Dougherty Valley HS Chemistry - AP
Bonding – Bond Energy Practice 2

Worksheet #10

Name: **Period:** **Seat#:**

Directions: Show all work in a way that would earn you credit on the AP Test! This is always the rule! Some answers are provided at the end of the worksheet.

Average Bond Enthalpies (kJ/mol)

Single Bonds

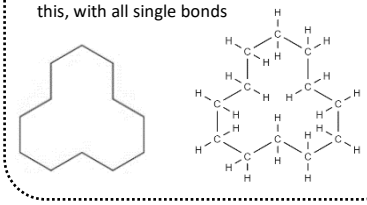
C—H	413	N—H	391	O—H	463	F—F	155
C—C	348	N—N	163	O—O	146		
C—N	293	N—O	201	O—F	190	Cl—F	253
C—O	358	N—F	272	O—Cl	203	Cl—Cl	242
C—F	485	N—Cl	200	O—I	234		
C—Cl	328	N—Br	243			Br—F	237
C—Br	276			S—H	339	Br—Cl	218
C—I	240	H—H	436	S—F	327	Br—Br	193
C—S	259	H—F	567	S—Cl	253		
		H—Cl	431	S—Br	218	I—Cl	208
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						

Multiple Bonds

C=C	614	N=N	418	O_2	495
C≡C	839	N≡N	941		
C=N	615			S=O	523
C≡N	891			S=S	418
C=O	799				
C≡O	1072				

Takes to break = +
Free to Form = -

Hint $C_{12}H_{24}$ is a weird molecule. It looks like this, with all single bonds



1) Considering bonds broken and formed ONLY, what is the enthalpy change for the following reaction:

$C_{40}H_{82} \rightarrow C_{16}H_{34} + 2C_{12}H_{24}$

2) The rxn **$BBr_3(g) + BCl_3(g) \rightarrow BBr_2Cl(g) + BCl_2Br(g)$** has a ΔH very close to zero. Explain why ΔH is so small.

3) Determine the enthalpy of reaction for the following using bond energies.

$H_2(g) + ½\ O_2(g) \rightarrow H_2O(g)$ **ΔH = −246 kJ**

4) Ammonia reacts with oxygen to form nitrogen dioxide and steam, as follows. Use data for bond energies to determine the bond energy of the N−O bond of NO_2 (Hint N-O bond has resonance. Just do the AVERGE N-O, assume all bonds are equal)

$4NH_3(g) + 7O_2(g) \rightarrow 4NO_2(g) + 6H_2O(g)$ **ΔH = −1135 kJ**

5) Determine the enthalpy of the following reaction using bond energies:

$CH_3CH=CH_2 + 4.5\ O=O \rightarrow 3\ O=C=O + 3\ H-O-H$

6) Determine the enthalpy for the following reaction: **$C(s) + CO_2(g) \rightarrow 2CO(g)$**

The enthalpy of sublimation of graphite, C(s) is 719 kJ/mol

7) Calculate the bond dissociation energy for one mole of O−F bonds, given the following data. (Hint: oxygen is the central atom of OF_2)

$F_2(g) + ½\ O_2(g) \rightarrow OF_2\ (g)\ \Delta H = 28\ kJ$

8) Using bond enthalpy (in kJ mol^{-1}) values, determine the heat of formation of methane:

Sublimation energy of C (s, gr) = 719 kJ/mol

9) An unknown gas, X_2, which behaves much like nitrogen gas (N≡N), is analyzed and the following enthalpies of formation are obtained. The X−H bond energy is known to be 383 kJ/mol. Use this information to estimate the X−X single-bond energy in the X_2H_4 molecule. (Hint Write a rxn forming X_2H_4 to start)

X(g) = 412 kJ/mol
H(g) = 217 kJ/mol
$X_2H_4(g)$ = 3 kJ/mol

Answers (Remember that answers for this topic vary greatly if not using the same bond enthalpy data charts! Not a big deal. Use my numbers when given so that your answers will match)

1) 0 KJ/mol
2) Breaking and making same number of same type of bonds
3) -243 KJ/mol
4) 467 KJ/mol
5) -1905 KJ/mol
6) 173 KJ/mol
7) 187 KJ/mol
8) -61 KJ/mol
9) 157 KJ/mol