

Name \_\_\_\_\_

Topic 4 Review Multiple Choice

\_\_\_\_\_ 1. Which molecule is polar and contains polar bonds?

- 1) NH<sub>3</sub>      2) CCl<sub>4</sub>  
3) CO<sub>2</sub>      4) N<sub>2</sub>

\_\_\_\_\_ 2. The electronegativity value of an element is a measure of the atoms

- 1) ability to attract protons  
2) degree of conductivity  
3) ability to attract electrons  
4) degree of stability

\_\_\_\_\_ 3. What type of bond is present in a water molecule?

- 1) ionic  
2) polar covalent  
3) nonpolar covalent  
4) electrovalent

\_\_\_\_\_ 4. The total number of pairs of shared electrons in a nitrogen molecule is

- 1) 1    2) 2    3) 3    4) 4

\_\_\_\_\_ 5. Which of the following is a molecular substance?

- 1) CO<sub>2</sub>                      2) KCl  
3) KClO<sub>3</sub>                    4) CaO

\_\_\_\_\_ 6. Which atom will form an ionic bond with a Br atom?

- 1) N    2) Li    3) C    4) O

\_\_\_\_\_ 7. The table below lists four different chemical bonds and the amount of energy released when 1 mole of each of the bonds is formed.

Bond	Energy released in Formation (kcal/mol)
H-F	135
H-Cl	103
H-Br	87
H-I	71

Which of the bonds is the *most* stable?

- 1) H-Br                      2) H-I  
3) H-F                      4) H-Cl

\_\_\_\_\_ 8. What type of bonding is characteristic of a substance that has a high melting point and electrical conductivity only in the liquid phase?

- 1) coordinate covalent  
2) nonpolar covalent  
3) metallic  
4) ionic

\_\_\_\_\_ 9. What type of attraction occurs between nonpolar covalent molecules?

- 1) hydrogen bonding  
2) dipole-dipole attractions  
3) ionic bonds  
4) Van der Waals forces

\_\_\_\_\_ 10. Which pair of atoms will share electrons when a bond is formed between them?

- 1) K and Cl                      2) Ba and I  
3) Br and Cl                    4) Li and I

\_\_\_\_\_ 11. Helium may be liquified at low temperature and high pressure primarily because of

- 1) covalent bonds  
2) weak intermolecular forces  
3) ionic attraction  
4) hydrogen bonding

\_\_\_\_\_ 12. Element X has an electronegativity of less than 1.2 and reacts with bromine to form the compound XBr<sub>2</sub>. Element X could be

- 1) Na    2) Ca    3) K    4) Al

\_\_\_\_\_ 13. Atoms of nonmetals generally react with atoms of metals by

- 1) sharing electrons to form covalent compounds  
2) gaining electrons to form ionic compounds  
3) gaining electrons to form covalent compounds  
4) sharing electrons to form ionic compounds

\_\_\_\_\_ 14. A characteristic of ionic solids is that they

- 1) have low boiling points  
2) are non crystalline  
3) have high melting points  
4) conduct electricity

\_\_\_\_\_ 15. When two atoms form a chemical bond by sharing electrons, the resulting molecule will be

- 1) either polar or nonpolar
- 2) polar, only
- 3) nonpolar, only
- 4) neither polar nor nonpolar

\_\_\_\_\_ 16. A substance that has a melting point of 1,074K conducts electricity when dissolved in water, but does not conduct electricity in the solid phase. The substance is *most* likely

- 1) an ionic solid
- 2) a network solid
- 3) a molecular solid
- 4) a metallic solid

\_\_\_\_\_ 17. The elements Li and F combine to form an ionic compound. The electron configurations in this compound are the same as the electron configurations of atoms in Group

- 1) 1
- 2) 14
- 3) 17
- 4) 18

\_\_\_\_\_ 18. Which factor distinguishes a metallic bond from an ionic bond or a covalent bond?

- 1) the unequal sharing of electrons
- 2) the mobility of protons
- 3) the equal sharing of electrons
- 4) the mobility of electrons

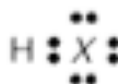
\_\_\_\_\_ 19. Generally, how many valence electrons are needed for atoms to be the *most* stable?

- 1) 8
- 2) 6
- 3) 18
- 4) 32

\_\_\_\_\_ 20. The bond between hydrogen and oxygen in a water molecule is classified as

- 1) covalent and polar
- 2) ionic and polar
- 3) ionic and nonpolar
- 4) covalent and nonpolar

\_\_\_\_\_ 21. Given the electron dot formula:



Which atom represented by X would have the *least* attraction for the electrons in the bond?

- 1) Br
- 2) Cl
- 3) I
- 4) F

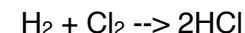
\_\_\_\_\_ 22. Which of the following statements *best* explains why a CH<sub>4</sub> molecule is nonpolar?

- 1) C and H have the same electronegativity
- 2) CH<sub>4</sub> has a symmetrical charge distribution
- 3) C and H are nonmetals
- 4) CH<sub>4</sub> is a gas at room temperature

\_\_\_\_\_ 23. When ionic bonds are formed, metallic atoms tend to

- 1) gain electrons and become positive ions
- 2) gain electrons and become negative ions
- 3) lose electrons and become negative ions
- 4) lose electrons and become positive ions

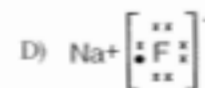
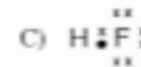
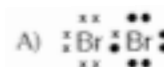
\_\_\_\_\_ 24. Given the reaction:



Which of the following statements *best* describes the energy change as bonds are formed and broken in this reaction?

- 1) The forming of the H-Cl bond absorbs energy
- 2) The breaking of the Cl-Cl bond releases energy
- 3) The breaking of the H-H bond releases energy
- 4) The forming of the H-Cl bond absorbs energy

\_\_\_\_\_ 25. Which electron dot formula represents a molecule that contains a nonpolar covalent bond?



\_\_\_\_\_ 26. The ability to conduct electricity in the solid state is a characteristic of metallic bonding. This characteristic is *best* explained by the presence of

- 1) high electronegativities
- 2) high ionization energies
- 3) mobile electrons
- 4) mobile protons

\_\_\_\_\_ 27. Why is  $\text{NH}_3$  classified as a polar molecule?

- 1)  $\text{NH}_3$  molecules have asymmetrical charge distributions
- 2)  $\text{NH}_3$  is a gas at STP
- 3) N-H bonds are non polar
- 4) Nitrogen and hydrogen are both nonmetals

\_\_\_\_\_ 28. Which particles may be gained, lost, or shared by an atom when it forms a chemical bond?

- 1) electrons
- 2) nucleons
- 3) neutrons
- 4) protons

\_\_\_\_\_ 29. Which type of bond is formed by the transfer of electrons for one atom to another?

- 1) a hydrogen bond
- 2) a coordinate covalent bond
- 3) an ionic bond
- 4) a covalent bond

\_\_\_\_\_ 30. A substance was found to be a soft, nonconducting solid at room temperature. The substance is *most* likely

- 1) a molecular solid
- 2) a network solid
- 3) an ionic solid
- 4) a metallic solid

\_\_\_\_\_ 31. Which two compounds contain only polar molecules?

- 1) CO and  $\text{CO}_2$
- 2) HCl and  $\text{Cl}_2$
- 3) HCl and  $\text{NH}_3$
- 4)  $\text{CCl}_4$  and  $\text{CH}_4$

\_\_\_\_\_ 32. Which type of bond is formed by the carbon and oxygen atoms in a  $\text{CO}_2$  molecule?

- 1) polar covalent
- 2) electrovalent
- 3) nonpolar covalent
- 4) ionic

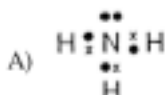
\_\_\_\_\_ 33. When  $\text{NaCl}_{(s)}$  is dissolved in  $\text{H}_2\text{O}_{(l)}$ , the sodium ion is attracted to the water molecule's

- 1) negative end, which is hydrogen
- 2) positive end, which is hydrogen
- 3) positive end, which is oxygen
- 4) negative end, which is oxygen

\_\_\_\_\_ 34. In which compound have the electrons been transferred to the oxygen atom

- 1)  $\text{Na}_2\text{O}$
- 2)  $\text{NO}_2$
- 3)  $\text{N}_2\text{O}$
- 4)  $\text{CO}_2$

\_\_\_\_\_ 35. Which molecule contains a polar covalent bond?



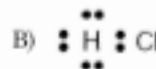
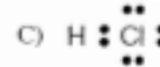
\_\_\_\_\_ 36. Which substance contains particles held together by metallic bonds?

- 1)  $\text{Ne}_{(s)}$
- 2)  $\text{Ni}_{(s)}$
- 3)  $\text{I}_{2(s)}$
- 4)  $\text{N}_{2(s)}$

\_\_\_\_\_ 37. What type of bonds are formed when two nonmetal atoms combine?

- 1) network bonds
- 2) metallic bonds
- 3) ionic bonds
- 4) covalent bonds

\_\_\_\_\_ 38. The correct electron dot diagram for hydrogen chloride is



\_\_\_\_\_ 39. Two atoms of element X unite to form a molecule of  $\text{X}_2$ . The bond between the atoms in the molecule is

- 1) electrovalent
- 2) polar covalent
- 3) nonpolar covalent
- 4) ionic

\_\_\_\_\_ 40. A pure substance melts at  $38^\circ\text{C}$  and does *not* conduct electricity in either the solid or liquid phase. The substance is classified as

- 1) electrovalent
- 2) molecular
- 3) metallic
- 4) ionic

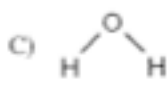
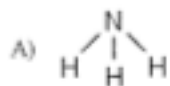
\_\_\_\_\_ 41. Which substance will conduct electricity in *both* the solid phase and the liquid phase?

- 1) HCl
- 2) Ag
- 3)  $\text{H}_2$
- 4) AgCl

\_\_\_\_\_ 42. Oxygen, nitrogen and fluorine bond with hydrogen to form molecules. These molecules are attracted to each other by

- 1) electrovalent bonds
- 2) coordinate covalent bonds
- 3) hydrogen bonds
- 4) ionic bonds

\_\_\_\_\_ 43. Which molecule is nonpolar?



\_\_\_\_\_ 44. Hydrogen bonds are *most* likely to form between molecules in which hydrogen is covalently bonded to an element of

- 1) small atomic radius and high electronegativity
- 2) small atomic radius and low electronegativity
- 3) large atomic radius and low electronegativity
- 4) large atomic radius and high electronegativity

\_\_\_\_\_ 45. Which compound contains ionic bonds?

- 1) CO
- 2)  $CO_2$
- 3)  $Na_2O$
- 4)  $N_2O$

\_\_\_\_\_ 46. Which formula represents a polar molecule containing polar covalent bonds?

- 1)  $Cl_2$
- 2)  $H_2O$
- 3)  $CO_2$
- 4)  $NaCl$

\_\_\_\_\_ 47. When sodium reacts with chlorine to form sodium chloride, electrons are lost by

- 1) chlorine, only
- 2) both sodium and chlorine
- 3) sodium, only
- 4) neither sodium nor chlorine

\_\_\_\_\_ 48. When metal atoms bond with non metal atoms, the nonmetal atoms will

- 1) gain electrons, and the resulting ions are smaller
- 2) gain electrons, and the resulting ions are larger
- 3) lose electrons, and the resulting ions are larger
- 4) lose electrons and the resulting ions are smaller

\_\_\_\_\_ 49. Which diagram *best* represents a polar molecule?



### Constructed Response Questions

Questions 1 and 2 refer to the following:

Given the binary compound formed from magnesium and chlorine:

1. In the box below, draw the Lewis electron-dot structure for the compound formed from magnesium and chlorine. [Include any charges or partial charges.]

2. Write the correct IUPAC name for this compound.

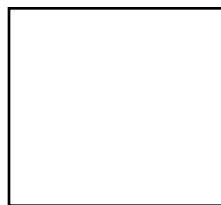
3. In the box below, draw a Lewis electron-dot structure for a molecule of iodine.

Questions 4 through 6 refer to the following:

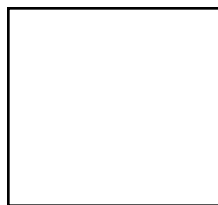
Given the binary compound formed from calcium and bromine:

4. Write the correct IUPAC name for this compound.

5. In the boxes below, draw the Lewis electron-dot structures for the elements Ca and Br.

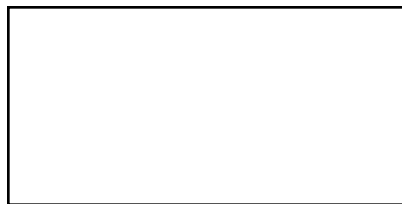


Calcium



Bromine

6. In the box below, draw the Lewis electron-dot structure for the compound formed by calcium and bromine. [*include any charges or partial charges.*]



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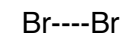
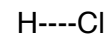
7. Describe the role of valence electrons in:

1. an ionic bond

2. a covalent bond

3. a metallic bond

Questions 8 through 11 refer to the following:



Bond A

Bond B

8. Draw the Lewis electron-dot diagrams for the *two* molecules above. Label any partial charges.



HCl



Br<sub>2</sub>

9. Is HCl a polar or a nonpolar molecule? [*Explain why.*]

10. State *one* way in which bond A and bond B are the same and *one* way in which they are different

11. Is Br<sub>2</sub> a polar or a nonpolar molecule? [*Explain why.*]

Questions 12 through 15 refer to the following:

In the laboratory, a student compares the properties of two unknown solids. the results of his experiment are reported in the data table below.

	<b>Substance A</b>	<b>Substance B</b>
<b>Melting Point</b>	low	high
<b>Solubility in Water</b>	nearly insoluble	soluble
<b>Hardness</b>	soft, waxy crystals	hard crystals
<b>Electrical Conductivity</b>	poor conductor in both solid and aqueous states	poor conductor in the solid state, but good conductor in the aqueous state

12. Explain, in terms of attractions, why substance A has a low melting point.

13. Predict the type of bonding in substance B.

14. Explain why substance A is a poor conductor of electricity, but substance B is a good conductor in the aqueous state.

15. Predict the type of bonding in substance A.