CHM151 Study Guide Fall 2010 Name:_____

1. The wavelength of light that has a frequency of $1.20 \times 10^{13} s^{-1}$ is _____ μm.
   a) 25.0 b) 2.50×10^{-5} c) 0.0400 d) 12.0 e) 2.5

2. The photoelectric effect is _____.
   a) the total reflection of light by metals giving them their typical luster
   b) the production of current by silicon solar cells when exposed to sunlight
   c) the ejection of electrons by a metal when struck by light
   d) the darkening of photographic film when exposed to an electric field
   e) a relativistic effect

3. The energy of a photon that has a wavelength of 12.3 nm is _____ J.
   a) 1.51×10^{-17} b) 4.42×10^{-23} c) 1.99×10^{-25}
   d) 2.72×10^{-50} e) 1.62×10^{-17}

4. Of the following transitions in the Bohr hydrogen atom, the _____ transition results in the emission of the highest-energy photon.
   a) $n = 1 \rightarrow n = 6$ b) $n = 6 \rightarrow n = 1$ c) $n = 6 \rightarrow n = 3$
   d) $n = 3 \rightarrow n = 6$ e) $n = 1 \rightarrow n = 4$

5. Calculate the energy (J) change associated with an electron transition from n=2 to n=5 in a Bohr hydrogen atom.
   a) 6.5×10^{-19} b) 5.5×10^{-19} c) 8.7×10^{-20}
   d) 4.6×10^{-19} e) 5.8×10^{-53}

6. There are ____ orbitals in the third shell.
   a) 25 b) 4 c) 9 d) 16 e) 1

7. Each p-subshell can accommodate a maximum of _____ electrons.
   a) 6 b) 2 c) 10 d) 3 e) 5

8. Which one of the following orbitals can hold two electrons?
   a) $2p_x$ b) 3s c) $4d_{xy}$
   d) all of the above e) none of the above

9. 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) $1s^2 2s^2 3s^2 3p^{10}$

10. 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) $[He] 2s^2 2p^4$

11. 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

12. In which of the following atoms is the 3s orbital closest to the nucleus?
    a) Br b) Cl c) At d) I
    e) The 3s orbitals are the same distance from the nucleus in all of these atoms.

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

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

15. 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

16. Which element has the greatest metallic character?
a) F b) Br c) Cl d) I
e) None of these elements has any metallic character.

17. Oxides of most nonmetals combine with water to form _____.
a) an acid b) a base c) water and a salt
d) water e) hydrogen gas

18. For which of the following atoms does the Lewis symbol have no unpaired electrons?

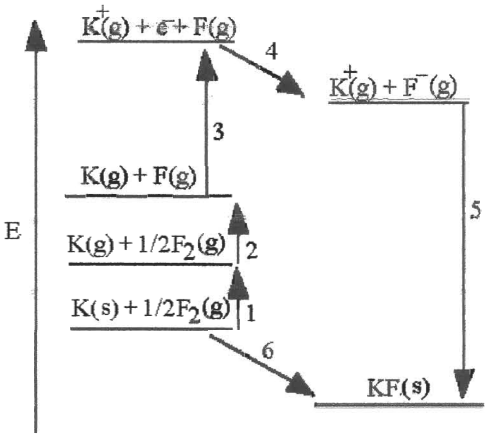
O F Se N Ne C

a) Ne b) C & Ne c) C, O & Ne
d) O, C, & N e) O, F, C, & Se

19. The chloride of which of the following metals should have the greatest lattice energy?
a) potassium b) rubidium c) sodium d) lithium e) cesium

20. Which one of the following is the electron configuration for the Fe^{2+} ion?
a) [Ar] $4s^0 3d^6$
b) [Ar] $4s^2 3d^4$
c) [Ar] $4s^0 3d^8$
d) [Ar] $4s^2 3d^8$
e) [Ar] $4s^6 3d^2$

21. The diagram below is the Born-Haber cycle for the formation of crystalline potassium fluoride. Which energy change corresponds to the negative lattice energy of potassium fluoride?
a) 2
b) 5
c) 4
d) 1
e) 6



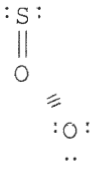
22. Which ion in the isoelectronic series below has the smallest radius?
a) Al^{3+} b) Na^+ c) O^{2-} d) F^- e) N^{3-}

23. The ion ICl_4^- has _____ valence electrons.
a) 34 b) 35 c) 36 d) 28 e) 8

24. The Lewis structure of AsH_3 shows _____ nonbonding electron pair(s) on As.
a) 0 b) 1 c) 2 d) 3
e) This cannot be determined from the data given.

25. Draw the Lewis structure of ICl_2^+.

26. The Lewis structure of SO_3 is _____.

a)


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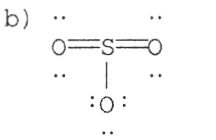

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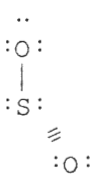
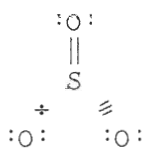
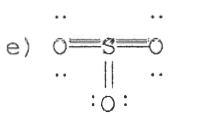
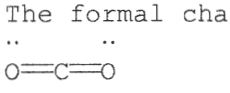


d)


e)


27. The formal charge on carbon in the molecule below is _____.



a) 0 b) +1 c) +2 d) +3 e) -1

28. How many resonance forms can be drawn for CO_3^{2-} (carbon is the central atom)?

29. The central atom in _____ violates the octet rule.
a) NF_3 b) IF_3 c) PF_3 d) SbF_3 e) SO_4^{2-}

30. From the information given below, calculate the heat of combustion of methane (CH_4) (in kJ/mol). Start by writing the balanced equation.

Bond	BE (kJ/mol)
C-H	413
O=O	495
C=O	799
O-H	463

Only questions up to number 30 apply to the fall 2011 exam 3;

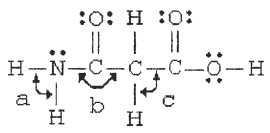
31. The basis of the VSEPR model of molecu
a) regions of electron density on an atom will organize themselves so as to maximize *s*-character
b) regions of electron density in the valence shell of an atom will arrange themselves so as to maximize overlap
c) atomic orbitals of the bonding atoms must overlap for a bond to form
d) electron pairs in the valence shell of an atom will arrange themselves so as to minimize repulsions
e) hybrid orbitals will form as necessary to, as closely as possible, achieve spherical symmetry

32. 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

33. The molecular geometry of _____ is square planar.
a) CCl_4 b) XeF_4 c) PH_3 d) XeF_2 e) ICl_3

34. The molecular geometry of the BrO_3^- ion is _____.
a) trigonal pyramidal b) trigonal planar
c) bent d) tetrahedral e) T-shaped

35. The bond angles marked a, b, and c in the molecule below are about ____, _____, and _____, respectively.
a) 90°, 90°, 90°
b) 120°, 120°, 90°
c) 120°, 120°, 109.5°
d) 109.5°, 120°, 109.5°
e) 109.5°, 90°, 120°



36. Of the molecules below, _____ is polar.
a) SbF_5 b) AsH_3 c) I_2 d) SF_6 e) CH_4

37. The molecular geometry of the BCl_3 molecule is _____, and this molecule is _____.
a) trigonal pyramidal, polar b) trigonal pyramidal, nonpolar
c) trigonal planar, polar d) trigonal planar, nonpolar
e) trigonal bipyramidal, polar

38. The hybridization of the central atom in the XeF_4 molecule is _____.
a) sp b) sp^2 c) sp^3 d) sp^3d e) sp^3d^2

39. A typical triple bond _____.
a) consists of one σ bond and two π bonds
b) consists of three shared electrons
c) consists of two σ bonds and one π bond
d) consists of six shared electron pairs
e) is longer than a single bond

40. The total number of π bonds in the H-C≡C-C≡C-C≡N molecule is _____.

ANSWER KEY FOR TEST - EX3PRS10

1. a
2. c
3. e
4. b

5. d
6. c

7. a

8. d

9. b

10. b

11. d
12. c

13. b

14. b

15. d

16. d

17. a

18. a

19. d

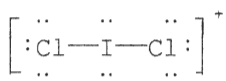
20. a

21. b

22. a

23. c

24. b

25. 

26. d

27. a

28. c Three

29. c

30. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$\rho H_{combustion}$ = (4 mol C-H)(BE_{C-H}) + (2 mol O=O)($BE_{O=O}$) - [(2 mol C=O)($BE_{C=O}$) - (4 mol O-H)(BE_{O-H})]

[(4 x 413 + 2 x 495) - (2 x 799 + 4 x 463)] kJ

$\rho H_{combustion}$ = -808 kJ

31. d

32. c

33. b

34. a

35. d

36. b

37. d

38. e

39. a

40. c six