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- 1 A bond that forms as a result of the attraction between positive and negative ions is called
- A a covalent bond.
  - B an ionic bond.
  - C a metallic bond.
  - D a polar bond.
- 2 In an ionic bond, the valence electrons
- A are shared by two or more atoms.
  - B are located on oppositely charged ions.
  - C move easily around a lattice of positive ions.
  - D are given off as beta particles.
- 3 The diagram is a model of two nitrogen (N) atoms bonded together. What do the lines represent in the model?  $\text{:N}\equiv\text{N:}$
- A ionic bonds
  - B metallic bonds
  - C double bonds
  - D covalent bonds
- 4 What happens to sodium's valence electron when sodium bonds with chlorine to form table salt?
- A The electron is gained by sodium.
  - B The electron is transferred to chlorine.
  - C The electron is lost to the environment.
  - D The electron is shared equally between the two atoms.
- 5 Metals are usually shiny and malleable. Nonmetals are dull and may be gases at room temperature. When a metal and nonmetal react, they *most often* form
- A a covalent compound that is a gas.
  - B a covalent compound that is shiny and brittle.
  - C an ionic compound that is hard and brittle.
  - D an ionic compound that is soft and malleable.
- 6 Which is an example of covalent bonding?

- A two oxygen atoms forming  $O_2$
- B sodium and chlorine atoms in a NaCl crystal
- C copper atoms in a pure Cu crystal
- D the attraction between water molecules

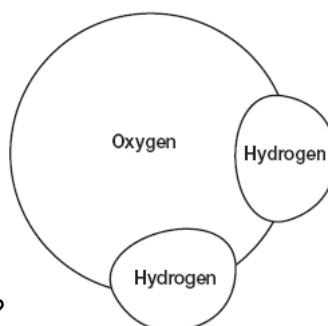
7 What kind of bond does the diagram above show?  $Na^x + \cdot\ddot{Cl}: \longrightarrow [Na]^+ + [\ddot{Cl}:]^-$

- A ionic bond
- B covalent bond
- C double bond
- D noble bond

8 Which of the following is the minimum number of atoms in a compound?

- A 1
- B 2
- C 3
- D 4

9



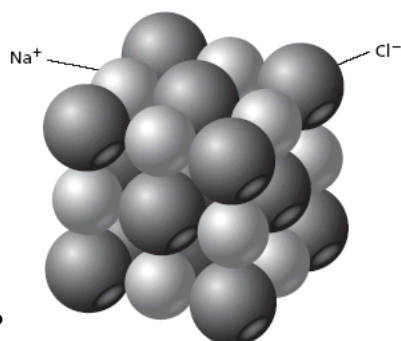
What kind of bonds are shown in the diagram?

- A covalent bonds
- B ionic bonds
- C metallic bonds
- D double bonds

10 Some compounds found in the human body are long chains of smaller molecules. These chains are called

- A carbon molecules.
- B covalent bonds.
- C crystals.
- D polymers.

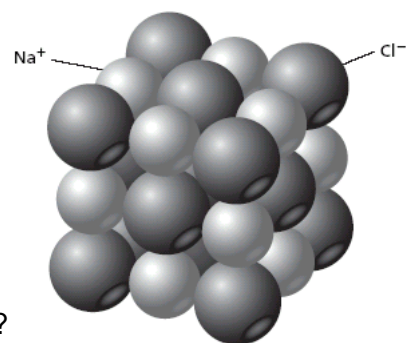
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What type of structure is shown in the diagram?

- A atom
- B crystal
- C molecule
- D polymer

12



Which of the following kinds of force helpshold the particles together?

- A electrical attraction
- B magnetic attraction
- C gravitational attraction
- D thermonuclear attraction

13 The periodic table above shows the chemical symbol for each of the elements. Which of the following chemical formulas indicates a compound that would not be found in

1	2											III	13	14	15	16	17	18
1	H												B	C	N	O	F	Ne
2	Li	Be																
3	Na	Mg											Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	* f	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra																

nature?

*	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
f	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lw

- A NaCl
- B FeO
- C ArO
- D CaS

14

I												III						IV						18
1	H											13	B	C	N	O	F	He						
2	Li	Be																						
		I								II														
3	Na	Mg	3	4	5	6	7	8	9	10	11	12	Al	Si	P	S	Cl	Ar						
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr						
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe						
6	Cs	Ba	*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn						
7	Fr	Ra	s	Unq	Unp	Unp	Uns	Uns	Uno															

Which of the following compounds includes calcium?

*	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
§	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lw

- |   |                                     |
|---|-------------------------------------|
| A | $\text{C}_6\text{H}_{12}\text{O}_6$ |
| B | $\text{CaS}$                        |
| C | $\text{KCl}$                        |
| D | $\text{NH}_3$                       |

- 15 The chemical formula for a molecule of sulfuric acid is  $\text{H}_2\text{SO}_4$ . How many different elements make up the compound sulfuric acid?

- |   |   |
|---|---|
| A | 2 |
| B | 3 |
| C | 6 |
| D | 7 |

- 16 The formation of a molecule by the bonding of atoms of two or more different elements is

- A a chemical change.  
B a physical change.  
C a change of state.  
D a change in valence.

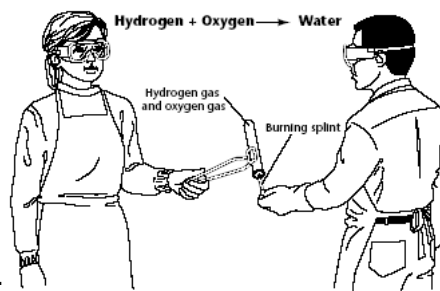
- 17 The *best* evidence for a chemical reaction is

- A the formation of a new substance.  
B the production of a gas.  
C a change in color.  
D the formation of a solid.

- 18 What takes place in a chemical reaction?

- A Atoms are destroyed.  
B Energy is changed into atoms.  
C Atoms are rearranged to form new substances.  
D New atoms are created.

19



Identify the reactant(s) and product(s) of this reaction.

- A The reactant is  $\text{H}_2\text{O}$ , and the products are  $\text{H}_2$  and  $\text{O}_2$ .
- B The reactants are  $\text{H}_2$  and  $\text{O}_2$ , and the product is  $\text{H}_2\text{O}$ .
- C The reactants are Hy and Ox, and the product is W.
- D The reactant is W, and the products are Hy and Ox.

20 Which of the following is *always* true in a chemical reaction?

- A The reactants and products have the same properties.
- B The reactants and products contain the same elements.
- C The reactants have greater energy than the products.
- D The reactants have less mass than the products.

21 When two or more substances combine to make a more complex compound, the process is called a

- A decomposition reaction.
- B replacement reaction.
- C precipitate reaction.
- D synthesis reaction.

22 The law of conservation of matter states that during a chemical reaction,

- A matter is created and then destroyed.
- B matter is not created or destroyed.
- C matter is not created but can be destroyed.
- D matter can be created but never destroyed.

23 In the chemical equation  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ , how does the total mass of the reactants compare to the total mass of the products?

- A The reactants have greater mass.
- B The products have greater mass.
- C You need more information.
- D The total masses are the same.

## CA Physical Science Benchmark Test 2

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- 24 Matter is conserved in a chemical reaction because
- A the amount of energy present decreases.
  - B the amount of energy present increases.
  - C the number and kind of atoms do not change.
  - D the number and kind of molecules do not change.
- 25 Berta wants to balance the equation shown. Which number should she place in front of  $\text{HNO}_3$  in order to balance the equation?  $\text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow \text{HNO}_3$
- A 1
  - B 2
  - C 3
  - D 4
- 26 How many nitrogen atoms will be found on each side of the balanced equation?  $\text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow \text{HNO}_3$
- A 2 in the reactants and 1 in the product
  - B 2 in the reactants and 2 in the product
  - C 5 in the reactants and 1 in the product
  - D 6 in the reactants and 6 in the product
- 27 Which of the following will balance the chemical equation shown?  $2\text{AgNO}_3 + \text{Na}_2\text{S} \rightarrow \text{Ag}_2\text{S} + ?$
- A  $\text{NaNO}_3$
  - B  $2\text{NaNO}_3$
  - C  $3\text{NaNO}_3$
  - D  $6\text{NaNO}_3$
- 28 Which of the following is true of *both* exothermic and endothermic reactions?
- A They absorb heat.
  - B They release heat.
  - C They require some energy to start.
  - D They use more energy than they produce.
- 29 A fire is a combustion reaction between oxygen and a fuel. What type of reaction is a combustion reaction?

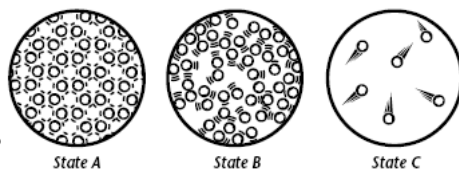
- A decomposition
- B endothermic
- C exothermic
- D synthesis

30 At the end of an endothermic reaction,

- A the products have more energy than the reactants.
- B the products have less energy than the reactants.
- C the products have the same energy as the reactants.
- D the products have no energy.

31 The diagram compares the particles in three different states of matter. What process changes

*Three States of a Substance*

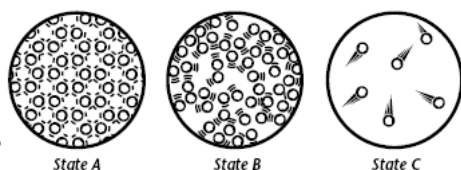


particles in State C to State B?

- A condensation
- B evaporation
- C freezing
- D melting

32 Which of the following processes is the opposite of the process that changes particles from State A to

*Three States of a Substance*

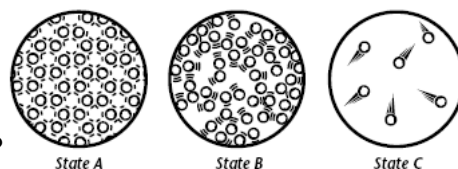


State B?

- A melting
- B freezing
- C evaporation
- D condensation

33

*Three States of a Substance*



Which term identifies the types of changes shown in the diagram?

- A chemical change
- B nuclear change
- C phase change
- D combustion change

34 A solution is one example of a mixture. The formation of a mixture from other substances is a(n)

- A chemical change.
- B decomposition reaction.
- C exothermic reaction.
- D physical change.

35 Which of the following is true of a solution?

- A All solutions are liquid.
- B It is a different substance than either the solute or the solvent.
- C It is produced through a chemical reaction.
- D The solvent and solute can be separated.

36 How do solutes affect the freezing and boiling points of solvents?

- A They decrease the freezing point and increase the boiling point.
- B They decrease both the freezing and boiling points.
- C They increase the freezing point and decrease the boiling point.
- D They increase both the freezing and boiling points.

37 A low pH value tells you that a solution has a

- A high concentration of  $\text{H}^+$  ions.
- B low concentration of  $\text{OH}^-$  ions.
- C low concentration of acid molecules.
- D high concentration of base molecules.

38 What is the name of a substance that produces hydroxide ions ( $\text{OH}^-$ ) in water?

- A acid
- B base
- C salt
- D pH

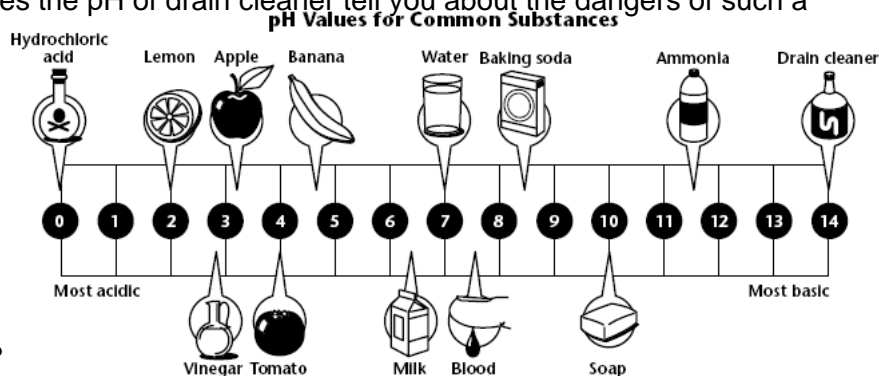
39 Any substance that forms hydrogen ions ( $H^+$ ) in water is

- A an acid.
- B a base.
- C an indicator.
- D a salt.

40 A substance that tastes bitter, feels slippery, and turns red litmus paper blue is

- A an acid.
- B a base.
- C an indicator.
- D a solvent.

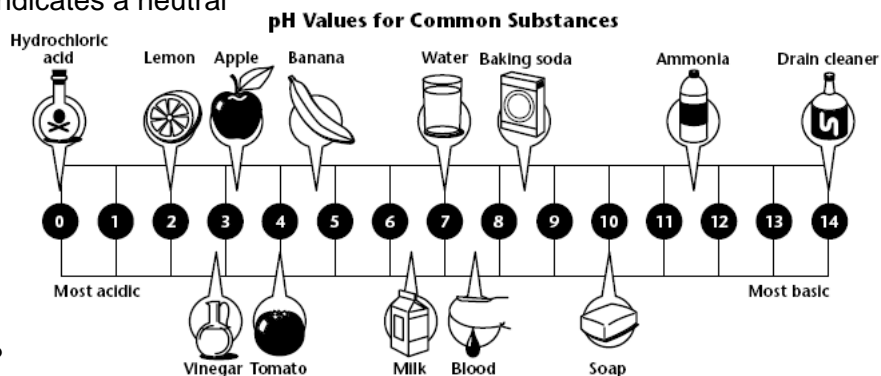
41 What does the pH of drain cleaner tell you about the dangers of such a



product?

- A It is a strong acid.
- B It is a weak acid.
- C It is a strong base.
- D It is a weak base.

42 Which pH indicates a neutral



substance?

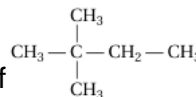
- A 0
- B 7
- C 10
- D 14

43 Unlike the atoms of most other elements, carbon atoms have which number of bonding electrons?

- A 1
- B 2
- C 3
- D 4

44

The carbon-based molecule shown in the diagram is an example of



- A an alcohol.
- B a hydrocarbon.
- C a polymer.
- D a ring.

45 Which element has the ability to form straight chains, branched chains, and rings?

- A carbon
- B hydrogen
- C nitrogen
- D oxygen

46 Organic molecules include all of the major molecules of life. Organic molecules contain which four main elements?

- A carbon, hydrogen, oxygen, nitrogen
- B water, proteins, fats, carbon dioxide
- C starch, sugar, chlorophyll, acids
- D amino acids, enzymes, carbohydrates, lipids

47 Nucleic acids are organic compounds that carry genetic information in living cells. Which element, in addition to the four major elements that make up living things, is needed to make these compounds?

- A chlorine (Cl)
- B phosphorus (P)
- C potassium (K)
- D sodium (Na)

48 Jessica holds a piece of cold glass over a burning piece of wood. She notices drops of water form on the glass. This is evidence that the wood *most likely* contains

- A carbon and nitrogen.
- B oxygen and hydrogen.
- C oxygen and nitrogen.
- D phosphorus and carbon.

49 When amino acids join into long chains, they form

- A nucleic acids.
- B lipids.
- C carbohydrates.
- D proteins.

50 Which of the following kinds of chemical compounds does *not* contain carbon?

- A sugar
- B lipid
- C protein
- D water

51 Which of the following elements is *not* found in lipids?

- A carbon
- B hydrogen
- C oxygen
- D phosphorus

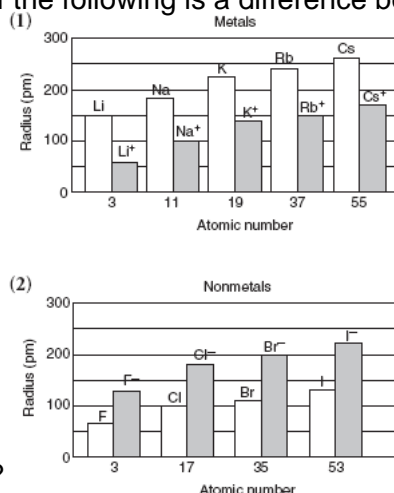
52 Which type of chemical bond occurs in metals but *not* in nonmetals?

- A covalent bonds
- B double bonds
- C ionic bonds
- D metallic bonds

53 All of the following are physical properties of metals except

- A malleability.
- B conductivity.
- C brittleness.
- D ductility.

54 Graph 1 compares the radii of atoms and ions of metals. Graph 2 compares the radii of atoms and ions of nonmetals. Which of the following is a difference between metals and nonmetals that can be



inferred from these graphs?

- A Metal ions have a larger radius than metal atoms.
- B Nonmetal atoms have a larger radius than nonmetal ions.
- C Nonmetals are likely to form ions, and metals are less likely to form ions.
- D Metals form positive ions, and nonmetals form negative ions.

55 Unlike metals, many nonmetals exist in their elemental form in nature as

- A ionically bonded crystals.
- B positively charged ions.
- C gases that are unlikely to react.
- D diatomic molecules.

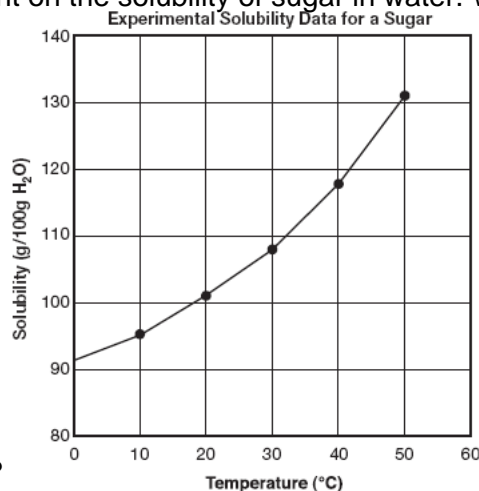
56 Unlike most nonmetals, metals form solid structures called

- A crystals.
- B ions.
- C metalloids.
- D molecules.

57 Which of the following properties is common in ionic compounds?

- A gas at room temperature
- B good electrical conductivity in solution
- C low boiling point
- D low melting point

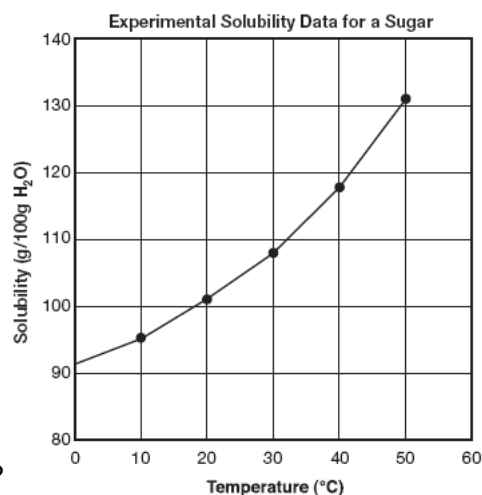
58 The graph shows the results of an experiment on the solubility of sugar in water. Which variable was



deliberately changed during the experiment?

- A amount of solute
- B amount of water
- C type of substance
- D temperature of water

59



Which variable did *not* change during the experiment?

- A amount of solute
- B amount of water
- C temperature of the water
- D temperature of the solution

60 Two students tested the effect of stirring on the speed at which sugar dissolves in water. Each one got different results. Which should the students do when they repeat the experiment?

- A Increase the amount of sugar used.
- B Decrease the amount of water used.
- C Test all the variables except stirring time.
- D Control all variables except time of stirring.