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Important Formulas of Clausius-Clapeyron Equation

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List of 22 Important Formulas of Clausius-Clapeyron Equation

Important Formulas of Clausius-Clapeyron Equation

1) August Roche Magnus Formula

Open Calculator

fx $$e_s = 6.1094 \cdot \exp\left(\frac{17.625 \cdot T}{T + 243.04}\right)$$

ex $$587.9994\text{Pa} = 6.1094 \cdot \exp\left(\frac{17.625 \cdot 85\text{K}}{85\text{K} + 243.04}\right)$$

2) Boiling Point given Enthalpy using Trouton's Rule

Open Calculator

fx $$bp = \frac{H}{10.5 \cdot [R]}$$

ex $$559.5128\text{K} = \frac{25\text{KJ}}{10.5 \cdot [R]}$$

3) Boiling Point using Trouton's Rule given Latent Heat

Open Calculator

fx $$bp = \frac{LH}{10.5 \cdot [R]}$$

ex $$286.5999\text{K} = \frac{25020.7\text{J}}{10.5 \cdot [R]}$$

4) Boiling Point using Trouton's Rule given Specific Latent Heat

Open Calculator

$$\text{fx}\quad \text{bp} = \frac{\text{L} \cdot \text{MW}}{10.5 \cdot [\text{R}]}$$

$$\text{ex}\quad 286.6\text{K} = \frac{208505.9\text{J/kg} \cdot 120\text{g}}{10.5 \cdot [\text{R}]}$$

5) Change in Pressure using Clausius Equation

Open Calculator

$$\text{fx}\quad \Delta\text{P} = \frac{\Delta\text{T} \cdot \Delta\text{H}_\text{v}}{(\text{V}_\text{m} - \text{v}) \cdot \text{T}_\text{abs}}$$

$$\text{ex}\quad 76.78485\text{Pa} = \frac{50.5\text{K} \cdot 11\text{KJ/mol}}{(32\text{m}^3\text{/mol} - 5.5\text{m}^3) \cdot 273}$$

6) Enthalpy of Vaporization using Trouton's Rule

Open Calculator

$$\text{fx}\quad \text{H} = \text{bp} \cdot 10.5 \cdot [\text{R}]$$

$$\text{ex}\quad 25.02071\text{KJ} = 286.6\text{K} \cdot 10.5 \cdot [\text{R}]$$

7) Enthalpy using Integrated Form of Clausius-Clapeyron Equation

Open Calculator

$$\text{fx}\quad \Delta\text{H} = \frac{-\ln\left(\frac{\text{P}_\text{f}}{\text{P}_\text{i}}\right) \cdot [\text{R}]}{\left(\frac{1}{\text{T}_\text{f}}\right) - \left(\frac{1}{\text{T}_\text{i}}\right)}$$

$$\text{ex}\quad 25020.29\text{J/kg} = \frac{-\ln\left(\frac{133.07\text{Pa}}{65\text{Pa}}\right) \cdot [\text{R}]}{\left(\frac{1}{700\text{K}}\right) - \left(\frac{1}{600\text{K}}\right)}$$

8) Entropy of Vaporization using Trouton's Rule

Open Calculator

$$S = (4.5 \cdot [R]) + ([R] \cdot \ln(T))$$

$$74.35334\text{J/K} = (4.5 \cdot [R]) + ([R] \cdot \ln(85\text{K}))$$

9) Final Pressure using Integrated Form of Clausius-Clapeyron Equation

Open Calculator

$$P_f = \left(\exp\left(-\frac{LH \cdot \left(\left(\frac{1}{T_f}\right) - \left(\frac{1}{T_i}\right)\right)}{[R]}\right)\right) \cdot P_i$$

$$133.0715\text{Pa} = \left(\exp\left(-\frac{25020.7\text{J} \cdot \left(\left(\frac{1}{700\text{K}}\right) - \left(\frac{1}{600\text{K}}\right)\right)}{[R]}\right)\right) \cdot 65\text{Pa}$$

10) Final Temperature using Integrated Form of Clausius-Clapeyron Equation

Open Calculator

$$T_f = \frac{1}{\left(-\frac{\ln\left(\frac{P_f}{P_i}\right) \cdot [R]}{LH}\right) + \left(\frac{1}{T_i}\right)}$$

$$699.9981\text{K} = \frac{1}{\left(-\frac{\ln\left(\frac{133.07\text{Pa}}{65\text{Pa}}\right) \cdot [R]}{25020.7\text{J}}\right) + \left(\frac{1}{600\text{K}}\right)}$$

11) Latent Heat of Evaporation of Water near Standard Temperature and Pressure

Open Calculator

$$LH = \left(\frac{dedT_{slope} \cdot [R] \cdot \left(T^2\right)}{e_S} \right) \cdot MW$$

$$25030J = \left(\frac{25Pa/K \cdot [R] \cdot \left((85K)^2\right)}{7.2Pa} \right) \cdot 120g$$

12) Latent Heat of Vaporization for Transitions

Open Calculator

$$LH = -(\ln(P) - c) \cdot [R] \cdot T$$

$$29178.33J = -(\ln(41Pa) - 45) \cdot [R] \cdot 85K$$

13) Latent Heat using Integrated Form of Clausius-Clapeyron Equation

Open Calculator

$$LH = \frac{-\ln\left(\frac{P_f}{P_i}\right) \cdot [R]}{\left(\frac{1}{T_f}\right) - \left(\frac{1}{T_i}\right)}$$

$$25020.29J = \frac{-\ln\left(\frac{133.07Pa}{65Pa}\right) \cdot [R]}{\left(\frac{1}{700K}\right) - \left(\frac{1}{600K}\right)}$$

14) Latent Heat using Trouton's Rule

Open Calculator

$$LH = bp \cdot 10.5 \cdot [R]$$

$$25020.71J = 286.6K \cdot 10.5 \cdot [R]$$

15) Saturation Vapor Pressure near Standard Temperature and Pressure

Open Calculator

$$e_S = \frac{dedT_{slope} \cdot [R] \cdot \left(T^2\right)}{L}$$

$$7.202673\text{Pa} = \frac{25\text{Pa/K} \cdot [R] \cdot \left((85\text{K})^2\right)}{208505.9\text{J/kg}}$$

16) Slope of Coexistence Curve given Pressure and Latent Heat

Open Calculator

$$dPbydT = \frac{P \cdot LH}{\left(T^2\right) \cdot [R]}$$

$$17.07699\text{Pa/K} = \frac{41\text{Pa} \cdot 25020.7\text{J}}{\left((85\text{K})^2\right) \cdot [R]}$$

17) Slope of Coexistence Curve of Water Vapor near Standard Temperature and Pressure

Open Calculator

$$dedT_{slope} = \frac{L \cdot e_S}{[R] \cdot \left(T^2\right)}$$

$$24.99072\text{Pa/K} = \frac{208505.9\text{J/kg} \cdot 7.2\text{Pa}}{[R] \cdot \left((85\text{K})^2\right)}$$

18) Slope of Coexistence Curve using Enthalpy

Open Calculator

$$\text{dPbydT} = \frac{\Delta \text{H'}}{\text{T} \cdot \Delta \text{V}}$$

$$17\text{Pa/K} = \frac{80920\text{J}}{85\text{K} \cdot 56\text{m}^3}$$

19) Slope of Coexistence Curve using Entropy

Open Calculator

$$\text{dPbydT} = \frac{\Delta \text{S}}{\Delta \text{V}}$$

$$16.07143\text{Pa/K} = \frac{900\text{J/K}}{56\text{m}^3}$$

20) Specific Latent Heat of Evaporation of Water near Standard Temperature and Pressure

Open Calculator

$$\text{L} = \frac{\text{dedT}_{\text{slope}} \cdot [\text{R}] \cdot \left(\text{T}^2\right)}{\text{e}_\text{S}}$$

$$208583.3\text{J/kg} = \frac{25\text{Pa/K} \cdot [\text{R}] \cdot \left((85\text{K})^2\right)}{7.2\text{Pa}}$$

21) Specific Latent Heat using Integrated Form of Clausius-Clapeyron Equation

Open Calculator

fx $$L = \frac{-\ln\left(\frac{P_f}{P_i}\right)\cdot[R]}{\left(\left(\frac{1}{T_f}\right)-\left(\frac{1}{T_i}\right)\right)\cdot MW}$$

ex $$208502.5\,J/kg = \frac{-\ln\left(\frac{133.07\,Pa}{65\,Pa}\right)\cdot[R]}{\left(\left(\frac{1}{700\,K}\right)-\left(\frac{1}{600\,K}\right)\right)\cdot 120\,g}$$

22) Specific Latent Heat using Trouton's Rule

Open Calculator

fx $$L = \frac{bp\cdot 10.5\cdot[R]}{MW}$$

ex $$208505.9\,J/kg = \frac{286.6\,K\cdot 10.5\cdot[R]}{120\,g}$$

Variables Used

- ΔT Change in Temperature *(Kelvin)*
- ΔV Change in Volume *(Cubic Meter)*
- **bp** Boiling Point *(Kelvin)*
- **c** Integration Constant
- **dedT$_{slope}$** Slope of Co-existence Curve of Water Vapor *(Pascal per Kelvin)*
- **dPbydT** Slope of Coexistence Curve *(Pascal per Kelvin)*
- **e$_s$** Saturation Vapour Pressure *(Pascal)*
- **e$_S$** Saturation Vapor Pressure *(Pascal)*
- **H** Enthalpy *(Kilojoule)*
- **L** Specific Latent Heat *(Joule per Kilogram)*
- **LH** Latent Heat *(Joule)*
- **MW** Molecular Weight *(Gram)*
- **P** Pressure *(Pascal)*
- **P$_f$** Final Pressure of System *(Pascal)*
- **P$_i$** Initial Pressure of System *(Pascal)*
- **S** Entropy *(Joule per Kelvin)*
- **T** Temperature *(Kelvin)*
- **T$_{abs}$** Absolute Temperature
- **T$_f$** Final Temperature *(Kelvin)*
- **T$_i$** Initial Temperature *(Kelvin)*
- **v** Molal Liquid Volume *(Cubic Meter)*
- **V$_m$** Molar Volume *(Cubic Meter per Mole)*

- **ΔH** Change in Enthalpy *(Joule per Kilogram)*
- **ΔH'** Enthalpy Change *(Joule)*
- ΔH_V Molal Heat of Vaporization *(KiloJoule Per Mole)*
- **ΔP** Change in Pressure *(Pascal)*
- **ΔS** Change in Entropy *(Joule per Kelvin)*

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: **Weight** in Gram (g)
  Weight Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Energy** in Kilojoule (KJ), Joule (J)
  Energy Unit Conversion
- Measurement: **Heat of Combustion (per Mass)** in Joule per Kilogram (J/kg)
  Heat of Combustion (per Mass) Unit Conversion
- Measurement: **Latent Heat** in Joule per Kilogram (J/kg)
  Latent Heat Unit Conversion
- Measurement: **Molar Magnetic Susceptibility** in Cubic Meter per Mole (m^3/mol)
  Molar Magnetic Susceptibility Unit Conversion
- Measurement: **Energy Per Mole** in KiloJoule Per Mole (KJ/mol)
  Energy Per Mole Unit Conversion

- Measurement: **Slope of Coexistence Curve** in Pascal per Kelvin (Pa/K)
  Slope of Coexistence Curve Unit Conversion
- Measurement: **Entropy** in Joule per Kelvin (J/K)
  Entropy Unit Conversion

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