Unit 4 - Week 3 : Themochemistry

Week 3 Assessment 3

The due date for submitting this assignment has passed. **Due on 2018-02-28, 23:59 IST.**

Submitted assignment

1) Calculate the heat of reaction of ethane in kJ mol^{-1}, as described in the equation $C_2H_{6(g)} + 3.5O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(l)}$, given the heats of formation of ethane gas, carbon dioxide gas and water liquid are –84.7 kJ mol^{-1}, -393.5 kJ mol^{-1} and –285.8 kJ mol^{-1} respectively *1 point*

- -1260
- -1360
- -1460
- -1560

No, the answer is incorrect.
Score: 0

Accepted Answers:
-1560

2) Determine the heat of formation of liquid methanol for which the heat of reaction of methanol, as described in the equation *2 points*

$$CH_3OH_{(l)} + 1½\ O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)},$$

is –715 kJ mol-1 and the heats of formation of carbon dioxide gas and water liquid are –393.5 kJ mol-1 and -285.8 kJ mol-1 respectively.

- -250.1
- -275.1
- -300.1
- -325.1

No, the answer is incorrect.
Score: 0

Accepted Answers:
-250.1

3) Determine heat of reaction for combustion reaction $CH_{4\ (g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O$, Given bond energy of C-H, O = O, C = O and O-H are 338,498,-745 and -460 kJ respectively *2 points*

- -922
- -942
- -962
- -982

Week 5 : Chemical Kinetics

Week 6 : Types of reaction and Introduction to Physics of combustion

Week 7 : Transport Phenomena

Week 8 : Conservation Equations

No, the answer is incorrect.
Score: 0

Accepted Answers:
-982

4) Hess's law states that a chemical reaction is independent of its path by which reactions takes place while keeping invariant, ***1 point***

- Initial conditions
- Final conditions
- Both (a) and (b)
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both (a) and (b)

5) The standard enthalpy changes for the formation of aluminium oxide and iron oxide are ***1 point***
2 Al(s) + 1.5 O_2(g) → Al_2O_3(s) ΔH_R = -1676 kJ
2 Fe(s) + 1.5 O_2(g) → Fe_2O_3(s) ΔH_R = -824 kJ
Calculate heat of reaction for the reaction,
Fe_2O_3(s) + 2 Al(s) → Al_2O_3(s) + 2 Fe(s)

- -852 kJ
- 2500 kJ
- 852 kJ
- Insufficient data

No, the answer is incorrect.
Score: 0

Accepted Answers:
-852 kJ

6) Calculate adiabatic flame temperature at constant volume for a combustor working with stoichiometric n-butane-air mixture. Assuming complete combustion with no dissociation. Assume the specific heat capacity of the combustion products is constant evaluated at 2000 K. The combustor operates at 1 atm with initial mixture entering at 298K. ***6 points***

Given:

$h^0_{f,C_4H_{10}}(298K) = -124733 \text{kJ/kmol}$
$h^0_{f,CO_2}(298K) = -393546 \text{kJ/kmol}$
$h^0_{f,H_2O}(298K) = -241845 \text{kJ/kmol}$
$c_{p,H_2O}(2000\,K) = 51.143 \text{ kJ/kmol} - \text{K}$
$c_{p,CO_2}(2000\,K) = 60.433 \text{ kJ/kmol} - \text{K}$
$c_{p,N_2}(2000\,K) = 35.988 \text{ kJ/kmol} - \text{K}$

- 2620K
- 2720K
- 2815K
- 2850K

No, the answer is incorrect.
Score: 0

Accepted Answers:
2720K

7) Determine the lower heating value of liquid ethanol in kJ/kg of C_2H_5OH for which the heat of formation of ethanol is -278000 J/mol ***1 point***

Given:

$h_{fg}(H_2O) = 44010\ kJ/kmol$

$h^0_{f,H_2O(g)}(298K) = -241845 kJ/kmol$

$h^0_{f,CO_2}(298K) = -393546 kJ/kmol$

- 65.32
- 35.36
- 45.20
- 26.84

No, the answer is incorrect.
Score: 0

Accepted Answers:
26.84

8) Evaluate heat of reaction per kJ/kg of C_2H_6 at STP for the following reaction. Use standard enthalpy of formation of C_2H_6 as -84667 kJ/kmol and H_2O in gaseous phase as -241845 kJ/kmol and CO_2 as -393546 kJ/kmol. ***1 point***

$$C_2H_6 + 3.5O_2 \Leftrightarrow 2CO_2 + 3H_2O(g)$$

- -35.5
- -47.5
- -58.5
- -63.8

No, the answer is incorrect.
Score: 0

Accepted Answers:
-47.5

9) Calculate adiabatic flame temperature at constant pressure for a combustor working with stoichiometric n-butane-air mixture. Assuming complete combustion with no dissociation. Assume the specific heat capacity of the combustion products is constant evaluated at 2000 K. The combustor operates at 1 atm with initial mixture entering at 298K. ***5 points***

Given:

$h^0_{f,C_4H_{10}}(298K) = -124733 kJ/kmol$

$h^0_{f,CO_2}(298K) = -393546 kJ/kmol$

$h^0_{f,H_2O}(298K) = -241845 kJ/kmol$

$c_{p,H_2O}(2000\ K) = 51.143\ kJ/kmol - K$

$c_{p,CO_2}(2000\ K) = 60.433\ kJ/kmol - K$

$c_{p,N_2}(2000\ K) = 35.988\ kJ/kmol - K$

- 2520
- 2229
- 2360
- 2230

No, the answer is incorrect.
Score: 0

Accepted Answers:
2229

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