# Non Sibi High School

Andover's Chem 550/580: Advanced Chemistry

Chapter 12, Review Quiz 1 Answers

1

Rank the compounds KI, $MgCl_2$, MgF_2 and $SiCl_4$ from lowest to highest melting point.

$SiCl_4$ = molecular = lowest melting point because other three are ionic with the following sum of one cation's charge magnitude + one anion's charge magnitude:

KI = K^+ and I^-, $1 + 1 = 2$

$MgCl_2$ = Mg^{2+} and Cl^-, $2 + 1 = 3$

MgF_2 = Mg^{2+} and F^-, $2 + 1 = 3$
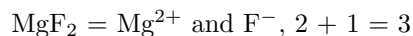
lower sum = lower melting point, so KI has second lowest melting point

smaller ionic radii = higher melting point, so MgF_2 has highest melting point because F^- has smaller ionic radius than Cl^-:

$SiCl_4 < KI < MgCl_2 < MgF_2$

2

State whether each of the following is a good or poor conductor of electricity in the solid state:

a. Na_2SO_4
b. Xe
c. SiC
d. Zn

a. Na^+ and $SO_4{}^{2-}$ = ionic = poor conductor in solid state because cations and anions are immobile (but good conductor in liquid or aqueous state because cations and anions are mobile)

b. nonmetal = molecular = poor conductor in solid state because electrons are localized (and also poor conductor in liquid state because electrons are localized)

c. network covalent with localized electrons = poor conductor in solid state

d. metallic = good conductor in solid state because electrons are delocalized (and also good conductor in liquid state because electrons are delocalized)

3

Rank the following from lowest to highest boiling point:

CH_3NH_2, CO, H_2, N_2, SiO_2

SiO_2 = network covalent = highest boiling point because all others are molecular

CH_3NH_2 is capable of hydrogen bonding = second highest boiling point

CO = 14 total electrons, H_2 = 2 total electrons, N_2 = 14 total electrons

H_2 has fewest total electrons = weakest London forces = lowest boiling point

CO and N_2 have same total electrons = roughly equal London forces, but CO is polar with dipole-dipole forces whereas N_2 is nonpolar with no dipole-dipole forces = CO has third highest boiling point, so:

$H_2 < N_2 < CO < CH_3NH_2 < SiO_2$

4

Predict whether each solute below will dissolve to a greater extent in carbon tetrachloride or water:

a. H_2O_2
b. Br_2
c. HCN
d. NH_4NO_3

CCl_4 is nonpolar, whereas water is polar and is capable of hydrogen bonding.

a. H_2O_2 is capable of hydrogen bonding, so will dissolve to a greater extent in water, which can hydrogen bond as well.

b. The nonpolar Br_2 will dissolve to a greater extent in the nonpolar carbon tetrachloride.

c. The polar HCN will dissolve to a greater extent in the polar water.

d. $NH_4NO_3 = NH_4^+$ and $NO_3^- =$ ionic, so will dissolve to a greater extent in the polar water (due to ion-dipole attraction).