- 1. For dinitrogen monoxide, the arrangement of atoms is N-N-O. In the Lewis structure with a double bond between NN and NO, the formal charges on N, N, and O, respectively, are
  - (a) -1, +1, 0 (b) 0, -1, +1 (c) 0, +1, -1 (d) 0, 0, 0 (e) -2, +1, +1
- 2. All of the following have a linear shape except
  - (a)  $CS_2$ (b)  $CH_2^{2+}$ (c)  $I_3^{-}$ (d)  $O_3$ (e) OCS (order as written)
- 3. What is the shape of  $SO_4^{2-}$ ?
  - (a) trigonal planar
  - (b) trigonal pyramidal

(c) seesaw(d) tetrahedral

4. All of the following can have the ground-state electron configuration  $[Xe]4f^{14}5d^{10}$ except (remember – e- come out of 6s first!)

(a) 
$$Hg^{2+}$$
 (b)  $Tl^{+}$  (c)  $Bi^{5+}$  (d)  $Au^{+}$  (e)  $Pb^{4+}$ 

5. Arrange the following elements in order of *increasing ionic radius*:  $Te^{2^{-}}$ ,  $O^{2^{-}}$ ,  $Se^{2^{-}}$ ,  $S^{2^{-}}$ (a)  $Te^{2^{-}} < O^{2^{-}} < Se^{2^{-}} < S^{2^{-}}$ (b)  $Te^{2^{-}} < Se^{2^{-}} < S^{2^{-}} < O^{2^{-}}$ (c)  $Te^{2^{-}} < S^{2^{-}} < Se^{2^{-}} < O^{2^{-}}$ (d)  $O^{2^{-}} < Se^{2^{-}} < Se^{2^{-}} < Te^{2^{-}}$ (e)  $O^{2^{-}} < S^{2^{-}} < Se^{2^{-}} < Te^{2^{-}}$ 

6. Arrange the following elements in order of *decreasing first ionization energy*:

## Exam 3 KEY

## magnesium, calcium, barium

(a) barium > calcium > magnesium

(c) magnesium > barium > calcium

- (b) magnesium > calcium > barium
- (d) magnesium < calcium < barium
- 7. Arrange the following four electromagnetic spectral regions in order of increasing energy. visible ultraviolet infrared radio
  - (a) visible < ultraviolet < radio < infrared
  - (b) radio < ultraviolet < visible < infrared
  - (c) radio < infrared < visible < ultraviolet
  - (d) infrared < ultraviolet < visible < radio
  - (e) infrared < visible < ultraviolet < radio
- 8. Determine the energy of a photon that has a wavelength of 645 nm.
  - (a)  $1.43 \times 10^{-48}$  J (b)  $3.08 \times 10^{-28}$  J (c)  $1.99 \times 10^{-25}$  J (d)  $3.08 \times 10^{-19}$  J (e)  $4.65 \times 10^{14}$  J
- 9. Which of the following completely defines the set of azimuthal quantum numbers that can exist for n = 3?

(a) l = 0 (b) l = 0, 1 (c) l = 0, 1, 2 (d) l = 0, 1, 2, 3 (e) l = 0, 1, 2, 3, 4

10. Which set of quantum numbers is not allowed?

(a)  $n = 0, l = 0, m_l = 0, m_s = +1/2$ (b)  $n = 1, l = 0, m_l = 0, m_s = +1/2$ (c)  $n = 2, l = 1, m_l = 1, m_s = +1/2$ (d)  $n = 3, l = 1, m_l = 0, m_s = +1/2$ (e)  $n = 4, l = 3, m_l = 0, m_s = -1/2$ 

11. Which statement is false?

(a) Cations are smaller than their corresponding neutral atom.

- (b) Anions are smaller than their corresponding neutral atom.
- (c)  $Mg^{2+}$  is larger than  $Be^{2+}$ .
- (d)  $O^{2-}$  is larger than  $F^{-}$ .
- (e) Br is smaller than I.
- 12. Which element has an electron affinity greater than zero?

Exam 3 KEY

- (a) Br (c) Te (b) I (d) As (e) Kr 13. Which molecule contains a triple bond? (a)  $C_2H_4$ (b)  $CCl_4$ (c)  $H_2O$ (d) N<sub>2</sub> (e)  $O_2$ 14. Which bond is longest? (b) C-P (a) C-O (c) C-H (d) C-C (e) C-N 15. <u>Which of the following represents a non-polar covalent bond ?</u> (a) O-O (b) C-O (c) NaCl (d) C-N (e) C=O16. Which statement properly describes the formal charges on the atoms in  $SO_4^{2-}$ ? (a) +2 on sulfur, -2 on oxygen (b) +2 on sulfur, -1 on oxygen (c) +1 on sulfur, -1 on oxygen
  - (c) 11 on suntri, -1 on oxygen
  - (d) -1 on sulfur, +2 on oxygen
  - (e) -2 on sulfur, 0 on oxygen
- 17. How many resonance forms will ozone,  $O_3$  have? (a) -1 (b) 0 (c) 1 (d) 2 (e) 3
- 18. Label the hybridization at C#1, C#2, C#3, and C#4 in the molecule. C1 C2 C3 C4

(a) sp	sp	sp <sup>3</sup>	sp <sup>3</sup> d	— н_с=с_с_н
(b) sp	sp	sp <sup>2</sup>	sp <sup>3</sup>	1 2 3 H
(c) sp	sp <sup>2</sup>	sp <sup>2</sup>	sp <sup>2</sup>	
(d) sp <sup>2</sup>	sp <sup>2</sup>	$sp^3$	sp <sup>3</sup>	
(e) $sp^3$	sp <sup>3</sup>	sp <sup>3</sup>	sp <sup>3</sup>	

19. Determine the hybridization around the central atom in KrF<sub>4</sub>. (a) sp (b) sp<sup>2</sup> (c) sp<sup>3</sup> (d) sp<sup>3</sup>d (e) sp<sup>3</sup>d<sup>2</sup>

20. For which of the following molecules will the electron-pair geometry be different than molecular geometry?

(a) 
$$NH_4^+$$
 (b) CO (c)  $CH_4$  (d)  $BH_3$  (e)  $H_2O$