CHM 151 Exam 3 Fall 2003 Name:_____

1. In general, as you go across a period in the periodic table from left to right: (1) the atomic radius _____; (2) the electron affinity becomes _____ negative; and (3) the first ionization energy _____.
   a. decreases, decreasingly, increases
   b. increases, increasingly, decreases
   c. increases, increasingly, increases
   d. decreases, increasingly, increases
   e. decreases, decreasingly, decreases

2. Which of the following would have to gain two electrons in order to achieve a noble gas electron configuration?

   O Sr Na Se Br

   a. Br
   b. Sr
   c. Na
   d. O & Se
   e. Sr, O, & Se

3. The wavelength of a photon that has an energy of 5.25×10^{-19} J is _____ m.
   a. 3.79×10^{-7}
   b. 2.64×10^{6}
   c. 2.38×10^{23}
   d. 4.21×10^{-24}
   e. 3.79×10^{7}

4. There are _____ unpaired electrons are there in a ground state phosphorus atom.
   a. 0
   b. 1
   c. 2
   d. 3
   e. 4

5. Which isoelectronic series is correctly arranged in order of increasing radius?
   a. $K^+ < Ca^{2+} < Ar < Cl^-$
   b. $Cl^- < Ar < K^+ < Ca^{2+}$
   c. $Ca^{2+} < Ar < K^+ < Cl^-$
   d. $Ca^{2+} < K^+ < Ar < Cl^-$
   e. $Ca^{2+} < K^+ < Cl^- < Ar$

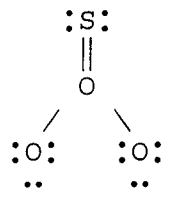
6. Which one of the following atoms has the largest radius?
   a. O
   b. F
   c. S
   d. Cl
   e. Ne

7. How many different resonance structures can be drawn for the molecule SO_3?
   a. 5
   b. 2
   c. 1
   d. 4
   e. 3

8. The molecular geometry of the $PHCl_2$ molecule is _____.
   a. bent
   b. trigonal planar
   c. trigonal pyramidal
   d. tetrahedral
   e. T-shaped

9. The Lewis structure of SO_3 is _____.

a.



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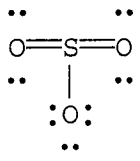

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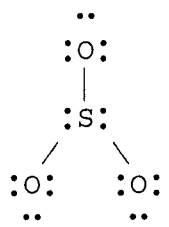

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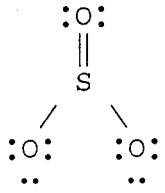

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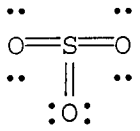


10. The molecular geometry of the CHF_3 molecule is _____, and the molecule is _____.
    a. trigonal pyramidal, polar
    b. tetrahedral, nonpolar
    c. seesaw, nonpolar
    d. tetrahedral, polar
    e. seesaw, polar

11. Which one of the following is the electron configuration for the Fe^{2+} ion?
    a. $[Ar]4s^03d^6$
    b. $[Ar]4s^23d^4$
    c. $[Ar]4s^03d^8$
    d. $[Ar]4s^23d^8$
    e. $[Ar]4s^63d^2$

12. The electron-domain geometry and molecular geometry of iodine trichloride are _____ and _____, respectively.
    a. trigonal planar, trigonal planar
    b. tetrahedral, trigonal pyramidal
    c. trigonal bipyramidal, T-shaped
    d. octahedral, trigonal planar
    e. T-shaped, trigonal planar

13. Which ion in the isoelectronic series below has the largest radius?
    a. Al^{3+}
    b. Na^{+}
    c. O^{2-}
    d. F^{-}
    e. N^{3-}

14. There are ____ orbitals in the second shell.
    a. 1
    b. 2
    c. 4
    d. 8
    e. 9

15. What is the frequency of light (cm^{-1}) that has a wavelength of 3.12×10^{-3} cm?
    a. 3.69
    b. 2.44×10^{16}
    c. 9.62×10^{12}
    d. 4.10×10^{-17}
    e. 1.04×10^{-13}

16. The Lewis structure of PF_3 shows that the central phosphorus atom has _____ nonbonding and _____ bonding electron pairs.
    a. 2, 2
    b. 1, 3
    c. 3, 1
    d. 2, 3
    e. 3, 3

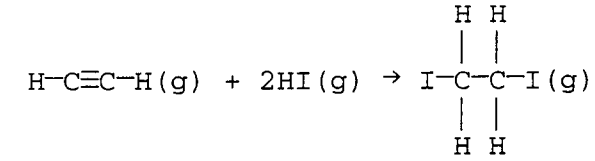
17. The energy (J) required for an electronic transition in a Bohr hydrogen atom from n=2 to n=3 is _____ J.
    a. 4.0×10^{-19}
    b. 3.0×10^{-19}
    c. -3.0×10^{-19}
    d. -7.9×10^{-19}
    e. 4.6×10^{14}

18. What is the frequency (s^{-1}) of electromagnetic radiation that has a wavelength of 0.53 m?
    a. 5.7×10^{8}
    b. 1.8×10^{-9}
    c. 1.6×10^{8}
    d. 1.3×10^{-33}
    e. 1.3×10^{33}

19. The total number of π bonds in the H-C≡C-C≡C-C≡N molecule is _____.
    a. 3
    b. 4
    c. 6
    d. 9
    e. 12

20. Of the following atoms, which has the largest <u>first</u> ionization energy?
    a. Br
    b. O
    c. C
    d. P
    e. I

21. Using the table of average bond energies below, the ΔH for the reaction:



    is _____ kJ.

Bond:	C≡C	C-C	H-I	C-I	C-H
BE(kJ/mol):	839	348	299	240	413

    a. +160
    b. -160
    c. -217
    d. -63
    e. +63

22. Which one of the following configurations depicts an excited oxygen atom?
    a. $1s^2 2s^2 2p^2$
    b. $1s^2 2s^2 2p^2 3s^2$
    c. $1s^2 2s^2 2p^1$
    d. $1s^2 2s^2 2p^4$
    e. $[He]2s^2 2p^4$

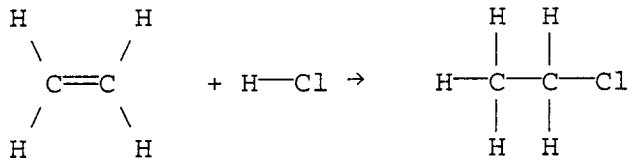
23. The ability of an atom in a molecule to attract electrons is best quantified by the _____.
    a. paramagnetism
    b. diamagnetism
    c. electronegativity
    d. electron change-to-mass ratio
    e. first ionization potential

24. Of the following, which gives the correct order for atomic radius for Mg, Na, P, Si and Ar?
    a. Mg > Na > P > Si > Ar
    b. Ar > Si > P > Na > Mg
    c. Si > P > Ar > Na > Mg
    d. Na > Mg > Si > P > Ar
    e. Ar > P > Si > Mg > Na

25. Which of the following sets contains species that are isoelectronic?
    a. F, Ne, Na
    b. P^{3-}, S^{2-}, Ar^-
    c. P^{3+}, S^{2-}, Ar
    d. Cl, Ar, K
    e. F^-, Ne, Na^+

26. The ground state electron configuration of Fe is _____.
    a. $1s^2 2s^2 3s^2 3p^6 3d^6$
    b. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$
    c. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
    d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^6$
    e. $1s^2 2s^2 3s^2 3p^{10}$

27. Using the table of bond dissociation energies, the ΔH for the following gas-phase reaction is _____ kJ.



Bond	BE(kJ/mol)
C-C	348
C=C	614
C-H	413
H-Cl	431
C-Cl	328

a. -44
b. 38
c. 304
d. 2134
e. -38

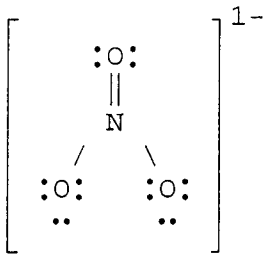
28. The F—Cl—F bond angle in ClF_3 is _____.
a. 109.5°
b. 120°
c. 180°
d. 90°
e. slightly less than 109.5°

29. The energy of a photon of light is _____ proportional to its frequency and _____ proportional to its wavelength.
a. directly, directly
b. inversely, inversely
c. inversely, directly
d. directly, inversely
e. indirectly, not

30. The _____ subshell contains only one orbital.
a. 5d
b. 6f
c. 4s
d. 3d
e. 1p

31. The hybridization of the carbon atom in carbon dioxide is _____.
    a. sp
    b. sp^2
    c. sp^3
    d. sp^3d
    e. sp^3d^2

32. The formal charge on nitrogen in NO_3^- is _____.



    a. -1
    b. 0
    c. +1
    d. +2
    e. -2

33. The 1s orbital is the smallest in _____ atoms.
    a. Cl
    b. F
    c. Br
    d. I
    e. the 1s orbitals in all of these atoms are the same size

34. Which of the following has the largest second ionization energy?
    a. Ca
    b. K
    c. Ga
    d. Ge
    e. Se

1. d
2. d
3. a
4. d
5. d
6. c
7. e
8. c
9. d
10. d
11. a
12. c
13. e
14. c
15. c
16. b
17. b
18. a
19. c
20. b
21. c
22. b
23. c
24. d
25. e
26. b
27. a
28. c
29. d
30. c
31. a
32. c
33. d
34. b