Name _____
Period_____

Physical Properties Worksheet

List 3 types of intramolecular forces (bonding).

_____
_____
_____

List 4 types of intermolecular forces.

_____
_____
_____
_____

1. List the types of intermolecular forces present in:
   (A) N_2
   (B) H_2S
   (C) H_2O

2. A certain solid substance dissolves in water to form a conducting solution (indicating _____substance). Upon heating, it decomposes to give off a gas and form another solid (_____ _____). This behavior would be characteristic of
   (A) CCl_4 (B) graphite (C) NaF (D) Li_2CO_3

3. Explain in your own words the difference between:
   (A) a dipole and an induced dipole

   (B) polar covalent bonds and dipole forces

   (C) hydrogen bonding and covalent bonding

4. Which should have a higher melting point, a. CCl_3F or KCl?
   b. CaO or KCl?

5. Arrange in order of increasing boiling points: Br_2, KCl, Cl_2

6. Explain in terms of structure why:
   (A) NaCl has a higher melting point than ICl

   (B) SiO_2 has a higher melting point than CO_2

   (C) Hg is a better conductor than S

   (D) H_2O has a higher boiling point than H_2S

7. Criticize each of the following statements:
   (A) All substances with high melting points are ionic.

   (B) Boiling point increases with formula mass (molecular weight).

   (C) Solutions prepared by shaking ionic solids with water are good conductors.

8. List the intermolecular forces present in:
   (A) CH_4
   (B) H_2O and HF
   (C) Cu
   (D) carbon

   (E) $CHCl_3$
   (F) asbestos
   (G) $MgCO_3$

9. For each of the following pairs of molecular substances, circle the one with a higher boiling point and tell why:
   (A) HF or HCl
   (B) O_2 or S_8
   (C) SiH_4 or PH_3
   (D) CH_4 or C_2H_6

10. Complete the following statements with either "increase", "decrease", or "not change":
   (A) If the intermolecular forces in a liquid increase, the normal boiling point will ___.
   (B) If the intermolecular forces in a liquid increase, the vapor pressure of the liquid will ___.
   (C) If the surface area of a liquid increases, the vapor pressure will ___.

11. Methyl alcohol, H_3COH, has a normal boiling point of 64.7°C. Another compound with the same elements, formaldehyde ($H_2C=O$), has a normal boiling point of 19.5°C. Briefly explain why these compounds have different boiling points.

12. Explain how a water molecule can interact with a molecule such as CO_2. What intermolecular force is involved?

13. Choose which of the following has the higher melting point, give your reasoning:
   a. CH_4 or SiH_4
   b. HCl or CH_4
   c. Cr or N_2
   d. H_20 or SiO_2

14. What intermolecular force(s) must be overcome to:
   (A) melt ice
   (B) melt solid I_2
   (C) remove the water of hydration from $MnCl_2 \cdot 4\ H_2O$
   (D) convert liquid NH_3 to NH_3 gas

15. Tell what type of intermolecular force(s) is/are important in converting each of the following from a gas to a liquid:
    (A) CO_2 (B) NH_3 (C) $CHCl_3$ (D) CCl_4

16. Rank the following in order of increasing strength of intermolecular forces in the pure substances: Ne, CH_4, CO, and CCl_4.

17. Circle one member of the following pairs of compounds you would expect to have the higher boiling point and tell why:
    (A) O_2 or N_2
    (B) HF or HI
    (C) SO_2 or CO_2
    (D) SiH_4 or GeH_4

18. Consider the following four compounds: SCl_2, NH_3, CH_4 and CO. Place the four compounds in order of increasing boiling point. Draw the structures first.

19. Decide which type of intermolecular force is involved in each case and place the interactions in order of increasing strength:
    (A) CH_4 and CH_4 (B) H_2O and H_3COH (C) H_2O and LiCl

20. Decide which type of intermolecular force is involved with:
    (A) N_2 and N_2
    (B) $MgSO_4$ and H_2O
    (C) CO_2 and H_2

21. Circle the compound with the highest melting point (m.p.) Why?

    a. CaO or NaCl
    b. KCl or ICl
    c. SiO_2 or CO_2
    d. HF of HCl
    e. O_2 or F_2
    f. SiH_4 or PH_3
    g. CH_4 or C_2H_6
    h. PH_3 or NH_3

22. Classify the following compounds as Ionic (I) Metallic (M) Molecular (Mo) Macromolecular (MM)

    a. CaO _____
    b. KCl _____
    c. SiO_2_____
    d. HF _____
    e. O_2_____
    f. Al_____
    g. CH_4_____
    h. starch_____

23. If a solid was insoluble in water a nonconductor and does not melt at 1000C, what type of solid could it be ? _____

24. Circle which of the following would have to overcome hydrogen bonds to become a vapor (gas)?
    a. HCl b. HF c. H_2O d. HI e. NH_3 f. AsH_3

25. If a substance is a good conductor of electricity when molten, is soluble in water and has a very low vapor pressure at 25 C What type of solid could it be?

26. If a substance is a nonconductor of electricity, is insoluble in water and has a very low vapor pressure at 25 C. What type of solid could it be?

27. Circle the following that would decompose before melting?
    a. NaF b. $Al(OH)_3$ c. $CuCl_2.5\ H_2O$ d. $Al_2(CO_3)_3$

28. A certain solid is insoluble in water, a nonconductor, and does not melt when heated to 1000 C. Which of the 4 categories does it belong?

29. Explain in terms of structure why
    a. graphite is much softer than diamond
    b. Cl2 has a higher boiling point than F2
    c. NaCl becomes a conductor when it melts
    d. metals are good reflectors of light

30. Which of the following statements are always valid? generally valid? generally invalid?
    a. dispersion forces exist between all molecules
    b. b. hydrogen bonds are found in all compounds containing hydrogen
    c. silicates have macromolecular structures

31. Classify each of the following as molecular, macromolecular, or metallic:
    a. sugar b. brass c. chromium d. propane e. talc

32. Which would be the higher melting substance in each of the following pairs? Circle please.
    a. NaF or MgO
    b. MgO or BaO
    c. NH_3 or PH_3
    d. PH_3 or SbH_3

33. For which of the following would it be necessary only to overcome dispersion forces to boil the substance?
    a. HCl b. Cr c. Carbon d. Nitrogen e. $MgCO_3$

34. Write the balanced equation for the thermal decomposition (loss of water or a gas carbon dioxide or sulfur dioxide) of
    a. $Mg(OH)_2$
    b. LiOH
    c. $Li2CO_3$
    d. $MgSO_3$