This print-out should have 16 questions. Multiple-choice questions may continue on the next column or page - find all choices before answering.
$001 \quad 10.0$ points
Based only on the difference in electronegativity ( $\triangle \mathrm{EN}$ ) identify the types of the labeled bonds in the molecule below, from left to right:


1. ionic, non-polar covalent, ionic
2. polar covalent, non-polar covalent, nonpolar covalent
3. polar covalent, non-polar covalent, polar covalent
4. ionic, polar covalent, polar covalent
5. non-polar covalent, non-polar covalent, polar covalent
$002 \quad 10.0$ points
Which of the following molecules is/are polar?
I)

II)

III)

6. III only
7. II only
8. II, III
9. I, II, III
10. I, III
11. I only
12. I, II
00310.0 points

Which of the following is the correct Lewis structure for ethene $\left(\mathrm{C}_{2} \mathrm{H}_{4}\right)$ ?


H
2.


4.


## $004 \quad 10.0$ points

Rank the labeled bonds in the molecule below from least to most polar.


1. $\mathrm{c}<\mathrm{d}<\mathrm{e}<\mathrm{b}<\mathrm{a}$
2. $\mathrm{c}<\mathrm{e}<\mathrm{b}<\mathrm{a}<\mathrm{c}$
3. $\mathrm{d}<\mathrm{c}<\mathrm{e}<\mathrm{b}<\mathrm{a}$
4. $\mathrm{d}<\mathrm{c}<\mathrm{b}<\mathrm{e}<\mathrm{a}$
5. $\mathrm{c}<\mathrm{d}<\mathrm{e}<\mathrm{a}<\mathrm{b}$

## $005 \quad 10.0$ points

Rank the following by the polarity of their bonds, from most polar to least: $\mathrm{LiH}, \mathrm{NH}_{3}, \mathrm{BH}_{3}$, HF.

1. $\mathrm{NH}_{3}>\mathrm{HF}>\mathrm{BH}_{3}>\mathrm{LiH}$
2. $\mathrm{HF}>\mathrm{LiH}>\mathrm{NH}_{3}>\mathrm{BH}_{3}$
3. $\mathrm{NH}_{3}>\mathrm{BH}_{3}>\mathrm{HF}>\mathrm{LiH}$
4. $\mathrm{BH}_{3}>\mathrm{HF}>\mathrm{LiH}>\mathrm{NH}_{3}$
5. $\mathrm{LiH}>\mathrm{NH}_{3}>\mathrm{BH}_{3}>\mathrm{HF}$
$006 \quad 10.0$ points
In which of the following do the unbonded electron pairs not distort the bond angles?
6. $\mathrm{H}_{2} \mathrm{O}$
7. $\mathrm{I}_{3}{ }^{-}$
8. $\mathrm{SF}_{4}$
9. $\mathrm{NH}_{3}$
10. $\mathrm{O}_{3}$
$007 \quad 10.0$ points
Which of the following is most likely to form multiple (double or triple) bonds?
11. F
12. Cl
13. Li
14. N
15. H

## $008 \quad 10.0$ points

Which would have the largest dipole moment?

1. $\mathrm{CCl}_{4}$
2. $\mathrm{CO}_{2}$
3. $\mathrm{NH}_{4}^{+}$
4. $\mathrm{NF}_{3}$
$009 \quad 10.0$ points
The molecular geometry about the carbon atoms in $\mathrm{C}_{2} \mathrm{H}_{6}$ is
5. tetrahedral.
6. linear.
7. octahedral.
8. trigonal bipyramidal.
9. trigonal planar.

## $010 \quad 10.0$ points

Which of the following ions has a tetrahedral molecular geometry?

1. $\mathrm{CO}_{3}^{2-}$
2. $\mathrm{H}_{2} \mathrm{~F}^{+}$
3. $\mathrm{NH}_{4}^{+}$
4. $\mathrm{H}_{3} \mathrm{O}^{+}$
5. $\mathrm{NO}_{3}^{-}$

## $011 \quad 10.0$ points

Which substance has nonpolar covalent bonds?

1. NaCl
2. CO
3. $\mathrm{O}_{2}$
4. $\mathrm{NO}_{2}$

## $012 \quad 10.0$ points

Which of these is NOT an ionic compound?

1. $\mathrm{NH}_{4} \mathrm{I}$
2. $\mathrm{MgCl}_{2}$
3. $\mathrm{K}_{2} \mathrm{CO}_{3}$
4. NaSCN
5. HCl
$013 \quad 10.0$ points
$\mathrm{CHF}_{3}$ is (less,more) polar than $\mathrm{CHI}_{3}$ because
6. more; the C-F bonds are more polar than the C-I bonds.
7. less; the C-H bond in $\mathrm{CHF}_{3}$ is a non-polar bond.
8. more; the C-H bond in $\mathrm{CHF}_{3}$ is a nonpolar bond.
9. less; the three polar C-F bonds are symmetrical and cancel the dipole moments.
10. less; the tetrahedral geometry decreases the polarity of C-F bonds.

## $014 \quad 10.0$ points

Which of the following only has bond angles of $90^{\circ}$ and $180^{\circ}$ ?
2. $\mathrm{BrF}_{3}$
3. $\mathrm{BCl}_{3}$
4. $\mathrm{NO}_{3}^{-}$
5. $\mathrm{ICl}_{4}^{+}$

## $015 \quad 10.0$ points

How many $\sigma$ (sigma) and how many $\pi$ (pi) bonds are there in the Lewis structure of the following organic molecule?


1. $10 ; 6$
2. 12; 0
3. 10; 4
4. 14; 0
5. 6; 4
$016 \quad 10.0$ points
Determine the electronegativity difference, the probable bond type, and the more electronegative atom with respect to bonds formed between between the pair of atoms H and F.
6. 3.1; polar covalent; H
7. 6.1; ionic; H
8. 3.1; ionic; H
9. 3.1; ionic; F
10. 6.1; ionic; F
11. 1.9; polar covalent; F
12. 1.9; ionic; F
13. 1.9; ionic; H
14. 1.9; polar covalent; H
15. 3.1; polar covalent; F
