Name_____

Section_____

Cem 151
Exam 3
November 5, 2014

Make sure you bubble in your PID on the answer sheet.
Choose the best answer, record on the provided bubble sheet (5 points).

1) Which of the following elements have the electron configuration [Kr]$5s^2 4d^4$

(a) Sr	(c) Cr	(e) Nd	(g) Rb
(b) Te	**(d) Mo**	(f) W	(h) U

2) Why is it that metals are more predominant as you go down the periodic table?

(a) The effective nuclear charge becomes higher as you go down the periodic table
(b) The electronegativity gets larger as you go down the periodic table
(c) The electron affinity becomes more negative as you go down the periodic table
(d) The valence electrons get further from the nucleus as you go down the periodic table
(e) The energy level (n) of the valence electrons becomes higher as you go down the periodic table
(f) All of the above
(g) a, b and e
(h) d and e
(i) c, d and e
(j) None of the above

3) List the following elements by size, from largest to smallest:

Al, Si, P, Cl, Mg, K

a) Al, Si, P, Cl, Mg, K	e) K, Mg, Si, P, Cl, Al
b) P, Si, Al, Cl, Mg, K	**f) K, Mg, Al, Si, P, Cl**
c) Cl, P, Si, Al, Mg, K	g) Mg, K, Al, Si, P, Cl
d) K,Al, Si, P, Cl, Mg,	h) Mg, K, Al, Si, P, Cl

4) List the following in order of *decreasing* electronegativity (lowest electronegativity first):

In, Ge, P, S, Cl

a) Cl, S, P, In, Ge
b) In, Ge, P, S, Cl
c) Cl, S, P, Ge, In
d) Cl, P, S, In, Ge
e) P, S, Cl, In, Ge,
f) Ge, In, Cl, S, P

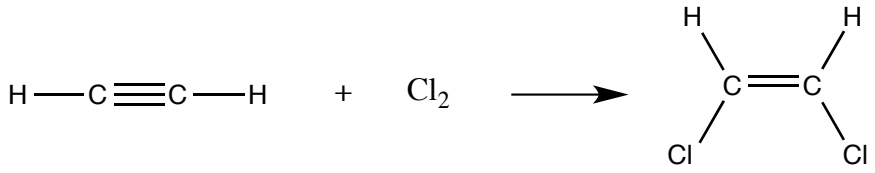
5) List the following in the order of first ionization energy (from highest to lowest):
Br, Ca, K, Kr, Rb, Se

a) Rb, Ca, K, Se, Br, Kr
b) Kr, Br, Se, K, Ca Rb
c) Rb, Se, Br, Kr, K, Ca
d) Ca, K, Kr, Br, Se, Rb
e) Rb, K, Ca, Se, Br, Kr
f) Kr, Br, Se, Ca, K, Rb
g) Br, Kr, Se, K, Ca, Rb
h) K, Ca, Rb, Se, Br, Kr

6) What is the effective nuclear charge of Po (use the simplest calculation)?

a) 1
b) 2
c) 3
d) 4
e) 5
f) 6
g) 7
h) 8

7) Using the table of bond energies given calculate the ΔH_{rxn} for the following process:



a) -1270
b) -1028
c) -656
d) -614
e) -680
f) -189
g) 189
h) 1270

8) Which of the following ionic compounds is predicted to have the lowest (least negative) lattice energy?

a) LiCl
b) MgCl
c) CaO
d) LiF
e) MgO
f) NaF
g) CsI
h) CaI_2
i) MgS
j) RbI

9) Which of the following electrons will feel the strongest effective nuclear charge?

a) The 2p electrons in Al
b) The 1s electrons in He
c) The 6p electrons in Rn
d) The 2s electrons in Na
e) The 3p electrons in Ar
f) The 3s electrons in S
g) The 4p electrons in Ge
h) The 4s electrons in Ge

10) Which two elements are most likely to form a metallic bond?

a) **Na and Ca**
b) Na and F
c) Ca and O
d) F and Si
e) Br and Rb
f) Cd and Cl
g) Ni and N
h) Na and Cl

11) Which neutral element is isoelectronic with Al^{3+} and N^{3-}?

a) Al
b) N
c) O
d) Si
e) **Ne**
f) Ar
g) He
h) P

TABLE 8.4 Average Bond Enthalpies (kJ/mol)

Single Bonds							
C—H	413	N—H	391	O—H	463	F—F	155
C—C	348	N—N	163	O—O	146		
C—N	293	N—O	201	O—F	190	Cl—F	253
C—O	358	N—F	272	O—Cl	203	Cl—Cl	242
C—F	485	N—Cl	200	O—I	234		
C—Cl	328	N—Br	243			Br—F	237
C—Br	276			S—H	339	Br—Cl	218
C—I	240	H—H	436	S—F	327	Br—Br	193
C—S	259	H—F	567	S—Cl	253		
		H—Cl	431	S—Br	218	I—Cl	208
Si—H	323	H—Br	366	S—S	266	I—Br	175
Si—Si	226	H—I	299			I—I	151
Si—C	301						
Si—O	368						
Si—Cl	464						
Multiple Bonds							
C=C	614	N=N	418	O_2	495		
C≡C	839	N≡N	941				
C=N	615	N=O	607	S=O	523		
C≡N	891			S=S	418		
C=O	799						
C≡O	1072						

For the following, draw correct Lewis structures showing any formal charges and resonance structures on this sheet. For each molecule, give the geometry, shape and hybridization of the central atom in the molecule and whether the molecule is polar or non-polar (has a dipole moment). *Fill in the table with these values.* In your diagram, show **one** of the bond angles between bonded atoms (you choose which one). Put the bond angle in the answer table as well. (8 points each unless otherwise marked)

12) The bicarbonate anion

Geometry	Shape	Hybridization	Polar?(y/n)	angle
Trig plan	Trig plan	Sp2	No	120

13) SO_2 sulfur dioxide

Geometry	Shape	Hybridization	Polar?(y/n)	angle
Trig plan	Bent	Sp2	Yes	120

14) The chlorite ion

Geometry	Shape	Hybridization	Polar?(y/n)	angle
TET	Bent	Sp3	Yes	109

15) SF_4

Geometry	Shape	Hybridization	Polar?(y/n)	angle
Tbp	See saw	Sp3d	Yes	120 90

16) The cyanide ion

Geometry	Shape	Hybridization	Polar?(y/n)	angle
Linear	Linear	Sp	Yes	

17) XeI_2

Geometry	Shape	Hybridization	Polar?(y/n)	angle

tbp	Linear	Sp3d	No	180

18) PCl_5

Geometry	Shape	Hybridization	Polar?(y/n)	angle
Tbp	Tbp	Sp3d	No	120 90

19) $XeCl_4$

Geometry	Shape	Hybridization	Polar?(y/n)	angle
Octo	Sq plan	Sp3d2	No	90

20) CH_3-COH (one carbon is bound to 3 hydrogens, 1 carbon is bound to 1 oxygen and 1 hydrogen). Give the geometry/shape hybridization for each carbon, and the bond angle at each carbon. (16 points)

Geometry	Shape	Hybridization	Polar?(y/n)	angle
TET	TET	Sp3	Yes	109

Geometry	Shape	Hybridization	Polar?(y/n)	angle
Trig plan	Trig plan	Sp2	yes	120