

Exam 3**Multiple Choice**

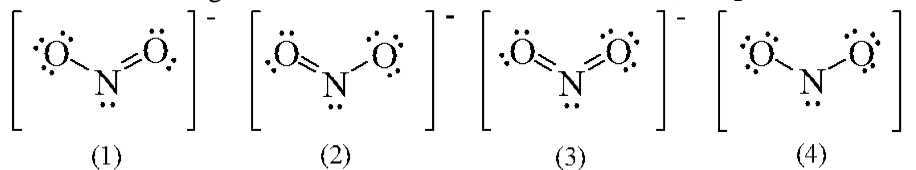
Identify the choice that best completes the statement or answers the question.

Record your name on the top of this exam and on the scantron form.

Record the test ID letter in the top right box of the scantron form.

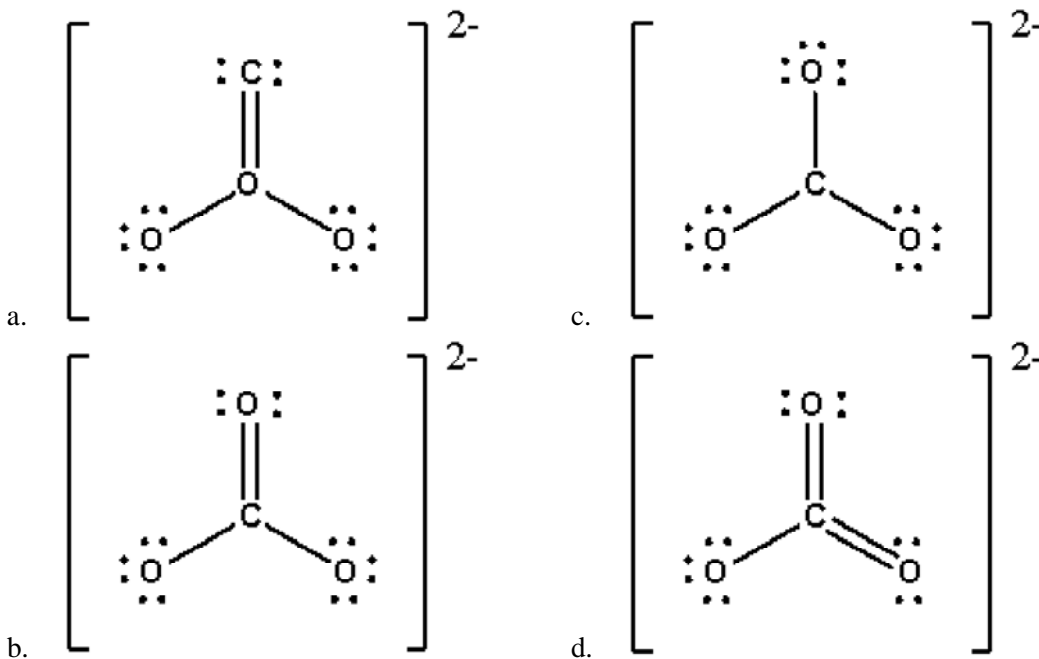
Record all of your answers on the scantron form.

- _____ 1. Which combination of atoms is most likely to produce a compound with covalent bonds?
- Ca and F
 - Al and Ge
 - S and Fe
 - O and Cl
- _____ 2. Place the following atoms in order of **increasing** atomic radii: Mg, F, P, and O.
- $F < O < P < Mg$
 - $O < F < Mg < P$
 - $P < Mg < F < O$
 - $Mg < P < O < F$
- _____ 3. How many electrons can be described by the quantum numbers $n = 5$, $\ell = 1$, $m_s = +1/2$?
- 1
 - 3
 - 5
 - 6
- _____ 4. Which of the following are resonance structures for nitrite ion, NO_2^- ?



- 1 and 2
- 2 and 4
- 3 and 4
- 1, 2, and 3
- 2, 3, and 4

_____ 5. Which of the following is the best Lewis structure for CO_3^{2-} ?



_____ 6. Predict the hybridization of the central atom in SO_3^{2-} .

- sp
- sp^2
- sp^3
- sp^3d

_____ 7. The general trend in electronegativity is to _____ as you **go down** the periodic table and _____ as you **go right** across the periodic table?

- increase, increase
- decrease, increase
- decrease, decrease
- increase, decrease

_____ 8. For which of the following elements is the **second** ionization energy greatest?

- Mg
- Al
- Na
- Sc
- Ti

- _____ 9. If the ground state electron configuration of an element is $[\text{Ar}]3d^{10}4s^24p^4$, what is the typical charge on the monatomic anion of the element?
- 4+
 - 2+
 - 1-
 - 2-

- _____ 10. What is the correct orbital box diagram for the ground state electron configuration of Cr?

<p>a. $[\text{Ar}]$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;"> </td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td></tr></table> $3d$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;">↑↓</td></tr></table> $4s$</p>		↑	↑	↑	↑	↑	↑↓	<p>c. $[\text{Ar}]$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td></tr></table> $3d$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;">↑</td></tr></table> $4s$</p>	↑	↑	↑	↑	↑	↑
	↑	↑	↑	↑	↑									
↑↓														
↑	↑	↑	↑	↑										
↑														
<p>b. $[\text{Ar}]$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td></tr></table> $3d$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;"> </td></tr></table> $4s$</p>	↑	↑	↑	↑	↑		<p>d. $[\text{Ar}]$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;">↑↓</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td><td style="width: 15px; height: 15px;">↑</td></tr></table> $3d$ <table style="display: inline-table; border: 1px solid black; text-align: center; margin: 0 10px;"><tr><td style="width: 15px; height: 15px;"> </td></tr></table> $4s$</p>	↑↓	↑	↑	↑	↑		
↑	↑	↑	↑	↑										
↑↓	↑	↑	↑	↑										

- _____ 11. Which of the following molecules or ions are isoelectronic: SO_2 , CO_2 , NO_2^+ , ClO_2^- ?
- SO_2 and CO_2
 - SO_2 and NO_2^+
 - CO_2 and ClO_2^-
 - CO_2 and NO_2^+
 - SO_2 , NO_2^+ , and ClO_2^-

- _____ 12. Which one of the following molecules is **polar**?
- CO_2
 - KrF_4
 - KrF_2
 - SeF_4

- _____ 13. Use VSEPR theory to predict the molecular geometry of BrF_5 .
- tetrahedral
 - see-saw
 - trigonal-bipyramidal
 - square-pyramidal
 - octahedral

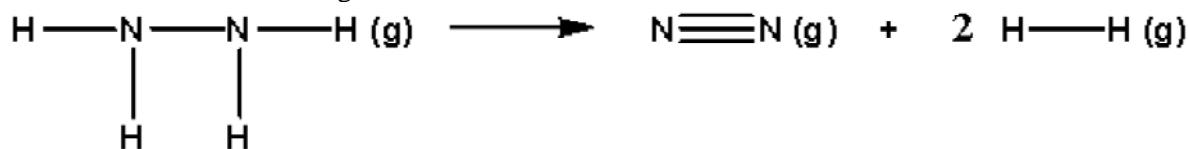
- _____ 14. In molecules, as bond order **increases**,
- bond length decreases and bond energy increases.
 - bond length is unchanged and bond energy increases.
 - bond length increases and bond energy is unchanged.
 - both bond length and bond energy decrease.
- _____ 15. Which of the following elements is most likely to form a molecular structure that **disobeys** the octet rule?
- B
 - C
 - N
 - O
 - F
- _____ 16. Which of the following elements is a *d*-block element?
- C
 - Cs
 - Cd
 - Cf
- _____ 17. One resonance structure for OCN^- ion is drawn below. What is the formal charge on each atom?
- $$\left[\text{:}\ddot{\text{O}}\text{---C}\equiv\text{N:} \right]^-$$
- O atom = 0, C atom = 0, and N atom = 0
 - O atom = 0, C atom = 0, and N atom = -1
 - O atom = -1, C atom = 0, and N atom = 0
 - O atom = -1, C atom = -1, and N atom = +1
 - O atom = +1, C atom = 0, and N atom = -2
- _____ 18. How many lone **pairs** of electrons are assigned to the sulfur atom in H_2S ?
- 0
 - 1
 - 2
 - 3
 - 4
- _____ 19. What is the ground state electron configuration for Cr^{2+} ?
- $[\text{Ar}]3d^6$
 - $[\text{Ar}]3d^4$
 - $[\text{Ar}]3d^24s^2$
 - $[\text{Ar}]3d^44s^2$

- _____ 20. Which of the following statements is/are **CORRECT**?
1. A diamagnetic substance is attracted to a magnetic field.
 2. An atom with an even number of electrons must be diamagnetic.
 3. Atoms with one or more unpaired electrons are paramagnetic.
- a. 1 only
 - b. 2 only
 - c. 3 only
 - d. 1 and 2
 - e. 1, 2, and 3
- _____ 21. The change in energy for the following reaction is referred to as the _____ for oxygen.
- $$\text{O(g)} + \text{e}^- \rightarrow \text{O}^-\text{(g)}$$
- a. oxidation number
 - b. electron affinity
 - c. electronegativity energy
 - d. first ionization energy
 - e. second ionization energy
- _____ 22. Which of the following statements is/are **CORRECT**?
1. The number of hybrid orbitals equals the number of atomic orbitals that are used to create the hybrids.
 2. HF is formed from the overlap of a hydrogen 1s orbital with a fluorine 2s orbital.
 3. The merging of an s orbital and a p orbital creates a pi-bond.
- a. 1 only
 - b. 2 only
 - c. 3 only
 - d. 2 and 3
 - e. 1, 2, and 3
- _____ 23. Which of the following statements concerning potassium is/are **CORRECT**?
1. Potassium is paramagnetic.
 2. Potassium is a p-block element.
 3. Potassium has two valence shell electrons.
- a. 1 only
 - b. 2 only
 - c. 3 only
 - d. 1 and 2
 - e. 2 and 3

- ____ 24. Which of the following molecules has the **smallest** bond angle between any **two fluorine atoms**?
- CF₄
 - BF₃
 - BeF₂
 - OF₂

- ____ 25. Which element has the electron configuration [Ar]3d¹⁰4s²?
- Cu
 - Zn
 - Cd
 - Ag

- ____ 26. Estimate the ΔH for the following reaction.



Bond	Bond Enthalpy (kJ/mol·rxn)	Bond	Bond Enthalpy (kJ/mol·rxn)
N-H	391	N-N	163
N-N	163	N=N	418
H-H	436	N≡N	941

Using average bond energies, calculate the enthalpy of reaction.

- 231 kJ
- 667 kJ
- 86 kJ
- 350 kJ