

Exam 4a

Chem 1141

Fall 2008

Name: _____

MULTIPLE CHOICE. [3 pts ea.] Circle the best response.

Q1. How many valence electrons does an atom of carbon contain?

- a) 1 b) 2 c) 3 d) 4 e) 5

Q2. How many core electrons does an atom of carbon contain?

- a) 1 b) 2 c) 3 d) 4 e) 5

Q3. The electron configuration of S^{2-} is:

- a) $1s^2$ b) $1s^2 2s^2$ c) $1s^2 2s^2 2p^6 3s^2$ d) $1s^2 2s^2 2p^6 3s^2 3p^6$ e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

Q4. The relative sizes of carbon, oxygen, and selenium atoms would be:

- a) $C < O < Se$ b) $Se < O < C$ c) $O < Se < C$ d) $Se < C < O$ e) $O < C < Se$

Q5. An element has the following ionization energies: $I_1 = 212$ kJ/mol, $I_2 = 422$ kJ/mol, $I_3 = 630$ kJ/mol, $I_4 = 13100$ kJ/mol. Which element is it be most likely to be?

- a) Si b) Al c) Mg d) Na e) Ne

Q6. The chemical equation corresponding to the first electron affinity of sodium is:

- a) $Na(g) \rightarrow Na^+(g) + e^-$
 b) $Na(s) \rightarrow Na^+(aq) + e^-$
 c) $e^- + Na(g) \rightarrow Na^-(g)$
 d) $e^- + Na(s) \rightarrow Na^+(s)$

Q7. The total number of valence electrons in the NO^- anion is:

- a) 16 b) 14 c) 12 d) 11 e) 10

Q8. The type of bond formed by the sharing of 2 electrons is:

- a) Ionic b) Polar covalent c) single bond d) double bond e) triple bond

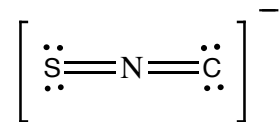
Q9. The number of lone pairs on a hydrogen sulfide molecule, H_2S is:

- a) 0 b) 1 c) 2 d) 3 e) 4

Q10. Which bond would be the most polar: $C-N$ or $C-O$?

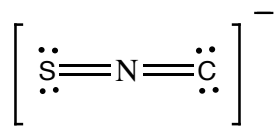
- a) $C-N$ b) $C-O$ c) Impossible to tell

Q11. The formal charge on the sulfur atom in the following polyatomic ion is:



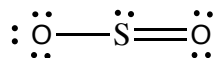
- a) -2 b) -1 c) 0 d) +1 e) +2

Q12. The formal charge the nitrogen atom in the following polyatomic ion is:



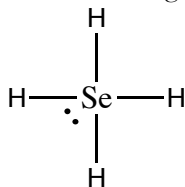
- a) -2 b) -1 c) 0 d) +1 e) +2

Q13. The molecular geometry of the following molecule is:



- a) Linear b) Bent c) Square Planar d) Tetrahedral e) Trigonal bipyramidal

Q14. The molecular geometry of the following molecule is:



- a) Octahedral b) Bent c) See-saw d) Tetrahedral e) Trigonal bipyramidal

Short Response.

Show ALL work to receive credit. Use the conversion factor method for all problems to receive full credit.

Q15. [8 pts.] Write full electron configurations for the following ions:

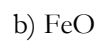
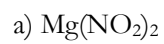
- a) Cr^+
b) Mg^{2+}
c) V^{2+}
d) O^{2-}

Q16. [6 pts.] Draw a valid Lewis structure for the sulfite ion, SO_3^{2-}

Q17. [6 pts.] Draw all possible resonance structures for S_3 .

Q18. [6 pts.] Is CSe_2 polar or non-polar? Explain.

Q19. [9 pts.] Name the following compounds:



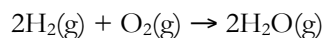
Q20. [12 pts.] Predict the *molecular* geometry of H_2S using VSEPR theory. Be sure to include (1) a valid Lewis structure, (2) a sketch of the molecular geometry, (3) the name of the molecular geometry, and (4) approximate bond angles.



Q21. [6 pts.] 24.5 mL of 0.100 M $\text{AgNO}_3(\text{aq})$ was mixed with 13.4 mL of 0.350 M $\text{MgCl}_2(\text{aq})$. A white precipitate is formed which weighs 0.283 g. Calculate the percent yield of the reaction.

Q22. [5 pts.] One of the most commonly used white pigments in paint is a compound of titanium and oxygen that contains 59.9% Ti by mass. Determine the empirical formula of this compound.

BONUS: (A) Predict ΔH° for the reaction:



Given the following table of bond energies:

Type of Bond	Bond Energy / kJ mol^{-1}
H–H	436.4
O=O	498.7
O–H	460

(B) How much heat would be produced/absorbed if 12.0 g of water was formed?



Periodic Table of the Elements

I												IIA														IIIA		IVA		VA		VIA		VIIA		VIIIA	
1																						18															
H 1.01																						He 4.00															
3		4																		5		6		7		8		9		10							
Li 6.94		Be 9.01																		B 10.81		C 12.01		N 14.01		O 16.00		F 19.00		Ne 20.18							
11		12																		13		14		15		16		17		18							
Na 22.99		Mg 24.31																		Al 26.98		Si 28.09		P 30.97		S 32.07		Cl 35.45		Ar 39.95							
19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36			
K 39.10		Ca 40.08		Sc 44.96		Ti 47.87		V 50.94		Cr 52.00		Mn 54.94		Fe 55.85		Co 58.93		Ni 58.69		Cu 63.55		Zn 65.39		Ga 69.72		Ge 72.61		As 74.92160		Se 78.96		Br 79.90		Kr 83.80			
37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54			
Rb 85.47		Sr 87.62		Y 88.91		Zr 91.22		Nb 92.91		Mo 95.94		Tc [98]		Ru 101.07		Rh 102.91		Pd 106.42		Ag 107.87		Cd 112.41		In 114.82		Sn 118.71		Sb 121.76		Te 127.60		I 126.90		Xe 131.29			
55		56		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86			
Cs 132.91		Ba* 137.33		Lu 174.97		Hf 178.49		Ta 180.95		W 183.84		Re 186.21		Os 190.23		Ir 192.22		Pt 195.08		Au 196.97		Hg 200.59		Tl 204.38		Pb 207.20		Bi 208.98		Po [210]		At [210]		Rn [222]			
87		88		103		104		105		106		107		108		109		110		111		112		113		114		115		116		117		118			
Fr [223]		Ra** [226]		Lr [262]		Rf [261]		Db [262]		Sg [266]		Bh [264]		Hs [265]		Mt [268]		[269]		[272]		[277]		[285]		[289]		[289]		[293]		[293]					
		*		57		58		59		60		61		62		63		64		65		66		67		68		69		70							
				La 138.91		Ce 140.12		Pr 140.91		Nd 144.24		Pm [145]		Sm 150.36		Eu 151.96		Gd 157.25		Tb 158.93		Dy 162.50		Ho 164.93		Er 167.26		Tm 168.93		Yb 173.04							
				89		90		91		92		93		94		95		96		97		98		99		100		101		102							
				Ac [227]		Th 232.04		Pa 231.04		U 238.03		Np [237]		Pu [244]		Am [243]		Cm [247]		Bk [247]		Cf [251]		Es [252]		Fm [257]		Md [258]		No [259]							