- D. At room temperature, water has an approximate density of 1 g/mL.

10. What happens when the temperature of a substance decreases significantly?

- A. Most substances will gain atoms.
- B. Most substances will expand.
- C. Most substances will disappear.
- D. Most substances will contract.

11. Each student in Ms. Major's class was given an unknown substance. Ms. Major gave her students a list, shown below, of substances and their properties to help them identify their unknown.

Substance	Density	Boiling Point	Appearance
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Water	1.0 g/mL	100°C	colorless liquid
Ethanol	0.789 g/mL	78.4°C	colorless liquid
Sodium Hydroxide	2.13 g/mL	1388°C	white solid
Phosphoric Acid	1.685 g/mL	158°C	white solid or colorless liquid

If a student's unknown is a colorless liquid and its boiling point was measured to be about 78°C, it is most likely _____.

- A. water
- B. ethanol
- C. phosphoric acid
- D. sodium hydroxide

12. A thermometer contains liquid mercury, and the volume of that mercury grows as the temperature grows, allowing us to make accurate measures of temperature. Which of the following properties of mercury is described here?

- A. thermal contraction
- B. thermal expansion
- C. thermal stasis
- D. thermal growth

13. Gasoline is a substance that is used to power automobiles. Gasoline will oxidize in air.



A _____ property of gasoline is that it will _____ in air.

- A. physical; explode
- B. chemical; evaporate
- C. physical; corrode
- D. chemical; burn

14. Marjorie is trying to determine the identity of an unknown substance. After running tests, she determines that the substance is insoluble in CCl_4 with a density of about 2.2 g/mL.

Substance	Density	Boiling Point	Solubility (in water)	Solubility (in CCl_4)
NaCl	2.165 g/mL	1413°C	soluble	insoluble
C_{10}H_8	1.14 g/mL	255°C	insoluble	soluble
FeCl_3	2.898 g/mL	315°C	soluble	insoluble
SiO_2	2.634 g/mL	2590°C	insoluble	insoluble

Using the data above, which of the following substances is most likely Marjorie's unknown?

- A. NaCl
- B. SiO_2
- C. FeCl_3
- D. C_{10}H_8

Metal	Density in g/cm^3
aluminum	2.70
zinc	7.14
iron	7.87
copper	8.96
silver	10.49
lead	11.34
mercury	13.55
gold	19.32

15. What is the identity of a sample that has a mass of 2.44 g and a volume of 0.34 cm³?

- A. zinc
- B. aluminum
- C. gold
- D. copper

16. Rachel is given 50 grams each of three different white powders that look very similar. She is told that each of these powders is commonly used in cooking. Without tasting any of them, she is asked to try to identify them. She is told the amounts of sugar and salt that can each be dissolved in 100 mL of water.

Substance	Solubility (g per 100 mL water)
table sugar	211
table salt	36
flour	not soluble

Rachel adds all 50 grams of one powder to 100 mL of water and stirs it for a while. Afterwards, she has a clear liquid with some powder on the bottom.

Which of the following could this powder have been?

- A. salt
- B. sugar
- C. flour
- D. all of these

17. Chemical properties of matter depend mostly on

- A. the substance's state of matter.
- B. the color of the substance.
- C. the types of atoms and bonds that a substance contains.
- D. the shape and size of the substance.

18. The temperature at which a substance in the liquid phase transforms to the

gaseous phase refers to the substance's _____.

- A. melting point
- B. sublimation point
- C. freezing point
- D. boiling point

19. Which physical property refers to the temperature at which a substance in a solid state transforms to a liquid state?

- A. melting point
- B. boiling point
- C. freezing point
- D. evaporating point

20. What is the **streak** of a mineral used for?

- A. measuring the hardness of the mineral
- B. identifying the mineral
- C. finding the volume of the mineral
- D. weighing the mineral

Metal	Density in g/cm ³
aluminum	2.70
zinc	7.14
iron	7.87
copper	8.96
silver	10.49
lead	11.34
mercury	13.55
gold	19.32

21. What is the identity of a sample that has a mass of 100.5 g and a volume of 7.42 cm³?

- A. lead
 - B. iron
 - C. gold
 - D. mercury
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22. Density is a measurable property of matter. How can the density of a substance be determined?

- A. Measure the mass and volume of the substance, then divide the volume by the mass.
 - B. Measure the length and weight of the substance, then multiply the length by the weight.
 - C. Measure the mass and volume of the substance, then divide the mass by the volume.
 - D. Measure the length, width, and height of the substance, then multiply these values together.
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23. A substance is found to be reactive, flammable, soluble, and explosive. Which of these observations is a physical property?

- A. soluble
 - B. explosive
 - C. flammable
 - D. reactive
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24. Jill likes to watch her dad cook. First, he puts liquid raw eggs in a hot pan, and the eggs get stiff. Then, he adds solid cheese to the pan and the cheese gets gooey.

The changes in the eggs and cheese illustrate that

- A. different substances can have different densities.
 - B. different substances can react differently to heat.
 - C. different substances can react differently to light.
 - D. different substances can have different volumes.
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25. A streak test is used to identify minerals by looking at the color of the streak made by rubbing the mineral against rough, uncolored ceramic or porcelain. The following table presents the colors of several minerals as well as the colors of the

streaks they make.

Mineral	Color	Streak Color
Gold	golden yellow	yellow
Pyrite	golden yellow	black
Quartz	colorless	white
Amethyst	purple	white
Hematite	metallic gray	red
Galena	metallic gray	lead gray

A teacher gives her students the mineral samples shown above. If a student produces a lead gray streak, what mineral does the student have?

- A. galena
- B. hematite
- C. pyrite
- D. gold

26. Which of the following describes a chemical property of a metal?

- A. high melting point
- B. reacts with acid
- C. conducts electricity
- D. attracted to a magnet

27. Methane is a colorless, odorless gas. It oxidizes in air and has a boiling point of -161 C. Which property of methane is a chemical property?

- A. boiling point
- B. oxidizes in air
- C. odor
- D. color

28. A cube of sodium chloride—which is table salt—is soluble in water.



A _____ property of salt is that it will _____ in water.

- A. chemical; sink
- B. physical; corrode
- C. chemical; dissolve
- D. physical; dissolve

29. A square block of steel with volume 10 cm^3 and mass of 75 g is cut precisely in half. The density of the two smaller pieces is now...

- A. one-fourth the original density.
- B. two times the original density.
- C. one-half the original density.
- D. the same as the original density.

30. Four boxes of the same volume are each completely filled with one of the following items: sand, marbles, paperclips, or dice. The order of boxes from least to greatest mass is as follows: paperclips, dice, marbles, and sand.

Which box has the greatest density?

- A. the box filled with paperclips
 - B. the box filled with dice
 - C. the box filled with sand
 - D. the box filled with marbles
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Answers

1. C
2. D
3. A
4. B
5. A
6. D
7. D
8. D
9. C

10. D
11. B
12. B
13. D
14. A
15. A
16. A
17. C
18. D
19. A
20. B
21. D
22. C
23. A
24. B
25. A
26. B
27. B
28. D
29. D
30. C

Explanations

1. Since observing the phase of matter does not change the identity of the substance (i.e. solid ice, liquid water, and gaseous steam are all forms of water), a substance's phase of matter is considered a **physical** property, and changing the phase of matter (e.g.

from a solid to a liquid or a liquid to a gas) is considered a physical change.

2. A physical property is a property that can be observed without a chemical reaction taking place. **Testing the density of a substance does not involve a chemical reaction and is a physical property.** The other three statements describe chemical properties because a reaction takes place in each one.
3. Chemical properties describe how a substance can change into a new substance. Reactivity and combustibility are examples of chemical properties.

Physical properties can be observed without changing the identity of a substance. An object's mass, volume, density, and color are all examples of physical properties. States of matter, melting point, and boiling point are also examples of physical properties.

4. A chemical property is a property that is observed when a chemical reaction takes place. Adam is testing whether the substance reacts with acids. Since **this involves a chemical reaction, the test is based on a chemical property.**
5. Substances that react slowly to oxygen have **the ability to rust.** The ability to rust and the ability to burn are both examples of chemical properties that some substances can have.
6. The color and size (e.g. height and thickness) of the candles are examples of physical properties. These properties can be observed without changing the candles' identity or substance.

The fact that candles can burn is a chemical property. This property describes how candles are able to react with oxygen in the air and combust to form heat and light.

7. A physical property of a substance can be observed without changing the identity of the substance.

So, **all of the answers are correct.**

8. Physical properties include color, density, melting point, boiling point, mass, and solubility. Chemical properties include electronegativity, ionization potential, reactivity, flammability, and toxicity.

Some physical properties of gold are **a melting point of 1064.58°C, a density of 19.32 g/mL, and a boiling point of 2807°C.**

9. The melting point, boiling point, and density of water are all examples of physical properties. These properties can be observed without changing water's identity.

The fact that **water is generally an unreactive compound** is a chemical property. This property describes how water tends not to react with other molecules to form new substances.

10. When the temperature of a substance decreases significantly, **most substances will contract.**

When heat is removed from a substance, the substance will decrease in temperature and contract. When heat is added to a substance, the substance will increase in temperature and expand. These patterns occur in solids, liquids, and especially gases.

11. In order to determine the identity of a substance, it can be useful to run tests to determine physical and chemical properties of the substance.

If a student's unknown is a colorless liquid with a boiling point of 78°C, it is most likely **ethanol**.

12. When a substance absorbs heat energy, it usually expands, or gets bigger.

Thermal expansion is the tendency of a substance to increase in volume as it increases in temperature.

13. Oxidizing in air is a **chemical** property of gasoline. This means it can **burn** in air.

A chemical property is a property that is observed when a substance undergoes a chemical reaction. Oxidation in air involves a chemical reaction between the substance and oxygen, which makes it a chemical property.

14. In order to determine the identity of a substance, it can be useful to run tests to determine physical and chemical properties of the substance.

Marjorie's unknown is most likely **NaCl**.

15. **Density** (D) is calculated by dividing the mass (m) of the substance by its volume(v):

$$D = m/v$$

$$7.18 \text{ g/cm}^3 = 2.44 \text{ g} / 0.34 \text{ cm}^3$$

To find the identity of a substance, compare the calculated density to the values listed in the table. A sample with a density of 7.18 g/cm³ would be **zinc**.

16. Sugar would completely dissolve, leaving a clear liquid. Some but not all of the **salt** could dissolve in 100 mL of water, so it would result in a clear liquid with some powder still on the bottom. Flour is not soluble in water. It creates a cloudy white suspension instead.
17. Chemical properties of matter depend mostly on **the types of atoms and bonds that a substance contains**.
18. The **boiling point** of a substance refers to the temperature at which the substance in the liquid phase transforms to the gaseous phase. Boiling point is a physical property of matter.

The boiling point of water is 100°C (212°F).

19. The **melting point** of a substance is the temperature at which substance transforms from a solid state into a liquid state.
20. The **streak** of a mineral is used along with its luster and color to help identify that mineral.
21. **Density** (D) is calculated by dividing the mass (m) of the substance by its volume(v):

$$D = m/v$$

$$13.5 \text{ g/cm}^3 = 100.5 \text{ g} / 7.42 \text{ cm}^3$$

To find the identity of a substance, compare the calculated density to the values listed in the table. A sample with a density of 13.5 g/cm³ would be **mercury**.

22. The density of a substance is its mass per unit volume. So, the density of a substance is determined by measuring the mass and volume of the substance, then dividing the mass by the volume.
23. A physical property is a property that can be observed without a chemical reaction taking place. **Solubility is a physical property because it does not involve a chemical reaction taking place** since the substance that dissolves still remains the same substance.
24. The eggs solidify in the pan because heat causes them to undergo a chemical reaction. The cheese gets gooey because the heat causes it to melt.

This illustrates that **different substances can react differently to heat**.

25. According to the table, a lead gray streak indicates that the mineral is **galena**.
26. A chemical property is a property that is observed when a substance undergoes a chemical reaction. Attraction to a magnet, melting point, and conduction of electricity do not involve a chemical reaction. **Reaction with acid does involve a chemical reaction and so is a chemical property**.
27. A chemical property is a property that is observed when a substance undergoes a chemical reaction. Color, odor, and boiling point are all observed without chemical reactions occurring. **Oxidation in air involves a chemical reaction between the substance and oxygen, which makes it a chemical property**.
28. Solubility in water is a **physical** property of salt, meaning salt will **dissolve** in water.

A physical property is a property that can be observed without a chemical reaction taking place. Solubility is a physical property because it does not involve a chemical reaction taking place since the substance that dissolves still remains the same

substance.

29. Since the density of a solid object is a constant proportion of mass divided by volume, it does not change when the volume of that object changes.

When we cut the steel block in half, we are cutting both the mass and volume in half at the same time. Therefore the ratio of the two numbers, or the density, will **remain the same**.

Before cutting...

$$D = m/V = 75 \text{ g}/10 \text{ cm}^3 = 7.5 \text{ g/cm}^3$$

After cutting...

$$D = m/V = 1/2(75 \text{ g}) / 1/2(10 \text{ cm}^3) = 7.5 \text{ g/cm}^3$$

30. Density is the ratio of an object's mass to its volume ($D = m/V$). However, since the volume is the same for all four boxes in this problem, we can simply compare masses. The box with the greatest mass, or **the box filled with sand**, has the greatest density.