Thermodynamics Quiz #2 V1 2020 Name : Ans /12

1. Find the ΔH_{rxn} of the following reaction using the blue table of $\Delta H°_f$ values. Is this reaction an exothermic or endothermic process?

$C_2H_{6\,(g)} + 7/2\ O_{2\,(g)} \rightarrow 2\ CO_{2\,(g)} + 3\ H_2O_{(l)}$ $\Delta H_{rxn} = ?$ -1559.7 kJ. exothermic

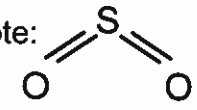
-84.7 0 -393.5 -285.8

ΔH = products − reactants

$= (2(-393.5) + 3(-285.8)) - (-84.7)$

$= (-1644.4) - (-84.7)$

$\Delta H_{rxn} = -1559.7\ kJ$

2. Use the table of bond energies to determine the ΔH_{rxn} of this reaction? Note: 

$$2\,H_2S_{(g)} + 3\,O_{2\,(g)} \rightarrow 2\,H_2O_{(l)} + 2\,SO_{2\,(g)}$$

$2(H-S-H) + 3(O=O) \rightarrow 2(H-O-H) + 2(O=S=O)$

Average enthalpy associated with breaking of certain bonds in kJ

C – H	413	C – O	358	O = O	495
O – H	460	O – O	146	S = O	523
S – H	339	S – O	347		

ΔH = broken − formed

$= (4(339) + 3(495)) - (4(460) + 4(523))$

$= (2841) - (3932)$

$\Delta H_{rxn} = -1091\ kJ$

3. Calculate the Calculate ΔH of reaction for: $B_2H_{6(g)} + 6\ Cl_{2(g)} \rightarrow 2\ BCl_{3(g)} + 6\ HCl_{(g)}$

Given:

1. $BCl_{3\,(g)} + 3\ H_2O_{(l)} \rightarrow H_3BO_{3(s)} + 3\ HCl_{\,(g)}$ $\Delta H = -112.5$ kJ flip x2
2. $B_2H_{6\,(g)} + 6\ H_2O_{\,(l)} \rightarrow 2\ H_3BO_{3(s)} + 6\ H_{2\,(g)}$ $\Delta H = -493.5$ kJ same
3. $\frac{1}{2}\ H_{2\,(g)} + \frac{1}{2}\ Cl_{2(g)} \rightarrow HCl_{(g)}$ $\Delta H = -92.3$ kJ x12

$6HCl + 2H_3BO_3 \rightarrow 2BCl_3 + 6H_2O$ $+112.5 \times 2 = 225.0$

$B_2H_6 + 6H_2O \rightarrow 2H_3BO_3 + 6H_2$ $= -493.5$

$6H_2 + 6Cl_2 \rightarrow 12\ HCl$ $-92.3 \times 12 = -1107.6$

$B_2H_6 + 6Cl_2 \rightarrow 2BCl_3 + 6HCl$ -1376.1 kJ

Thermodynamics Quiz #2 V2 2020 Name : Ans /12

1. Find the ΔH_{rxn} of the following reaction using the blue table of $\Delta H°_f$ values. Is this reaction an exothermic or endothermic process?

$CaSO_{4\,(s)} + 2\,HCl_{(g)} \rightarrow CaCl_{2(s)} + H_2SO_{4(l)}$ $\Delta H_{rxn} = ?$ 11 kJ endothermic

-1432.7 -92.3 -795.0 -811.3

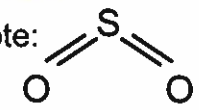
ΔH = products − reactants

$= (-795.0 + -811.3) - (-1432.7 + 2(-92.3))$

$= (-1606.3) - (-1617.3)$

$\Delta H = 11$ kJ

2. Use the table of bond energies to determine the ΔH_{rxn} of this reaction? Note: reverse.



$$2\,H_2S_{(g)} + 3\,O_{2(g)} \rightarrow 2\,H_2O_{(l)} + 2\,SO_{2(g)}$$

2(H-S-H) + 3(O=O) → 2(H-O-H) + 2(O=S=O)

Average enthalpy associated with breaking of certain bonds in kJ

C – H	413	C – O	358	O = O	495
O – H	460	O – O	146	S = O	523
S – H	339	S – O	347		

ΔH = broken − formed

$= (4(339) + 3(495)) - (4(460) + 4(523))$

$= (2841) - (3932)$

$\Delta H = -1091$ kJ

3. Calculate the Calculate ΔH of reaction for: $CH_3OH(g) \longrightarrow H_2CO(g) + H_2(g)$

Given:

$2\,CH_3OH(g) + 3\,O_2(g) \longrightarrow 2\,CO_2(g) + 4\,H_2O(g)$ $\Delta H = -1353$ kJ) ÷ 2

$H_2CO(g) + O_2(g) \longrightarrow H_2O(g) + CO_2(g)$ $\Delta H = -520$ kJ Flip.

$2\,H_2(g) + O_2(g) \longrightarrow 2\,H_2O(g)$ $\Delta H = -484$ kJ) Flip ÷ 2

$CH_3OH + 1.5\,O_2 \rightarrow CO_2 + 2\,H_2O$ $\frac{-1353}{2} = -676.5$

$H_2O + CO_2 \rightarrow H_2CO + O_2$ $= +520$

$H_2O \rightarrow H_2 + 0.5\,O_2$ $\frac{+484}{2} = +242$

$CH_3OH \rightarrow H_2CO + H_2$ 85.5 kJ

86 kJ