**8.1 Multiple-Choice and Bimodal Questions**

1) There are _____ paired and _____ unpaired electrons in the Lewis symbol for a phosphorus atom.

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

2) In the Lewis symbol for a fluorine atom, there are _____ paired and _____ unpaired electrons.

A) 4, 2
B) 4,1
C) 2, 5
D) 6, 1
E) 0, 5

3) Based on the octet rule, magnesium most likely forms a _____ ion.

A) $Mg^{2+}$
B) $Mg^{2-}$
C) $Mg^{6-}$
D) $Mg^{6+}$
E) $Mg^{-}$

4) Based on the octet rule, phosphorus most likely forms a _____ ion.

A) $P^{3+}$
B) $P^{3-}$
C) $P^{5+}$
D) $P^{5-}$
E) $P^{+}$

5) Based on the octet rule, iodine most likely forms an _____ ion.

A) $I^{2+}$
B) $I^{4+}$
C) $I^{4-}$
D) $I^{+}$
E) $I^{-}$

6) There are _____ unpaired electrons in the Lewis symbol for an oxygen atom.

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

7) How many unpaired electrons are there in the Lewis structures of a $N^{3-}$ ion?

A) 0
B) 1
C) 2
D) 3
E) This cannot be predicted.

8) How many unpaired electrons are there in an $O^{2-}$ ion?

A) 0
B) 1
C) 2
D) 3
E) This cannot be predicted.

9) The electron configuration of the phosphide ion ($P^{3-}$) is _____.

A) $[Ne]3S^2$
B) $[Ne]3S^2 3P^1$
C) $[Ne]3S^2 3P^3$
D) $[Ne]3P^2$
E) $[Ne]3S^2 3P^6$

10) The halogens, alkali metals, and alkaline earth metals have _____ valence electrons, respectively.

A) 7, 4, and 6
B) 1, 5, and 7
C) 8, 2, and 3
D) 7, 1, and 2
E) 2, 7, and 4

11) The only noble gas without eight valence electrons is _____.

A) Ar
B) Ne
C) He
D) Kr
E) All noble gases have eight valence electrons.

12) Which of the following would have to lose two electrons in order to achieve a noble gas electron configuration?
O Sr Na Se Br

A) O, Se
B) Sr
C) Na
D) Br
E) Sr, O, Se

13) 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

14) For a given arrangement of ions, the lattice energy increases as ionic radius _____ and as ionic charge _____.

A) decreases, increases
B) increases, decreases
C) increases, increases
D) decreases, decreases
E) This cannot be predicted.

15) The electron configuration of the $S^{2-}$ ion is _____.

A) $[Ar]3S^2 3p^6$
B) $[Ar]3S^2 3p^2$
C) $[Ne]3S^2 3p^2$
D) $[Ne]3S^2 3p^6$
E) $[Kr]3S^2 2p^{-6}$

16) The principal quantum number of the electrons that are lost when tungsten forms a cation is _____.

A) 6
B) 5
C) 4
D) 3
E) 2

17) Which one of the following species has the electron configuration $[Ar]3d^4$?

A) $Mn^{2+}$
B) $Cr^{2+}$
C) $V^{3+}$
D) $Fe^{3+}$
E) $K^+$

18) What is the electron configuration for the $Co^{2+}$ ion?

A) $[Ar]4S^1 3d^6$
B) $[Ar]4S^0 3d^7$
C) $[Ar]4S^0 3d^5$
D) $[Ar]4S^2 3d^9$
E) $[Ne]3S^2 3p^{10}$

19) What 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) $[Ar]4S^6 3d^2$

20) The formula of palladium(IV) sulfide is _____.

A) $Pd_2S_4$

B) $PdS_4$

C) $Pd_4S$

D) $PdS_2$

E) $Pd_2S_2$

21) Elements from opposite sides of the periodic table tend to form _____.

A) covalent compounds
B) ionic compounds
C) compounds that are gaseous at room temperature
D) homonuclear diatomic compounds
E) covalent compounds that are gaseous at room temperature

22) Determining lattice energy from Born-Haber cycle data requires the use of _____.

A) the octet rule
B) Coulomb's law
C) Periodic law
D) Hess's law
E) Avogadro's number

23) How many single covalent bonds must a silicon atom form to have a complete octet in its valence shell?

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

24) A _____ covalent bond between the same two atoms is the longest.

A) single
B) double
C) triple
D) They are all the same length.
E) strong

25) How many hydrogen atoms must bond to silicon to give it an octet of valence electrons?

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

26) A double bond consists of _____ pairs of electrons shared between two atoms.

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

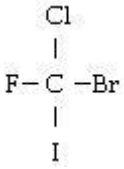
27) What is the maximum number of double bonds that a hydrogen atom can form?

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

28) What is the maximum number of double bonds that a carbon atom can form?

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

29) In the molecule below, which atom has the largest partial negative charge _____?




A) Cl
B) F
C) Br
D) I
E) C

30) 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

31) Given the electronegativities below, which covalent single bond is most polar?

| Element: | H | C | N | O |
|---|---|---|---|---|
| Electronegativity: | 2.1 | 2.5 | 3.0 | 3.5 |

A) C-H
B) N-H
C) O-H
D) O-C
E) O-N

32) Electronegativity _____ from left to right within a period and _____ from top to bottom within a group.

A) decreases, increases
B) increases, increases
C) increases, decreases
D) stays the same, increases
E) increases, stays the same

33) A nonpolar bond will form between two _____ atoms of _____ electronegativity.

A) different, opposite
B) identical, different
C) different, different
D) similar, different
E) identical, equal

34) The ion $ICl_4^-$ has _____ valence electrons.

A) 34
B) 35
C) 36
D) 28
E) 8

35) The ion $NO^-$ has _____ valence electrons.

A) 15
B) 14
C) 16
D) 10
E) 12

36) 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.

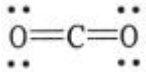
37) The Lewis structure of $PF_3$ shows that the central phosphorus atom has _____ nonbonding and _____ bonding electron pairs.

A) 2, 2
B) 1, 3
C) 3, 1
D) 1, 2
E) 3, 3

38) The Lewis structure of HCN (H bonded to C) shows that _____ has _____ nonbonding electron pairs.

A) C, 1
B) N, 1
C) H, 1
D) N, 2
E) C, 2

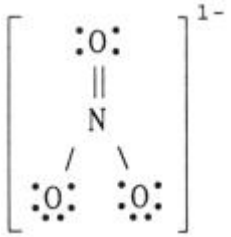
39) The formal charge on carbon in the molecule below is _____.



A) 0
B) +1
C) +2
D) +3
E) -1

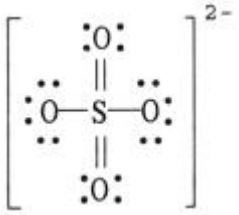
40) The formal charge on nitrogen in $NO_3^-$ is

_____.



A) -1
B) 0
C) +1
D) +2
E) -2

41) The formal charge on sulfur in $SO_4^{2-}$ is _____, where the Lewis structure of the ion is:

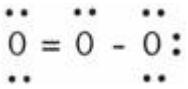


A) -2
B) 0
C) +2
D) +4
E) -4

42) In the Lewis structure of ClF, the formal charge on Cl is _____ and the formal charge on F is _____.

A) -1, -1
B) 0, 0
C) 0, -1
D) +1, -1
E) -1, +1

43) In the resonance form of ozone shown below, the formal charge on the central oxygen atom is _____.



A) 0
B) +1
C) -1
D) +2
E) -2

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

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

45) How many equivalent resonance forms can be drawn for $SO_2$ without expanding octet on the sulfur atom (sulfur is the central atom)?

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

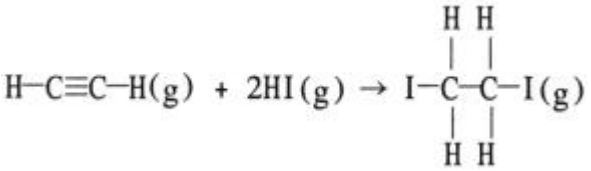
46) How many equivalent resonance structures can be drawn for the molecule of $SO_3$ without having to violate the octet rule on the sulfur atom?

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

47) How many different types of resonance structures can be drawn for the ion $SO_3^{2-}$ where all atoms satisfy the octet rule?

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

48) Using the table of average bond energies below, the $\Delta H$ for the reaction is _____ kJ.



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

A) +160
B) -160
C) -217
D) -63
E) +63

49) Using the table of average bond energies below, the $\Delta H$ for the reaction is _____ kJ.

$$H-C\equiv C-H\,(g) + H-I\,(g) \rightarrow H_2C=CHI\,(g)$$

| Bond: | C≡C | C=C | H-I | C-I | C-H |
|---|---|---|---|---|---|
| D (kJ/mol): | 839 | 614 | 299 | 240 | 413 |

A) +506
B) -931
C) -506
D) -129
E) +129

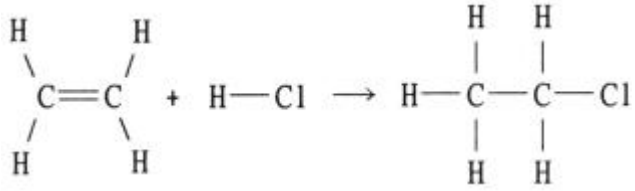
50) Using the table of average bond energies below, the $\Delta H$ for the reaction is _____ kJ.

$$C\equiv O\,(g)+2H_2\,(g) \rightarrow H_3C-O-H\,(g)$$

| Bond: | C-O | C=O | C≡O | C-H | H-H | O-H |
|---|---|---|---|---|---|---|
| D (kJ/mol): | 358 | 799 | 1072 | 413 | 436 | 463 |

A) +276
B) -276
C) +735
D) -735
E) -116

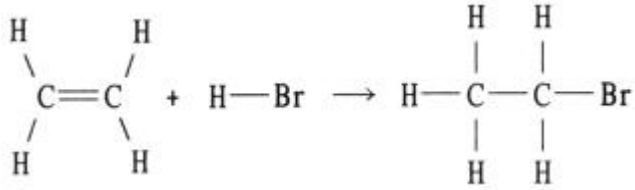
51) Using the table of bond dissociation energies, the $\Delta H$ for the following gas-phase reaction is _____ kJ.



| Bond | D (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

52) Using the table of bond dissociation energies, the $\Delta H$ for the following gas-phase reaction is _____ kJ.



| Bond | D (kJ/mol) |
|---|---|
| C-C | 348 |
| C=C | 614 |
| C-H | 413 |
| H-Br | 366 |
| C-Br | 276 |

A) 291
B) 2017
C) -57
D) -356
E) -291

53) Using the table of bond dissociation energies, the $\Delta H$ for the following reaction is _____ kJ.

$$2HCl\,(g) + F_2\,(g) \rightarrow 2HF\,(g) + Cl_2\,(g)$$

| Bond | D (kJ/mol) |
|---|---|
| H-Cl | 431 |
| F-F | 155 |
| H-F | 567 |
| Cl-Cl | 242 |

A) -359
B) -223
C) 359
D) 223
E) 208

**8.2 Multiple-Choice Questions**

1) Which ion below has a noble gas electron configuration?

A) $Li^{2+}$
B) $Be^{2+}$
C) $B^{2+}$
D) $C^{2+}$
E) $N^{2-}$

2) Of the ions below, only _____ has a noble gas electron configuration.

A) $S^{3+}$
B) $O^{2+}$
C) $I^{+}$
D) $K^{-}$
E) $Cl^{-}$

3) Which of the following has eight valence electrons?

A) $Ti^{4+}$
B) Kr
C) $Cl^{-}$
D) $Na^{+}$
E) all of the above

4) Which of the following does <u>not</u> have eight valence electrons?

A) $Ca^{+}$
B) $Rb^{+}$
C) Xe
D) $Br^{-}$
E) All of the above have eight valence electrons.

5) The chloride of which of the following metals should have the greatest lattice energy?

A) potassium
B) rubidium
C) sodium
D) lithium
E) cesium

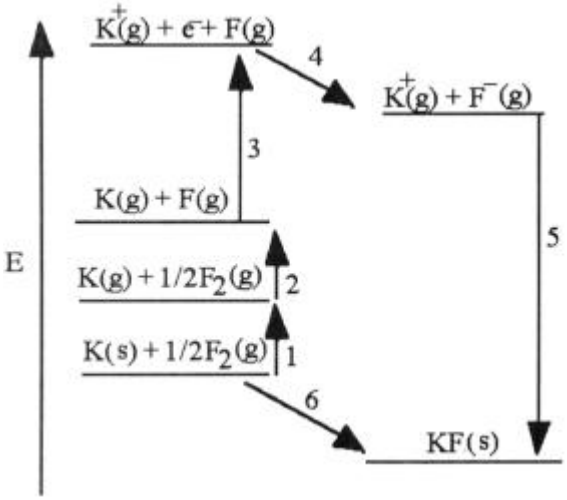
6) Lattice energy is _____.

A) the energy required to convert a mole of ionic solid into its constituent ions in the gas phase
B) the energy given off when gaseous ions combine to form one mole of an ionic solid
C) the energy required to produce one mole of an ionic compound from its constituent elements in their standard states
D) the sum of ionization energies of the components in an ionic solid
E) the sum of electron affinities of the components in an ionic solid

7) In ionic bond formation, the lattice energy of ions _____ as the magnitude of the ion charges _____ and the radii _____.

A) increases, decrease, increase
B) increases, increase, increase
C) decreases, increase, increase
D) increases, increase, decrease
E) increases, decrease, decrease

8)The diagram below is the Born-Huber cycle for the formation of crystalline potassium fluoride.




8) Which energy change corresponds to the electron affinity of fluorine?

A) 2
B) 5
C) 4
D) 1
E) 6

9) Which energy change corresponds to the first ionization energy of potassium?

A) 2
B) 5
C) 4
D) 3
E) 6

10) The electron configuration $[Kr]4d^{10}$ represents _____.

A) $Sr^{+2}$
B) $Sn^{+2}$
C) $Te^{+2}$
D) $Ag^{+1}$
E) $Rb^{+1}$

11) $Fe^{+2}$ ions are represented by _____.

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

12) Using the Born-Haber cycle, the $\Delta H_f°$ of KBr is equal to _____.

A)
$\Delta H_f°[K(g)] + \Delta H_f°[Br(g)] + I_1(K) + E(Br) + \Delta H_{lattice}$

B)
$\Delta H_f°[K(g)] - \Delta H_f°[Br(g)] - I_1(K) - E(Br) - \Delta H_{lattice}$

C)
$\Delta H_f°[K(g)] - \Delta H_f°[Br(g)] + I_1(K) - E(Br) + \Delta H_{lattice}$

D)
$\Delta H_f°[K(g)] + \Delta H_f°[Br(g)] - I_1 - E(Br) + \Delta H_{lattice}$

E)
$\Delta H_f°[K(g)] + \Delta H_f°[Br(g)] + I_1(K) + E(Br) - \Delta H_{lattice}$

13) The type of compound that is most likely to contain a covalent bond is _____.

A) one that is composed of a metal from the far left of the periodic table and a nonmetal from the far right of the periodic table
B) a solid metal
C) one that is composed of only nonmetals
D) held together by the electrostatic forces between oppositely charged ions
E) There is no general rule to predict covalency in bonds.

14) In which of the molecules below is the carbon-carbon distance the shortest?

A) $H_2C=CH_2$
B) $H-C=C-H$
C) $H_3C-CH_3$
D) $H_2C=C=CH_2$
E) $H_3C=CH_2=CH_3$

15) Of the atoms below, _____ is the most electronegative.

A) Br

B) O
C) Cl
D) N
E) F

16) Of the atoms below, _____ is the most electronegative.

A) Si
B) Cl
C) Rb
D) Ca
E) S

17) Of the atoms below, _____ is the least electronegative.

A) Rb
B) F
C) Si
D) Cl
E) Ca

18) Which of the elements below has the largest electronegativity?

A) Si
B) Mg
C) P
D) S
E) Na

19) Of the molecules below, the bond in _____ is the most polar.

A) HBr
B) HI
C) HCl
D) HF
E) $H_2$

20) Of the bonds below, _____ is the least polar.

A) Na, S
B) P, S
C) C, F
D) Si, Cl
E) Na, Cl

21) Which of the following has the bonds correctly arranged in order of increasing polarity?

A) Be – F, Mg – F, N – F, O – F
B) O – F, N – F, Be – F, Mg – F
C) O – F, Be – F, Mg – F, N – F
D) N – F, Be – F, Mg – F, O – F
E) M – gF, Be – F, N – F, O – F

22) Which two bonds are most similar in polarity?

A) O – F and Cl – F
B) B – F and Cl – F
C) Al – Cl and I – Br
D) I – Br and Si – Cl
E) Cl – Cl and Be – Cl

23) The bond length in an HI molecule is 1.61 Å and the measured dipole moment is 0.44 D. What is the magnitude (in units of *e*) of the negative charge on I in HI?
(1 debye = $3.34\times10^{-30}$ coulomb-meters; ; e=1.6 $\times10^{-19}$ coulombs)

A) $1.6\times10^{-19}$
B) 0.057
C) 9.1
D) 1
E) 0.22

24) Which of the following names is/are correct for the compound $TiO_2$?

A) titanium dioxide and titanium (IV) oxide
B) titanium (IV) dioxide
C) titanium oxide
D) titanium oxide and titanium (IV) dioxide
E) titanium (II) oxide

25) Which of the following names is/are correct for the compound $SnCl_4$?

A) tin (II) chloride and tin (IV) chloride
B) tin tetrachloride and tin (IV) chloride
C) tin (IV) tetrachloride

D) tin chloride
E) tin chloride and tin (II) tetrachloride

26) The Lewis structure of $N_2H_2$ shows _____.

A) a nitrogen-nitrogen triple bond
B) a nitrogen-nitrogen single bond
C) each nitrogen has one nonbonding electron pair
D) each nitrogen has two nonbonding electron pairs
E) each hydrogen has one nonbonding electron pair

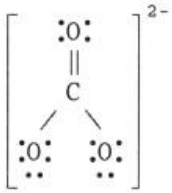
27) There are _____ valence electrons in the Lewis structure of $CH_3CH_2Cl$.

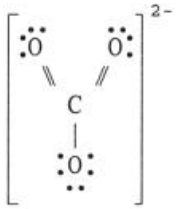
A) 14
B) 12
C) 18
D) 20
E) 10

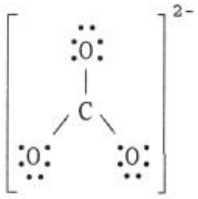
28) In the Lewis symbol for a sulfur atom, there are _____ paired and _____ unpaired electrons.

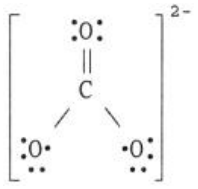
A) 2, 2
B) 4, 2
C) 2, 4
D) 0, 6
E) 5, 1

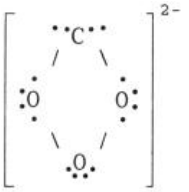
29) The Lewis structure of the $CO_3^{2-}$ ion is _____.

A) 

B) 

C) 

D) 

E) 

30) In the nitrite ion $(NO_2^-)$, _____.

A) both bonds are single bonds
B) both bonds are double bonds
C) one bond is a double bond and the other is a single bond
D) both bonds are the same
E) there are 20 valence electrons

31) Resonance structures differ by _____.

A) number and placement of electrons
B) number of electrons only
C) placement of atoms only
D) number of atoms only
E) placement of electrons only

32) The oxidation number of phosphorus in $PF_3$ is _____.

A) -2
B) +1
C) +3
D) +2
E) -3

33) To convert from one resonance structure to another, _____.

A) only atoms can be moved
B) electrons and atoms can both be moved

C) only electrons can be moved
D) neither electrons nor atoms can be moved
E) electrons must be added

34) For resonance forms of a molecule or ion, _____.

A) one always corresponds to the observed structure
B) all the resonance structures are observed in various proportions
C) the observed structure is an average of the resonance forms
D) the same atoms need not be bonded to each other in all resonance forms
E) there cannot be more than two resonance structures for a given species

*For the questions that follow, consider the BEST Lewis structures of the following oxyanions:*

(i) $NO_2^-$ (ii) $NO_3^-$ (iii) $SO_3^{2-}$ (iv) $SO_4^{2-}$ (v) $BrO_3^-$

35) There can be four equivalent best resonance structures of _____.

A) (ii)
B) (iii)
C) (i)
D) (iv)
E) (v)

36) In which of the ions do all X-O bonds (X indicates the central atom) have the same length?

A) none
B) all
C) (i) and (ii)
D) (iii) and (v)
E) (iii), (iv), and (v)

37) Of the following, _____ cannot accommodate more than an octet of electrons.

A) P
B) As
C) O
D) S
E) I

38) A valid Lewis structure of _____ cannot be drawn without violating the octet rule.

A) $NF_3$
B) $IF_3$
C) $PF_3$
D) $SbF_3$
E) $So_4^{2-}$

39) Based on the octet rule, boron will most likely form a _____ ion.

A) $B^{3-}$
B) $B^{1+}$
C) $B^{3+}$
D) $B^{2+}$
E) $B^{2-}$

40) Which of the following does <u>not</u> have eight valence electrons?

A) $Cl^-$
B) Xe
C) $Ti^{+4}$
D) $Rb^{+1}$
E) $Sr^{+1}$

41) A valid Lewis structure of _____ cannot be drawn without violating the octet rule.

A) $PO_4^{3-}$
B) $SiF_4$
C) $CF_4$
D) $SeF_4$
E) $NF_3$

42) The central atom in _____ does not violate the octet rule.

A) $SF_4$
B) $KrF_2$
C) $CF_4$
D) $XeF_4$

E) $ICl_4^-$

43) The central atom in _____ violates the octet rule.

A) $NH_3$
B) $SeF_2$
C) $BF_3$
D) $AsF_3$
E) $CF_4$

44) A valid Lewis structure of _____ cannot be drawn without violating the octet rule.

A) $ClF_3$
B) $PCl_3$
C) $SO_3$
D) $CCl_4$
E) $CO_2$

45) A valid Lewis structure of _____ cannot be drawn without violating the octet rule.

A) $NI_3$
B) $SO_2$
C) $ICl_5$
D) $SiF_4$
E) $CO_2$

46) A valid Lewis structure of _____ cannot be drawn without violating the octet rule.

A) $NF_3$
B) $BeH_2$
C) $SO_2$
D) $CF_4$
E) $SO_3^{2-}$

47) Why don't we draw double bonds between the Be atom and the Cl atoms in $BeCl_2$?

A) That would give positive formal charges to the chlorine atoms and a negative formal charge to the beryllium atom.
B) There aren't enough electrons.
C) That would result in more than eight electrons around beryllium.
D) That would result in more than eight electrons around each chlorine atom.
E) That would result in the formal charges not adding up to zero.

48) Which atom can accommodate an octet of electrons, but doesn't necessarily have to accommodate an octet?

A) N
B) C
C) H
D) O
E) B

49) Bond enthalpy is _____.

A) always positive
B) always negative
C) sometimes positive, sometimes negative
D) always zero
E) unpredictable

50) Given that the average bond energies for C-H and C-Br bonds are 413 and 276 kJ/mol, respectively, the heat of atomization of bromoform ($CHBr_3$) is _____ kJ/mol.

A) 1241
B) 689
C) -689
D) 1378
E) -1378

51) Of the bonds C-N, $C = N$, and $C \equiv N$, the C-N bond is _____.

A) strongest/shortest
B) strongest/longest
C) weakest/shortest
D) weakest/longest
E) intermediate in both strength and length

52) As the number of covalent bonds between two atoms increases, the distance between the atoms

_____ and the strength of the bond between them _____.

A) increases, increases
B) decreases, decreases
C) increases, decreases
D) decreases, increases
E) is unpredictable

53) Of the possible bonds between carbon atoms (single, double, and triple), _____.

A) a triple bond is longer than a single bond
B) a double bond is stronger than a triple bond
C) a single bond is stronger than a triple bond
D) a double bond is longer than a triple bond
E) a single bond is stronger than a double bond

54) Most explosives are compounds that decompose rapidly to produce _____ products and a great deal of _____.

A) gaseous, gases
B) liquid, heat
C) soluble, heat
D) solid, gas
E) gaseous, heat

55) Dynamite consists of nitroglycerine mixed with _____.

A) potassium nitrate
B) damp KOH
C) TNT
D) diatomaceous earth or cellulose
E) solid carbon

56) Dynamite _____.

A) was invented by Alfred Nobel
B) is made of nitroglycerine and an absorbent such as diatomaceous earth
C) is a much safer explosive than pure nitroglycerine
D) is an explosive
E) all of the above

**8.3 Short Answer Questions**

1) The electron configuration that corresponds to the Lewis symbol,  is _____.

2) Write the balanced chemical equation for the reaction for which $\Delta H°_{rxn}$ is the lattice energy for potassium bromide.

3) Using the noble gas shorthand notation, write the electron configuration for $Fe^{+3}$.

4) Give the electron configuration of $Cu^{2+}$.

5) Which halogen, bromine or iodine, will form the more polar bond with phophorus?

6) Draw the Lewis structure of $ICl_2^+$.

7) Alternative but equivalent Lewis structures are called _____.

8) Benzene is an _____ compound with _____ equivalent Lewis structures.

9) In a reaction, if the bonds in the reactants are stronger than the bonds in the product, the reaction is _____.

10) In compounds of _____ and _____, the octet rule is violated due to the presence of fewer than eight valence electrons.

11) Polyatomic ions with an odd number of electrons will _____ the octet rule.

12) The strength of a covalent bond is measured by its _____.

13) To produce maximum heat, an explosive compound should have _____ chemical bonds and decompose to molecule with _____ bonds.

14) Calculate the bond energy of C-F given that the heat of atomization of CHFClBr is 1502 kJ/mol, and that the bond energies of C-H, C-Br, and C-Cl are 413, 276, and 328 kJ/mol, respectively.

15) The reaction below is used to produce

methanol:

$$CO(g) + 2H_2(g) \rightarrow CH_3OH(l)$$
$$\Delta H_{rxn} = -128KJ$$

(a) Calculate the C-H bond energy given the following data:

| Bond | D (kJ/mol) |
|---|---|
| C≡O | 1072 |
| H−H | 436 |
| C−O | 358 |
| O−H | 463 |

(b) The tabulated value of the (C-H) bond energy is 413 kJ/mol. Explain why there is a difference between the number you have calculated in (a) and the tabulated value.

16) From the information given below, calculate the heat of combustion of methane $(CH_4)(\text{in kj/mol})$ Start by writing the balanced equation.

| Bond | D (kJ/mol) |
|---|---|
| C−H | 413 |
| O=O | 495 |
| C=O | 799 |
| O−H | 463 |

**8.4 True/False Questions**

1) Atoms surrounded by eight valence electrons tend to lose electrons.

2) The greater the lattice energy, the greater the charges on the participatory ions and the smaller their radii.

3) Most transition metals do not form ions with a noble gas configuration.

4) When a metal gains an electron, the process is endothermic.

5) Electron affinity is a measure of how strongly an atom can attract additional electrons.

6) As electronegativity difference increases, bond length will decrease.

7) In some molecules and polyatomic ions, the sum of the valence electrons is odd and as a result the octet rule fails.

8) Bond enthalpy can be positive or negative.