This print-out should have 6 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

**LDE Identifying Bonds 004**

001 5.0 points

Based only on the difference in electronegativity (ΔEN) identify the types of the labeled bonds in the molecule below, from left to right:

\[
\begin{array}{c}
\text{H} \\
\text{B} \\
\text{H}
\end{array}
\begin{array}{c}
\text{H} \\
\text{C} \\
\text{O}
\end{array}
\begin{array}{c}
\text{S} \\
\text{H} \\
\text{H}
\end{array}
\]

1. ionic, non-polar covalent, ionic
2. polar covalent, non-polar covalent, non-polar covalent
3. polar covalent, non-polar covalent, polar covalent correct
4. non-polar covalent, non-polar covalent, polar covalent
5. ionic, polar covalent, polar covalent

**Explanation:**
The B-H bond will have a ΔEN of less than 2 but more than zero, and thus will be a polar covalent bond. The C-C bond will have a ΔEN of zero, and thus will be non-polar covalent. The C=S bond will have a ΔEN of less than 1 but more than zero, and thus will be polar covalent.

**LDE VB Hybridization 005**

002 5.0 points

All of the molecules below have the same hybridization except for one of them. Which is it?

1. IBr₂
2. PH₅
3. IF₅ correct
4. ClF₃
5. TeCl₄

**Explanation:**
The molecule IF₅ would have 6 regions of electron density around the central atom giving it \(sp^3d^2\) hybridization. All of the other choices have 5 regions of electron density giving them \(sp^3d\) hybridization.

**LDE VSEPR Molecular Geometry 009**

003 5.0 points

A certain molecule has a central atom with 2 singly bonded atoms and 2 doubly bonded atoms. Which of the following is a possible molecular geometry?

1. linear
2. tetrahedral correct
3. trigonal pyramidal
4. see-saw
5. trigonal bipyramidal
6. square planar

**Explanation:**
Based on the provided description, the central atom has four bonded atoms and 12 total valence electrons which means it has no non-bonding electrons. It is therefore tetrahedral for both electronic and molecular geometry.

**LDE Molecular Polarity 001**

004 5.0 points

Which of the following molecules is/are polar?

I) NO₃⁻
II) NO
III) NO₂

1. I only
2. I and III correct
3. II only
4. I and II
5. II and III correct
6. III only
7. I, II and III

Explanation:
All of the molecules contain polar N-O and N=O bonds. But, nitrate is symmetrical and therefore non-polar. Nitric oxide and nitrogen dioxide are both asymmetrical and polar.

LDE VB Sigma Pi Bonds 006
005 5.0 points
How many $\sigma$ (sigma) and how many $\pi$ (pi) bonds are there in the Lewis structure of the following organic molecule?

```
H    C    H
    ||    \O. \\
H — C ≡ C — C — C
    \O.    H
```

1. 10; 4 correct
2. 14; 0
3. 10; 6
4. 12; 0
5. 6; 4

Explanation:

LDE Hybridization and MO Theory 001
006 5.0 points
Which of the molecules below will contain more than one $\sigma_{sp^2,sp^2}$ bond?

1. CF$_3$CHCHCBr$_3$
2. CH$_3$PHCH$_3$