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Temperature and Pressure Effects Formulas

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List of 9 Temperature and Pressure Effects Formulas

Temperature and Pressure Effects

1) Adiabatic Heat of Equilibrium Conversion

Open Calculator

fx $$\Delta H_{r1} = \left(-\frac{\left(C' \cdot \Delta T \right) + \left(\left(C'' - C' \right) \cdot \Delta T \right) \cdot X_A}{X_A} \right)$$

ex $$-886.666667\text{J/mol} = \left(-\frac{(7.98\text{J/(kg*K)} \cdot 50\text{K}) + ((14.63\text{J/(kg*K)} - 7.98\text{J/(kg*K)}) \cdot 50\text{K}) \cdot 0.72}{0.72} \right)$$

2) Equilibrium Conversion of Reaction at Final Temperature

Open Calculator

fx $$K_2 = K_1 \cdot \exp\left(-\left(\frac{\Delta H_r}{[R]} \right) \cdot \left(\frac{1}{T_2} - \frac{1}{T_1} \right) \right)$$

ex $$0.62993 = 0.6 \cdot \exp\left(-\left(\frac{\text{-955J/mol}}{[R]} \right) \cdot \left(\frac{1}{368\text{K}} - \frac{1}{436\text{K}} \right) \right)$$

3) Equilibrium Conversion of Reaction at Initial Temperature

Open Calculator

fx $$K_1 = \frac{K_2}{\exp\left(-\left(\frac{\Delta H_r}{[R]} \right) \cdot \left(\frac{1}{T_2} - \frac{1}{T_1} \right) \right)}$$

ex $$0.600067 = \frac{0.63}{\exp\left(-\left(\frac{\text{-955J/mol}}{[R]} \right) \cdot \left(\frac{1}{368\text{K}} - \frac{1}{436\text{K}} \right) \right)}$$

4) Final Temperature for Equilibrium Conversion

Open Calculator

fx $$T_2 = \frac{-(\Delta H_r) \cdot T_1}{\left(T_1 \cdot \ln\left(\frac{K_2}{K_1} \right) \cdot [R] \right) + (-(\Delta H_r))}$$

ex $$367.8693\text{K} = \frac{-(\text{-955J/mol}) \cdot 436\text{K}}{\left(436\text{K} \cdot \ln\left(\frac{0.63}{0.6} \right) \cdot [R] \right) + (-(\text{-955J/mol}))}$$

5) Heat of Reaction at Equilibrium Conversion

Open Calculator

fx $$\Delta H_r = \left(-\frac{\ln\left(\frac{K_2}{K_1}\right) \cdot [R]}{\frac{1}{T_2} - \frac{1}{T_1}} \right)$$

ex $$-957.17613\text{J/mol} = \left(-\frac{\ln\left(\frac{0.63}{0.6}\right) \cdot [R]}{\frac{1}{368\text{K}} - \frac{1}{436\text{K}}} \right)$$

6) Initial Temperature for Equilibrium Conversion

Open Calculator

fx $$T_1 = \frac{-(\Delta H_r) \cdot T_2}{-(\Delta H_r) - \left(\ln\left(\frac{K_2}{K_1}\right) \cdot [R] \cdot T_2\right)}$$

ex $$436.1837\text{K} = \frac{-(-955\text{J/mol}) \cdot 368\text{K}}{-(-955\text{J/mol}) - \left(\ln\left(\frac{0.63}{0.6}\right) \cdot [R] \cdot 368\text{K}\right)}$$

7) Non Adiabatic Heat of Equilibrium Conversion

Open Calculator

fx $$Q = (X_A \cdot \Delta H_{r2}) + \left(C' \cdot \Delta T\right)$$

ex $$1908.12\text{J/mol} = (0.72 \cdot 2096\text{J/mol}) + (7.98\text{J/(kg*K)} \cdot 50\text{K})$$

8) Reactant Conversion at Adiabatic Conditions

Open Calculator

fx $$X_A = \frac{C' \cdot \Delta T}{-\Delta H_{r1} - \left(C'' - C'\right) \cdot \Delta T}$$

ex $$0.722172 = \frac{7.98\text{J/(kg*K)} \cdot 50\text{K}}{-(-885\text{J/mol}) - (14.63\text{J/(kg*K)} - 7.98\text{J/(kg*K)}) \cdot 50\text{K}}$$

9) Reactant Conversion at Non Adiabatic Conditions

Open Calculator

fx $$X_A = \frac{\left(C' \cdot \Delta T\right) - Q}{-\Delta H_{r2}}$$

ex $$0.718511 = \frac{(7.98\text{J/(kg*K)} \cdot 50\text{K}) - 1905\text{J/mol}}{-2096\text{J/mol}}$$

Variables Used

- ΔT Change in Temperature *(Kelvin)*
- C' Mean Specific Heat of Unreacted Stream *(Joule per Kilogram per K)*
- C'' Mean Specific Heat of Product Stream *(Joule per Kilogram per K)*
- K_1 Thermodynamic Constant at Initial Temperature
- K_2 Thermodynamic Constant at Final Temperature
- Q Total Heat *(Joule Per Mole)*
- T_1 Initial Temperature for Equilibrium Conversion *(Kelvin)*
- T_2 Final Temperature for Equilibrium Conversion *(Kelvin)*
- X_A Reactant Conversion
- ΔH_r Heat of Reaction per Mole *(Joule Per Mole)*
- ΔH_{r1} Heat of Reaction at Initial Temperature *(Joule Per Mole)*
- ΔH_{r2} Heat of Reaction per Mole at Temperature T2 *(Joule Per Mole)*

Constants, Functions, Measurements used

- Constant: **[R]**, 8.31446261815324 Joule / Kelvin * Mole
  Universal gas constant
- Function: **exp**, exp(Number)
  Exponential function
- Function: **ln**, ln(Number)
  Natural logarithm function (base e)
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Temperature Difference** in Kelvin (K)
  Temperature Difference Unit Conversion
- Measurement: **Specific Heat Capacity** in Joule per Kilogram per K (J/(kg*K))
  Specific Heat Capacity Unit Conversion
- Measurement: **Energy Per Mole** in Joule Per Mole (J/mol)
  Energy Per Mole Unit Conversion

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