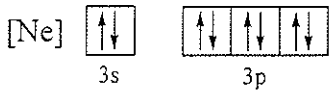
_____ 1. Which element has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^2$?

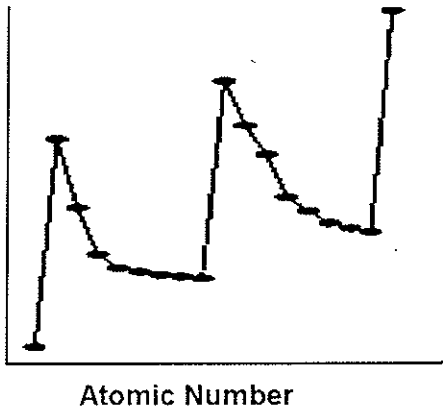
(a) Mg
(b) S
(c) Si
(d) Se
(e) Ga

____ 2. The X^{3-} ion with the following electron configuration is formed from:



(a) oxygen.
(b) nitrogen.
(c) phosphorus.
(d) aluminum.
(e) magnesium.

_____ 3. The figure is a portion of a plot of :



(a) Highest principal quantum number vs. atomic number.
(b) 1st ionization energy vs. atomic number.
(c) Electron affinity vs. atomic number.
(d) Atomic radius vs. atomic number.
(e) Atomic charge vs atomic number.

_____ 4. Place the following atoms in order of INCREASING atomic radii: Ca, Mg, P, and Cl.

(a) Ca < Cl < P < Mg
(b) Mg < P < Cl < Ca
(c) Ca < Mg < P < Cl
(d) P < Cl < Mg < Ca
(e) Cl < P < Mg < Ca

_____ 5. An element in period 2 has the following values of its first four ionization energies:

$IE_1 = 0.80$ MJ/mol
$IE_2 = 2.42$ MJ/mol
$IE_3 = 3.66$ MJ/mol
$IE_4 = 25.02$ MJ/mol

What is the element?

(a) Be
(b) B
(c) C
(d) N
(e) O

_____ 6. What is the formula of the oxide of Al?

(a) AlO
(b) AlO_2
(c) AlO_3
(d) Al_2O_2
(e) Al_2O_3

_____ 7. Consider the following data for lattice energies of alkaline earth oxides:

Metal Oxide	**Lattice Energy (kJ/mol)**
MgO	−3795
CaO	−3414
SrO	−3217
BaO	−3029

The trend in this data can best be explained by the following:

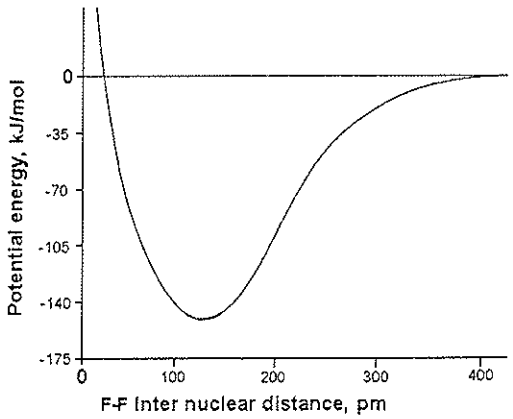
(a) The electron configuration of each atom
(b) The electron affinity of each atom.
(c) The radius of each atom.
(d) The radius of each ion.
(e) The charge on each ion.

_____ 8. Use the following information to calculate the first ionization energy of Li.

$LiF(s) \rightarrow Li^+(g) + F^-(g)$	1050 kJ/mol LiF
$Li(s) + \frac{1}{2} F_2(g) \rightarrow LiF(s)$	−617 kJ/mol Li
$F_2(g) \rightarrow 2\ F(g)$	160 kJ/mol F_2
$Li(s) \rightarrow Li(g)$	161 kJ/mol Li
$F(g) \rightarrow F^-(g)$	−328 kJ/mol F

(a) 216 kJ/mol Li
(b) 346 kJ/mol Li
(c) 426 kJ/mol Li
(d) 440 kJ/mol Li
(e) 520 kJ/mol Li

_____ 9. Determine the bond length of F_2 from the Morse curve:



(a) 52 pm
(b) 128 pm
(c) 384 pm
(d) −120 kJ/mol
(e) 155kJ/mol

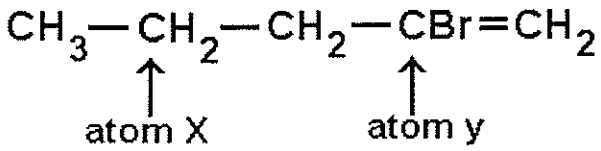
_____ 10. Which of these molecules is NOT planar?

(a) NI_3
(b) XeF_4
(c) BF_3
(d) SO_3
(e) $CF_2{=}CF_2$

_____ 11. Use VSEPR theory to predict the electron-pair geometry and the molecular geometry of iodine trichloride, ICl_3.

	Electron-pair Geometry	**Molecular Geometry**
(a)	Trigonal planar	Trigonal pyramidal
(b)	Tetrahedral	Trigonal planar
(c)	Tetrahedral	Trigonal planar
(d)	Trigonal bipyramidal	Trigonal
(e)	Trigonal bipyramidal	T-shaped

_____ 12. Identify the geometry about atoms X and Y:



	Atom X	**Atom Y**
(a)	linear	T-shaped
(b)	Bent	trigonal planar
(c)	tetrahedral	trigonal planar
(d)	tetrahedral	trigonal pyramidal
(e)	linear	trigonal pyramidal

_____ 13. What are the O–S–O bond angles in SO_3?

(a) All equal to 109.5 degrees.
(b) All equal to 120 degrees.
(c) All smaller than 109.5 degrees.
(d) Two are greater than 120 degrees and one is less than 120 degrees.
(e) Two are less than 120 degrees and one is greater than 120 degrees.

_____ 14. Which compound contains both ionic and covalent bonds?

(a) $CaCl_2$

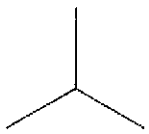
(b) CH_3CO_2H

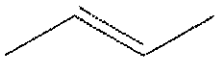
(c) $ClNO_2$

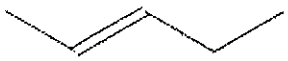
(d) K_2S

(e) $NaNO_2$

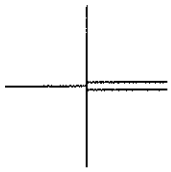
_____ 15. Which is the structure for butene?

(a) 

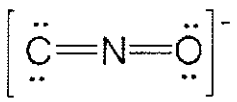
(b) 

(c) 

(d) 

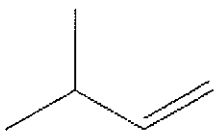
(e) 

_____ 16. What is the formal charge on the C atom in this structure of the CNO^- ion?



(a) −2
(b) −1
(c) 0
(d) +1
(e) +2

_____ 17. What is the molecular formula for the following structure?



(a) C_5H_{11}

(b) C_4H_5

(c) C_5H_{10}

(d) C_4H_{10}

(e) C_5H_9

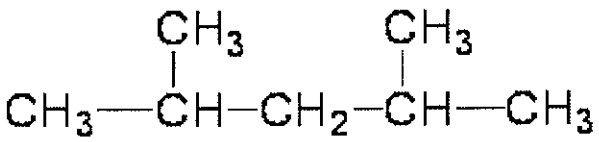
_____ 18. What can you say about the energy change in the following reaction?

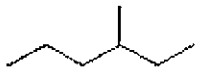
$$H_2 + H_2C{=}CH_2 \rightarrow H_3C{-}CH_3$$

C—C = 346 kJ/mol
C=C = 610 kJ/mol
C—H = 413 kJ/mol
H—H = 436 kJ/mol

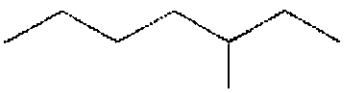
(a) This reaction is isothermic.
(b) This reaction is endothermic.
(c) This reaction is exothermic.
(d) This reaction is energy neutral ($\Delta H = 0$).
(e) The energy change will depend on which isomer is present.

_____ 19. Identify an isomer of the following molecule:



(a) 

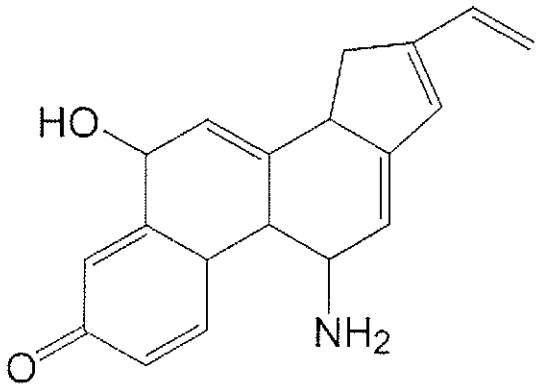
(d) 

(b) 

(e) 

(c) 

_____ 20. Which of the functional groups listed are present in the following molecule?



I.	hydroxyl	III.	carboxylic acid
II.	carbonyl	IV.	amine

(a) I, IV

(b) I, II, IV

(c) I, III, IV

(d) II, III, IV

(e) III, IV

END OF EXAM

1) Please make sure that you have entered 20 answers on your scan sheet.
2) Make sure that you have entered your name, ID number, and lab section number (4 digits).
3) You MUST turn the scan sheet in to your TA before leaving the exam!