

1. How many unpaired electrons are present in Fe^{2+}
 - a. 0
 - b. 2
 - c. 4
 - d. 5
 - e. 6
2. Which of the following particles has the largest radius?
 - a. Ne
 - b. F^-
 - c. O^{2-}
 - d. Mg^{2+}
 - e. N^{3-}
3. Rank Ba, Ca, Na in order of increasing 2nd ionization energy.
 - a. $\text{Ba} < \text{Ca} < \text{Na}$
 - b. $\text{Ba} < \text{Na} < \text{Ca}$
 - c. $\text{Ca} < \text{Ba} < \text{Na}$
 - d. $\text{Na} < \text{Ca} < \text{Ba}$
 - e. $\text{Na} < \text{Ba} < \text{Ca}$
4. According to molecular orbital theory, which of the following species is unlikely to exist?
 - a. H_2
 - b. H_2^+
 - c. He_2^+
 - d. He_2
 - e. H_2^-
5. Using the VSEPR theory, predict the molecular shape of SCl_2 .
 - a. triangular planar
 - b. T-shaped
 - c. linear
 - d. tetrahedral
 - e. angular (bent)

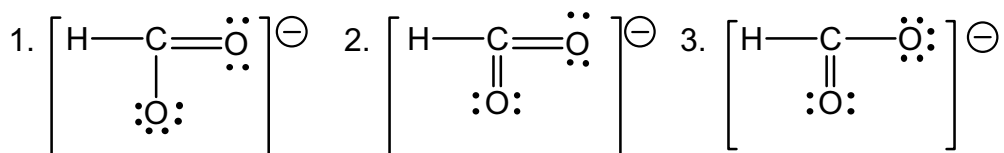
6. Which of the following sets of quantum numbers is not allowed?

- $n = 3, l = 2, m_l = 0, m_s = -1/2$
- $n = 3, l = 2, m_l = +2, m_s = +1/2$
- $n = 2, l = 2, m_l = -1, m_s = +1/2$
- $n = 4, l = 2, m_l = +1, m_s = -1/2$
- $n = 4, l = 3, m_l = -3, m_s = -1/2$

7. Which of the following elements is a d-block element?

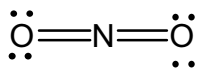
- copper
- chlorine
- aluminum
- sodium
- lead

8. Which of the following is (are) **CORRECT** resonance structure(s) for the formate ion?



- 1 only
- 2 only
- 3 only
- 1 and 3 only
- 1,2, and 3

9. The Lewis structure



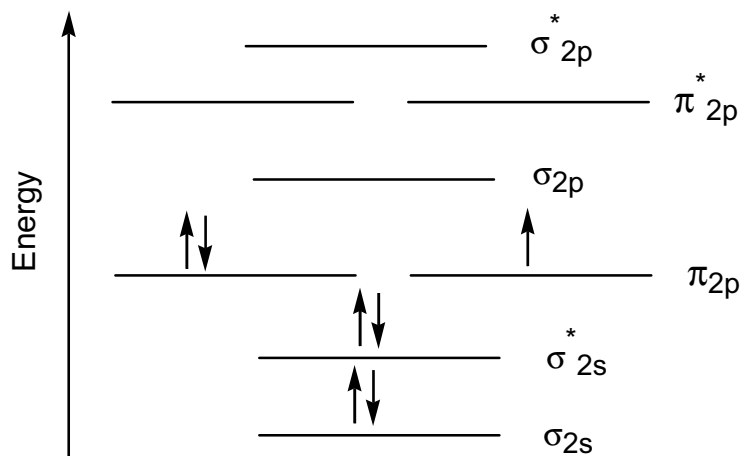
represents

- NO_2
- NO_2^+
- NO_2^-
- both NO_2^+ and NO_2^-
- $\text{NO}_2, \text{NO}_2^+,$ and NO_2^-

10. In the Lewis electron dot structure for hydrazine, N_2H_4 , the total number of lone electron pairs around the two nitrogen atoms is
- 0
 - 1
 - 2
 - 3
 - 4
11. Which compound contains a carbon-oxygen bond with a bond order of 2?
- CO_2
 - CH_3OH
 - CH_3OCH_3
 - CO
 - $\text{C}_2\text{H}_5\text{OH}$
12. Using the VSEPR theory, predict the molecular shape of ClF_3 .
- triangular planar
 - T-shaped
 - linear
 - tetrahedral
 - square planar
13. What is the hybridization of the nitrogen atoms in NH_3 and NH_4^+ respectively?
- sp^3 , sp^4
 - sp^3 , sp^3
 - sp^2 , sp^3
 - sp^2 , sp^2
 - sp^3 , sp
14. In the combustion of methane, CH_4 , what change in hybridization (if any) occurs to the carbon atom?
- sp^2 to sp^3
 - sp^3 to sp^4
 - sp^2 to sp^3
 - sp^3 to sp
 - no change in hybridization occurs

15. What type of hybrid orbital set is used by the sulfur atom in the compound SF₆?
- sp
 - sp²
 - sp³
 - sp³d
 - sp³d²
16. Consider the diatomic molecules of the second period Li₂, Be₂, and C₂. Which is (are) unlikely to exist?
- Li₂
 - Li₂ and Be₂
 - Be₂
 - C₂
 - Be₂ and C₂
17. In order to create a *p-type* semiconductor, a silicon crystal could be doped with
- Ga
 - Ge
 - As
 - He
 - None of these
18. What are the oxidation numbers of sulfur and oxygen in the molecule SO₃?
- Sulfur is +1 and oxygen is -1.
 - Sulfur is +6 and oxygen is -2.
 - Sulfur is +6 and oxygen is -6.
 - Sulfur is +3/2 and oxygen is -3.
 - Sulfur is -2 and oxygen is -2.

19. The following molecular orbital energy level diagram is appropriate for which one of the listed particles?



- B_2^+
- B_2^-
- N_2^+
- N_2^-
- N_2

20. Which response contains all the characteristics listed that should apply to BF_3 ?

- trigonal planar
 - one unshared pair of electrons on B
 - sp^2 hybridized boron atom
 - polar molecule
 - polar bonds
- 2,4, and 5
 - 1, 3, and 4
 - 1,2, and 3
 - 1, 3, and 5
 - 3, 4, and 5