

Name \_\_\_\_\_

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

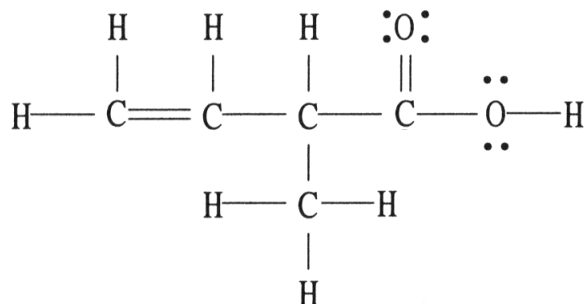
- 1) The energy of a photon of light is \_\_\_\_\_ proportional to its frequency and \_\_\_\_\_ proportional to its wavelength. 1) \_\_\_\_\_  
A) directly, inversely  
B) directly, directly  
C) indirectly, not  
D) inversely, inversely  
E) inversely, directly
- 2) What color of visible light has the longest wavelength \_\_\_\_\_? 2) \_\_\_\_\_  
A) violet            B) green            C) yellow            D) red            E) blue
- 3) Of the following transitions in the Bohr hydrogen atom, the \_\_\_\_\_ transition results in the emission of the highest-energy photon. 3) \_\_\_\_\_  
A)  $n = 1 \rightarrow n = 6$   
B)  $n = 3 \rightarrow n = 6$   
C)  $n = 6 \rightarrow n = 3$   
D)  $n = 1 \rightarrow n = 4$   
E)  $n = 6 \rightarrow n = 1$
- 4) The \_\_\_\_\_ subshell contains only one orbital. 4) \_\_\_\_\_  
A) 6f            B) 4s            C) 1p            D) 3d            E) 5d
- 5) The ground state electron configuration for Zn is \_\_\_\_\_. 5) \_\_\_\_\_  
A)  $[\text{Ar}]4s^23d^{10}$   
B)  $[\text{Kr}]3s^23d^{10}$   
C)  $[\text{Kr}]4s^23d^{10}$   
D)  $[\text{Ar}]4s^13d^{10}$   
E)  $[\text{Ar}]3s^23d^{10}$
- 6) All of the \_\_\_\_\_ have a valence shell electron configuration  $ns^1$ . 6) \_\_\_\_\_  
A) noble gases  
B) alkali metals  
C) chalcogens  
D) halogens  
E) alkaline earth metals
- 7) Elements in the modern version of the periodic table are arranged in order of increasing \_\_\_\_\_. 7) \_\_\_\_\_  
A) oxidation number  
B) average atomic mass  
C) number of isotopes  
D) atomic mass  
E) atomic number

- 8) In general, as you go across a period in the periodic table from left to right: 8) \_\_\_\_\_
- (1) the atomic radius \_\_\_\_\_;
  - (2) the electron affinity becomes \_\_\_\_\_ negative; and
  - (3) the first ionization energy \_\_\_\_\_.
- A) decreases, increasingly, increases
  - B) decreases, increasingly, decreases
  - C) increases, increasingly, decreases
  - D) decreases, decreasingly, increases
  - E) increases, increasingly, increases
- 9) The \_\_\_\_\_ have the lowest ionization energy. 9) \_\_\_\_\_
- A) alkali metals
  - B) chalcogens
  - C) transition metals
  - D) halogens
  - E) alkaline earth metals
- 10) In the Lewis symbol for a fluorine atom, there are \_\_\_\_\_ paired and \_\_\_\_\_ unpaired 10) \_\_\_\_\_  
electrons.
- A) 4,1
  - B) 6, 1
  - C) 4, 2
  - D) 0, 5
  - E) 2, 5
- 11) Based on the octet rule, phosphorus most likely forms a \_\_\_\_\_ ion. 11) \_\_\_\_\_
- A)  $P^{3+}$
  - B)  $P^+$
  - C)  $P^{5+}$
  - D)  $P^{5-}$
  - E)  $P^{3-}$
- 12) The only noble gas without eight valence electrons is \_\_\_\_\_. 12) \_\_\_\_\_
- A) Ne
  - B) Ar
  - C) He
  - D) Kr
  - E) All noble gases have eight valence electrons.
- 13) Which of the following would have to lose two electrons in order to achieve a noble gas electron 13) \_\_\_\_\_  
configuration \_\_\_\_\_?
- O    Sr    Na    Se    Br
- A) Na
  - B) Sr, O, Se
  - C) Sr
  - D) O, Se
  - E) Br
- 14) A double bond consists of \_\_\_\_\_ pairs of electrons shared between two atoms. 14) \_\_\_\_\_
- A) 1
  - B) 2
  - C) 3
  - D) 4
  - E) 6
- 15) A polar bond will form between two \_\_\_\_\_ atoms of \_\_\_\_\_ electronegativity. 15) \_\_\_\_\_
- A) different, opposite
  - B) identical, different
  - C) similar, different
  - D) identical, equal
  - E) different, different

- 16) The formal charge on carbon in the molecule below is \_\_\_\_\_. 16) \_\_\_\_\_
- $\begin{array}{c} \cdot\cdot & & \cdot\cdot \\ \cdot\cdot & \text{O}=\text{C}=\text{O} & \cdot\cdot \\ \cdot\cdot & & \cdot\cdot \end{array}$
- A) +1                      B) +2                      C) +3                      D) -1                      E) 0
- 17) According to VSEPR theory, if there are four electron domains in the valence shell of an atom, they will be arranged in a(n) \_\_\_\_\_ geometry. 17) \_\_\_\_\_
- A) trigonal planar  
B) octahedral  
C) trigonal bipyramidal  
D) linear  
E) tetrahedral
- 18) The molecular geometry of the CS<sub>2</sub> molecule is \_\_\_\_\_. 18) \_\_\_\_\_
- A) tetrahedral  
B) linear  
C) T-shaped  
D) bent  
E) trigonal planar
- 19) According to valence bond theory, which orbitals on hydrogen atoms overlap in the formation of the bond in H<sub>2</sub>? 19) \_\_\_\_\_
- A) 1s                      B) 1p                      C) 2s                      D) 2p                      E) 3d
- 20) The hybridization of orbitals on the central atom in a molecule is sp<sup>2</sup>. The electron-domain geometry about this central atom is \_\_\_\_\_. 20) \_\_\_\_\_
- A) trigonal planar  
B) tetrahedral  
C) linear  
D) octahedral  
E) trigonal bipyramidal
- 21) In order to produce sp<sup>3</sup> hybrid orbitals, \_\_\_\_\_ s atomic orbital(s) and \_\_\_\_\_ p atomic orbital(s) must be mixed. 21) \_\_\_\_\_
- A) one, three              B) two, two              C) two, three              D) one, two              E) one, one
- 22) There are \_\_\_\_\_ σ and \_\_\_\_\_ π bonds in the H<sub>2</sub>C=C=CH<sub>2</sub> molecule. 22) \_\_\_\_\_
- A) 6, 4                      B) 4, 2                      C) 2, 2                      D) 2, 6                      E) 6, 2

23) There is/are \_\_\_\_\_  $\pi$  bond(s) in the molecule below.

23) \_\_\_\_\_



A) 0

B) 1

C) 2

D) 4

E) 16

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

24) (3 pts) What is the energy (J) of a green photon of light that has wavelength of 532 nm? 24) \_\_\_\_\_  
( $h = 6.626 \times 10^{-34}$  J s)

25) (3 pts) Explain the main observation about the H-emission spectrum and what new theory concerning the structure of the atom is inspired. 25) \_\_\_\_\_

26) (2 pts) What is the condensed electronic configuration aluminum (Al) and indicate how many core electrons it has and how many valence electrons it has. 26) \_\_\_\_\_

27) (3 pts) Why does effective nuclear charge increase from left to right on the periodic table? 27) \_\_\_\_\_

28) (2 pts) (Circle the right choice) Halogens are very reactive because they ARE / ARE NOT very electronegative. 28) \_\_\_\_\_

29) (3 pts) Briefly describe the characteristics of a covalent bond 29) \_\_\_\_\_

30) (9 pts) Draw the Lewis structure for  $\text{C}_2\text{F}_4$ , CO, and  $\text{SO}_3$  (draw all resonance structures, if any). For each compound indicate the total number of electrons and the formal charge of each atom. 30) \_\_\_\_\_

31) (5 pts) How many electron domains are there in  $\text{CHCl}_3$ ? what will the shape be? Is it polar or nonpolar? 31) \_\_\_\_\_

32) (5 pts) How many electron domains are there in  $\text{N}_3^-$ ? what will the shape be? Is it polar or nonpolar? 32) \_\_\_\_\_

33) (2 pts) Describe the location of the electrons in a pi bond with respect to the nuclei. 33) \_\_\_\_\_

34) (8 pts) Draw a picture of the resulting orbitals when an 's' orbital hybridizes with a 'p' orbital. How many hybrid orbitals are produced? What is the 3-D shape that these orbitals have? What is the name of this hybridization? 34) \_\_\_\_\_

35) (3 pts) Explain how nonbonding electrons influence the shape of molecules. 35) \_\_\_\_\_

## Answer Key

### Testname: PRACTICE TEST 3

- 1) A
- 2) D
- 3) E
- 4) B
- 5) A
- 6) B
- 7) E
- 8) A
- 9) A
- 10) B
- 11) E
- 12) C
- 13) C
- 14) B
- 15) E
- 16) E
- 17) E
- 18) B
- 19) A
- 20) A
- 21) A
- 22) E
- 23) C
- 24)  $3.74 \times 10^{-19} \text{ J}$
- 25) The colors that were emitted were in discrete lines, not a continuum. This led to the conclusion that electrons were in quantized orbits around the nucleus and that light absorbed or emitted corresponded to distinct jumps between these energy levels. This was the Bohr model of the atom.
- 26) Al :  $[\text{Ne}] 3s^2 3p^1$  10 core electrons and 3 valence
- 27) Because the atomic number (Z) increases but the number of shielding electrons (S) stays the same. Since  $Z_{\text{eff}} = Z - S$ , if Z increases and S is the same, then  $Z_{\text{eff}}$  will increase.
- 28) ARE
- 29) A covalent bond occurs between two atoms when they share electrons. Electrons in half full orbitals will overlap to complete their octet and act a 'glue' to hold the nuclei together.
- 30)  $\text{C}_2\text{F}_4$  has 36 e<sup>-</sup>, all atoms have a formal charge of 0.  
CO has 10 e<sup>-</sup>, the formal charges are: C = -1 and O = +1  
 $\text{SO}_3$  has 24 e<sup>-</sup>, the formal charges are: S = +2, O = 0, O = -1, and O = -1.
- 31) 4 domains, tetrahedral, polar
- 32) 2 domains, linear, nonpolar
- 33) The bonding electrons in above and below the nuclei.
- 34) 2 orbitals are produced. The hybridization is an 'sp' hybrid.
- 35) Nonbonding electrons take up more space than bonding electrons and act to compress the bond angles of the other electron domains.