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Last KeyFirst Answer

Question 1

3 Points

Consider the reaction: $2 \text{C}_2\text{H}_6(\text{g}) + 7 \text{O}_2(\text{g}) \longrightarrow 4 \text{CO}_2(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$ for which $\Delta H^\circ = -2855 \text{ kJ}$ and $\Delta S^\circ = 92.70 \text{ J/K}$ at 298 K.Calculate the entropy change of the UNIVERSE when 1.606 moles of $\text{C}_2\text{H}_6(\text{g})$ react under standard conditions at 298 K.

$$\Delta S^\circ_{\text{Universe}} = \underline{7768} \text{ J/K}$$

See bottom of page for explanation

- Is this reaction reactant or product favored? Product
- If the reaction is product favored, is it enthalpy favored, entropy favored, or favored by both enthalpy and entropy? If the reaction is reactant favored, choose reactant favored. Both

Question 2

2 Points

A student determines the value of the equilibrium constant to be 3.9×10^{13} for the following reaction.

Based on this value of K:

- ΔG° for this reaction is expected to be >0 or <0 : <0
- Calculate the free energy change for the reaction of 1.57 moles of HCl(g) at standard conditions at 298K. Must show work for full credit

$$\begin{aligned} \Delta G^0 &= -RT \ln K \\ &= -8.314(298) \ln 3.9 \times 10^{13} \\ &= -7.75 \times 10^4 \text{ J} \\ &= -77.5 \text{ kJ} \end{aligned}$$

Note the stoichiometry highlighted

$$\begin{aligned} \Delta G^0_{\text{rxn}} &= 1.57 \times (-77.5/4) \\ &= -30.4 \text{ kJ} \end{aligned}$$

$$\Delta G^0_{\text{rxn}} = \underline{-30.4} \text{ kJ}$$

Question 3

3 Points

Without doing any calculations, match the following thermodynamic properties with their appropriate numerical value given on the right for the following exothermic reaction.



- ΔS_{rxn} 1
- ΔG_{rxn} 2
- $\Delta S_{\text{universe}}$ 1

- > 0
- < 0
- $= 0$
- > 0 at low T, < 0 at high T
- < 0 at low T, > 0 at high T

Question 1
Explanation

I am going to use different colors for each part of this which I hope will help.

$$DS^0_{\text{univ}} = DS^0_{\text{sys}} + DS^0_{\text{Surr}}$$

$$DS^0_{\text{sys}} = 92.7 \text{ J/K} \dots \text{ see question, this is given.}$$

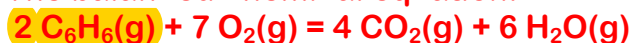
$$\begin{aligned} DS^0_{\text{surr}} &= -DH^0_{\text{rxn}} / T \\ &= -(-2,855,000/298) \\ &= 9581 \text{ J/K} \end{aligned}$$

$$\begin{aligned} DS^0_{\text{univ}} &= 92.7 + 9581 \\ &= 9673.7 \text{ J/K} \end{aligned}$$

In an Exam many would give this answer and receive significant partial credit but you would have omitted the stoichiometry.

a) The question asks DS^0_{univ} when 1.606 mol of $\text{C}_2\text{H}_6(\text{g})$ reacts

b) The balanced chemical equation:-



$$\begin{aligned} DS^0_{\text{univ}} &= 1.606 \times (9673.7/2) \\ &= 7767.9 \text{ J/K} \end{aligned}$$