

Q1 STUDY GUIDE

Multiple Choice

Identify the choice that best completes the statement or answers the question.

- ___ 1. Which of these is the smallest particle to retain the properties of an element?
- A. an atom
 - B. a proton
 - C. a molecule
 - D. an electron
- ___ 2. An atom's mass number is 210 and its atomic number is 85. How many neutrons does the atom have?
- A. 85
 - B. 125
 - C. 210
 - D. 295
- ___ 3. Calcium is an element. What is the smallest particle of calcium that has all the chemical properties of calcium?
- A. an atom of calcium
 - B. a proton from a calcium atom
 - C. an electron from a calcium atom
 - D. a molecule that contains calcium
- ___ 4. Which of the following is not made up of atoms?
- A. elements
 - B. molecules
 - C. pure substances
 - D. subatomic particles
- ___ 5. Which process is an example of a physical change?
- A. burning
 - B. rusting
 - C. flattening
 - D. decomposing
- ___ 6. Chemical changes result in new substances, but physical changes do not. Which process is an example of a chemical change?
- A. chopping a tree
 - B. cooking a steak
 - C. heating a cup of tea
 - D. drying clothes in the dryer

- ___ 7. Rita wants to make some toast for breakfast, which she knows involves a chemical change to the bread. She puts a slice of bread in the toaster, but, after 10 minutes, she notices that the sides of the bread are black. What caused this chemical change to go too far?
- A. the type of bread
 - B. the size of the bread
 - C. a decrease in temperature
 - D. an increase in temperature
- ___ 8. Which state of matter will take both the volume and shape of the container that holds it?
- A. gas
 - B. ice
 - C. liquid
 - D. solid
- ___ 9. In which state(s) of matter are particles constantly moving?
- A. gases only
 - B. liquids only
 - C. gases and liquids only
 - D. gases, liquids, and solids
- ___ 10. Which of the following statements describes a liquid?
- A. A liquid has both a definite shape and a definite volume.
 - B. A liquid has neither a definite volume nor a definite shape.
 - C. A liquid has a definite shape but not a definite volume.
 - D. A liquid has a definite volume but not a definite shape.
- ___ 11. Which statement is true of all matter?
- A. It has mass.
 - B. It can be seen.
 - C. It exists only as a solid.
 - D. It maintains its shape and size.
- ___ 12. Amin had two metal cubes of identical sizes. He placed cube A on one side of a pan balance and cube B on the other side of the balance. The pan that held cube B was now lower than the pan that held cube A. What conclusion can Amin draw about the two cubes?
- A. The masses of the two cubes are the same.
 - B. The volumes of the two cubes are different.
 - C. The weights of the two cubes are the same.
 - D. The densities of the two cubes are different.
- ___ 13. Some properties are the same in a substance no matter the amount of the substance. Which of the following properties does not change based on the amount of the substance?
- A. density
 - B. mass
 - C. volume

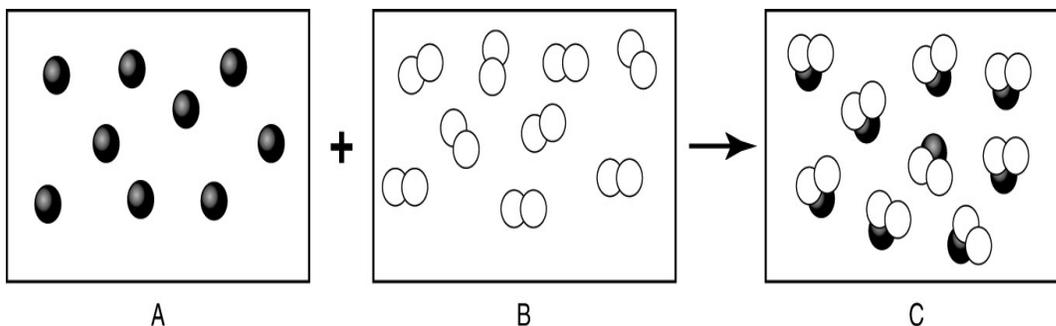
D. weight

- ___ 14. Which of these choices is an example of a physical property?
- A. the tarnishing of silverware
 - B. the texture of a piece of chocolate
 - C. the effect of acid rain on automobiles
 - D. the combustion of gasoline in a car engine
- ___ 15. Which of these statements describes an example of a chemical property?
- A. A silver statue begins to tarnish.
 - B. A painter coats a building with red paint.
 - C. A freshly waxed floor has a bright shine.
 - D. A metal turns to liquid at a certain temperature.
- ___ 16. A beaker containing ice and water is placed on a warm hotplate. Will the ice in the beaker undergo a physical or chemical change?
- A. a physical change because it will change state
 - B. a chemical change because it will change state
 - C. a physical change because it will form a new substance
 - D. a chemical change because it will form a new substance
- ___ 17. At which temperature does ice melt into liquid water?
- A. 0 °C
 - B. 32 °C
 - C. 100 °C
 - D. 212 °C
- ___ 18. On a hot day, a puddle dries up. Which statement describing this event is true?
- A. The water in the puddle boils and becomes a gas.
 - B. The water in the puddle evaporates into water vapor.
 - C. The water in the puddle condenses and becomes part of air.
 - D. The water in the puddle changes into particles of oxygen in the air.
- ___ 19. What happens to the particles of a sample of matter as its temperature increases?
- A. The particles melt.
 - B. The particles move faster.
 - C. The particles grow in size.
 - D. The particles become lighter.
- ___ 20. Which process can occur when the particles in a sample of matter experience an increase in kinetic energy?
- A. freezing
 - B. deposition
 - C. evaporation
 - D. condensation

___ 21. Which of these common substances is a homogeneous mixture?

- A. table salt
- B. pure water
- C. whole milk
- D. maple syrup

___ 22. The diagram below shows a chemical reaction.



What is being formed in the box labeled C?

- A. a compound
 - B. an element
 - C. a mixture
 - D. an atom
- ___ 23. There are several differences between chemical and physical changes. Which process is an example of a chemical change?
- A. steam rising from a boiling pot of soup
 - B. a metal railing rusting in damp weather
 - C. alcohol evaporating from a cotton swab
 - D. a piece of wood shrinking as it dries out
- ___ 24. Which process is an example of a chemical change?
- A. an iron nail rusting
 - B. bath water cooling while you take a bath
 - C. a piece of metal being heated until it expands
 - D. a glass window breaking when hit with a baseball
- ___ 25. When paper is burned, the mass of the remaining ash is less than the mass of the original paper. Which statement best explains this result?
- A. The ash has less volume than the paper.
 - B. Some of the matter is destroyed during the reaction.
 - C. The mass of the ash cannot be accurately determined.
 - D. Some of the products of the reaction were given off as a gas.

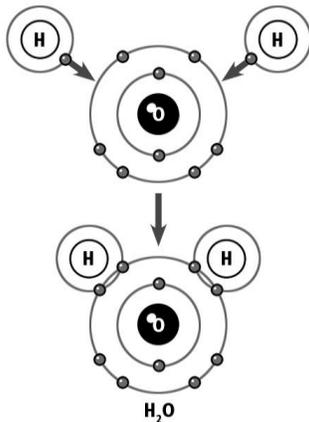
___ 26. Which process is an example of a physical change?

- A. burning
- B. rusting
- C. flattening
- D. decomposing

___ 27. Which observation is a sign of a chemical change?

- A. A rotting potato gives off a bad smell.
- B. A melting block of ice leaves a large puddle.
- C. A cloud changes shape when blown by wind.
- D. A plaster statue breaks when it falls onto the floor.

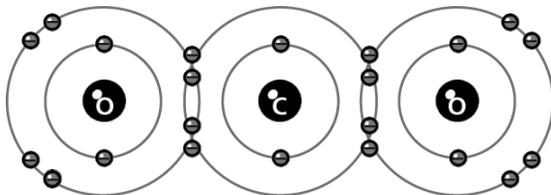
___ 28. The diagram shows the formation of water.



Which of the following occurs when water forms?

- A. Two hydrogen atoms are destroyed to form atoms of water.
- B. One oxygen atom shares electrons with two hydrogen atoms.
- C. Two hydrogen atoms each give an electron to an oxygen atom.
- D. One oxygen atom gives an electron to each of two hydrogen atoms.

___ 29. The diagram below represents carbon dioxide



Based on the type of bonding shown, which term best describes a unit of carbon dioxide?

- A. ion

- B. mixture
- C. element
- D. molecule

- ___ 30. Which property makes metals good conductors of electricity?
- A. The electrons in a metal can move freely.
 - B. The positively charged metal ions attract free electrons around them.
 - C. The electrons are shared equally by all of the atoms that make up the metal.
 - D. The negative charge of the electrons cancels the positive charge of the metal ions.
- ___ 31. Water is made up of units called molecules. Which description best defines a molecule?
- A. an atom that has gained or lost electrons
 - B. a solid ionic compound formed from a three-dimensional pattern
 - C. an attraction between positively charged metal ions and free electrons
 - D. a group of atoms, usually belonging to nonmetals, joined by covalent bonds
- ___ 32. A student is investigating an ionic compound. Which property should the student expect to observe?
- A. The compound should be a gas at room temperature.
 - B. The compound should not dissolve when placed in water.
 - C. The compound should have low melting and boiling points.
 - D. The compound should conduct electricity when placed in water.
- ___ 33. Each atom of magnesium has 2 valence electrons. Each atom of chlorine has 1 valence electron. Magnesium and chlorine can form the ionic compound magnesium chloride. How many atoms of each element are required to form one unit of magnesium chloride?
- A. 1 atom of magnesium and 1 atom of chlorine
 - B. 1 atom of magnesium and 2 atoms of chlorine
 - C. 2 atoms of magnesium and 1 atom of chlorine
 - D. 2 atoms of magnesium and 2 atoms of chlorine
- ___ 34. The segment of the periodic table below shows the elements in Groups 1 through 9.

Part of the Periodic Table

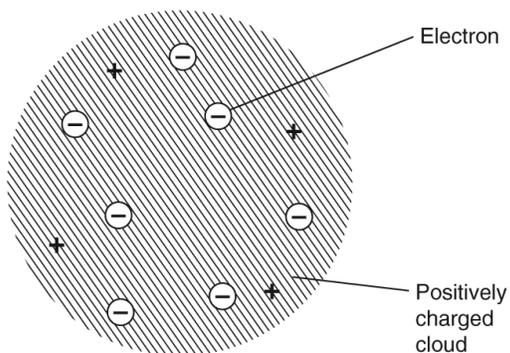
	1								
1	H 1.008								
	2								
2	Li 6.941	Be 9.012							
	3								
3	Na 22.99	Mg 24.31							
	4								
4	K 39.10	Ca 40.08	Sc 44.96	Ti 47.86	V 50.94	Cr 52.00	Mn 54.94	Fe 55.85	Co 58.93
	5								
5	Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc (98)	Ru 101.1	Rh 102.9
	6								
6	Cs 132.9	Ba 137.3	La 138.9	Hf 178.5	Ta 180.9	W 183.9	Re 186.2	Os 190.2	Ir 192.2
	7								
7	Fr (223)	Ra (226)	Ac (227)	Rf (263)	Db (262)	Sg (266)	Bh (267)	Hs (277)	Mt (268)

Which pair of elements are in the same group?

- A. Rb and Cs
- B. Ca and Ti

- C. Li and Be
- D. Na and Mg

- ___ 35. The prefix *semi-* means “partly.” Based on your knowledge of the properties of elements, which kind of element is most likely used to make semiconductors?
- A. liquids
 - B. metals
 - C. metalloids
 - D. nonmetals
- ___ 36. What do elements in the same group on the periodic table have in common?
- A. They have the same atomic number.
 - B. They have similar chemical symbols.
 - C. They have similar chemical properties.
 - D. They have the same average atomic mass.
- ___ 37. Which of these is the smallest particle to retain the properties of an element?
- A. an atom
 - B. a proton
 - C. a molecule
 - D. an electron
- ___ 38. A British scientist named J. J. Thomson discovered the electron in 1897. He suggested that the atom looked like the model below, with electrons in a mass, or cloud, of positive charge.



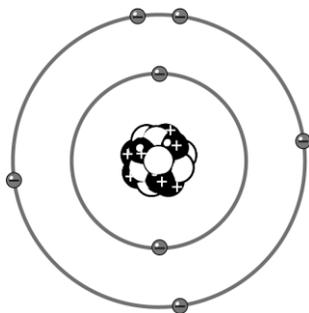
How was the Thomson model different from the Bohr model that followed it?

- A. The Bohr model did not include positive charges in the atom.
 - B. The Bohr model showed electrons surrounding the positive nucleus.
 - C. The Bohr model consisted of a single, solid mass with no smaller particles.
 - D. The Bohr model showed neutrons in a cloud surrounding the negative nucleus.
- ___ 39. Which statement is supported by the atomic theory?
- A. Atoms combine to make all the substances on Earth.
 - B. Atoms are made up of smaller particles called molecules.
 - C. Atoms are easily destroyed when matter is cooled or heated.

D. Atoms come in different sizes, but most are visible using a simple hand lens.

- ___ 40. An atom of the element gallium (Ga) has 31 protons and 39 neutrons. What is the atomic number of gallium?
- A. 8
 - B. 31
 - C. 39
 - D. 70

- ___ 41. The diagram below shows a Bohr model of an atom of nitrogen.

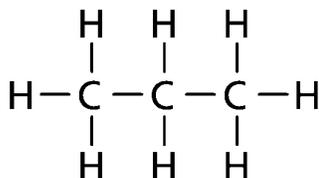


According to the model, how many valence electrons does the atom have?

- A. 2
 - B. 5
 - C. 7
 - D. 14
- ___ 42. Which of the following atoms is least likely to form chemical bonds with other atoms?
- A. a hydrogen atom containing 1 valence electron
 - B. a carbon atom containing 4 valence electrons
 - C. a neon atom containing 8 valence electrons
 - D. a sodium atom containing 1 valence electron
- ___ 43. Which property makes metals good conductors of electricity?
- A. The electrons in a metal can move freely.
 - B. The positively charged metal ions attract free electrons around them.
 - C. The electrons are shared equally by all of the atoms that make up the metal.
 - D. The negative charge of the electrons cancels the positive charge of the metal ions.
- ___ 44. How does the strength of a metallic bond compare to other types of bonds?
- A. Metallic bonds are weaker than ionic bonds or covalent bonds.
 - B. Metallic bonds are equal in strength to ionic and covalent bonds.
 - C. Metallic bonds are weaker than ionic bonds, but stronger than covalent bonds.
 - D. Metallic bonds are weaker than covalent bonds, but stronger than ionic bonds.
- ___ 45. How do covalent bonds form?
- A. Free electrons move around positive ions.

- B. Outer electrons on some atoms are destroyed.
- C. Electrons are transferred from one atom to another.
- D. Atoms of elements, usually nonmetals, share electrons.

___ 46. The diagram shows the structural formula for propane.



Based on the diagram, which of the following is the molecular formula for propane?

- A. CH
- B. C₃H
- C. C₃H₃
- D. C₃H₈

___ 47. Which statement about carbon molecules is true?

- A. They may take the form of rings.
- B. They never form branched chains.
- C. They always take the form of long chains.
- D. They rarely contain more than two carbon atoms.

___ 48. The following appears in a chemical equation:



How many atoms of carbon are represented by this formula?

- A. 2
- B. 3
- C. 5
- D. 6

___ 49. A student observed a precipitate form during a chemical reaction. Which of the following did the student most likely observe?

- A. Bubbles of gas floated to the top of a solution.
- B. The color of a liquid changed when a solid was added to it.
- C. Steam rose from a flask when a powder was added to a liquid.
- D. A solid sank to the bottom of a container when two liquids were mixed.

___ 50. The chemical formula of acetate is shown below.



How many atoms of carbon are in one molecule of acetate?

- A. 1
- B. 2
- C. 3

Short Answer

1. A student is investigating the particles in a glass window, raindrops on the window, and the air around the window. Assume the window, the raindrops, and the air are all at 25 °C.

Identify the state of matter for each sample of matter.

Compare the attractions between the particles in each sample of matter.

2. An unknown substance has a volume of 2 cm³ and a mass of 38.6 grams. What is the density of the sample?

Material	Density (g/cm ³)
Water	1.0
Aluminum	2.7
Iron	7.9
Silver	10.5
Gold	19.3

Use the chart above to determine the identity of the unknown sample:

List three other physical properties that could be used to identify this sample.

3. An unknown substance has a volume of 2 cm³ and a mass of 38.6 grams. What is the density of the sample?

Material	Density (g/cm ³)
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Water	1.0
Aluminum	2.7
Iron	7.9
Silver	10.5
Gold	19.3

Use the chart above to determine the identity of the unknown sample:

List three other physical properties that could be used to identify this sample.

4. A sample liquid is heated in a closed container and turns into a gas. What happens to the size of the particles in the sample?

What happens to the number of particles in the sample?

What happens to speed of the particles?

5. Describe the difference between a chemical change and a physical change.

What are three examples of physical changes?

What are three signs that a chemical change has taken place?

How does temperature affect chemical changes?

6. List three properties of metals that nonmetals typically do not have.

Describe where metals and nonmetals are found on the periodic table.

What are elements that have some properties of metals and some properties of nonmetals called?

7. The diagram below shows a portion of the periodic table.

1 H	2
3 Li	4 Be
11 Na	12 Mg
19 K	20 Ca
37 Rb	38 Sr
55 Cs	56 Ba
87 Fr	88 Ra

Based on the periodic table, how many protons does each atom of potassium (K) have? Explain how you know.

How many electrons does each neutral atom of potassium have? Explain how you know.

8. The diagram below shows a portion of the periodic table.

1	
1 H	2
3 Li	4 Be
11 Na	12 Mg
19 K	20 Ca
37 Rb	38 Sr
55 Cs	56 Ba
87 Fr	88 Ra

Based on the periodic table, how is the number of valence electrons different for potassium (K) than it is for calcium (Ca)? Explain how you know.

Use the numbers of valence electrons to explain how atoms of each element could form bonds with other atoms.

9. Fluorine has 7 valence electrons. What type of bond is likely to form between two atoms of fluorine?

Draw two atoms of fluorine showing the bond that forms between them.

How does the number of valence electrons of an atom help to determine whether an atom is likely to form bonds?

10. In the space below, draw a Bohr model of an atom.

Label the valence electrons. How many valence electrons does this atom have? _____
What element does your atom represent? Explain.

Bohr models do not correctly show the location of electrons in an atom. Explain why they are still useful to predict bonding of atoms.

11. What do all formulas for organic molecules show?

How does a full structural formula differ from a simplified structural formula?

12. One class of organic compounds is organic acids.

What is an organic acid?

What is a carboxyl group? Explain how you could use a diagram to represent a carboxyl group.

What are two examples of organic acids?

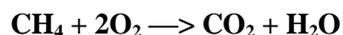
13. Many common materials are made up of polymers.

What is a polymer?

What are the structural units of polymers called?

What are two examples of polymers?

14. The following chemical equation shows the reaction of methane and oxygen to form carbon dioxide and water.



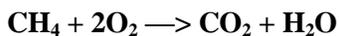
Balance the above reaction by writing in the correct coefficient.

How does a balanced equation demonstrate the law of conservation of mass?

What molecule in the above equation is organic?

Draw a full structural formula for the organic molecule in the formula above.

15. The following chemical equation shows the reaction of methane and oxygen to form carbon dioxide and water.



Balance the above reaction by writing in the correct coefficient.

How does a balanced equation demonstrate the law of conservation of mass?

What molecule in the above equation is organic?

Draw a full structural formula for the organic molecule in the formula above.

Essay

1. Atoms are made up of smaller particles.

Identify the three particles within an atom.

Compare these particles in terms of charge.

Compare these particles in terms of mass.

Describe how these particles are arranged within the structure of an atom.

2. Atoms are made up of smaller particles.

How does the structure of an atom relate to its atomic number?

How does the structure of an atom relate to its mass number?

Where is most of the mass of an atom concentrated? Explain.

Why are atoms electrically neutral if they contain charged particles?

3. Solid dry ice changes directly into carbon dioxide gas. This change of state is known as _____.

What happens during this change of state?

Compare the motion of the particles in dry ice and carbon dioxide gas.

Compare the original mass of dry ice with the mass of carbon dioxide gas that forms. Explain how you arrived at your answer.

4. An ice cube that has a mass of 20 g is in a sealed container. As the container is heated, the ice first melts, but eventually it changes to water vapor.

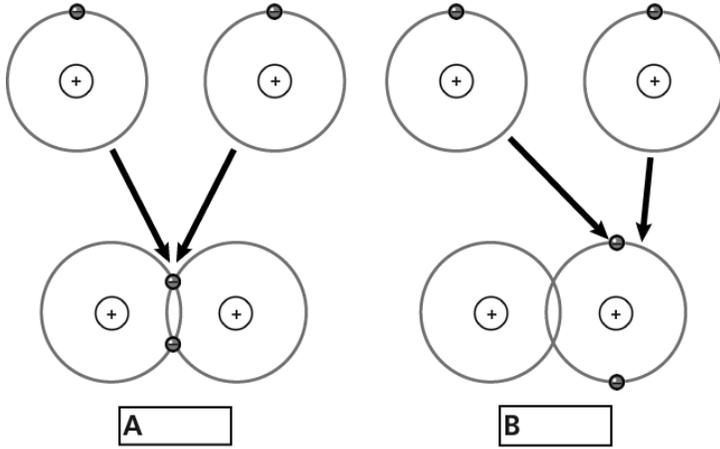
The temperature at which the ice melts is _____.

Compare the motion of the particles in each state.

Compare the attraction of the particles in each state.

Compare the mass of the ice cube with the mass of the water vapor.

5. The diagram shows the formation of two different types of bonds.



Identify each type of bond, and describe the difference between each type.

Contrast the properties of the compounds that result from each bond, and give an example of each type of compound.

6. Atoms are made up of smaller particles.

Identify the three particles within an atom.

Compare these particles in terms of charge.

Compare these particles in terms of mass.

Describe how these particles are arranged within the structure of an atom.

7. Atoms are made up of smaller particles.

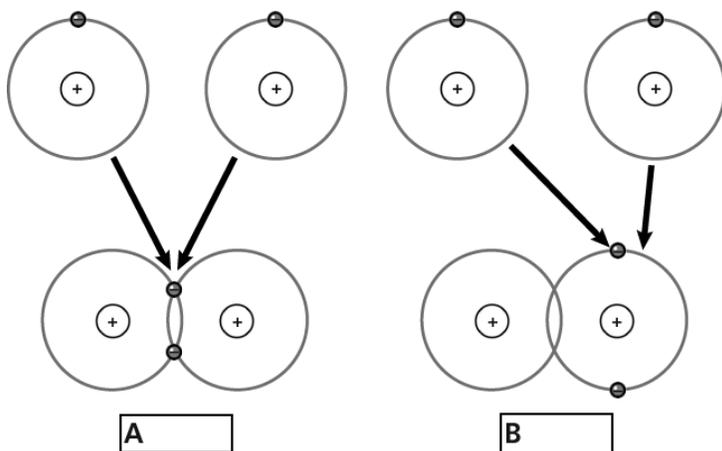
How does the structure of an atom relate to its atomic number?

How does the structure of an atom relate to its mass number?

Where is most of the mass of an atom concentrated? Explain.

Why are atoms electrically neutral if they contain charged particles?

8. The diagram shows the formation of two different types of bonds.



Identify each type of bond, and describe the difference between each type.

Contrast the properties of the compounds that result from each bond, and give an example of each type of compound.

Other

1. A(n) _____ is a bond that forms when electrons are transferred from one atom to another.
2. A(n) _____ is a bond forms when atoms share one or more pairs of electrons.
3. A(n) _____ is the smallest particle of an element that has the chemical properties of that element.
4. A(n) _____ is a negatively-charged subatomic particle.
5. A(n) _____ is an interaction that holds two atoms together.
6. A(n) _____ is a bond that forms when electrons are transferred from one atom to another.
7. A(n) _____ is a bond forms when atoms share one or more pairs of electrons