

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

- 1) Which one of the following is not one of the postulates of Dalton's atomic theory? 1) \_\_\_\_\_
- A) Compounds are formed when atoms of more than one element combine; a given compound always has the same relative number and kind of atoms.
  - B) Atoms are composed of protons, neutrons, and electrons.
  - C) Each element is composed of extremely small particles called atoms.
  - D) Atoms of an element are not changed into different types of atoms by chemical reactions: atoms are neither created nor destroyed in chemical reactions.
  - E) All atoms of a given element are identical; the atoms of different elements are different and have different properties.
- 2) Which pair of substances could be used to illustrate the law of multiple proportions? 2) \_\_\_\_\_
- A) H<sub>2</sub>O, O<sub>2</sub>
  - B) CO, CO<sub>2</sub>
  - C) NaCl, KCl
  - D) SO<sub>2</sub>, H<sub>2</sub>SO<sub>4</sub>
  - E) CH<sub>4</sub>, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>
- 3) Which statement below correctly describes the responses of alpha, beta, and gamma radiation to an electric field? 3) \_\_\_\_\_
- A) Both alpha and gamma are deflected in the same direction, while beta shows no response.
  - B) Only alpha is deflected, while beta and gamma show no response.
  - C) Both beta and gamma are deflected in the same direction, while alpha shows no response.
  - D) Both alpha and beta are deflected in the same direction, while gamma shows no response.
  - E) Alpha and beta are deflected in opposite directions, while gamma shows no response.
- 4) Of the three types of radioactivity characterized by Rutherford, which is/are electrically charged? 4) \_\_\_\_\_
- A)  $\alpha$ -rays,  $\beta$ -rays, and  $\gamma$ -rays
  - B)  $\beta$ -rays
  - C)  $\alpha$ -rays and  $\gamma$ -rays
  - D)  $\alpha$ -rays and  $\beta$ -rays
  - E)  $\alpha$ -rays
- 5) There are \_\_\_\_\_ electrons, \_\_\_\_\_ protons, and \_\_\_\_\_ neutrons in an atom of  $^{132}_{54}\text{Xe}$ . 5) \_\_\_\_\_
- A) 54, 54, 78
  - B) 78, 78, 54
  - C) 78, 78, 132
  - D) 54, 54, 132
  - E) 132, 132, 54

6) In the symbol below, x = \_\_\_\_\_. 6) \_\_\_\_\_



- A) 8
- B) 17
- C) 7
- D) 6
- E) not enough information to determine

7) Different isotopes of a particular element contain the same number of \_\_\_\_\_. 7) \_\_\_\_\_

- A) protons
- B) subatomic particles
- C) neutrons
- D) protons, neutrons, and electrons
- E) protons and neutrons

8) Which isotope has 45 neutrons? 8) \_\_\_\_\_

- A)  ${}^{78}_{34}\text{Se}$       B)  ${}^{80}_{36}\text{Kr}$       C)  ${}^{103}_{45}\text{Rh}$       D)  ${}^{34}_{17}\text{Cl}$       E)  ${}^{80}_{35}\text{Br}$

9) Silver has two naturally occurring isotopes with the following isotopic masses: 9) \_\_\_\_\_

${}^{107}_{47}\text{Ar}$	${}^{107}_{47}\text{Ar}$
106.90509	108.9047

The average atomic mass of silver is 107.8682 amu. The fractional abundance of the lighter of the two isotopes is \_\_\_\_\_.

- A) 0.24221      B) 0.48168      C) 0.75783      D) 0.51835      E) 0.90474

10) Element X has three naturally occurring isotopes. The masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is \_\_\_\_\_ amu. 10) \_\_\_\_\_

Isotope	Abundance	Mass
${}^{38}\text{X}$	5.07	37.919
${}^{39}\text{X}$	15.35	39.017
${}^{42}\text{X}$	79.85	42.111

- A) 39.68      B) 38.64      C) 41.54      D) 39.07      E) 33.33

11) Vanadium has two naturally occurring isotopes,  ${}^{50}\text{V}$  with an atomic mass of 49.9472 amu and  ${}^{51}\text{V}$  with an atomic mass of 50.9440. The atomic weight of vanadium is 50.9415. The percent abundances of the vanadium isotopes are \_\_\_\_\_%  ${}^{50}\text{V}$  and \_\_\_\_\_%  ${}^{51}\text{V}$ . 11) \_\_\_\_\_

- A) 1.0, 99
- B) 99, 1.0
- C) 49, 51
- D) 99.75, 0.25
- E) 0.25, 99.75

- 12) Which pair of elements would you expect to exhibit the greatest similarity in their physical and chemical properties? 12) \_\_\_\_\_  
A) H, Li                      B) Cs, Ba                      C) C, O                      D) Ca, Sr                      E) Ga, Ge
- 13) Which one of the following molecular formulas is also an empirical formula? 13) \_\_\_\_\_  
A)  $C_2H_6SO$                       B)  $C_6H_6$                       C)  $C_6H_6O_2$                       D)  $H_2P_4O_6$                       E)  $H_2O_2$
- 14) Of the choices below, which one is not an ionic compound? 14) \_\_\_\_\_  
A)  $MoCl_6$                       B)  $RbCl$                       C)  $PbCl_2$                       D)  $PCl_5$                       E)  $NaCl$
- 15) A molecular formula always indicates \_\_\_\_\_. 15) \_\_\_\_\_  
A) how many of each atom are in a molecule  
B) the geometry of a molecule  
C) which atoms are attached to which in a molecule  
D) the isotope of each element in a compound  
E) the simplest whole-number ratio of different atoms in a compound
- 16) Barium reacts with a polyatomic ion to form a compound with the general formula  $Ba_3(X)_2$ . 16) \_\_\_\_\_  
What would be the most likely formula for the compound formed between sodium and the polyatomic ion X?  
A)  $Na_2X_2$                       B)  $NaX$                       C)  $Na_2X$                       D)  $Na_3X_2$                       E)  $Na_3X$
- 17) Which pair of elements is most apt to form a molecular compound with each other? 17) \_\_\_\_\_  
A) magnesium, iodine  
B) aluminum, oxygen  
C) sulfur, fluorine  
D) barium, bromine  
E) potassium, lithium
- 18) Which formula / name pair is incorrect? 18) \_\_\_\_\_  
A)  $FeS$                       iron(II) sulfide  
B)  $Fe_2(SO_4)_3$                       iron(III) sulfide  
C)  $FeSO_4$                       iron(II) sulfate  
D)  $FeSO_3$                       iron(II) sulfite  
E)  $Fe_2(SO_3)_3$                       iron(III) sulfite
- 19) The suffix -ide is used primarily \_\_\_\_\_. 19) \_\_\_\_\_  
A) for monoatomic cations  
B) for the name of the first element in a molecular compound  
C) to indicate binary acids  
D) for monatomic anion names  
E) for polyatomic cation names
- 20) Which metal forms cations of differing charges? 20) \_\_\_\_\_  
A) Sn                      B) Ba                      C) Cs                      D) Al                      E) K

- 21) The correct name for  $\text{Ni}(\text{CN})_2$  is \_\_\_\_\_. 21) \_\_\_\_\_  
A) nickel (II) cyanide  
B) nickel (I) cyanide  
C) nickel cyanate  
D) nickel (I) nitride  
E) nickel carbonate
- 22) Which element forms an ion with the same charge as the ammonium ion? 22) \_\_\_\_\_  
A) potassium  
B) nitrogen  
C) oxygen  
D) chlorine  
E) calcium
- 23) The correct name for  $\text{NaHCO}_3$  is \_\_\_\_\_. 23) \_\_\_\_\_  
A) sodium hydride  
B) carbonic acid  
C) persodium hydroxide  
D) sodium bicarbonate  
E) persodium carbonate
- 24) Which one of the following is correct? 24) \_\_\_\_\_  
A)  $v = c\lambda$   
B)  $\lambda = cv$   
C)  $v\lambda = c$   
D)  $v + \lambda = c$   
E)  $v \div \lambda = c$
- 25) The photoelectric effect is \_\_\_\_\_. 25) \_\_\_\_\_  
A) the ejection of electrons by a metal when struck with light of sufficient energy  
B) the production of current by silicon solar cells when exposed to sunlight  
C) the darkening of photographic film when exposed to an electric field  
D) the total reflection of light by metals giving them their typical luster  
E) a relativistic effect
- 26) Of the following transitions in the Bohr hydrogen atom, the \_\_\_\_\_ transition results in the emission of the lowest-energy photon. 26) \_\_\_\_\_  
A)  $n = 6 \rightarrow n = 3$   
B)  $n = 3 \rightarrow n = 6$   
C)  $n = 1 \rightarrow n = 4$   
D)  $n = 6 \rightarrow n = 1$   
E)  $n = 1 \rightarrow n = 6$
- 27) Which one of the following is an incorrect subshell notation? 27) \_\_\_\_\_  
A) 3s                      B) 2d                      C) 2p                      D) 4f                      E) 3d

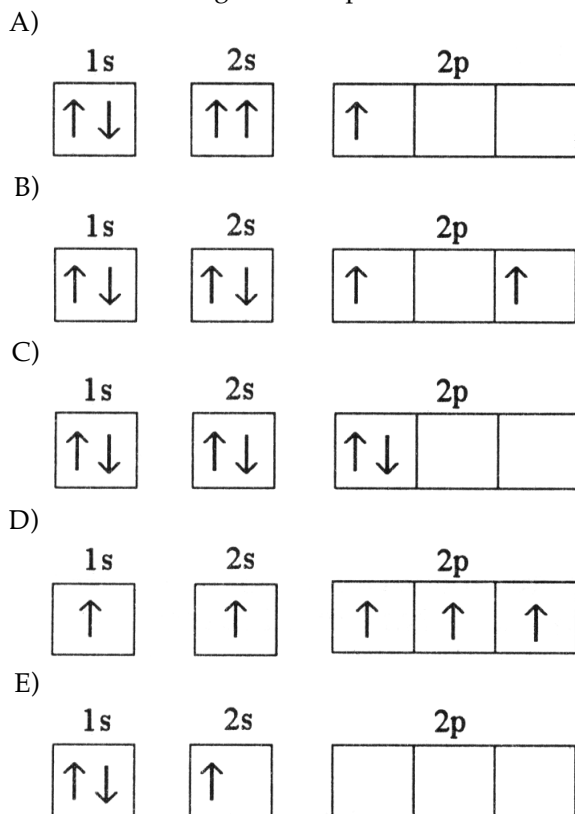
28) The de Broglie wavelength of a \_\_\_\_\_ will have the shortest wavelength when traveling at 30 cm/s. 28) \_\_\_\_\_

A) uranium atom  
 B) marble  
 C) planet  
 D) car  
 E) hydrogen atom

29) According to the Heisenberg Uncertainty Principle, it is impossible to know precisely both the position and the \_\_\_\_\_ of an electron. 29) \_\_\_\_\_

A) charge  
 B) momentum  
 C) mass  
 D) color  
 E) shape

30) Which electron configuration represents a violation of the Pauli exclusion principle? 30) \_\_\_\_\_



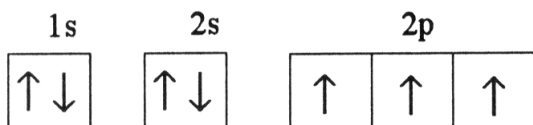
31) The ground-state electron configuration of \_\_\_\_\_ is  $[\text{Ar}]4s^13d^5$ . 31) \_\_\_\_\_

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

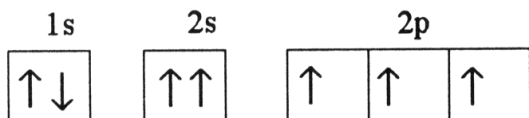
32) Which one of the following is the correct electron configuration for a ground-state nitrogen atom?

32) \_\_\_\_\_

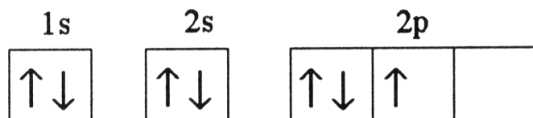
A)



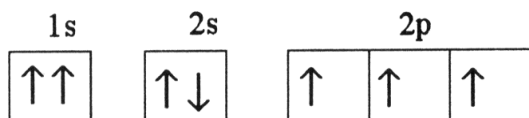
B)



C)



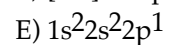
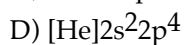
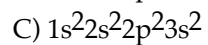
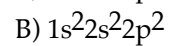
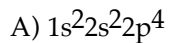
D)



E) None of the above is correct.

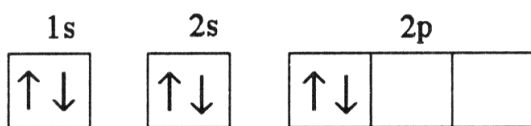
33) Which one of the following configurations depicts an excited oxygen atom?

33) \_\_\_\_\_

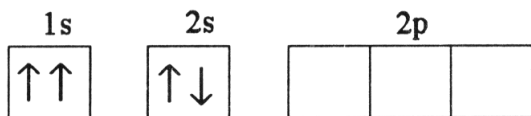


34) Which electron configuration represents a violation of Hund's rule for an atom in its ground state? 34) \_\_\_\_\_

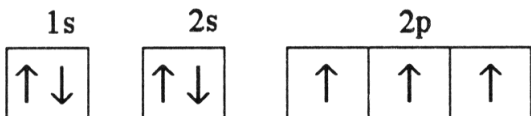
A)



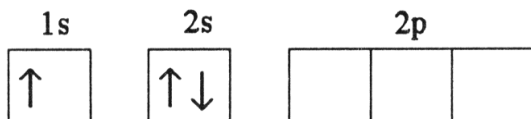
B)



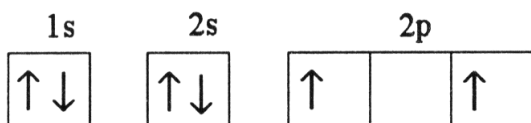
C)



D)



E)



35) The lowest orbital energy is reached when the number of electrons with the same spin is maximized. This statement describes \_\_\_\_\_. 35) \_\_\_\_\_

- A) deBroglie hypothesis
- B) Planck's constant
- C) Hund's rule
- D) Heisenberg Uncertainty Principle
- E) Pauli Exclusion Principle

36) The valence shell of the element X contains 2 electrons in a 5s subshell. Below that shell, element X has a partially filled 4d subshell. What type of element is X? 36) \_\_\_\_\_

- A) transition metal
- B) chalcogen
- C) halogen
- D) alkali metal
- E) main group element

37) In which set of elements would all members be expected to have very similar chemical properties? 37) \_\_\_\_\_

- A) S, Se, Si
- B) Na, Mg, K
- C) Ne, Na, Mg
- D) O, S, Se
- E) N, O, F

- 38) Electrons in the 1s subshell are much closer to the nucleus in Ar than in He due to the larger \_\_\_\_\_ in Ar. 38) \_\_\_\_\_
- A) azimuthal quantum number
  - B) paramagnetism
  - C) diamagnetism
  - D) nuclear charge
  - E) Hund's rule
- 39) The effective nuclear charge of an atom is primarily affected by \_\_\_\_\_. 39) \_\_\_\_\_
- A) inner electrons
  - B) orbital radial probability
  - C) nuclear charge
  - D) electron distribution
  - E) outer electrons
- 40) Of the following, which gives the correct order for atomic radius for Mg, Na, P, Si and Ar? 40) \_\_\_\_\_
- A) Ar > P > Si > Mg > Na
  - B) Si > P > Ar > Na > Mg
  - C) Na > Mg > Si > P > Ar
  - D) Mg > Na > P > Si > Ar
  - E) Ar > Si > P > Na > Mg
- 41) Which isoelectronic series is correctly arranged in order of increasing radius? 41) \_\_\_\_\_
- A)  $K^+ < Ca^{2+} < Ar < Cl^-$
  - B)  $Ca^{2+} < K^+ < Ar < Cl^-$
  - C)  $Cl^- < Ar < K^+ < Ca^{2+}$
  - D)  $Ca^{2+} < K^+ < Cl^- < Ar$
  - E)  $Ca^{2+} < Ar < K^+ < Cl^-$
- 42) Of the choices below, which gives the order for first ionization energies? 42) \_\_\_\_\_
- A) Ga > Ge > Se > Br > Kr
  - B) Kr > Br > Se > Ge > Ga
  - C) Ga > Br > Ge > Kr > Se
  - D) Kr > Se > Br > Ga > Ge
  - E) Br > Se > Ga > Kr > Ge
- 43) Which of the following correctly represents the second ionization of aluminum? 43) \_\_\_\_\_
- A)  $Al(g) \rightarrow Al^+(g) + e^-$
  - B)  $Al^+(g) \rightarrow Al^{2+}(g) + e^-$
  - C)  $Al^+(g) + e^- \rightarrow Al^{2+}(g)$
  - D)  $Al^+(g) + e^- \rightarrow Al(g)$
  - E)  $Al^-(g) + e^- \rightarrow Al^{2-}(g)$
- 44) Of the following species, \_\_\_\_\_ has the largest radius. 44) \_\_\_\_\_
- A)  $Rb^+$
  - B) Ar
  - C)  $Sr^{2+}$
  - D) Kr
  - E)  $Br^-$



Consider the following electron configurations to answer the questions that follow:

- (i)  $1s^2 2s^2 2p^6 3s^1$
- (ii)  $1s^2 2s^2 2p^6 3s^2$
- (iii)  $1s^2 2s^2 2p^6 3s^2 3p^1$
- (iv)  $1s^2 2s^2 2p^6 3s^2 3p^4$
- (v)  $1s^2 2s^2 2p^6 3s^2 3p^5$

45) The electron configuration belonging to the atom with the highest second ionization energy is \_\_\_\_\_ 45) \_\_\_\_\_  
A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

46) The electron configuration of the atom with the most negative electron affinity is \_\_\_\_\_ 46) \_\_\_\_\_  
A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

47) The electron configuration of the atom that is expected to have a positive electron affinity is \_\_\_\_\_ 47) \_\_\_\_\_  
A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

48) Sodium is much more apt to exist as a cation than is chlorine. This is because \_\_\_\_\_ 48) \_\_\_\_\_  
A) chlorine has a greater ionization energy than sodium does  
B) chlorine is more metallic than sodium  
C) chlorine is a gas and sodium is a solid  
D) chlorine is bigger than sodium  
E) chlorine has a greater electron affinity than sodium does

49) Which equation correctly represents the electron affinity of calcium? 49) \_\_\_\_\_  
A)  $\text{Ca}^-(\text{g}) \rightarrow \text{Ca}(\text{g}) + \text{e}^-$   
B)  $\text{Ca}^+(\text{g}) + \text{e}^- \rightarrow \text{Ca}(\text{g})$   
C)  $\text{Ca}(\text{g}) + \text{e}^- \rightarrow \text{Ca}^-(\text{g})$   
D)  $\text{Ca}(\text{g}) \rightarrow \text{Ca}^+(\text{g}) + \text{e}^-$   
E)  $\text{Ca}(\text{g}) \rightarrow \text{Ca}^-(\text{g}) + \text{e}^-$

50) Of the elements below, \_\_\_\_\_ is the most metallic. 50) \_\_\_\_\_  
A) sodium  
B) calcium  
C) cesium  
D) magnesium  
E) barium

51) The list that correctly indicates the order of metallic character is \_\_\_\_\_ 51) \_\_\_\_\_  
A)  $\text{F} > \text{Cl} > \text{Br}$   
B)  $\text{Sr} > \text{Ca} > \text{Mg}$   
C)  $\text{Li} > \text{Na} > \text{K}$   
D)  $\text{O} > \text{Se} > \text{S}$   
E)  $\text{C} > \text{Ge} > \text{Si}$

- 52) Transition metals within a period differ mainly in the number of \_\_\_\_\_ electrons. 52) \_\_\_\_\_  
A) d  
B) s  
C) p  
D) f  
E) all of the above
- 53) When two elements combine to form a compound, the greater the difference in metallic character between the two elements, the greater the likelihood that the compound will be \_\_\_\_\_. 53) \_\_\_\_\_  
A) metallic  
B) a gas at room temperature  
C) nonmetallic  
D) a liquid at room temperature  
E) a solid at room temperature
- 54) Which one of the following compounds would produce an acidic solution when dissolved in water? 54) \_\_\_\_\_  
A) CaO                      B) SrO                      C) Na<sub>2</sub>O                      D) CO<sub>2</sub>                      E) MgO
- 55) Consider the general valence electron configuration of  $ns^2np^5$  and the following statements: 55) \_\_\_\_\_  
(i) Elements with this electron configuration are expected to form -1 anions.  
(ii) Elements with this electron configuration are expected to have large positive electron affinities.  
(iii) Elements with this electron configuration are nonmetals.  
(iv) Elements with this electron configuration form acidic oxides.  
Which statements are true?  
A) (ii) and (iii)  
B) (i), (iii,) and (iv)  
C) (i) and (ii)  
D) (i), (ii), and (iii)  
E) All statements are true.
- 56) Which one of the following is not true about the alkali metals? 56) \_\_\_\_\_  
A) They all have 2 electrons in their valence shells.  
B) They have the lowest first ionization energies of the elements.  
C) They are low density solids at room temperature.  
D) They are very reactive elements.  
E) They all readily form ions with a +1 charge.
- 57) Which of the following generalizations cannot be made with regard to reactions of alkali metals? 57) \_\_\_\_\_  
(The symbol M represents any one of the alkali metals.)  
A)  $2M(s) + 2H_2O(l) \rightarrow 2MOH(aq) + H_2(g)$   
B)  $2M(s) + Cl_2(g) \rightarrow 2MCl(s)$   
C)  $M(s) + O_2(g) \rightarrow MO_2(s)$   
D)  $2M(s) + H_2(g) \rightarrow 2MH(s)$   
E)  $2M(s) + S(s) \rightarrow M_2S(s)$

- 58) Which one of the following elements has an allotrope that is produced in the upper atmosphere by lightning? 58) \_\_\_\_\_  
A) O                      B) N                      C) He                      D) Cl                      E) S
- 59) The noble gases were, until relatively recently, thought to be entirely unreactive. Experiments in the early 1960s showed that Xe could, in fact, form compounds with fluorine. The formation of compounds consisting of Xe is made possible by \_\_\_\_\_. 59) \_\_\_\_\_  
A) xenon's relatively low ionization energy  
B) xenon's relatively low electron affinity  
C) xenon's noble gas electron configuration  
D) the availability of xenon atoms  
E) the stability of xenon atoms
- 60) Hydrogen is unique among the elements because \_\_\_\_\_. 60) \_\_\_\_\_  
1. It has only one valence electron.  
2. It is the only element that can emit an atomic spectrum.  
3. Its electron is not at all shielded from its nucleus.  
4. It is the lightest element.  
5. It is the only element to exist at room temperature as a diatomic gas.  
A) 2, 3, 4  
B) 1, 2, 3, 4, 5  
C) 1, 2, 3, 4  
D) 3, 4  
E) 1, 3, 4
- 61) Astatine has a(n) \_\_\_\_\_ density and a(n) \_\_\_\_\_ atomic radius compared to iodine. 61) \_\_\_\_\_  
A) greater; greater  
B) smaller; greater  
C) equal; equal  
D) greater; smaller  
E) smaller; smaller
- 62) Alkali metals tend to be more reactive than alkaline earth metals because \_\_\_\_\_. 62) \_\_\_\_\_  
A) alkali metals have lower densities  
B) alkali metals have lower ionization energies  
C) alkali metals have greater electron affinities  
D) alkali metals have lower melting points  
E) Alkali metals are not more reactive than alkaline earth metals.

Answer Key

Testname: UNIT 2 STUDY GUIDE

- 1) B
- 2) B
- 3) E
- 4) D
- 5) A
- 6) E
- 7) A
- 8) E
- 9) D
- 10) C
- 11) E
- 12) D
- 13) A
- 14) D
- 15) A
- 16) E
- 17) C
- 18) B
- 19) D
- 20) A
- 21) A
- 22) A
- 23) D
- 24) C
- 25) A
- 26) A
- 27) B
- 28) C
- 29) B
- 30) A
- 31) A
- 32) A
- 33) C
- 34) A
- 35) C
- 36) A
- 37) D
- 38) D
- 39) A
- 40) C
- 41) B
- 42) B
- 43) B
- 44) E
- 45) A
- 46) E
- 47) B
- 48) A
- 49) C

Answer Key

Testname: UNIT 2 STUDY GUIDE

- 50) C
- 51) B
- 52) A
- 53) E
- 54) D
- 55) B
- 56) A
- 57) C
- 58) A
- 59) A
- 60) D
- 61) A
- 62) B