1. Choose the correct IUPAC name for CrO₃.
   A) chromium(VI) oxide  B) chromium trioxide
   C) chromium(III) oxide  D) chromium(VI) trioxide

2. Which compound below has the IUPAC name uranium hexafluoride?
   A) UF₇  B) UF₆  C) UF₅

3. If X is a period 3 metal, and Y is a period 4 non-metal, what is the most likely compound to form between X and Y?

4. Which ions below are isoelectronic with Ar?
   I) Zr²⁺  II) Br⁻  III) P³⁻  IV) Ca²⁺  V) Na⁺
   A) I & III  B) III & V  C) II  D) I & IV  E) III & IV

5. What is the correct IUPAC name of NH₄C₂H₃O₂⁻?
   A) ammonia acetide  B) ammonium carbonate
   C) ammonium acetate  D) ammonia carbonate

6. Based on the most common oxidation states and atomic properties, what is the most likely ionic compound to form between Ba and F⁻?
   A) BaF₂  B) Ba₂F  C) Ba₂F₃  D) BaF

7. Choose the chemical compound in which nitrogen has the lowest (most negative) oxidation state.
   A) N₂O  B) NO⁺  C) NO₃⁻  D) NH₃
8. Chose the balanced reaction of element nitrogen and elemental oxygen that produces dinitrogen monoxide.

A) \( 2N + O \rightarrow N_2O \)  
B) \( N_2 + 2O_2 \rightarrow 2NO_2 \)  
C) \( N_2 + O_2 \rightarrow N_2O_2 \)  
D) \( 2N_2 + O_2 \rightarrow 2N_2O \)  
E) \( N^{3+} + 2O^{2-} \rightarrow NO_2^{-} \)

9. How many grams of oxygen are present in 75.0 grams of sodium sulfate?

A) 54.1 g O  
B) 40.3 g O  
C) 8.44 g O  
D) 4.69 g O  
E) 33.8 g O

10. Using the electronegativity chart below, which bond is the MOST polar?

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<th>N</th>
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A) O-Si  
B) O-F  
C) N-O  
D) H-O

11. In which bonds does the bond polarity arrow point to the left (←)?

I) C-O  
II) O-Br  
III) B-C  
IV) F-I

A) I & II  
B) II & IV  
C) I & III  
D) III & IV

12. Choose the best structure for SO₂. (Do not add any electrons to atoms.)

A  
B  
C  
D

13. Energy diagrams for the three types of bonds are shown below. Looking at the diagram below, choose the combination of atoms that represents an ionic bond.

A) A-M  
B) B-N  
C) C-O
14. What is the C-O bond order in the oxalate ion?

A) 7/5  B) 4/3  C) 2 and 1  D) 3/2

15. Cross-linking of the amino acid cysteine is responsible for the curliness of hair. What oxidation state change, if any, does each sulfur undergo during the reaction below?

\[ \text{H-C-S-H} + \text{H-C-S-H} \rightarrow \text{H-C-S-S-C-H} + \text{H}_2 \]

Limited Table of Electronegativities

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<tbody>
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</table>

A) 0 \rightarrow 0  B) -1 \rightarrow 0  C) +6 \rightarrow +4  D) -2 \rightarrow -1

16. Choose the best structure for ClO₂⁺. (Do not add any electrons to atoms.)

17. Using formal charge, determine the charge on the compound below. Do not add or remove any electrons on this structure.

\[ \text{N=N=\text{N}} \]

A) +2  B) -2  C) 0  D) +1  E) -1

18. Consider the formal charge distribution and the net formal charge on the structures shown below. Choose the structure that is the best representation of N₂O. (Do not add any electrons to atoms.)

A  B  C  D
19. Choose the picture that best represents a pi anti-bonding (\(\pi^*\)) overlap.

[Diagram of molecular orbitals]

A) B) C) D)

20. Select the statement below that is FALSE.
A) A double bond is stronger than a single bond.
B) A molecule that can be represented with resonance structures is flipping back and forth between the resonance structures.
C) A center that is sp hybridized has two unhybridized p orbitals.
D) Mixing of two s and one p atomic orbital produces three sp\(^2\) hybrid orbitals.
E) None of the above.

21. Compare the carbon to oxygen bonds in the series of compounds below and determine the compound with the: 
- weakest bond and
- shortest bond

[Diagram of molecular structures]

A) I, II B) I, I C) II, III D) I, III E) I, II

Tamiflu is a molecule that minimizes the effect of flu symptoms. Consider the molecule below to answer the next four questions. **Add electrons as necessary to octet atoms.**

22. What is the bond angle about the carbon labeled V?
A) 90° B) 120° C) 180° D) 109°

23. What center has a molecular shape that is trigonal planar?
A) R B) S C) T D) U E) none

24. What is the hybridization about the nitrogen labeled U?
A) sp\(^3\) B) sp C) sp\(^2\) D) s\(^2\)p\(^2\)
25. The MO diagrams for a molecule containing 4 unhybridized p orbitals are shown below. Please them in order from:

\[
\text{lowest energy} = \sqrt{\text{I} < \text{II} < \text{III} < \text{IV}} \text{ highest energy}
\]


26. If the molecule above has 6 electrons in the molecular orbitals, which MO is the LUMO?

A) I  B) II  C) III  D) IV  E) V

27. How many sp orbitals (not sp centers, sp ORBITALS) are in the molecule below?

A) 5  B) 2  C) 4  D) 10  E) 6

28. Using the following energy level diagram, determine the bond order and number of unpaired electrons in \( \text{O}_2^{2-} \).

A) bond order = 1, unpaired electrons = 0  B) bond order = 2, unpaired electrons = 2  C) bond order = 1, unpaired electrons = 2  D) bond order = 6, unpaired electrons = 2

I pledge that I have neither given nor received aid on this exam.

Signature: ___________________________
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