

Conversation enriches the understanding, but solitude is the school of genius.
--Edward Gibbon

Unit 6 Sample Test

The test will be similar in format to previous tests with five multiple choice questions, two required problems, a choice of one out of three smaller problems, a choice of two out of four chemical reactions to write and one essay question. Remember that on this test the first *five* solubility rules will be missing. **An electronegativity table will be included.**

The following are representative of typical multiple choice questions but do not necessarily indicate topics to be addressed on your actual test.

Use these choices for the following **TWO** questions:

- a. BCl_3
- b. H_2O
- c. NH_3
- d. PCl_3
- e. all

_____ 1. Which of the molecules is non-polar?

_____ 2. For which are dispersion forces the only intermolecular forces that would exist?

_____ 3. Select the geometry that best describes NH_4^+

- a. linear
- b. bent (v-shaped)
- c. trigonal planar
- d. trigonal pyramid
- e. tetrahedron

_____ 4. The molecule CH_4 is tetrahedral in shape. The most likely hybridization of the central atom is

- a. sp
- b. sp^2
- c. sp^3
- d. sp^3d
- e. sp^3d^2

_____ 5. Assuming roughly equal masses of the particles occupying the lattice points, which type of solid listed below is likely to have the lowest melting point?

- a. ionic
- b. covalent (network)
- c. molecular
- d. metallic

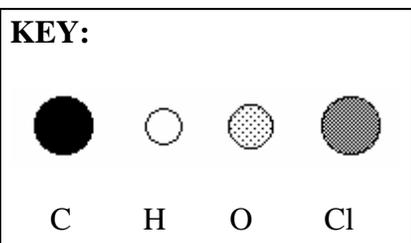
The next section consists of representative problems which might be found in the required section. All students are expected to work on both of the required problems.

6. For each of the following:

- Draw a correct Lewis structure
- Draw the molecule or ion showing the correct geometry using 3-D conventions
- Give the correct VSEPR classification ($A_xB_yE_z$)
- Tell what kind of hybrid orbitals would be used
- Indicate whether the neutral species are polar or non-polar

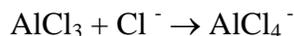


7. Consider the compounds whose structures are represented below. Give the strongest type of intermolecular force expected in each case and arrange them in order of lowest to highest vapor pressure, based on the nature of the intermolecular forces expected.



The next section consists of representative problems such as might be found in the "options" section. Each student is expected to select one problem from this section to work on.

8. Consider the reaction



Describe the change (if any) in hybridization of the aluminum atom and the change in geometry (if any) of the aluminum/chlorine species. **Show orbital diagrams to support your answer.**

9. If you were given a sample of a white solid and asked to determine whether the compound probably was an ionic solid, a polar molecular solid or a non-polar molecular solid, explain how you would make your decision based on the information given below in sequence (i.e., consider each piece of evidence in addition to whatever has been given before):

a. the solid melts at 110°C

b. the solid dissolves in water

c. the water solution of the solid does not conduct electricity

10. In each of the following groups of substances, pick the one that has the given property. Justify each answer.

a. highest boiling point: NaCl, N₂, H₂O

b. weakest surface tension: H₂O, CH₃OH, C₅H₁₂ (pentane)

c. lowest freezing point: H₂, CH₄, I₂

d. smallest vapor pressure at 25°C: SiO₂ (network), CO₂, H₂O

e. greatest viscosity: CH₃CH₂CH₂CH₃, CH₃CH₂OH, HOCH₂CH₂OH

f. strongest hydrogen bonding: NH₃, PH₃, SbH₃

g. greatest ΔH_{vap} : HF, HCl, HBr, HI

h. smallest ΔH_{fus} : H₂, CO₂, MgO

The next section consists of representative reactions to complete and write balanced net-ionic equations for. Note that some reactions do not occur in aqueous solution and thus molecular equations are all that would be needed. Each student is expected to choose two from this section.

11. For each of the following, complete the word equation, write a balanced net-ionic reaction, and tell what type of reaction it is. (all reactions occur in aqueous solution)

a. potassium chloride + silver nitrate → _____

type: _____

b. iron + hydrochloric acid → (a compound containing iron(III) is among the products) _____

type: _____

c. bromine + sodium chloride → _____

type: _____

d. iodate ions (IO_3^-) and sulfide ions are mixed in a **basic** solution; iodide ions and sulfur are among the products

The final section of the test will consist of one essay question selected from the following topics:

- concepts behind VSEPR and preferred shapes for molecules and ions
- concepts behind existence of expanded octets
- polar bonds vs. polar molecules
- correlation of structure with liquid properties

[Answers](#)