CHM151 Quiz 9b 25 Pts Fall 2013 Name: _____

1. (5 Pts) Use the bond enthalpy data given to estimate the heat released when ~~25.0 g~~ 2 moles of acetylene gas, C_2H_2, burns in excess oxygen to yield carbon dioxide and water vapor at 25°C.

   BE(C–C) = 347 kJ/mol
   BE(C≡C) = 812 kJ/mol
   BE(C=O in CO_2) = 799 kJ/mol
   BE(C–H) = 414 kJ/mol
   BE(O–H) = 460 kJ/mol
   BE(O=O) = 498.7 kJ/mol

   $2H-C\equiv C-H + 5O_2 \rightarrow 4O=C=O + 2H-O-H$

2. (3 Pts) Calculate the number of valence electrons for each of the following.

   a. SF_4 _____ b. XeF_4 _____ c. SO_3^{2-} _____

3. (9 Pts) Write the Lewis structure of ammonia (nitrogen trihydride).

   a. ammonia (NH_3) b. sulfur dioxide c. chlorite ion ClO_2^{1-}

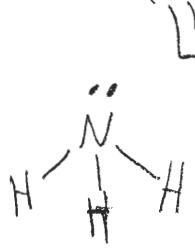
4. (3 Pts) Write a Lewis structure for SO_3 that expands the octet to minimize formal charges and if necessary places negative formal charges on the most electronegative atom(s).

5. (5 Pts) Write a Lewis structure for the nitrate ion, NO_3^-, showing all non-zero formal charges and then show any resonance structures.

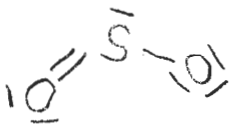
CHM151 Quiz 9 25 Pts Fall 2013 Name: Key

1. (9 Pts) Write the Lewis structure of ammonia (nitrogen trihydride).

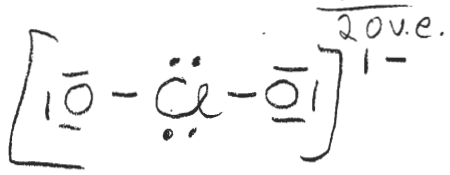
a. ammonia (NH_3)



b. sulfur dioxide SO_2



c. chlorite ion ClO_2^{1-}



2. (5 Pts) Use the bond enthalpy data given to estimate the heat released when ~~200 g~~ 2 moles of acetylene gas, C_2H_2, burns in excess oxygen to yield carbon dioxide and water vapor at 25°C.

BE(C–C) = 347 kJ/mol
BE(C≡C) = 812 kJ/mol
BE(C=O in CO_2) = 799 kJ/mol
BE(C–H) = 414 kJ/mol
BE(O–H) = 460 kJ/mol
BE(O=O) = 498.7 kJ/mol

$2H-C\equiv C-H + 5O_2 \rightarrow 4O=C=O + 2H-O-H$

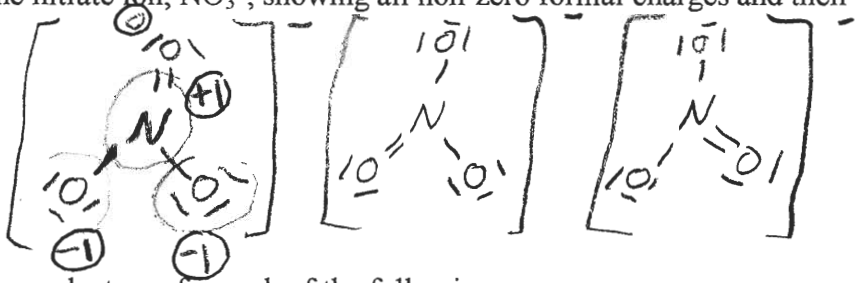
C≡C 2 × 812
C–H 2 × 2 × 414
O_2 5 × 498.7 = +5773.4

C=O 4 × 2 × 799
O–H 2 × 2 × 460 = −8232

+5773.4 + −8232 = −2458.6 kJ

3. (5 Pts) Write a Lewis structure for the nitrate ion, NO_3^-, showing all non-zero formal charges and then show any resonance structures.

NO_3^-
3 × 6 = 18
1 × 5 = 5
+1
24 v.e.



4. (3 Pts) Calculate the number of valence electrons for each of the following.

a. SF_4 34 (4 × 7, 1 × 6)

b. XeF_4 36 (4 × 7, 1 × 8)

c. SO_3^{2-} 26

5. (3 Pts) Write a Lewis structure for SO_3 that expands the octet to minimize formal charges and if necessary places negative formal charges on the most electronegative atom(s).

SO_3
24 v.e