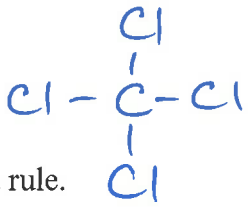
Mr. Bracken
AP Chemistry

Name BRACKEN KEY
Period ____

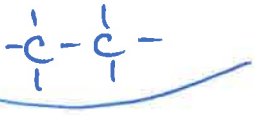
Multiple Choice Review: Intermolecular Forces (2014)

1. Which statement best describes why carbon tetrachloride (CCl_4) is nonpolar?
   (a) Each carbon-chlorine bond is polar.
   (b) Carbon and chlorine are both nonmetals.
   (c) Carbon tetrachloride is an organic molecule.
   (d) The carbon tetrachloride molecule is symmetrical.
   (e) Multiple resonance structures can be drawn without violating the octet rule.



2. Which term applies to the attraction between nonpolar molecules?
   (a) hydrogen bonding
   (b) ionic bonding
   (c) covalent bonding
   (d) London dispersion forces

3. Which one of the following compounds would be expected to have the highest boiling point?
   (a) C_2Br_6
   (b) C_2H_6
   (c) C_2I_6
   (d) C_2Cl_6
   (e) C_2F_6



highest London largest — formula wt so largest forces exist due to electron cloud

4. The weakest London dispersion forces exist between the molecules of
   (a) ethane C_2H_6
   (b) propane C_3H_8
   (c) pentane C_5H_{12}
   (d) hexane C_6H_{14}
   (e) octane C_8H_{18}

larger molecules have stronger London forces.

5. Helium may be liquefied at low temperature and high pressure primarily because of
   (a) hydrogen bonding
   (b) covalent bonds
   (c) London dispersion forces
   (d) ionic attractions
   (e) high electronegativity

6. As a solid element melts, the atoms become _____ and they have _____ attraction for one another.
   (a) larger, greater
   (b) more separated, less
   (c) more separated, more
   (d) closer together, more
   (e) closer together, less

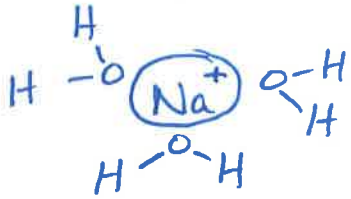
in general, melting process increases the volume

7. A gas is _____ and assumes _____ of its container whereas a liquid is _____ and assumes _____ of its container.
   (a) condensed, the shape, compressible, the volume and shape.
   (b) condensed, the volume and shape, condensed, the volume and shape
   (c) compressible, the volume and shape, not compressible, the shape of a portion
   (d) compressible, the shape, not compressible, the volume and shape
   (e) compressible, the volume and shape, compressible, the volume

8. The best explanation for the observed difference in the normal boiling points of **ICl** (97°C; molecular mass = 162 amu) and **Br_2** (59°C; molecular mass = 160 amu) is _____.
   (a) dipole-dipole interactions
   (b) hydrogen bonding
   (c) London-dispersion forces
   (d) ion-ion interactions
   (e) both hydrogen bonding and dipole-dipole interactions

   I-Cl dipole-dipole + London
   Br-Br London only

9. When NaCl dissolves in water, aqueous Na^{1+} and Cl^{1-} ions result. The force of attraction that exists between an ion like Na^{1+} and H_2O is called a(n) _____ interaction.
   (a) dipole-dipole
   (b) ion-ion
   (c) ion-dipole
   (d) hydrogen bonding
   (e) London dispersion force



   Na^+ ion
   H_2O is polar + has a dipole

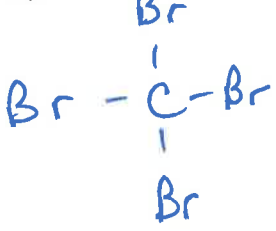
10. Of the following substances, only _____ exhibits London dispersion forces as the only intermolecular force.
   (a) NH_3
   (b) CH_3OH
   (c) H_2S
   (d) HCl
   (e) Kr

11. Hydrogen bonding is a special case of _____.
   (a) ion-ion attractions
   (b) dipole-dipole attractions
   (c) ion-dipole attractions
   (d) London dispersion forces
   (e) Bronsted forces

   ← dipole-dipole

   H-F
   H-O
   H-N

12. What is the primary intermolecular force in CBr_4?
   (a) ion-dipole attraction
   (b) ionic bonding
   (c) dipole-dipole attraction
   (d) London dispersion forces
   (e) hydrogen bonding



   nonpolar due to symmetry

13. What intermolecular force is responsible for the fact that ice is less dense than liquid water?
    (a) ion-dipole forces
    (b) hydrogen bonding
    (c) ionic bonding
    (d) London dispersion forces
    (e) ion-ion attraction

many of water's unique properties can be attributed to H-bonding

14. Decane ($C_{10}H_{22}$) molecules shown what type of intermolecular attractions?
    (a) hydrogen bonding
    (b) ion-dipole interactions
    (c) dipole-dipole interactions
    (d) London dispersion forces
    (e) fusion forces

15. Viscosity is _____.
    (a) unaffected by temperature NO
    (b) the resistance to flow
    (c) inversely proportional to molar mass NO
    (d) the "skin" on a liquid surface caused by intermolecular attraction NO
    (e) the same as density NO

16. The substance with the largest heat of vaporization is _____.
    (a) F_2
    (b) I_2 ← strongest London forces so takes most energy to vaporize. I_2 is the largest molecule of choices
    (c) Cl_2
    (d) Br_2

17. The shape of a liquid's meniscus is determined by _____.
    (a) the volume of the liquid
    (b) the extent of hydrogen bonding in the liquid
    (c) the type of material the container is made of
    (d) the viscosity of the liquid
    (e) the relative magnitude of cohesive forces in the liquid and the adhesive forces between the liquid and its container.

SEE NOTES #2

18. Which statements about viscosity are true?
    I. Viscosity increases as temperature decreases. YES
    II. Viscosity increases as molecular weight increases. LOGICAL - London get stronger
    III. Viscosity increases as intermolecular forces increase. YES

    (a) **I** only
    (b) **II** and **III**
    (c) **III** only
    (d) **I** and **III**
    (e) **I, II** and **III**

19. In general, the vapor pressure of a substance increases as _____ increases.
    (a) hydrogen bonding
    (b) temperature
    (c) molecular weight
    (d) surface tension
    (e) viscosity

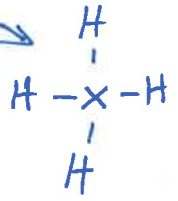
SEE NOTES #1

20. Some foods take longer to cook at higher altitudes than at lower altitudes because _____.
    (a) water boils at a higher temperature at high altitudes than at low altitudes
    (b) natural gas flames don't burn as hot at high altitudes
    (c) there is a higher moisture content in the air at high altitudes
    (d) water boils at a lower temperature at high altitude than at low altitude
    (e) heat energy is not conducted as effectively in lower density air

21. Large intermolecular forces in a substance result in
    (a) high critical temperatures and pressures
    (b) high boiling points yes
    (c) low vapor pressure yes
    (d) high heats of fusion and vaporization yes
    (e) all of the above

22. Consider the following similar compounds: **CH_4, SiH_4, GeH_4, SnH_4** The intermolecular forces responsible for CH_4 having the lowest boiling point is/are:

    (a) mainly London dispersion forces but also dipole-dipole interactions
    (b) London dispersion forces
    (c) dipole-dipole interactions
    (d) mainly hydrogen bonding but also dipole-dipole interactions
    (e) hydrogen bonding



Nonpolar due to symmetry

23. What is a substance's normal boiling point?
    (a) the time necessary to evaporate a substance on Mount Everest
    (b) the temperature when a solid starts to melt at reduced pressure
    (c) the temperature at which a liquid boils at an atmospheric pressure of 1.0 atmosphere
    (d) the mass of the liquid divided by its formula weight
    (e) approximately one-third of a substance's number of hydrogen bonds