Name: KEY.
Date:

Chemistry: Semester 1
QUEST 4: VSEPR & IMF's

TOTAL POINT = /50

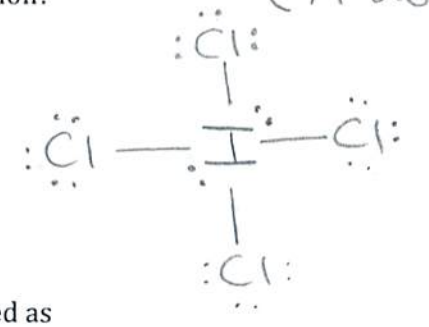
Part I - MC (1 points each) Directions: *There are 13 Multiple Choice Questions. Please read each question carefully and choose the best answer. Please write the letter of choice in the space provided. (40pts)*

1. A

The complex ion ICl_4^- consists of four chlorine atoms bonded to a central iodine atom. There are two lone pairs of electrons associated with the central I atom. What is the geometry of this ion?

a. square planar
b. tetrahedral
c. octahedral
d. rectangular
e. linear

ICl_4^- (7 + 28 + 1 = 36)

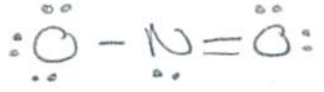


2. A

The geometry of the nitrite ion, NO_2^-, is best described as

a. bent.
b. trigonal planar.
c. tetrahedral.
d. pyramidal.
e. trigonal pyramidal.

NO_2^- (5 + 12 + 1 = 18)

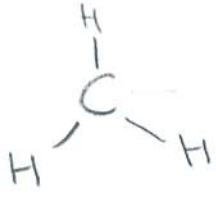


3. D

The approximate H—C—H bond angle in CH_3^+ is

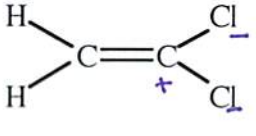
a. 60°.
b. 90°.
c. 109°.
d. 120°.
e. 180°.

CH_3^+ (4 + 3 − 1 = 6)

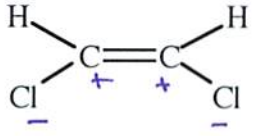


4. D

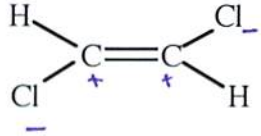
The following question pertains to compounds that have the molecular formula $C_2H_2Cl_2$.



x



y



z

The compound(s) that is (are) polar is (are)

a. x only.
b. y only.
c. z only.
d. x and y.
e. x and z.

5. E

Of the following molecules, which one would show an overall (measurable) dipole?

a. 

b. CO_2.
c. CCl_4
d. HCCH
e. CF_2Cl_2

6. A

Which response contains all the characteristics listed that should apply to SF_6?

1. octahedral
2. one unshared pair of electrons on S
3. sp^3d-hybridized sulfur atom
4. non-polar molecule
5. polar bonds

a. 1, 4, and 5
b. 2, 3, and 4
c. 1, 2, and 4
d. 2, 4, and 5
e. 1, 3, and 5

7. E

When a carbon atom has sp^3 hybridization, it has

a. Four π bonds.
b. Three π bonds and one σ bond.
c. Two π bonds and two σ bonds.
d. One π bond and three σ bonds.
e. Four σ bonds.

8. B

The hybridization of the central atom in a molecule is described as sp^2. The arrangement in space of the hybrid orbitals about that atom is

a. linear.
b. trigonal planar.
c. tetrahedral.
d. trigonal bipyramidal.
e. octahedral.

9. E

Which statements describe the bonding in the water molecule?

1. polar covalent bonds
2. π bond
3. sp^3 hybridization

a. 1 only
b. 2 only
c. 3 only
d. 1 and 2 only
e. 1 and 3 only

10. d

A π (pi) bond is the result of the

a. overlap of two s orbitals.
b. overlap of an s orbital and a p orbital.
c. overlap of two p orbitals that are perpendicular to each other.
d. overlap of two parallel p orbitals.
e. overlap of two s orbitals.

11. C

Which of the following species has the shortest bond?

1. HF (1+7=8)
2. O_2^{2-} (12+2=14)
3. O_2^{2+} (12-2=10)

a. 1 only
b. 2 only
c. 3 only
d. 1 and 2 only
e. 2 and 3 only

12. B

Which of the groups below describe the strength of Intermolecular Forces from weakest to strongest?

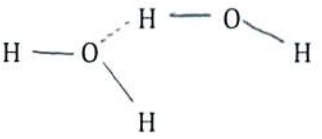
a. Dipole-Dipole, Covalent Bonding Hydrogen Bonding
b. London Forces, Dipole-Dipole, Hydrogen Bonding
c. Hydrogen Bonding, Dipole-Dipole, London Forces
d. Covalent Bonding, Dipole-Dipole, Hydrogen Bonding
e. London Forces, Hydrogen Bonding, Dipole-Dipole

13. E

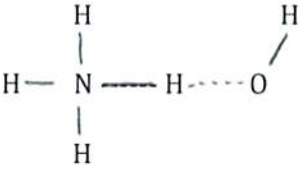
Which of the following does NOT illustrate Hydrogen Bonding?

a.

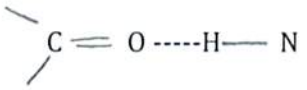
b.



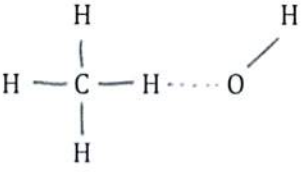
c.



d.

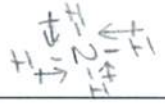


e.

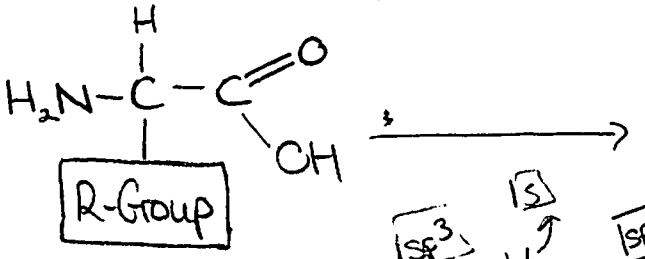


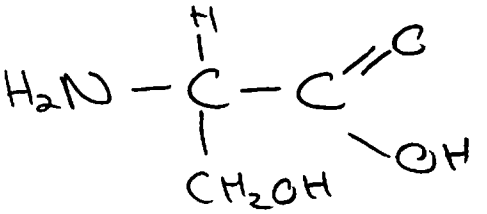
Part II- Conceptual. *Please make all illustrations* clear and understandable.

1. For the following molecules: (1pt/box, Total = 12 pts)
   a. Check (put an 'X') on those that are polar
   b. Identify those (with an 'X') that can form Hydrogen Bonds with another molecule of itself.
   c. Identify those that can form Hydrogen Bonds with ammonia (NH_3)

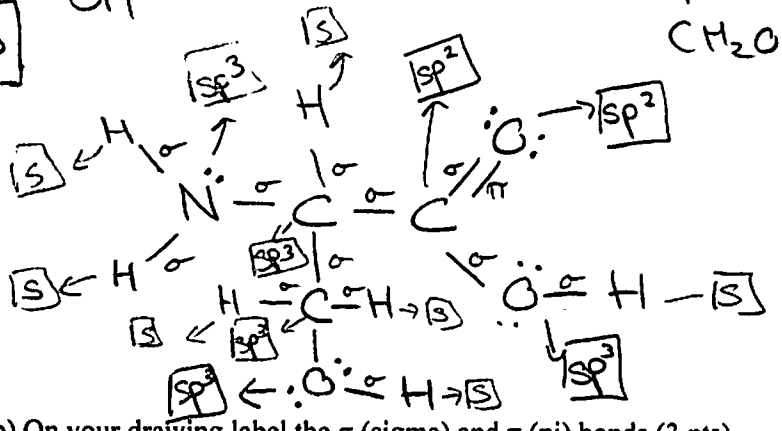
	H_2O	HBr		NH_4^+ (5+4-1=8) 
Is it polar?	X	X	X	
Hydrogen Bond with identical molecule.	X			
Hydrogen Bond with ammonia (NH_3)	X		X	X

2. a)Draw a **regular** Lewis Structure of the amino acid, Serine, where the R-group is CH_2OH (6 pts)





C: 4×3 = 12
N: 5×1 = 5
O: 6×3 = 18
H: 1×7 = 7
42



b) On your drawing label the σ (sigma) and π (pi) bonds (3 pts)

c) Choose 3 atoms in the molecule and identify their type of hybridized orbital they create. You may use arrows on the diagram to identify which atoms you are referring to. (3 pts)

3. For each molecule below,

a) Identify whether it is nonpolar or polar (write it next to the molecule) (4 pts)
b) The Intermolecular Force that holds molecules (of the same kind) together (4 pts)
c) Rank them in order of increasing Boiling Point, with 1 being the lowest. (3 pts)

CH_4 nonpolar, London Forces, 1

C_8H_{18} nonpolar, London Forces, 2 (more slash-ability)

H_2O polar, hydrogen bonding, 4

HCl polar, dipole-dipole, 3