Chemistry 141 Name -

Dr. Cary Willard

Quiz 8A (20 points) March 17, 2011

1. (4 points) The standard molar enthalpy of formation ofliquid methanol, CH3OH is -238.7 kJ/mol. Write a balanced equation representing the reaction this Hfo describes.

C(s) + 2 H2(g) + ½ O2(g) 🡪 CH3OH(l)

1. (10 points) The first step in the production of nitric acid from ammonia involves the oxidation of NH3.

4 NH3(g) + 5 O2(g) 🡪 4 NO(g) + 6 H2O(g)

* 1. Using enthalpies of formation, determine the heat of reaction for this process.

|  |  |
| --- | --- |
|  | Hfo (kJ/mol) |
| NH3(g) | -46.11 |
| NH3(aq) | -80.29 |
| NO(g) | 90.25 |
| H2O(l) | -285.8 |
| H2O(g) | -241.8 |

$$∆H\_{rxn}=4\left(∆H\_{f},NO,g\right)+6\left(∆H\_{f},H\_{2}O,g\right)-4\left(∆H\_{f},NH\_{3},g\right)-5\left(∆H\_{f},O\_{2},g\right)$$

$$=4\left(90.25 kJ\right)+6\left(-241.8 kJ\right)-4\left(-46.11 kJ\right)-5\left(0 kJ\right)$$

$$=\left(361 kJ\right)+\left(-1450.8 kJ\right)—184.44 kJ-\left(0 kJ\right)$$

$$=361 kJ-1450.8 kJ+184.44 kJ$$

$$=-905 kJ$$

* 1. Is this process endothermic or exothermic?

exothermic

* 1. Calculate the energy change when 25.0 grams of ammonia are converted to nitrogen monoxide.

$$?kJ=25.0 g NH\_{3}×\frac{1 mol NH\_{3}}{17.03 g NH\_{3} }×\frac{905 kJ }{4 mol NH\_{3}}=332 kJ energy produced by reaction$$

1. (6 points) Estimate the heat of reaction for the reaction below using bond energies.



Bonds broken

1 C≡C + 837 kJ

2 Br-Br 2 (192 kJ) = + 384 kJ

Total + 1221 kJ

Bonds formed

1 C-C - 347 kJ

4 C-Br 4(- 276 kJ) = -1104 kJ

Total - 1451 kJ

Estimated heat of reaction - 230 kJ

Chemistry 141 Name -

Dr. Cary Willard

Quiz 8B (20 points) March 17, 2011

1. (4 points) The standard molar enthalpy of formation of ethanol, CH3CH2OH is -277.7 kJ/mol. Write a balanced equation representing the reaction this Hfo describes.

2 C(s) + 3 H2(g) + ½ O2(g) 🡪 CH3CH2OH(l)

1. (10 points) The first step in the production of nitric acid from ammonia involves the oxidation of NH3.

4 NH3(g) + 5 O2(g) 🡪 4 NO(g) + 6 H2O(g)

* 1. Using enthalpies of formation, determine the heat of reaction for this process.

|  |  |
| --- | --- |
|  | Hfo (kJ/mol) |
| NH3(g) | -46.11 |
| NH3(aq) | -80.29 |
| NO(g) | 90.25 |
| H2O(l) | -285.8 |
| H2O(g) | -241.8 |

$$∆H\_{rxn}=4\left(∆H\_{f},NO,g\right)+6\left(∆H\_{f},H\_{2}O,g\right)-4\left(∆H\_{f},NH\_{3},g\right)-5\left(∆H\_{f},O\_{2},g\right)$$

$$=4\left(90.25 kJ\right)+6\left(-241.8 kJ\right)-4\left(-46.11 kJ\right)-5\left(0 kJ\right)$$

$$=\left(361 kJ\right)+\left(-1450.8 kJ\right)—184.44 kJ-\left(0 kJ\right)$$

$$=361 kJ-1450.8 kJ+184.44 kJ$$

$$=-905 kJ$$

* 1. Is this process endothermic or exothermic?

exothermic

* 1. Calculate the energy change when 15.0 grams of ammonia are converted to nitrogen monoxide.

$$?kJ=15.0 g NH\_{3}×\frac{1 mol NH\_{3}}{17.03 g NH\_{3} }×\frac{905 kJ }{4 mol NH\_{3}}=199 kJ energy produced by reaction$$

1. (6 points) Estimate the heat of reaction for the reaction below using bond energies.



Bonds broken

1 C≡C + 837 kJ

2 Cl-Cl 2 (243 kJ) = + 486 kJ

Total + 1323 kJ

Bonds formed

1 C-C - 347 kJ

4 C-Cl 4(- 330 kJ) = -1320 kJ

Total - 1667 kJ

Estimated heat of reaction - 344 kJ