Unit Five Practice Test (Part I)
PT – C – U5 – P1

Name____________________________________________  Period_______________

LPS Standard(s): ---  State Standard(s): 12.3.1

Short Answers. Answer the following questions. (5 points each)

1. Write the electron configuration for chromium.

2. Write the electron configuration for oxygen.

3. Write the electron configuration for gold.

4. Write the electron configuration for bromine.

5. Write the electron configuration for phosphorus.

6. Write the electron configuration for molybdenum.

___________/ 30  Percentage: _____________%  LPS/State Standard 1 met?  Yes  No
Identification. Identify the element based on the provided information. (3 points each)

___________________ 7. Element that has 4 outer electrons on the third period of the periodic table of elements

___________________ 8. Element with a $4s^24p^3$ electron configuration

___________________ 9. The 5th period Group 5A element

___________________ 10. Element that has an outer electron configuration of $2s^22p^4$

___________________ 11. Element that is a halogen and in the fourth period

___________________ 12. Element that is a noble gas and is in the second period

___________________ 13. Element that has an outer electron configuration of $4d^{10}5s^1$

___________________ 14. Element that has an outer electron configuration of $5s^1$

___________________ 15. Element that has an outer electron configuration of $5s^25p^2$

___________________ 16. Element that has 2 outer electrons on the sixth period of the periodic table of elements

___________________ 17. Element that is an alkali metal and has its outermost electrons in the sixth energy level

___________________ 18. Element that is an alkaline earth metal and has its outermost electrons in the second energy level

___________________ 19. Has an electron configuration of $1s^2$

___________________ 20. Has an electron configuration of $1s^22s^22p^63s^23p^64s^13d^{10}$

___________________ 21. The 4th period Group 4A element

___________________ 22. The 2nd period element with a complete outermost energy level

___________________ 23. The 2nd period element containing only 2 $p$ electrons in the outermost energy level

___________________ 24. The 4th period element containing only 7 $d$ electrons

___________________ 25. The only element that is an exception to the $p$-block

___________________ 26. The only element containing only one $s$ electron

__________/ 60 Percentage: ____________%  LPS/State Standard 2 met?  Yes  No
Multiple Choice. Identify the letter of the choice that best completes the statement or answers the question. (3 points each)

27. What is the basis for exceptions to the Aufbau rule?
   (A) Filled and half-filled energy sublevels are more stable than partially-filled ones.
   (B) Electron configurations are only probable.
   (C) Electron spins are more important than energy levels in determining electron configuration.
   (D) Some elements have unusual atomic orbitals.

28. If only two electrons occupy two p orbitals, what is the direction of the spins of these two electrons?
   (A) Both are always clockwise.
   (B) Both are always counterclockwise.
   (C) They are either both clockwise or both counterclockwise.
   (D) One is clockwise and the other is counterclockwise.

29. Which of the following states that no more than two electrons can occupy an atomic orbital?
   (A) Aufbau Principle
   (B) Dalton’s Theory
   (C) Hund’s Rule
   (D) Pauli Exclusion Principle

30. Which of the following states that electrons enter orbitals of lowest energy first?
   (A) Aufbau Principle
   (B) Dalton’s Theory
   (C) Hund’s Rule
   (D) Pauli Exclusion Principle

31. Which of the following states that when electrons occupy orbitals of equal energy, one electron enters each orbital until all orbitals contain one electron with their spins parallel?
   (A) Aufbau Principle
   (B) Dalton’s Theory
   (C) Hund’s Rule
   (D) Pauli Exclusion Principle

Short Answers. Answer the following question.

32. What is wrong with writing the electron configuration of \(1s^22s^22p^63s^23p^64s^23d^4\)? Explain and correct the error. (5 points)
Short Answers. Answer the following questions.

33. What is the explanation for the discrete lines in atomic emission spectra? (10 points)

34. What happens in the photoelectric effect? (10 points)

LPS Standard(s): 12.2.5d  State Standard(s): 12.3.2b

Multiple Choice. Identify the letter of the choice that best completes the statement or answers the question. (3 points each)

35. Which of the following elements has the smallest first ionization energy?
   (A) sodium      (B) calcium      (C) potassium      (D) magnesium

36. Which of the following elements has the smallest atomic radius?
   (A) lithium      (B) potassium      (C) oxygen      (D) sulfur

37. Which of the following increases with increasing atomic number in the alkali metal group?
   (A) atomic radius      (C) first ionization energy
   (B) electronegativity      (D) number of outermost electrons

38. What is the most electronegative element?
   (A) helium      (B) fluorine      (C) hydrogen      (D) lithium

39. As you move from left to right across the second period of the periodic table, ___.
   (A) the ionization energy increases      (C) the electronegativity decreases
   (B) the atomic radii increase      (D) the atomic mass decreases
40. Which of the following factors contributes to the greater ionization energy of the elements on the right side of a period in the periodic table?
   (A) more shielding by inner electrons  (C) greater number of protons in nuclei
   (B) larger nuclei  (D) smaller number of valence electrons

41. Why is the radius of a positive ion always less than the radius of its neutral atom?
   (A) The nucleus pulls the remaining electrons in closer.
   (B) The number of principal energy levels is always reduced.
   (C) The atomic orbitals contract all by themselves.
   (D) Electron speeds are reduced.

42. Stable electron configurations are likely to contain ___.
   (A) filled energy sublevels
   (B) fewer electrons than unstable configurations
   (C) unfilled s orbitals
   (D) electrons with a clockwise spin

43. For Group 2A metals, which electron is the most difficult to remove from a neutral atom?
   (A) the first     (B) the second     (C) the third     (D) All are equally difficult.

44. Which group has the highest second ionization energy?
   (A) 1A  (B) 2A  (C) 3A  (D) 7A  (E) 8A

LPS Standard(s): ---  

State Standard(s): 12.3.3a,d

Calculation. Answer the following questions. Show work or receive no credit. You must also show proper units. Express ALL answers using correct significant figures. (10 points each)

45. What is the frequency of a photon of light if it has an energy of $6.6 \times 10^{-22}$ J?

46. What is the frequency of light with a wavelength of 10 nm? ($1 \text{ m} = 1 \times 10^9 \text{ nm}$)
Structures and Geometry. For each of the following molecules or anions, do the following:

a. Show the total number of valence electrons for the molecule or anion. (2 points each)
b. Draw the correct Lewis dot structure (not structural formula) for the molecule or anion. (4 points each)
c. Name the geometry of the molecule or anion. (4 points each)

47. NO₃⁻ (nitrate ion)

a. ____________  

b. __________________________

c. __________________________

48. CCl₄ (carbon tetrachloride)

a. ____________

b. __________________________

c. __________________________

49. NCl₃ (nitrogen trichloride)

a. ____________

b. __________________________

c. __________________________

50. H₂O (water)

a. ____________
51. $\text{SiO}_3^{2-}$ (silicate ion) 
   a. 
   b. 
   c. 

52. $\text{PO}_3^{3-}$ (phosphite ion) 
   a. 
   b. 
   c. 

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LPS Standard(s): 12.2.5e
State Standard(s): 12.3.1

Structures and Geometry. For each of the following electron configurations, do the following:

a. Identify the element being represented. (6 points each)
   b. Draw the correct electron dot structure for the element. (4 points each)

53. $1s^22s^22p^63s^23p^64s^23d^{10}4p^5$ 
   a. 
   b. 

54. $1s^22s^22p^63s^1$ 
   a. 
   b. 

55. $1s^22s^22p^4$ 
   a. 

56. $1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^2$ 
   a. 
   b. 

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LPS/State Standard 7 met? Yes   No
Percentage: ____________%
Identification. Identify the following properties or compounds as being those of (A) molecular compounds or (B) ionic compounds. (3 points each)

______ 57. Have lower melting points
______ 58. Generally poor conductors of electricity
______ 59. Generally more soluble in water
______ 60. Involve the transfer of electrons
______ 61. Representative unit of this compound is a molecule
______ 62. Physical state at room temperature is almost always a solid
______ 63. Formed by reactions of metals and nonmetals
______ 64. Hydrogen bonds exist between these compounds
______ 65. NaCl
______ 66. C₂H₆

67. Explain how partial negative and partial positive charges exist in a molecule. (10 points)

68. What determines if a molecule will be a polar molecule or nonpolar molecule? (10 points)
Multiple Choice. Identify the letter of the choice that best completes the statement or answers the question. (2 points each)

_____ 69. ___ electrons are shared in a triple covalent bond.
(A) 0          (B) 2          (C) 4          (D) 6

_____ 70. Which of the following elements can form diatomic molecules held together by triple covalent bonds?
(A) hydrogen       (B) fluorine       (C) chlorine       (D) nitrogen

_____ 71. When reacting with atoms of their own element, most halogens form ___ covalent bonds.
(A) single       (B) double       (C) triple       (D) no

_____ 72. What is the total number of covalent bonds normally associated with a single carbon atom in a compound?
(A) 1          (B) 2          (C) 3          (D) 4

_____ 73. How many covalent bonds are there in a covalently bonded molecule containing one phosphorus atom and three chlorine atoms?
(A) 1          (B) 2          (C) 3          (D) 4

_____ 74. Which of the following elements do not exist as diatomic molecules?
(A) neon       (B) fluorine       (C) hydrogen       (D) iodine

_____ 75. Why do atoms share electrons in covalent bonds?
(A) to become ions and attract each other
(B) to attain a noble-gas electron configuration
(C) to become more polar
(D) to increase their atomic number

_____ 76. How do atoms achieve noble-gas electron configurations in single covalent bonds?
(A) One atom completely loses two electrons to the other atom in the bond.
(B) Two atoms share two pairs of electrons.
(C) Two atoms share one electron.
(D) Two atoms share two electrons.

_____ 77. A molecule with a single covalent bond is ___.
(A) CO          (B) CO₂          (C) Cl₂          (D) N₂

_____ 78. A molecule with double covalent bonds is ___.
(A) CO          (B) CO₂          (C) Cl₂          (D) N₂

_____ 79. A molecule with a triple covalent bond is ___.
(A) CO          (B) CO₂          (C) Cl₂          (D) N₂
80. A diatomic molecule that does not obey the octet rule is ___.
   (A) Cl₂    (B) H₂    (C) N₂    (D) O₂

81. Which of the following pairs of elements can be joined by a covalent bond?
   (A) Na and C    (B) Mg and C    (C) Li and Cl    (D) N and C

82. In which of the following compounds is the octet expanded to include 12 electrons?
   (A) H₂S    (B) SO₃    (C) SO₃²⁻    (D) SCl₆

Resonance Structures. Show the resonance structures for the following molecule, SO₃. Include arrows as needed. (12 points)

83. Resonance structures: _________________________________________________________

/ 40 Percentage: ______________% LPS/State Standard 11 met? Yes No

LPS Standard(s): 12.2.5e State Standard(s): 12.3.3c

Multiple Choice. Identify the letter of the choice that best describes the transfer of electrons between the specified elements to create a compound. (3 points each)

84. Potassium and chlorine
   (A) one potassium atom gains seven electrons from a chlorine atom
   (B) one chlorine atom gains seven electrons from a potassium atom
   (C) one potassium atom gains one electron from a chlorine atom
   (D) one chlorine atom gains one electron from a potassium atom

85. Potassium and oxygen
   (A) one potassium atom gains six electrons from two oxygen atoms
   (B) one oxygen atom gains six electrons from two potassium atoms
   (C) one potassium atom gains two electrons from two oxygen atoms
   (D) one oxygen atom gains two electrons from two potassium atoms

86. Magnesium and chlorine
   (A) one magnesium atom gains two electrons from two chlorine atoms
   (B) one chlorine atom gains two electrons from two magnesium atoms
   (C) two magnesium atoms gain two electrons from one chlorine atom
   (D) two chlorine atoms gain two electrons from one magnesium atom
87. Lithium and phosphorus
(A) one phosphorus atom gains three electrons from three lithium atoms
(B) one lithium atom gains three electrons from three phosphorus atoms
(C) one phosphorus atom gains three electrons from one lithium atom
(D) one lithium atom gains seven electrons from one phosphorus atom

88. In what way do electrons transfer between metals and nonmetals?
(A) Electrons transfer from a metal to a nonmetal.
(B) Electrons transfer from a nonmetal to a metal.
(C) Electrons never transfer between metals and nonmetals but are shared instead.
(D) Electrons are deposited first with Mr. Geist and then transferred as he sees fit.

89. What is the formula of the ion formed when phosphorus achieves a noble-gas electron configuration?
(A) P^{3+} (B) P^{2+} (C) P^{-} (D) P^{2-} (E) P^{3-}

90. What is the formula of the ion formed when potassium achieves a noble-gas electron configuration?
(A) K^{2+} (B) K^{+} (C) K^{-} (D) K^{2-} (E) K^{3-}

91. How many electrons does barium have to give up to achieve a noble-gas electron configuration?
(A) 1 (B) 2 (C) 3 (D) 6 (E) 8

92. How does calcium obey the octet rule when reacting to form compounds?
(A) It gains electrons.  (B) It loses electrons.  (C) It neither gains nor loses electrons.

93. How does oxygen obey the octet rule when reacting to form compounds?
(A) It gains electrons.  (B) It loses electrons.  (C) It neither gains nor loses electrons.

__________/30 Percentage: _____________% LPS/State Standard 12 met? Yes No