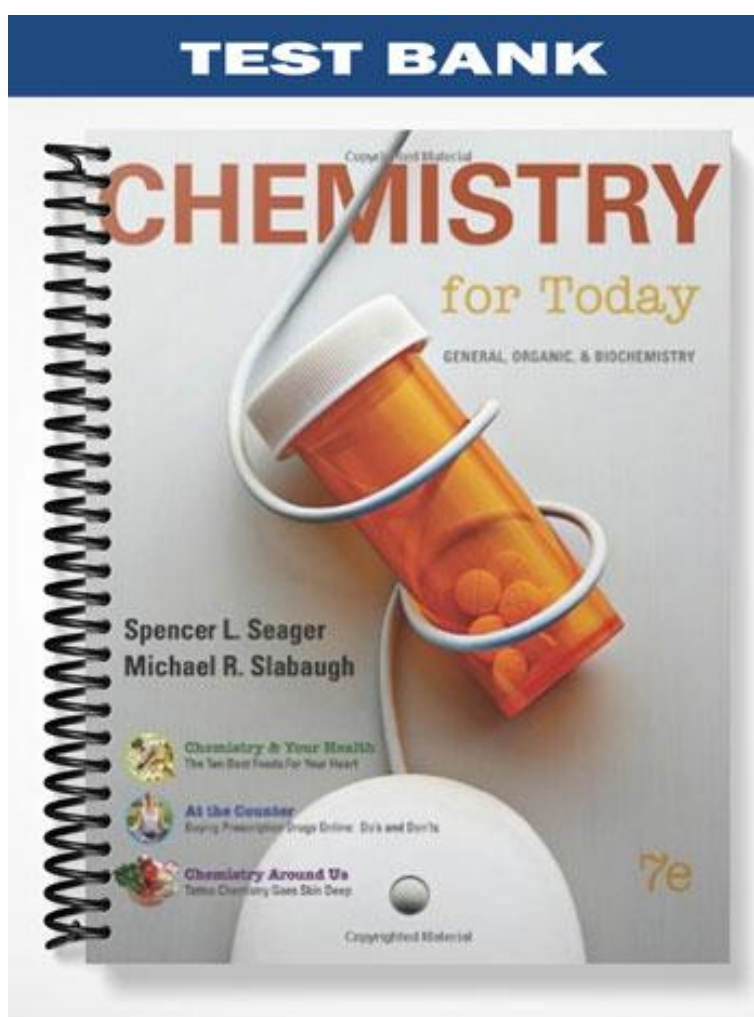


# TEST BANK



## Chapter 3--Electronic Structure and the Periodic Law

Student: \_\_\_\_\_

1. Which of the following elements is found in the same period of the periodic table period as Sn?

- A. Si
- B. As
- C. Te
- D. more than one response is correct

2. Which element is the first one in the group IVA(14) of the periodic table?

- A. C
- B. Na
- C. Sc
- D. Ti

3. What is the symbol of the element that is in Period 4, and Group IIA(2) of the periodic table?

- A. Zn
- B. Ca
- C. C
- D. Ti

4. Silver, Ag, belongs to what period of the periodic table?

- A. IB
- B. 2
- C. 5
- D. 12

5. If the formula for sulfuric acid is  $\text{H}_2\text{SO}_4$ , what would be the expected formula for the compound between hydrogen and tellurium, Te?

- A.  $\text{H}_2\text{TeO}_4$
- B. HTe
- C.  $\text{HTe}_2$
- D.  $\text{H}_2\text{Te}$

6. Which of the following statements applies to  $p$  subshells?
- A. The  $p$  subshell can contain a maximum of 14 electrons.
  - B. The  $p$  subshell is subdivided into three perpendicular shapes.
  - C. The  $p$  subshell fills with 2 electrons in the first subdivision, then 2 in the next, etc.
  - D. All of these statements are correct with reference to  $p$  subshells.

7. Which of the following subshells has the higher energy?
- A.  $4s$
  - B.  $4p$
  - C.  $4d$
  - D.  $4f$

8. Suppose an electron moved from the second shell to the third shell.
- A. The move required an input of energy.
  - B. The move gave off energy.
  - C. Electrons can move spontaneously from shell to shell.
  - D. Electrons can't move from shell to shell, but can move into the nucleus.

9. The total number of  $f$  orbitals in an  $f$  subshell is
- A. 2
  - B. 5
  - C. 7
  - D. 10

10. The maximum number of electrons that can occupy a  $3d$  subshell is
- A. 2
  - B. 4
  - C. 6
  - D. 10

11. The maximum number of electrons that can occupy a  $4p$  orbital is
- A. 2
  - B. 4
  - C. 6
  - D. 10

12. What is the maximum number of electrons that can occupy the third shell?

- A. 2
- B. 10
- C. 18
- D. 32

13. How many electrons are in the outer shell of element 15?

- A. 5
- B. 3
- C. 15
- D. 2

14. Which of the following elements should have properties similar to those of nitrogen (element 7)?

- A. C
- B. Si
- C. P
- D. O

15. Which of the following has the same number of outer shell electrons as sulfur, S?

- A. C
- B. O
- C. N
- D. F

16. What is the shell number for the outer shell electrons in bromine, Br?

- A. 4
- B. 3
- C. 5
- D. 6

17. Which of the following elements has an electronic configuration of  $1s^2 2s^2 2p^6 3s^2 3p^1$ ?

- A. F
- B. Al
- C. Mg
- D. Ga

18. The total number of unpaired electrons in silicon, Si, is

- A. 0
- B. 1
- C. 2
- D. 3

19. Which of the following contains the same total number of unpaired electrons as potassium (K)?

- A. Sc
- B. Cl
- C. Mg
- D. more than one response is correct

20. Which of the following will not have electrons in the 3rd orbital?

- A. K
- B. Mg
- C.  $\text{Na}^+$
- D.  $\text{Ag}^+$

21. Which of the following pairs have the same number of electrons in the outermost shell?

- A. K and Ca
- B.  $\text{S}^{4+}$  and  $\text{Al}^{3+}$
- C.  $\text{Na}^+$  and Ne
- D. Ne and He

22. The electronic configuration of element 17 ends with

- A.  $2p^3$
- B.  $3p^5$
- C.  $2p^5$
- D.  $3p^3$

23. Which of the following elements contains a total of 10 "s" electrons?

- A. Sr
- B. Sb
- C. Cs
- D. more than one response is correct

24. What type of electron is the distinguishing electron in S?

- A. *s*
- B. *p*
- C. *d*
- D. *f*

25. Which of the following distinguishing electrons represents an element with properties similar to an element with a  $3p^3$  distinguishing electron?

- A.  $4p^3$
- B.  $3p^2$
- C.  $3d^3$
- D.  $2p^2$

26. Which element is represented by the distinguishing electron configuration  $5d^9$ ?

- A. Pd
- B. Ag
- C. Pt
- D. Au

27. Which of the following elements is most likely to be a metalloid?

- A. Ge
- B. Mo
- C. S
- D. Cs

28. Metalloids can express the characteristics of both metals and nonmetals. Which of the elements below is more likely to have the characteristics of a metal than a nonmetal?

- A. As
- B. Se
- C. Si
- D. Sb

29. In which of the following elements does the distinguishing electron occupy a *d* subshell?

- A. Cr
- B. O
- C. Kr
- D. Sr

30. Which of the following elements is classified as a transition element?

- A. element 76
- B. element 60
- C. element 56
- D. element 17

31. Which of the following elements is classified as a representative metal?

- A. element 30
- B. element 26
- C. element 38
- D. element 63

32. Which of the following elements is a nonmetal?

- A. Ni
- B. Cu
- C. Ba
- D. I

33. Which one of these elements is a gas at room temperature?

- A. antimony
- B. phosphorus
- C. nitrogen
- D. arsenic

34. Which element has the distinguishing electron,  $5p^4$ ?

- A. Br
- B. Mn
- C. Te
- D. Kr

35. The radius of a K atom is \_\_\_\_\_ a Ca atom.

- A. smaller than
- B. larger than
- C. equal to
- D. inverted from

36. The melting point of oxygen is \_\_\_\_\_ selenium, Se.
- A. lower than
  - B. higher than
  - C. equal to
  - D. inverted from
37. Which of the following is a noble gas?
- A. gold
  - B. platinum
  - C. neon
  - D. chlorine
38. The symbol of the element in period 2, group IIIA (13) is
- A. Mg
  - B. Be
  - C. Al
  - D. B
39. Which element is used for relieving the symptoms of a cold?
- A. Au
  - B. K
  - C. Zn
  - D. Fe
40. Which of the following statements conforms to the trends within the Periodic Table of the Elements?
- A. Elements become more likely to be gases at the bottom of a group.
  - B. Elements become more likely to be a solid at the bottom of a group.
  - C. Elements become more likely to be darkly colored at the bottom of a group.
  - D. Elements become more likely to be more brittle at the bottom of a group.
41. The highest-energy shell of an element that contains electrons is known as the
- A. subshell
  - B. atomic orbital
  - C. valence shell
  - D. none of these

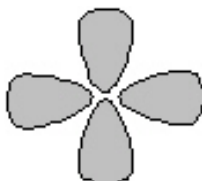


42. \_\_\_\_\_ states that, electrons will not join other electrons in an orbital if an empty orbital of the same energy is available.
- A. Hund's rule
  - B. Pauli exclusion principle
  - C. Periodic law
  - D. None of these
43. \_\_\_\_\_ explains why orbitals can contain a maximum of two electrons.
- A. Hund's rule
  - B. Pauli exclusion principle
  - C. Periodic law
  - D. None of these
44. Choose the correct electronic configuration for the following element: As
- A.  $[\text{Ar}] 4s^2 3d^{10} 4p^3$
  - B.  $4s^2 3d^{10} 4p^3$
  - C.  $[\text{Ar}] 4s^2 4d^{10} 4p^3$
  - D.  $4s^2 4d^{10} 4p^3$
45. Which element has the largest atomic radii?
- A. I
  - B. F
  - C. Li
  - D. Cs
46. The element chlorine is found in the same group of the periodic table as:
- A. I
  - B. F
  - C. Br
  - D. all of these
47. The family name for group VIIIA(18) of the periodic table is:
- A. transition metals
  - B. noble gases
  - C. representative elements
  - D. There is no family name

48. Which of the following is a reasonable explanation as to why atomic radii become smaller as one moves to the right for the representative elements in a period?

- A. The charge of the nucleus increases, pulling the shells closer.
- B. More densely packed shells are always smaller.
- C. Elements become less metallic.
- D. Atomic radii actually increase as you move to the right.

49. Which of the following choices is a possible designation for an electron that occupies a volume around the nucleus that has the given shape?



- A.  $2p$
- B.  $3s$
- C.  $3d$
- D.  $4f$

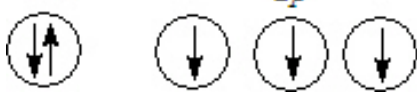



50. Which of the following correctly arranges the given subshells in order of increasing energy (lowest to highest)?

- A.  $2s < 3d < 4s$
- B.  $4s < 3p < 3s$
- C.  $2s < 3d < 4p$
- D.  $4p < 4f < 5s$

51. Which of the following violates the Pauli exclusion principle?

- A.  $2s$   $2p$
- B.  $2s$   $2p$
- C.  $2s$   $2p$
- D. Both a and c

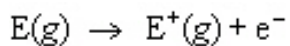
52. Which of the following is the correct valence electron configuration of phosphorus?

- A.  $2s$   $2p$   

- B.  $3s$   $3p$   

- C.  $3s$   $3p$   

- D.  $3s$   $3p$   


53. Which pair of the following represents the same electron configuration?

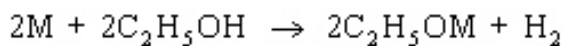
- A.  $[\text{Ne}] 3s^2$  and  $1s^2 2s^2 2p^6 3s^2$   
 B.  $[\text{He}] 3s^2$  and  $1s^2 2s^2 2p^6 3s^2$   
 C.  $[\text{Ar}] 3s^2$  and  $1s^2 2s^2 2p^6 3s^2$   
 D. All represent the same configuration.

54. For which of the listed elements (E) would the energy required for the following reaction be the **least**?



- A. Ga  
 B. Na  
 C. Ca  
 D. K

55. Which of the following metals (M) would produce the fastest reaction with ethyl alcohol ( $\text{C}_2\text{H}_5\text{OH}$ ) as shown below?



- A. K  
 B. Li  
 C. Sr  
 D. Al

56. The fifth period begins with Rb.

True False

57. A  $3d$  orbital can hold 6 electrons.

True False

58. Tin (Sn) is a representative element.

True False

59. The electron configuration for each shell starts with an  $s$  subshell.

True False

60. All of the transition elements are metals.

True False

61. Sodium, Na, and potassium, K, are in the same period.

True False

62. The radius of a magnesium atom is larger than the radius of a sodium atom.

True False

63. The magnesium atom loses an electron easier than a calcium atom.

True False

64. The distinguishing electron in antimony, Sb, is found in a  $5p$  subshell.

True False

65. The fourth shell contains four subshells.

True False

66. The second shell has a maximum capacity of 6 electrons.

True False

67. Element number 92, uranium, U, is a metal.

True False

68. Argon completes the fourth period of the periodic table.

True False

69. Hydrogen is a noble gas.

True False

70. A bromine atom has a larger radius than a chlorine atom.

True False

71. All non-metals are representative elements.

True False

72. An anion is smaller than the atom from which it is produced.

True False

73. The distinguishing electron for most non-metals is an *s* electron.

True False

74. Tin (Sn), which is found in Group IVA, has four electrons in the outside shell.

True False

75. As one moves across the 4th period from left to right, the valence electrons go into the same shell, and the atomic radius decreases. The decrease in atomic radius is due to the increase in the attraction of the nucleus for the electrons in the shells.

True False

76. Based on the physical states of the other group members, the yet undiscovered sixth member of group VIIA(17) would be a solid.

True False

77. The distinguishing electron for any element is a valence electron.

True False

## Chapter 3--Electronic Structure and the Periodic Law **Key**

1. Which of the following elements is found in the same period of the periodic table period as Sn?

- A. Si
- B. As
- C. Te**
- D. more than one response is correct

2. Which element is the first one in the group IVA(14) of the periodic table?

- A. C**
- B. Na
- C. Sc
- D. Ti

3. What is the symbol of the element that is in Period 4, and Group IIA(2) of the periodic table?

- A. Zn
- B. Ca**
- C. C
- D. Ti

4. Silver, Ag, belongs to what period of the periodic table?

- A. IB
- B. 2
- C. 5**
- D. 12

5. If the formula for sulfuric acid is  $\text{H}_2\text{SO}_4$ , what would be the expected formula for the compound between hydrogen and tellurium, Te?

- A.  $\text{H}_2\text{TeO}_4$**
- B. HTe
- C.  $\text{HTe}_2$
- D.  $\text{H}_2\text{Te}$

6. Which of the following statements applies to  $p$  subshells?

A. The  $p$  subshell can contain a maximum of 14 electrons.

**B.** The  $p$  subshell is subdivided into three perpendicular shapes.

C. The  $p$  subshell fills with 2 electrons in the first subdivision, then 2 in the next, etc.

D. All of these statements are correct with reference to  $p$  subshells.

7. Which of the following subshells has the higher energy?

A.  $4s$

B.  $4p$

C.  $4d$

**D.**  $4f$

8. Suppose an electron moved from the second shell to the third shell.

**A.** The move required an input of energy.

B. The move gave off energy.

C. Electrons can move spontaneously from shell to shell.

D. Electrons can't move from shell to shell, but can move into the nucleus.

9. The total number of  $f$  orbitals in an  $f$  subshell is

A. 2

B. 5

**C.** 7

D. 10

10. The maximum number of electrons that can occupy a  $3d$  subshell is

A. 2

B. 4

C. 6

**D.** 10

11. The maximum number of electrons that can occupy a  $4p$  orbital is

A. 2

B. 4

**C.** 6

D. 10



12. What is the maximum number of electrons that can occupy the third shell?

- A. 2
- B. 10
- C. 18**
- D. 32

13. How many electrons are in the outer shell of element 15?

- A. 5**
- B. 3
- C. 15
- D. 2

14. Which of the following elements should have properties similar to those of nitrogen (element 7)?

- A. C
- B. Si
- C. P**
- D. O

15. Which of the following has the same number of outer shell electrons as sulfur, S?

- A. C
- B. O**
- C. N
- D. F

16. What is the shell number for the outer shell electrons in bromine, Br?

- A. 4**
- B. 3
- C. 5
- D. 6

17. Which of the following elements has an electronic configuration of  $1s^2 2s^2 2p^6 3s^2 3p^1$ ?

- A. F
- B. Al**
- C. Mg
- D. Ga

18. The total number of unpaired electrons in silicon, Si, is

- A. 0
- B. 1
- C. 2**
- D. 3

19. Which of the following contains the same total number of unpaired electrons as potassium (K)?

- A. Sc
- B. Cl
- C. Mg
- D. more than one response is correct**

20. Which of the following will not have electrons in the 3rd orbital?

- A. K
- B. Mg
- C. Na<sup>+</sup>**
- D. Ag<sup>+</sup>

21. Which of the following pairs have the same number of electrons in the outermost shell?

- A. K and Ca
- B. S<sup>4+</sup> and Al<sup>3+</sup>
- C. Na<sup>+</sup> and Ne**
- D. Ne and He

22. The electronic configuration of element 17 ends with

- A.  $2p^3$
- B.  $3p^5$**
- C.  $2p^5$
- D.  $3p^3$

23. Which of the following elements contains a total of 10 "s" electrons?

- A. Sr
- B. Sb
- C. Cs
- D. more than one response is correct**

24. What type of electron is the distinguishing electron in S?

- A. *s*
- B. *p***
- C. *d*
- D. *f*

25. Which of the following distinguishing electrons represents an element with properties similar to an element with a  $3p^3$  distinguishing electron?

- A.  $4p^3$**
- B.  $3p^2$
- C.  $3d^3$
- D.  $2p^2$

26. Which element is represented by the distinguishing electron configuration  $5d^9$ ?

- A. Pd
- B. Ag
- C. Pt
- D. Au**

27. Which of the following elements is most likely to be a metalloid?

- A. Ge**
- B. Mo
- C. S
- D. Cs

28. Metalloids can express the characteristics of both metals and nonmetals. Which of the elements below is more likely to have the characteristics of a metal than a nonmetal?

- A. As
- B. Se
- C. Si
- D. Sb**

29. In which of the following elements does the distinguishing electron occupy a *d* subshell?

- A. Cr**
- B. O
- C. Kr
- D. Sr

30. Which of the following elements is classified as a transition element?

- A.** element 76
- B. element 60
- C. element 56
- D. element 17

31. Which of the following elements is classified as a representative metal?

- A. element 30
- B. element 26
- C.** element 38
- D. element 63

32. Which of the following elements is a nonmetal?

- A. Ni
- B. Cu
- C. Ba
- D.** I

33. Which one of these elements is a gas at room temperature?

- A. antimony
- B. phosphorus
- C.** nitrogen
- D. arsenic

34. Which element has the distinguishing electron,  $5p^4$ ?

- A. Br
- B. Mn
- C.** Te
- D. Kr

35. The radius of a K atom is \_\_\_\_\_ a Ca atom.

- A. smaller than
- B.** larger than
- C. equal to
- D. inverted from

36. The melting point of oxygen is \_\_\_\_\_ selenium, Se.

- A.** lower than
- B. higher than
- C. equal to
- D. inverted from

37. Which of the following is a noble gas?

- A. gold
- B. platinum
- C.** neon
- D. chlorine

38. The symbol of the element in period 2, group IIIA (13) is

- A. Mg
- B. Be
- C. Al
- D.** B

39. Which element is used for relieving the symptoms of a cold?

- A. Au
- B. K
- C.** Zn
- D. Fe

40. Which of the following statements conforms to the trends within the Periodic Table of the Elements?

- A. Elements become more likely to be gases at the bottom of a group.
- B.** Elements become more likely to be a solid at the bottom of a group.
- C. Elements become more likely to be darkly colored at the bottom of a group.
- D. Elements become more likely to be more brittle at the bottom of a group.

41. The highest-energy shell of an element that contains electrons is known as the

- A. subshell
- B. atomic orbital
- C.** valence shell
- D. none of these

42. \_\_\_\_\_ states that, electrons will not join other electrons in an orbital if an empty orbital of the same energy is available.

- A.** Hund's rule
- B. Pauli exclusion principle
- C. Periodic law
- D. None of these

43. \_\_\_\_\_ explains why orbitals can contain a maximum of two electrons.

- A. Hund's rule
- B.** Pauli exclusion principle
- C. Periodic law
- D. None of these

44. Choose the correct electronic configuration for the following element: As

- A.**  $[\text{Ar}] 4s^2 3d^{10} 4p^3$
- B.  $4s^2 3d^{10} 4p^3$
- C.  $[\text{Ar}] 4s^2 4d^{10} 4p^3$
- D.  $4s^2 4d^{10} 4p^3$

45. Which element has the largest atomic radii?

- A. I
- B. F
- C. Li
- D.** Cs

46. The element chlorine is found in the same group of the periodic table as:

- A. I
- B. F
- C. Br
- D.** all of these

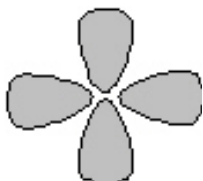
47. The family name for group VIIIA(18) of the periodic table is:

- A. transition metals
- B.** noble gases
- C. representative elements
- D. There is no family name

48. Which of the following is a reasonable explanation as to why atomic radii become smaller as one moves to the right for the representative elements in a period?

- A.** The charge of the nucleus increases, pulling the shells closer.
- B. More densely packed shells are always smaller.
- C. Elements become less metallic.
- D. Atomic radii actually increase as you move to the right.

49. Which of the following choices is a possible designation for an electron that occupies a volume around the nucleus that has the given shape?



- A.  $2p$
- B.  $3s$
- C.**  $3d$
- D.  $4f$

50. Which of the following correctly arranges the given subshells in order of increasing energy (lowest to highest)?

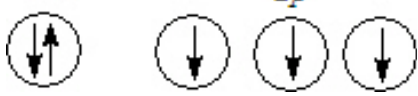



- A.  $2s < 3d < 4s$
- B.  $4s < 3p < 3s$
- C.**  $2s < 3d < 4p$
- D.  $4p < 4f < 5s$

51. Which of the following violates the Pauli exclusion principle?

- A.  $2s$   $2p$
- 
- B.  $2s$   $2p$
- 
- C.**  $2s$   $2p$
- 

- D. Both a and c

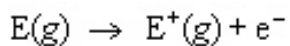
52. Which of the following is the correct valence electron configuration of phosphorus?

- A.  $2s$   $2p$   

- B.  $3s$   $3p$   

- C.  $3s$   $3p$   

- D.  $3s$   $3p$   


53. Which pair of the following represents the same electron configuration?

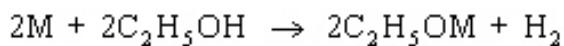
- A.** [Ne]  $3s^2$  and  $1s^2 2s^2 2p^6 3s^2$   
 B. [He]  $3s^2$  and  $1s^2 2s^2 2p^6 3s^2$   
 C. [Ar]  $3s^2$  and  $1s^2 2s^2 2p^6 3s^2$   
 D. All represent the same configuration.

54. For which of the listed elements (E) would the energy required for the following reaction be the **least**?



- A. Ga  
 B. Na  
 C. Ca  
**D.** K

55. Which of the following metals (M) would produce the fastest reaction with ethyl alcohol ( $C_2H_5OH$ ) as shown below?



- A.** K  
 B. Li  
 C. Sr  
 D. Al



56. The fifth period begins with Rb.

**TRUE**

57. A  $3d$  orbital can hold 6 electrons.

**FALSE**

58. Tin (Sn) is a representative element.

**TRUE**

59. The electron configuration for each shell starts with an  $s$  subshell.

**TRUE**

60. All of the transition elements are metals.

**TRUE**

61. Sodium, Na, and potassium, K, are in the same period.

**FALSE**

62. The radius of a magnesium atom is larger than the radius of a sodium atom.

**FALSE**

63. The magnesium atom loses an electron easier than a calcium atom.

**FALSE**

64. The distinguishing electron in antimony, Sb, is found in a  $5p$  subshell.

**TRUE**

65. The fourth shell contains four subshells.

**TRUE**

66. The second shell has a maximum capacity of 6 electrons.

**FALSE**

67. Element number 92, uranium, U, is a metal.

**TRUE**

68. Argon completes the fourth period of the periodic table.

**FALSE**

69. Hydrogen is a noble gas.

**FALSE**

70. A bromine atom has a larger radius than a chlorine atom.

**TRUE**

71. All non-metals are representative elements.

**TRUE**

72. An anion is smaller than the atom from which it is produced.

**TRUE**

73. The distinguishing electron for most non-metals is an *s* electron.

**FALSE**

74. Tin (Sn), which is found in Group IVA, has four electrons in the outside shell.

**TRUE**

75. As one moves across the 4th period from left to right, the valence electrons go into the same shell, and the atomic radius decreases. The decrease in atomic radius is due to the increase in the attraction of the nucleus for the electrons in the shells.

**TRUE**

76. Based on the physical states of the other group members, the yet undiscovered sixth member of group VIIA(17) would be a solid.

**TRUE**

77. The distinguishing electron for any element is a valence electron.

**TRUE**