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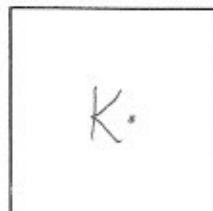
- 1) A chemical bond between two atoms results from a simultaneous
☒ A) repulsion by the valence electrons of the atoms ☒ B) attraction by the protons for the neutrons
☒ C) repulsion by the protons in the two nuclei ☒ D) attraction by the two nuclei for the electrons
- 2) What type of bond exists between the carbon atoms in diamonds?
☒ A) metallic ☒ B) covalent ☒ C) hydrogen ☒ D) ionic
- 3) Which particles may be gained, lost, or shared by an atom when it forms a chemical bond?
 A) protons ☒ B) electrons C) neutrons D) nucleons
- 4) Which type of bond is formed by the transfer of electrons from one atom to another?
 A) a coordinate covalent bond B) a hydrogen bond C) a covalent bond ☒ D) an ionic bond
- 5) When ionic bonds are formed, metallic atoms tend to
☒ A) lose electrons and become positive ions B) lose electrons and become negative ions
 C) gain electrons and become positive ions D) gain electrons and become negative ions
- 6) A white crystalline salt conducts electricity when it is melted and when it is dissolved in water. What type of bond does this salt contain?
 A) metallic B) covalent ☒ C) ionic D) network
- 7) Which compound contains both covalent bonds and ionic bonds?
 A) HCl(g) B) NaCl(s) ☒ C) $\text{NaNO}_3\text{(s)}$ D) $\text{N}_2\text{O}_5\text{(g)}$
- 8) Which atoms are most likely to form covalent bonds?
☒ A) nonmetal atoms that share electrons B) metal atoms that share electrons
 C) metal atoms that share protons D) nonmetal atoms that share protons
- 9) Which terms describe a substance that has a low melting point and poor electrical conductivity?
☒ A) covalent and molecular B) ionic and molecular C) covalent and metallic D) ionic and metallic
- 10) Which formula represents a molecular solid?
 A) KF(s) B) Cu(s) ☒ C) $\text{C}_6\text{H}_{12}\text{O}_6\text{(s)}$ D) NaCl(s)
- 11) What type of bond is present in a water molecule?
 A) electrovalent ☒ B) polar covalent C) ionic D) nonpolar covalent
- 12) The electrons in a bond between two iodine atoms (I_2) are shared
☒ A) unequally, and the resulting bond is nonpolar B) unequally, and the resulting bond is polar
☒ C) equally, and the resulting bond is nonpolar D) equally, and the resulting bond is polar

- 13) Which of the following statements best explains why a CH_4 molecule is nonpolar?
 A) C and H are nonmetals. ☒ B) CH_4 has a symmetrical charge distribution.
 C) C and H have the same electronegativity. D) CH_4 is a gas at room temperature.
- 14) The four single bonds of a carbon atom are spatially directed toward the corners of a regular
☒ A) tetrahedron B) triangle C) square D) rectangle
- 15) Which structural formula represents a polar molecule?
 A) $\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{H} \\ | \\ \text{H} \end{array}$ B) $\text{H}-\text{H}$ C) $\text{H}-\text{C}\equiv\text{C}-\text{H}$ ☒ D) $\begin{array}{c} \text{H}-\text{O} \\ | \\ \text{H} \end{array}$
- 16) Which molecule is nonpolar due to a symmetrical distribution of charge?
 A) $\begin{array}{c} \text{O} \\ / \quad \backslash \\ \text{H} \quad \text{H} \end{array}$ B) $\text{H}-\text{Cl}$ C) $\begin{array}{c} \text{H}-\text{N}-\text{H} \\ | \\ \text{H} \end{array}$ ☒ D) $\text{O}=\text{C}=\text{O}$
- 17) Which substance is a good conductor of electricity in both the solid and liquid phases?
☒ A) a network substance B) a metallic substance C) an ionic substance D) a molecular substance
- 18) Which factor distinguishes a metallic bond from an ionic bond or a covalent bond?
 A) the unequal sharing of electrons B) the mobility of protons
 C) the equal sharing of electrons ☒ D) the mobility of electrons
- 19) The ability to conduct electricity in the solid state is a characteristic of metallic bonding. This characteristic is best explained by the presence of
☒ A) high electronegativities B) mobile protons C) mobile electrons D) high ionization energies
- 20) Oxygen, nitrogen, and fluorine bond with hydrogen to form molecules. These molecules are attracted to each other by
☒ A) ionic bonds B) hydrogen bonds C) electrovalent bonds D) coordinate covalent bonds
- 21) Compared to the boiling point of H_2S , the boiling point of H_2O is relatively high. Which type of bonding causes this difference?
☒ A) covalent B) network C) ionic D) hydrogen
- 22) Argon has a higher boiling point than neon because argon has
☒ A) fewer electrons in its 2nd principal energy level
☒ B) more electrons in its outermost principal energy level
☒ C) stronger intermolecular forces of attraction
☒ D) weaker intermolecular forces of attraction

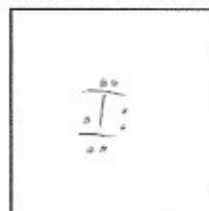
Questions 23 and 24 refer to the following:

Given the binary compound formed from potassium and iodine:

23) In the boxes below, draw the Lewis electron-dot diagrams for the elements K and I.

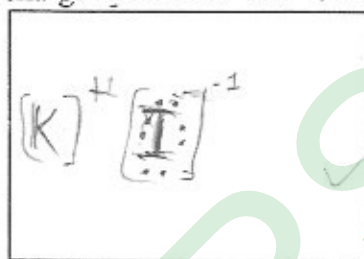


potassium



iodine

24) In the box below, draw the Lewis electron-dot structure for the compound formed from potassium and iodine. [Include any charges and use brackets for the ions.]

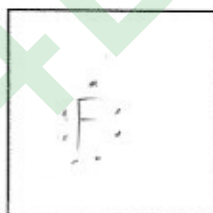


25) In the boxes below, draw a correct Lewis electron-dot structure for:

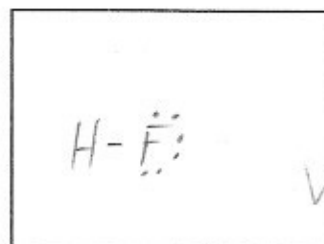
- (1) an atom of hydrogen
- (2) an atom of fluorine
- (3) a molecule of hydrogen fluoride (HF)



(1) hydrogen



(2) fluorine



(3) hydrogen fluoride

26) Describe the role of valence electrons in:

- (1) an ionic bond *they transfer to the other* ✓
- (2) a covalent bond *they are shared with the other* ✓
- (3) a metallic bond *'sea of electrons' they move around and conduct electricity* ✓

Name:

Rafael Thalheim

- 1) An atom of argon rarely bonds to an atom of another element because an argon atom has
 A) 3 electron shells
 B) 8 valence electrons
 C) 2 electrons in the first shell
 D) 22 neutrons
- 2) Which term indicates how strongly an atom attracts the electrons in a chemical bond?
 A) atomic mass
 B) activation energy
 C) alkalinity
 D) electronegativity
- 3) Which substance contains bonds that involved the transfer of electrons from one atom to another?
 A) Cl_2
 B) KBr
 C) NH_3
 D) CO_2
- 4) The bonds in BaO are *best* described as
 A) ionic, because valence electrons are shared
 B) covalent, because valence electrons are shared
 C) ionic, because valence electrons are transferred
 D) covalent, because valence electrons are transferred
- 5) Which formula represents an ionic compound?
 A) H_2
 B) CH_3OH
 C) NH_4Cl
 D) CH_4
- 6) Which of the following Lewis electron-dot diagrams represents calcium oxide?
 A) $\text{Ca} \times \times \ddot{\text{O}} :$
 B) $\times \text{Ca} : \ddot{\text{O}} :$
 C) $[\times \text{Ca} \times]^{2+} \text{O}^{2-}$
 D) $\text{Ca}^{2+} [\times \ddot{\text{O}} \times]^{2-}$
- 7) An ionic compound is formed when there is a reaction between the elements
 A) strontium and chlorine
 B) hydrogen and chlorine
 C) nitrogen and oxygen
 D) sulfur and oxygen
- 8) Based on bond type, which of the following compounds has the *highest* melting point?
 A) C_6H_{14}
 B) CCl_4
 C) CaCl_2
 D) CH_3OH
- 9) Which type of substance can conduct electricity in the liquid phase but *not* in the solid phase?
 A) ionic compound
 B) nonmetallic element
 C) molecular compound
 D) metallic element
- 10) Which one of the following compounds has *both* ionic and covalent bonds?
 A) CH_3OH
 B) Na_2CO_3
 C) NaI
 D) CO_2
- 11) What are the two categories of compounds?
 A) ionic and molecular
 B) covalent and metallic
 C) covalent and molecular
 D) ionic and metallic
- 12) Given a formula for oxygen: $\ddot{\text{O}} = \ddot{\text{O}} :$
 What is the total number of electrons shared between the atoms represented in this formula?
 A) 1
 B) 2
 C) 8
 D) 4
- 13) The degree of polarity of a chemical bond in a molecule of a compound can be predicted by determining the difference in the
 A) densities of the elements in the compound
 B) melting points of the elements in the compound
 C) electronegativities of the bonded atoms in a molecule of the compound
 D) atomic masses of the bonded atoms in a molecule of the compound
- 14) The chemical bond between which two atoms is *most* polar?
 A) Si-O 1.5
 B) C-N .4
 C) S-Cl .6
 D) H-H 0
- 15) Which one of the following formulas represents a polar molecule?
 A) CO_2
 B) H_2O
 C) CCl_4
 D) H_2

- 16) Why is a molecule of CO_2 nonpolar even though the bonds between the carbon atom and the oxygen atoms are polar?
- A) The CO_2 molecule has an excess of electrons.
 B) The shape of the CO_2 molecule is asymmetrical.
 C) The CO_2 molecule has a deficiency of electrons.
 D) The shape of the CO_2 molecule is symmetrical.
- 17) Given the formula representing a molecule:



The molecule is

- A) asymmetrical and polar
 B) symmetrical and nonpolar
 C) asymmetrical and nonpolar
 D) symmetrical and polar
- 18) A solid substance is an excellent conductor of electricity. The chemical bonds in this substance are most likely
- A) ionic, because the valence electrons are mobile
 B) ionic, because the valence electrons are shared between atoms
 C) metallic, because the valence electrons are mobile
 D) metallic, because the valence electrons are stationary
- 19) Hydrogen bonding is a type of
- A) strong intermolecular force
 B) strong covalent bond
 C) weak ionic bond
 D) weak intermolecular force
- 20) Which compound has hydrogen bonding between its molecules?
- A) CH_4
 B) KH
 C) CaH_2
 D) NH_3
- 21) The relatively high boiling point of water is due to water having
- A) hydrogen bonding
 B) metallic bonding
 C) strong ionic bonding
 D) nonpolar covalent bonding
- 22) Which of the following statements explains why low temperature and high pressure are required to liquefy chlorine gas?
- A) Chlorine molecules have weak covalent bonds.
 B) Chlorine molecules have weak intermolecular forces of attraction.
 C) Chlorine molecules have strong intermolecular forces of attraction.
 D) Chlorine molecules have strong covalent bonds.

Name: _____

- 1) Explain, in terms of electronegativity, why a P-Cl bond in a molecule of PCl_5 is more polar than a P-S bond in a molecule of P_2S_5 .
b/c the electronegativity when substance is 2
- 2) Bond energy is the amount of energy required to break a chemical bond. The table below gives a formula and the carbon-nitrogen bond energy for selected nitrogen compounds.

Selected Nitrogen Compounds

Compound	Formula	Carbon-Nitrogen Bond Energy (kJ/mol)
hydrogen cyanide	$\text{H}-\text{C}\equiv\text{N}$	890.
isocyanic acid	$\text{H}-\text{N}=\text{C}=\text{O}$	615
methanamine	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{N}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	293

Explain, in terms of charge distribution, why the molecule of hydrogen cyanide shown in the table is polar.

b/c it has the highest Carbon-Nitrogen bond energy distribution
890

Questions 3 and 4 refer to the following:

Physical Properties of CF_4 and NH_3 at Standard Pressure

Compound	Melting Point ($^{\circ}\text{C}$)	Boiling Point ($^{\circ}\text{C}$)	Solubility in Water at 20.0°C
CF_4	-183.6	-127.8	insoluble
NH_3	-77.7	-33.3	soluble

- 3) State evidence on the given table that indicates NH_3 has stronger intermolecular forces than CF_4 .
b/c it has a higher melting point and a higher boiling point and is soluble
-77.7 *-33.3*
- 4) In the box below, draw a Lewis electron-dot diagram for CF_4 .

