Student name:_____

TRUE/FALSE - Write 'T' if the statement is true and 'F' if the statement is false.

1) Each shell (principal energy level) of quantum number n contains n subshells.

⊙ true
⊙ false

2) For all atoms of the same element, the 2s orbital is larger than the 1s orbital.

⊙ true
⊙ false

MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.

3) Visible light, radio waves, microwave radiation, infrared, ultraviolet radiation, X-rays, and gamma rays all constitute the electromagnetic spectrum. Which of the following characteristics do all of these kinds of radiation share?

A) They all have the ability to generate heat in objects.
B) They all have the same frequencies.
C) They are all the transmission of energy in the form of waves.
D) They have equal energies.
E) They have the same electron spin state.

4) Select the arrangement of electromagnetic radiation which starts with the shortest wavelength and increases to longest wavelength.

A) radio, infrared, ultraviolet, gamma rays
B) radio, ultraviolet, infrared, gamma rays
C) gamma rays, radio, ultraviolet, infrared
D) gamma rays, infrared, radio, ultraviolet
E) gamma rays, ultraviolet, infrared, radio

5) Select the arrangement of electromagnetic radiation which starts with the lowest energy and increases to the greatest energy.

A) radio, infrared, ultraviolet, gamma rays
B) radio, ultraviolet, infrared, gamma rays
C) gamma rays, infrared, radio, ultraviolet
D) gamma rays, ultraviolet, infrared, radio
E) infrared, ultraviolet, radio, gamma rays

6) What is the emission of light at only specific wavelengths?

A) emission spectra
B) hydrogen spectrum
C) wave spectra
D) limited spectra
E) line spectra

7) List the following types of radiation from lowest frequency to highest frequency: microwave, X ray, ultraviolet, visible, and infrared

A) microwave < infrared < visible < ultraviolet < X ray
B) X ray < ultraviolet < visible < infrared < microwave
C) visible < ultraviolet < microwave < X ray < infrared
D) infrared < X ray < microwave < ultraviolet < visible
E) infrared < visible < microwave < ultraviolet < X ray

8) Which of the following electron transitions would be expected to emit any light in the Bohr model of the atom?

A) $n = 1$ to $n = 3$
B) $n = 5$ to $n = 6$
C) $n = 2$ to $n = 5$
D) $n = 4$ to $n = 3$

9) Which of the following electron transitions would be expected to emit any light in the Bohr model of the atom?

A) $n = 1$ to $n = 4$
B) $n = 3$ to $n = 1$
C) $n = 2$ to $n = 3$
D) $n = 5$ to $n = 7$

10) Which of the following electron transitions would be expected to absorb any light in the Bohr model of the atom?

A) $n = 1$ to $n = 3$
B) $n = 3$ to $n = 2$
C) $n = 4$ to $n = 2$
D) $n = 6$ to $n = 5$

11) Which of the following electron transitions would be expected to absorb any light in the Bohr model of the atom?

A) $n = 7$ to $n = 2$
B) $n = 5$ to $n = 6$
C) $n = 1$ to $n = 3$
D) $n = 3$ to $n = 5$

12) The size of an atomic orbital is associated with

A) the principal quantum number (n).
B) the angular momentum quantum number (l).
C) the magnetic quantum number (m_l).
D) the spin quantum number (m_s).
E) the angular momentum and magnetic quantum numbers, together.

13) Atomic orbitals developed using quantum mechanics

A) describe regions of space in which one is most likely to find an electron.
B) describe exact paths for electron motion.
C) give a description of the atomic structure, which is essentially the same as the Bohr model.
D) allow scientists to calculate an exact volume for the

hydrogen atom.

E) are in conflict with the Heisenberg uncertainty principle.

14) The number of orbitals in a d subshell is

A) 1.
B) 2.
C) 3.
D) 5.
E) 7.

15) How many orbitals can have the 3*p* description in a given atom?

A) 1
B) 2
C) 3
D) 5

16) How many orbitals can have the 3*d* description in a given atom?

A) 1
B) 2
C) 3
D) 5

17) How many orbitals can have the 4*s* description in a given atom?

A) 1
B) 2
C) 3
D) 5

18) How many orbitals can have the 4*p* description in a given atom?

A) 1
B) 2
C) 3
D) 4

19) Determine which sublevel designation is legitimate.

A) 1*f*
B) 2*d*
C) 3*c*
D) 4*s*

20) Determine which sublevel designation is legitimate.

A) 1*p*
B) 2*p*
C) 3*f*
D) 4*z*

21) Determine which sublevel designation is not legitimate.

A) 1*p*
B) 2*s*
C) 3*d*
D) 4*p*

22) Determine which sublevel designation is not legitimate.

A) 4*s*
B) 2*d*
C) 3*s*
D) 5*p*

23) How many orbitals are there in the n = 4 level of the H-atom?

A) 4
B) 6
C) 8
D) 16
E) 18

24) The orbital diagram for a ground-state nitrogen atom is

	1*s*	2*s*	2*p*		
A	1↓	1↓	1	1	1
B	1↓	1	1↓	1	-
C	1↓	1↓	1↓	1	-
D	1↓	1↓	1↓	1	1
E	1↓	1↓	1↓	1↓	1

A) A
B) B
C) C
D) D
E) E

25) The orbital diagram for a ground-state oxygen atom is

	1*s*	2*s*	2*p*		
A	1↓	1↓	1	1	1
B	1↓	1↓	1↓	1↓	-
C	1↓	1↓	1↓	1	-
D	1↓	1↓	1↓	1	1
E	1↓	1↓	1↓	1↓	1

A) A
B) B
C) C
D) D
E) E

26) The orbital diagram for a ground-state carbon atom is

	1*s*	2*s*	2*p*		
A	1↓	1↓	1↓	-	-
B	1↓	1	1	1	1
C	1↓	1↓	1	1	1
D	1↓	1↓	1	1	-
E	1↓	1↓	1↓	1↓	1

A) A
B) B
C) C
D) D
E) E

27) Which ground-state atom has an electron configuration described by the following *orbital diagram*?

[Ar]	1↓	1↓	1↓	1↓	1↓	1↓	1↓	1	1
	4*s*			3*d*				4*p*	

A) phosphorus
B) germanium
C) selenium
D) tellurium

E) potassium

28) Which ground-state atom has an electron configuration described by the following orbital diagram?

A) phosphorus
B) nitrogen
C) arsenic
D) vanadium
E) sulfur

29) How many unpaired electrons does a ground-state atom of sulfur have?

A) 0
B) 1
C) 2
D) 3
E) 4

30) Which element has the following ground-state electron configuration? 1s2 2s2 2p6 3s2

A) Na
B) Mg
C) Al
D) Si
E) Ne

31) Which element has the following ground-state electron configuration? [Kr]5s24d105p3

A) Sn
B) Sb
C) Pb
D) Bi
E) Te

32) Which element has the following ground-state electron configuration? [Kr]5s24d105p2

A) Sn
B) Sb
C) Pb
D) Ge
E) Te

33) The electron configuration of a ground-state Co atom is

A) [Ar]$4s^2 3d^7$.
B) $1s^2 2s^2 2p^6 3s^2 3d^9$.
C) [Ne]$3s^2 3d^7$.
D) [Ar]$4s^1 3d^5$.
E) [Ar]$4s^2 4d^7$.

34) The electron configuration of a ground-state vanadium atom is

A) [Ar]$4s^2 4d^3$.
B) [Ar]$4s^2 4p^3$.
C) [Ar]$4s^2 3d^3$.
D) [Ar]$3d^5$.
E) [Ar]$4s^2 3d^7$.

35) The ground-state electron configuration for an atom of indium is

A) [Kr]$5s^2 4p^6 4d^5$.
B) [Ar]$4s^2 3d^{10} 4p^1$.
C) [Ar]$4s^2 4p^6 3d^5$.
D) [Kr]$5s^2 5p^6 4d^5$.
E) [Kr]$5s^2 4d^{10} 5p^1$.

36) The ground-state electron configuration of a calcium atom is

A) [Ne]$3s^2$.
B) [Ne]$3s^2 3p^6$.
C) [Ar]$4s^1 3d^1$.

D) [Ar]$4s^2$.
E) [Ar]$3d^2$.

37) Select the correct electron configuration for sulfur (Z = 16).

A) $1s^2 1p^6 2s^2 2p^6$
B) $1s^2 2s^2 2p^8 3s^2 3p^4$
C) $1s^2 2s^2 2p^8 3s^2 3p^2$
D) $1s^2 2s^2 2p^6 3s^2 3p^4$
E) $1s^2 2s^2 2p^6 3s^2 3d^4$

38) Select the correct electron configuration for Te (Z = 52).

A) $[Kr]5s^2 5p^6 4d^8$
B) $[Kr]5s^2 5d^{10} 5p^4$
C) $[Kr]5s^2 4d^{10} 5p^6$
D) $[Kr]5s^2 4f^{14}$
E) $[Kr]5s^2 4d^{10} 5p^4$

39) What is the correct electron configuration for a germanium (Ge) atom?

A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^2$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$
C) $1s^2 2s^2 2p^6 3s^2 3p^2$
D) $1s^2 2s^2 3s^2 3p^5$
E) None of the answers is correct.

40) The electronic structure 1s22s22p63s23p64s23d8 refers to the ground state of

A) Kr.
B) Ni.
C) Fe.
D) Pd.
E) None of the answers is correct.

41) How many electrons are in the 4p orbitals of selenium?

A) 0
B) 2
C) 4
D) 5
E) 6

42) How many electrons are in the 4p orbitals of vanadium?

A) 0
B) 2
C) 4
D) 5
E) 6

43) How many electrons are in the 4d orbitals of Tc?

A) 1
B) 2
C) 3
D) 4
E) 5

44) How many electrons are there in the 2nd principal energy level (n = 2) of a phosphorus atom?

A) 3
B) 5
C) 6
D) 8
E) 10

45) How many electrons are there in the 3rd principal energy level (n = 3) of a phosphorus atom?

A) 3
B) 5
C) 6
D) 8
E) 10

46) What element is represented by the electron configuration

A) Mn
B) Ca
C) K
D) Cr
E) V

47) What element is represented by the electron configuration 1s22s22p63s23p64s23d104p65s14d10?

A) Ag
B) Rb
C) Cd
D) Sr
E) Cu

48) What is the electron configuration for tungsten?

A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^6$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^1 4f^{14} 5d^5$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^4$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^7$
E) $1s^2 2s^2 2p^6 3s^2 3p^5 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^7$

49) What is the electron configuration for silicon?

A) $1s^2 2s^2 2p^6 3s^1 3p^3$
B) $1s^2 2s^2 2p^6 3s^2 3p^2$
C) $1s^2 2s^2 2p^6 3s^4$
D) $1s^2 2s^2 2p^6 3p^4$
E) $1s^2 2s^2 2p^6 3s^2 3p^3$

50) What is the electron configuration for bromine?

A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 4d^{10} 4p^6$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^5$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10} 4p^6$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$
E) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

51) Which of the following elements has the largest number of unpaired electrons in the ground state?

A) K
B) V
C) S

D) Si

E) Cl

52) The general electron configuration for atoms of all elements in Group 5A is

A) ns^2np^6.
B) ns^2np^5.
C) ns^2np^4.
D) ns^2np^3.
E) ns^2np^1.

53) Which of these choices is the general electron configuration for the outermost electrons of elements in the alkaline earth group?

A) ns^1
B) ns^2
C) ns^2np^4
D) ns^2np
E) $ns^2np^6\ (n-1)d^6$

54) The general electron configuration for atoms of the halogen group is

A) ns^2np^6.
B) ns^2np^5.
C) $ns^2np^6\ (n-1)d^7$.
D) ns^1.
E) ns^2np^7.

55) The general electron configuration for noble gas atoms is

A) ns^2np^6.
B) ns^2np^5.
C) ns^2np^4.
D) ns^2np^3.
E) ns^2.

56) Each of the noble gases has a completely filled p subshell except for which one?

A) Xenon
B) Neon
C) Radon
D) Argon
E) Helium

57) An element with the general electron configuration for its outermost electrons of ns2np1 would be in which element group?

A) 2A
B) 3A
C) 4A
D) 5A
E) 8A

58) In what group of the periodic table is the element with the electron configuration [Ar]4s23d104p3?

A) 1A
B) 2A
C) 3A
D) 4A
E) 5A

59) Consider the element with the electron configuration [Kr]5s24d7. This element is

A) a halogen.
B) a transition metal.
C) a nonmetal.
D) an actinide element.
E) a noble gas.

60) Consider the element with the electron configuration [Kr]5s24d105p5. This element is

A) a halogen.
B) a transition metal.

C) an alkali metal.
D) an actinide element.
E) a noble gas.

61) Consider the element with the electron configuration [Xe]6s24f7. This element is

A) a halogen.
B) a lanthanide element.
C) a nonmetal.
D) an actinide element.
E) a noble gas.

62) How many valence electrons does a carbon atom have?

A) 1
B) 2
C) 3
D) 4
E) 6

63) How many valence electrons does a tin (Sn) atom have?

A) 2
B) 4
C) 14
D) 36
E) 50

64) An element with the electron configuration [noble gas]ns2(n − 1)d8 has _____ valence electrons.

A) 2
B) 6
C) 8
D) 10
E) None of the answers is correct.

65) An element with

the electron configuration [noble gas]ns2(n − 1)d10np3 has _____ valence electrons.

A) 2
B) 3
C) 5
D) 10
E) 15

66) How does atomic radius change as you move across the periodic table?

A) Atomic radius decreases moving from left to right across a period and increases from top to bottom.
B) Atomic radius increases moving left to right across a period and decreases from top to bottom.
C) Smaller nuclear charge lowers energy; more electrons in an orbital lowers energy.
D) Atomic radius increases diagonally across the periodic table.
E) None of the answers is correct.

67) Which of these atoms has the smallest radius?

A) Al
B) P
C) As
D) Te
E) Na

68) Which of these atoms has the largest radius?

A) B
B) Ga
C) Br
D) Si
E) Cl

69) Which of the elements listed below has the greatest atomic radius?

A) B
B) Al
C) S

D) P

E) Si

70) Which one of these ions has the smallest radius?

A) Cl^-

B) K^+

C) S^{2-}

D) Na^+

E) O^{2-}

71) Arrange P, S, and O in order of increasing atomic radius.

A) S < O < P

B) P < S < O

C) O < S < P

D) O < P < S

E) The answer cannot be determined from the data given.

72) Arrange these ions in order of increasing ionic radius: K+ , P3− , S2− , Cl−.

A) $K^+ < Cl^- < S^{2-} < P^{3-}$

B) $K^+ < P^{3-} < S^{2-} < Cl^-$

C) $P^{3-} < S^{2-} < Cl^- < K^+$

D) $Cl^- < S^{2-} < P^{3-} < K^+$

E) $Cl^- < S^{2-} < K^+ < P^{3-}$

73) Which of the following elements has the largest atomic size?

A) S

B) Ca

C) Ba

D) Po

E) Rn

A) Na
B) Ar
C) K
D) Ca
E) Kr

75) Select the element that will lose an electron most easily, based on the periodic trend.

A) Li
B) Na
C) K
D) He

76) Select the element that will lose an electron most easily, based on the periodic trend.

A) Na
B) Mg
C) Ar
D) P

77) Select the element that will gain an electron most easily, based on the periodic trend.

A) Ca
B) Mg
C) O
D) P

78) Select the element that will gain an electron most easily, based on the periodic trend.

A) Rb
B) Al
C) S
D) Na

79) Which of these elements has the greatest metallic character?

A) Br
B) F
C) Ge
D) Mn
E) Sc

80) Which of these elements has the greatest metallic character?

A) Br
B) Se
C) Ni
D) As
E) Si

81) Select the element with the greatest metallic character.

A) Li
B) Ca
C) Al
D) Pb
E) Cs

82) Select the element with the least metallic character.

A) Sn
B) Sr
C) Tl
D) Ge
E) Ga

83) Using the periodic table, predict the charge on the common ion of calcium.

A) +1
B) +2
C) −1
D) −2

84) Using the periodic table, predict the charge on the common ion of selenium.

A) +1
B) +2
C) −1
D) −2

85) Using the periodic table, predict the charge on the common ion of rubidium.

A) +1
B) +2
C) −1
D) −2

86) Using the periodic table, predict the charge on the common ion of bromine.

A) +1
B) +2
C) −1
D) −2

87) The Lewis dot symbol consists of the symbol for the element surrounded by dot(s). What does the symbol represent?

A) electron configuration
B) valence electrons
C) atomic number
D) atomic mass
E) nucleus and core electrons

88) The Lewis dot symbol consists of the symbol for the element surrounded by dot(s). What does the dot or dots represent?

A) electron configuration
B) valence electrons
C) atomic number
D) atomic mass
E) core electrons

89) How many dots does the Lewis dot symbol for argon have around it?

A) 1
B) 2
C) 4
D) 6
E) 8

90) How many dots does the Lewis dot symbol for sodium have around it?

A) 1
B) 2
C) 0
D) 3
E) 7

91) How many dots does the Lewis dot symbol for magnesium have around it?

A) 1
B) 2
C) 0
D) 3
E) 7

92) How many dots does the Lewis dot symbol for chlorine have around it?

A) 1
B) 2
C) 5
D) 7
E) 17

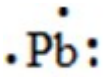
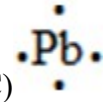
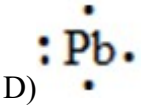
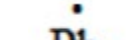
93) How many dots does the Lewis dot symbol for carbon have around it?

A) 4
B) 2
C) 6
D) 3
E) 7

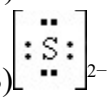
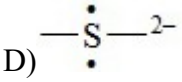
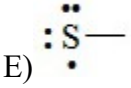
94) How many dots does the Lewis dot symbol for oxygen have around it?

A) 4
B) 2
C) 6
D) 3
E) 7

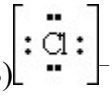
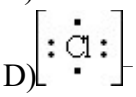
95) The Lewis dot symbol for the a lead atom is

A) 
B)
C) 
D) 
E) 

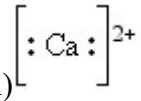
96) The Lewis dot symbol for the S2− ion is

A) 
B) 
C) S^{2-}
D) 
E) 

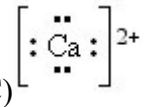
97) The Lewis dot symbol for the chloride ion is

A) 
B) 
C) 
D) 
E) Cl^-

98) The Lewis dot symbol for the calcium ion is

A) 

B) —Ca—

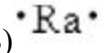
C) 

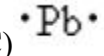
D) Ca^{2+}

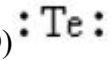
E) Ca

99) Select the element whose Lewis symbol is correct.

A) 

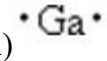
B) 

C) 

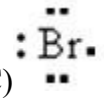
D) 

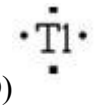
E) 

100) Select the element whose Lewis symbol is correct.

A) 

B) 

C) 

D) 

E) 

101) A magnesium ion, Mg2+, has

A) 12 protons and 13 electrons.

B) 24 protons and 26 electrons.

C) 12 protons and 10 electrons.

D) 24 protons and 22 electrons.

E) 12 protons and 14 electrons.

102) An aluminum ion, Al3+, has

A) 13 protons and 13 electrons.
B) 27 protons and 24 electrons.
C) 16 protons and 13 electrons.
D) 13 protons and 10 electrons.
E) 10 protons and 13 electrons.

103) An oxide ion, O2–, has

A) 8 protons and 10 electrons.
B) 10 protons and 8 electrons.
C) 8 protons and 9 electrons.
D) 8 protons and 7 electrons.
E) 10 protons and 7 electrons.

104) A sulfide ion, S2–, has

A) 16 protons and 16 electrons.
B) 32 protons and 16 electrons.
C) 16 protons and 14 electrons.
D) 16 protons and 18 electrons.
E) 32 protons and 18 electrons.

105) How many protons and electrons are present in one Br– ion?

A) 35 protons, 35 electrons
B) 80 protons, 81 electrons
C) 35 protons, 34 electrons
D) 35 protons, 36 electrons
E) 80 protons, 34 electrons

106) An isoelectronic series is

A) a series that has two or more species that have identical nuclear charges, but have different electron configurations.
B) a series that has the same ionization potentials.
C) a series that can have only up to three species and have similar electron configuration and similar nuclear charges.

D) a series that has two or more species that have identical electron configurations, but different nuclear charges.

E) a series that has the same nuclear charge.

107) Which of these species make an isoelectronic pair: Cl−, O2−, F, Ca2+, Fe3+?

A) Ca^{2+} and Fe^{3+}
B) O^{2-} and F
C) F and Cl^{-}
D) Cl^{-} and Ca^{2+}
E) None of the species are part of an isoelectronic series.

108) Which of these pairs consists of isoelectronic species?

A) Mn^{2+} and Ar
B) Zn^{2+} and Cu^{2+}
C) Na^{+} and K^{+}
D) Cl^{-} and S
E) K^{+} and Cl^{-}

109) Which ion is isoelectronic with Ar?

A) Fe^{2+}
B) F^{-}
C) Br^{-}
D) Ga^{3+}
E) Ca^{2+}

110) Which one of these ions is not isoelectronic with Kr?

A) As^{3+}
B) Se^{2-}
C) Rb^{+}
D) Sr^{2+}
E) Br^{-}

111) Which of these choices is the electron configuration for the aluminum ion?

A) $1s^2 2s^2 2p^6 3s^2$

B) $1s^2 2s^2 2p^6 3s^2 3p^2$

C) $1s^2 2s^2 2p^6 3s^2 3p^1$

D) $1s^2 2s^2 2p^6$

E) $1s^2 2s^2 2p^6 3s^2 3p^4$

112) Which of these choices is the electron configuration for the chloride ion?

A) [Ne]$3s^2 3p^4$

B) [Ne]$3s^2 3p^7$

C) [Ar]

D) [Ar]$4s^1$

E) [Ne]$3s^2 3p^5$

Answer Key

Test name: CH2

1) TRUE

2) TRUE

3) C

4) E

5) A

6) E

7) A

8) D

9) B

10) A

11) C

12) A

13) A

14) D

15) C

16) D

17) A

18) C

19) D

20) B

21) A

22) B

23) D

24) A

25) D

26) D

27) C

28) A

29) C

30) B

31) B

32) A

33) A

34) C

35) E

36) D

37) D

38) E

39) B

40) B

41) C

42) A

43) E

44) D

45) B

46) D

47) A

48) C

49) B

50) E

51) B

52) D

53) B

54) B

55) A

56) E

57) B

58) E

59) B

60) A

61) B

62) D

63) B

64) D

65) C

66) A

67) B

68) B

69) B

70) D

71) C

72) A

73) C

74) B

75) C

76) A

77) C

78) C

79) E

80) C

81) E

82) D

83) B

84) D

85) A

86) C

87) E

88) B

89) E

90) A

91) B

92) D

93) A

94) C

95) C

96) B

97) B

98) D

99) B

100) C

101) C

102) D

103) A

104) D

105) D

106) D

107) D

108) E

109) E

110) A

111) D

112) C