| Ch | emical Class Date |
|---------------|---|
| BOI Part I | nding BONDING TE / EXAM REVIEW |
| | Select the answer that best completes each statement. Write the letter of each ans the space provided on the left. |
| | Between atoms in a covalent bond, a. the attractions are weaker than the repulsions b. electrons are shared c. no electrons are located d. the electronegativity difference is 1.7 or greater |
| | 2. As two atoms approach each other to bond, a. electrons are repelled by protons b. attractive forces decrease in strength c. orbitals merge completely d. the potential energy is lowered |
| | 3. A dipole occurs when a. two atoms with an electronegativity difference of between 0.3 and 1.6 bond b. electrons are transferred from one atom to another c. two atoms of the same electronegativity bond d. electrons are shared equally between two atoms |
| | 4. In ionic bonding, a. the electronegativity difference between atoms is 1.7 or greater b. electrons are shared equally c. protons are transferred d. there are no more than two atoms |
| | 5. Substances with polar molecules tend to exhibit a. less attraction than usual between the molecules b. higher boiling points than expected c. less solubility than expected d. lower bond energies than expected |
| | 6. Which of the following would not have a molecular dipole? a. HCl b. H₂O d. NH₃ |
| | 7. The CCl₄ molecule does not behave as a polar molecule because a. the C-Cl bonds are nonpolar b. the C-Cl bonds are ionic c. the bond dipoles cancel d. the shape of the molecule is linear |
| | 8. Which of the following does <i>not</i> describe the growth of crystals? a. The potential energy of the system decreases. b. lons form a lattice. c. Heat is removed. d. Melting temperature decreases. |

Name _____

Class _____

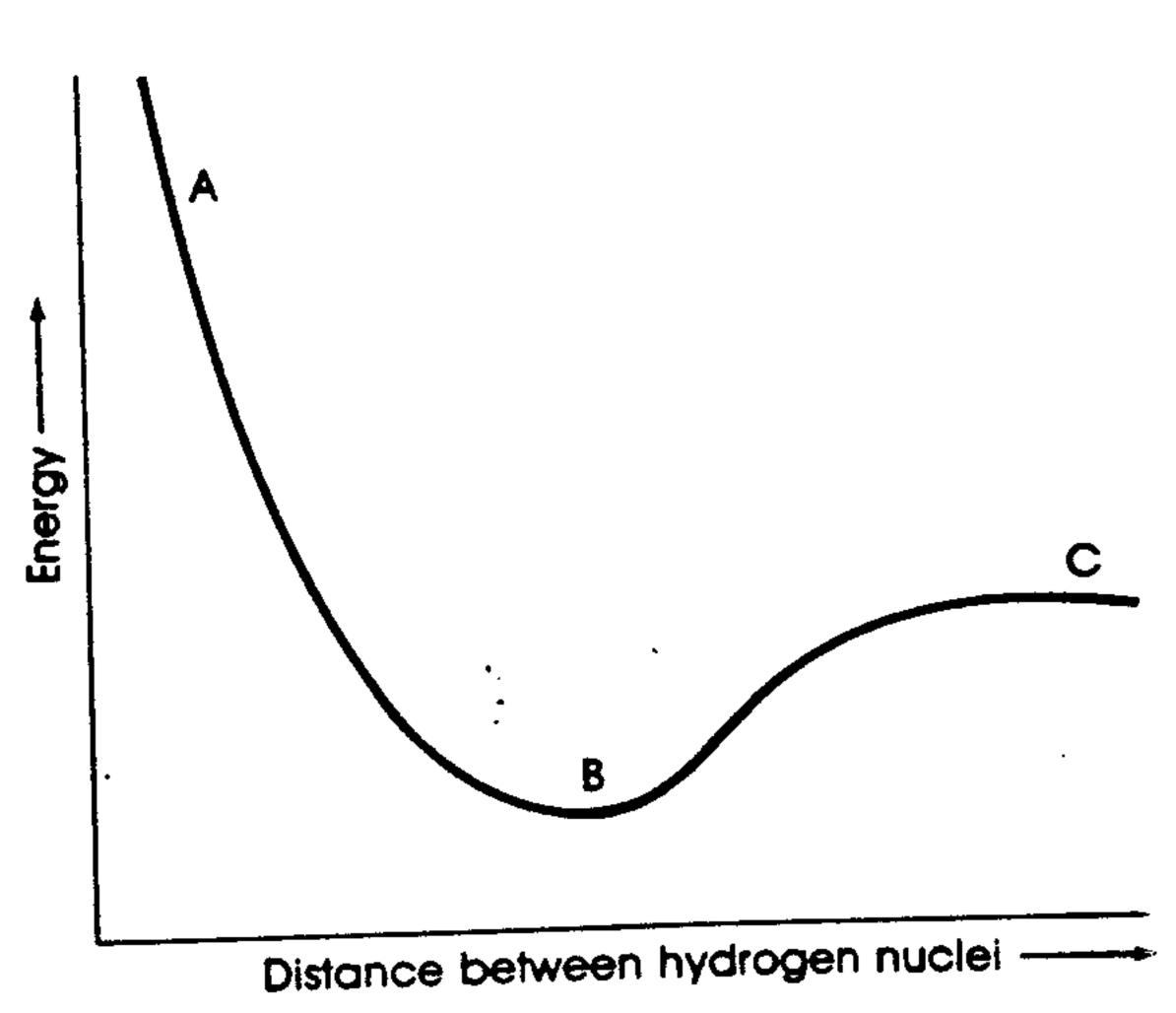
Date _____

| | 9. Van der Waals force | s include | |
|----------------|---|---------------------------------|---|
| | a. dipole-dipole force | S | c. both a and b |
| | b. London forces | | d. neither a nor b |
| | 10. Noble gases liquefy | because of | |
| | a. momentary dipole | S | c. hydrogen bonds |
| | b. permanent dipole | | d. ionic attractions |
| | 11. Which of the following | g is the weakest? | |
| | a. covalent bonds | | c. hydrogen bonds |
| | b. London forces | | d. dipole-dipole forces |
| | 12. The valence shell ele | ctron pair repulsion | theory (VSEPR) would account for the fact that |
| | a. all valence electro | ns must be involved | in the bonding process |
| | b. the C-H bonds in | the CH ₄ molecule al | I have bond angles of 109.5° |
| | c. the carbon atom h | | |
| | | | cule have equal measure |
| | 13. Exceptions to the oc | tet rule arise when _ | • |
| | | • | atom with fewer than eight electrons |
| | b. a stable molecule | possesses a central | atom surrounded by more than eight electrons. |
| | c. both a and b | | |
| | d. neither a nor b | | |
| | | | |
| | | | · |
| | | | • |
| D+ | | | |
| Part | | | |
| and the second | | | |
| | Select the answer tha | t best completes ead | ch statement or fill in the blank with the correct |
| | answer. | | |
| | 14. In which of the follow | ving are electrons sl | nared unequally? |
| | a. H ₂ | | c. HCl |
| | b. S ₈ | | d. Cl ₂ |
| | 15. The electron dot form | nula for atom X, which | h has the electron configuration 1s ² 2s ² 2p ⁵ , is |
| | | | |
| | a. :X: | | C. X |
| | b. :X: | | d. :X· |
| | 16. The correct electron | dot formula for CaH | _ ie |
| | | | |
| | н н н а. н :C:C:C:H:H:Н | | C. H:C::C:C:H:H:H |
| | Н | | HHH |
| | HHH | | d. H. H. |
| | b. H:C:C:C:H | | H:C:H:C:H |
| | • • • • • | | H |
| | HHH | | |
| | | ving is the carbon-ca | arbon bond distance the greatest? |
| | | wing is the carbon-c | arbon bond distance the greatest? |
| | 17. In which of the followers | wing is the carbon-ca | |
| | 17. In which of the follow | ving is the carbon-c | c. HH |
| | 17. In which of the followa. H. H. A. C::C: H. H. H. H. | wing is the carbon-c | c. H.H. H:C:C:H |
| | 17. In which of the followers | ving is the carbon-c | c. HH. H:C:C:H |

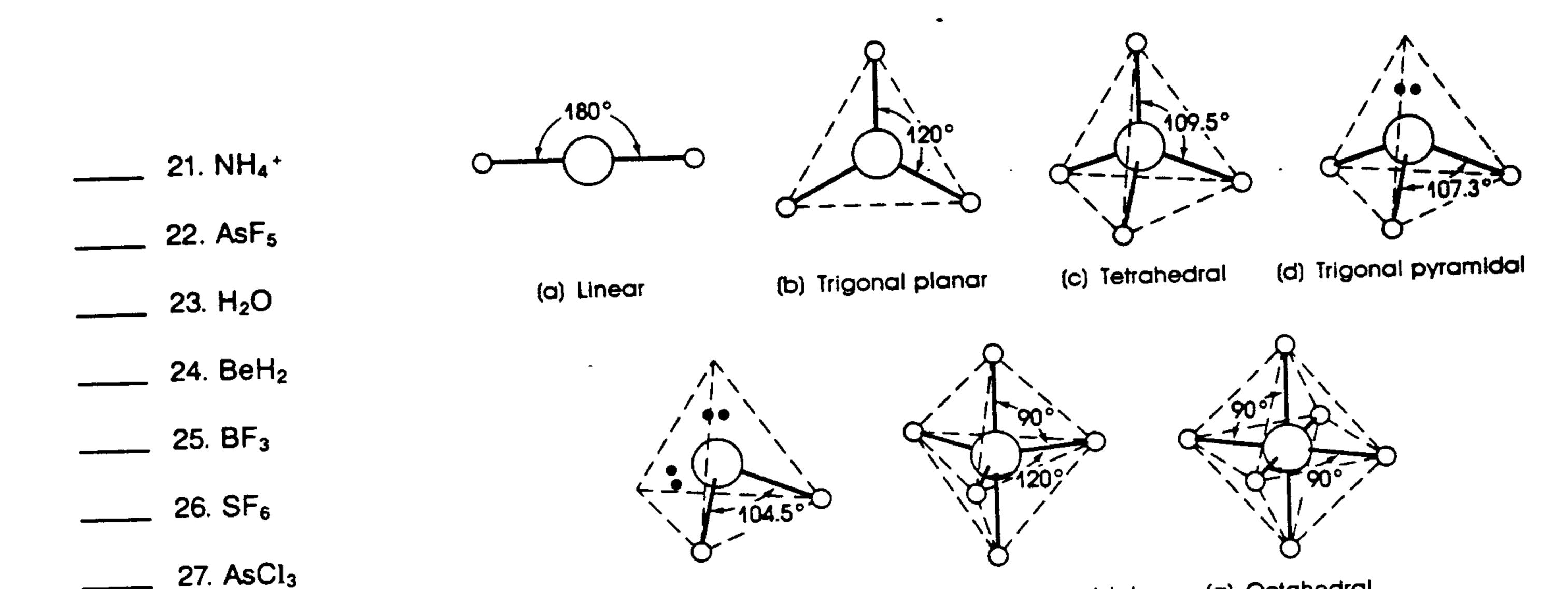
300

Questions 18 through 20 refer to the graph.

- 18. For which of the lettered regions (A-C) are there no significant forces between the atoms?
 - 19. For which of the lettered regions are repulsive forces stronger than attractive forces?
- 20. For which of the lettered regions are the atoms forming a chemical bond?



For each of the following, choose the letter of the drawing, below, that best represents its shape.



28. Indicate whether the bonds in each of the following molecules are ionic (I), polar covalent (P), or nonpolar covalent (C). Electronegativities are given in the chart below.

(e) Angular

(f) Trigonal bipyramidal

ELECTRONEGATIVITIES

| Hydrogen 2.1 | Sodium 0.9 |
|--------------|--------------|
| Boron 2.0 | Chlorine 3.0 |
| Carbon 2.5 | Calcium 1.0 |
| Oxygen 3.5 | Bromine 2.8 |
| Fluorine 4.0 | lodine 2.5 |

- ____ a. HBr
- ____ b. CaO
- ____ c. CO₂
- ____ d. CCl₄ ____ e. I₂
- ____ f. NaBr
- ____ g. B₂H₆

(g) Octahedral

Draw electron dot structures for the following compounds.

29. F₂

33. N₂H₂

30. H₂O₂

34. SiCl4

31. CH₄

35. NCl_{3.}

32. CO

Chapter Tests

| | _ Date | Der - | | CHEM BONDING I |
|--|--|--|--|--|
| | | | | - TEST PEVILEN |
| | lly exhibit bond | Ing which is primar | 11 y | |
| | ` | | | 11. |
| (B) 10nic | | | ve ions imme | ersed in |
| | | asc contains positi | | , |
| | | C) Cu | | |
| • • | | | | 12 |
| (B) SIU ₂ | acod conducte | or of electricity in | both its solid | and its |
| 13. If a pure substitute is a liquid phases then the h | anding in the SI | ibstance is predomi | nantly | |
| | onanig in the st | C) polar covalent | | |
| | | • • | | 13 |
| 14 Which compound exhibi | | • • | | • |
| | | | | - |
| | | | | 14. |
| 15 A pure substance melts | | | ectricity in ei | ther the |
| solid or liquid phase. Th | e substance is c | lassified as | | |
| | | (C) electrovalent | | |
| | | (D) molecular | | 15 |
| | dipole? | | | |
| (A) HBr (B) H ₂ O (C) | NH_3 (D) CC | L | | 16 |
| 17. Experiment shows that | H ₂ O is a dipo | ole while CO ₂ is no | ot a dipole. | The two |
| structures that best illust | rate this fact ar | :e | | |
| (A) O = C = O H | | (C) O = C = O | H-O-H | |
| | | | | |
| ^ O— | H | | | |
| (D) (| • | (T) (| TT | |
| (B) (C) (B) | | (D) (U | ∏ . | 17 |
| C = O H | Н—О | |) | |
| | | C = O | U H | |
| - | | | | 18 |
| (A) H2 (B) N2 (C) C | Π_4 (D) Π_{Γ} | | • | |
| 19. Which molecule is polar | ? | | ~ | |
| | | $(C) \cap C = C$ | | |
| (A) H—U | | (C) $C=C$ | | |
| | | | | |
| | | C 1 | | |
| | | | | |
| (B) H—H | | (D) Cl—C—Cl | | |
| | | | | |
| | | Ċl | | 19 |
| 20. Which best explains wh | y a methane (C | CH ₄) molecule is no | npolar? | • |
| (A) Each carbon-hydro | gen bond is po | lar. | | |
| (B) Carbon and hydrog | gen are both no | nmetals. | | |
| | | | | |
| (D) The methane molec | cule is symmetr | ical. | | 20 |
| | | | | |
| | (A) covalent (B) ionic 12. Which of the following a sea of mobile electrons (A) O ₂ (B) SiO ₂ 13. If a pure substance is a liquid phases, then the be (A) ionic (B) metallic 14. Which compound exhibit (A) CsCl (B) RbBr 15. A pure substance melts solid or liquid phase. The (A) ionic (B) metallic 16. Which molecule is not ae (A) HBr (B) H ₂ O (C) 17. Experiment shows that structures that best illust (A) O=C=O H (B) O (C=O H— 18. Which molecule is a diperation of the compound exhibit of the compoun | 11. Silicon compounds usually exhibit bond (A) covalent (B) ionic 12. Which of the following in its solid ph a sea of mobile electrons? (A) O ₂ (B) SiO ₂ 13. If a pure substance is a good conducte liquid phases, then the bonding in the su (A) ionic (B) metallic 14. Which compound exhibits bonds having (A) CsCl (B) RbBr 15. A pure substance melts at 38°C and d solid or liquid phase. The substance is c (A) ionic (B) metallic 16. Which molecule is not a dipole? (A) HBr (B) H ₂ O (C) NH ₃ (D) CC 17. Experiment shows that H ₂ O is a dipole structures that best illustrate this fact at (A) O=C=O H O—H (B) O C=O H—H—O 18. Which molecule is a dipole? (A) H ₂ (B) N ₂ (C) CH ₄ (D) HF 19. Which molecule is polar? (A) H—O H (B) H—H (C=O C=O H—H—O (C) Mich best explains why a methane (C) (A) Each carbon-hydrogen bond is po (B) Carbon and hydrogen are both not (C) Methane is an organic compound | 11. Silicon compounds usually exhibit bonding which is primar (A) covalent (C electrovalent (B) ionic (D) coordinate 12. Which of the following in its solid phase contains positia a sea of mobile electrons? (A) O2 (C) Cu (B) SiO2 (D) CuO 13. If a pure substance is a good conductor of electricity in liquid phases, then the bonding in the substance is predoming (A) ionic (C) polar covalent (D) nonpolar coval 14. Which compound exhibits bonds having the least ionic chat (A) CsCl (C) KF (B) RbBr (D) NaI 15. A pure substance melts at 38°C and does not conduct elsolid or liquid phase. The substance is classified as (A) ionic (C) electrovalent (D) molecular 16. Which molecule is not a dipole? (A) HBr (B) H2O (C) NH3 (D) CCL 17. Experiment shows that H2O is a dipole while CO2 is not structures that best illustrate this fact are (A) O=C=O H (C) O=C=O (B) O (D) O (C=O H-H-O C=O 18. Which molecule is a dipole? (A) H2 (B) N2 (C) CH4 (D) HF 19. Which molecule is polar? (A) H-O (C) C=C=O (C) C=C=O (C) C=C=O (C) C=C=O (C) C=C=C (C) C=C=C | 11. Silicon compounds usually exhibit bonding which is primarily (A) covalent (C electrovalent (B) ionic (D) coordinate 12. Which of the following in its solid phase contains positive ions immed a sea of mobile electrons? (A) O ₂ (C) Cu (B) SiO ₂ (D) CuO 13. If a pure substance is a good conductor of electricity in both its solid liquid phases, then the bonding in the substance is predominantly (A) ionic (C) polar covalent (B) metallic (D) nonpolar covalent 14. Which compound exhibits bonds having the least ionic character? (A) CsCl (C) KF (B) RbBr (D) NaI 15. A pure substance melts at 38°C and does not conduct electricity in eissolid or liquid phase. The substance is classified as (A) ionic (C) electrovalent (B) metallic (D) molecular 16. Which molecule is not a dipole? (A) HBr (B) H ₂ O (C) NH, (D) CCL 17. Experiment shows that H ₃ O is a dipole while CO ₂ is not a dipole. The structures that best illustrate this fact are (A) O=C=O H (C) O=C=O H—O—H (B) O (D) O H C=O H—H—O (C) O=C=O H—O—H 18. Which molecule is a dipole? (A) H ₂ (B) N ₂ (C) CH ₄ (D) HF 19. Which molecule is polar? (A) H—O (C) O=C=O H (B) H—H (D) Cl—C—Cl Cl 20. Which best explains why a methane (CH ₄) molecule is nonpolar? (A) Each carbon-hydrogen bond is polar. (B) Carbon and hydrogen are both nonmetals. (C) Methane is an organic compound. |

| Nam | e | · · · · · · · · · · · · · · · · · · · | Class | _ Date | |
|-------------|--|---------------------------------------|-----------------------------|--------------|-------------|
| 1400 | BONDING 2 TOX CE | ·CUT | | | |
| 21. | Hydrogen bonds are formed be | | | | |
| | bonded to an element whose at | tomic radius and electro | onegativity, re | espectively, | |
| | are | | . • | | |
| | (A) large and low | (C) large and hi | • | | |
| | (B) small and low | (D) small and h | igh | 21 | |
| 22. | Multiple covalent bonds exist in | | | ~~ | |
| •• | (A) F_2 (B) H_2 (C) N_2 (D) C | | . _ • 1 . | 22 | |
| 23. | Which is an example of a no bonds? | onpoiar moiecule that | contains poi | ar covaient | |
| | (A) CCL (B) N ₂ (C) H ₂ O (I | D) NH ₃ | | 23 | |
| 24. | As the distance between molec | • | ct of the van | der Waals | |
| • • | forces between the molecules | | | | |
| | (A) decreases (B) increases (| C) remains the same | | 24 | |
| 25. | Which molecule is nonpolar? | | | | |
| | (A) H_2O (B) HF (C) NF_3 (I | D) CF ₄ | | 25 | |
| 26. | Which reaction would require the | • | nergy? | | |
| | (A) Na + energy \rightarrow Na ⁺ + e ⁻ | | | | |
| | (B) Mg + energy \rightarrow Mg ⁺ + e ⁻ | | | | |
| | (C) Al + energy \rightarrow Al ⁺ + e ⁻ | | | | |
| | (D) Si + energy \rightarrow Si ⁺ + e ⁻ | | | 26 | |
| | In which noble gas are the van | der Waals forces the gre | atest? | | |
| | (A) Ne (B) Ar (C) Kr (D) 3 | | | 27 | |
| 28. | What is the nature of the bond i | n ICl? | | | |
| | (A) ionic | (C) polar covale | ent | | |
| | (B) nonpolar | (D) coordinate | covalent | 28 | |
| 29. | The attraction that nonpolar m | olecules have for each | other is prima | rily caused | |
| | by | | | | |
| | (A) hydrogen bonding | | | | |
| | (B) high ionization | | | | |
| | (C) electronegativity difference | es | | | |
| | (D) van der Waals forces | _ | _ | 29 | <u></u> |
| 30 . | Xenon has a higher boiling poin | it than neon because xen | on has | | |
| | (A) smaller molecules | | | | |
| | (B) weaker van der Waals force | S | | • | |
| | (C) a smaller molecular mass | | | | |
| | (D) more electrons per atom | | | 30 | |
| | The major attractive force between | _ | | | |
| | (A) dipole attraction | (C) hydrogen bo | • | | |
| | (B) electrostatic bonding | (D) van der Was | | 31. — | |
| | Which type of bonding account | - - | oint of H ₂ O as | compared | |
| | with the relatively low boiling po | | ~ d ~ | | |
| | (A) van der Waals forces | (C) covalent box | | 22 | |
| | (B) hydrogen bonds | (D) electrovalen | it bonas | 32. | |

| Name | Class | Date | |
|----------|-------|------|--|
| 1 (MIII) | | | |

Self Test 4-C Bonding II - TEST REVIEW

From the list A-F below, select the bond or attractive force that is most closely associated with each of the following phrases, and write its letter in the space at the right. (E) van der Waals forces (A) ionic bonds (C) coordinate covalent bonds (F) covalent bonds (B) hydrogen bonds (D) metallic bonds 1. Hold the iodine atoms together in a molecule of I₂. 2. Hold the many molecules of I2 together in a crystal of iodine. 3. Account for the relatively high boiling and freezing points of pure water. 4. Are illustrated by the compounds formed when fluorine reacts with active metals. 5. Hold magnesium atoms in a crystal lattice. 6. Mobile electrons in the crystal that permit electrical conductivity in the solid state. 7. Responsible for the extremely high melting point of diamond (above 3500°C). 8. Permit helium and hydrogen to exist in liquid or solid phases under conditions of low temperature and high pressure. 9. Link water molecules to neighboring water molecules. 10. Produce substances that are nonconductors in the solid phase and 10. conductors in the liquid phase. 11. Are weak enough to permit solid iodine to sublime readily upon heating. 12. Cause the boiling point of hydrogen fluoride to be much higher than that of hydrogen chloride, hydrogen bromide, or hydrogen iodide. 13. Link the atoms within a molecule of a diatomic gaseous element. 14. Bond noble gas atoms in the liquid phase. 15. _____ 15. Account for the attraction between gas molecules in a nonideal gas. 16. Responsible for the formation of ice crystals. Select the best answer and write its letter in the space at the right. 17. Among the following, the compound that has the highest degree of ionic bonding is (A) CCl_4 (B) $MgCl_2$ (C) H_2O (D) CO_2 18. A compound that has polar molecules is (A) CCl₄ (B) MgCl₂ (C) H₂O (D) CO₂ 19. When compared to hydrogen chloride (HCl), hydrogen fluoride (HF) has an unusually high boiling point. This is due to the magnitude of the (C) van der Waals forces (A) hydrogen bonds (D) nonpolar covalent bonds (B) coordinate covalent bonds

| (B) van der Waals, hydrogen, (| ovalent | • | | |
|--|---|---------------------------------|---------------|-----------------------|
| (C) covalent, hydrogen, van de (D) hydrogen, van der Waals, | r Waais covalent | | | 21 |
| From the list A-D below, select the letter in the space at the right. | | hat best answ | vers each que | stion, and write its |
| (A) CsCl | (B) CO ₂ | (C) CCL | (D) H_2O | |
| 22. Which compound best represer | its a tetrahedra | l molecule? | | 22 |
| 23. Which compound would sh structure? | ow a bent | V-shaped) n | nolecular | 23 |
| 24. Which compound has the high | est degree of ion | nic bonding? | | 24 |
| 25. Which compound probably has structure? | | | nolecular | 25 |
| 26. Which compound has polar co | valent molecule | es? | | 26 |
| (A) ionic bond(B) metallic bond | (D) po | npolar covale lar covalent b | | 27. |
| 27. the hydrogen and chlorine atom | ns in HCl | | | 27. |
| 28. the magnesium and chlorine pa | articles in MgC | l ₂ | | 28 |
| 29. the nitrogen and hydrogen ato | ms in NH ₃ | • | | 29 |
| 30. the nitrogen atoms in N ₂ | | | | 30 |
| 31. the atoms in Cu wire | | | | 31 |
| From the list A-G below, select the its letter in the space at the right. (A) HCl (B) N ₂ | (C) CH ₄ (D) SiO ₂ | (E) Cu (F) Xe | (G) KBr | ich phrase, and write |
| 32. Conducts an electric current in the molten state but not in the solid state. | | | | 32 |
| | 33. Its molecules contain only one atom. | | | |
| 34. Mobile electrons permit electrons | 34. Mobile electrons permit electrical conductivity in the solid phase. | | | |
| 35. A nonpolar covalent compound. | | | | 35 |
| 36. An example of a network solid | | | | 36 |

(A) covalent, van der Waals, hydrogen