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Important formulae on Clausius Model of Real Gas Formulas

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List of 19 Important formulae on Clausius Model of Real Gas Formulas

Important formulae on Clausius Model of Real Gas

1) Actual Pressure of Real Gas given Clausius Parameter a, Reduced and Critical Parameters

Open Calculator

fx $$\mathrm{Pa} = \left(\frac{27 \cdot \left([\mathrm{R}]^2\right) \cdot \left(\mathrm{T'}_c^3\right)}{64 \cdot \mathrm{a}}\right) \cdot \mathrm{P_r}$$

ex $$8.6\mathrm{E\hat{}8Pa} = \left(\frac{27 \cdot \left([\mathrm{R}]^2\right) \cdot \left((154.4\mathrm{K})^3\right)}{64 \cdot 0.1}\right) \cdot 0.8$$

2) Actual Pressure of Real Gas given Clausius Parameter b, Reduced and Actual Parameters

Open Calculator

fx $$\mathrm{Pb} = \left(\frac{[\mathrm{R}] \cdot \left(\frac{\mathrm{T_{rg}}}{\mathrm{T_r}}\right)}{4 \cdot \left(\left(\frac{\mathrm{V_{real}}}{\mathrm{V_r}}\right) - \mathrm{b'}\right)}\right) \cdot \mathrm{P_r}$$

ex $$21.56464\mathrm{Pa} = \left(\frac{[\mathrm{R}] \cdot \left(\frac{300\mathrm{K}}{10}\right)}{4 \cdot \left(\left(\frac{22\mathrm{L}}{9.5\mathrm{L}}\right) - 2.43\mathrm{E\hat{}-3}\right)}\right) \cdot 0.8$$

3) Actual Pressure of Real Gas given Clausius Parameter c, Reduced and Actual Parameters

Open Calculator

fx $$\mathrm{Pc} = \left(\frac{3 \cdot [\mathrm{R}] \cdot \left(\frac{\mathrm{T_{rg}}}{\mathrm{T_r}}\right)}{8 \cdot \left(\mathrm{c} + \left(\frac{\mathrm{V_{real}}}{\mathrm{V_r}}\right)\right)}\right) \cdot \mathrm{P_r}$$

ex $$32.31023\mathrm{Pa} = \left(\frac{3 \cdot [\mathrm{R}] \cdot \left(\frac{300\mathrm{K}}{10}\right)}{8 \cdot \left(0.0002 + \left(\frac{22\mathrm{L}}{9.5\mathrm{L}}\right)\right)}\right) \cdot 0.8$$

4) Actual Temperature of Real Gas given Clausius Parameter a, Reduced and Actual Parameters

Open Calculator

fx $$T_{RP} = \left(\left(\frac{a \cdot 64 \cdot \left(\frac{p}{P_r} \right)}{27 \cdot \left([R]^2 \right)} \right)^{\frac{1}{3}} \right) \cdot T_r$$

ex $$15.07935K = \left(\left(\frac{0.1 \cdot 64 \cdot \left(\frac{800Pa}{0.8} \right)}{27 \cdot \left([R]^2 \right)} \right)^{\frac{1}{3}} \right) \cdot 10$$

5) Actual Temperature of Real Gas using Critical and Reduced Temperature

Open Calculator

fx $$T_{RT} = T_r \cdot T'_c$$

ex $$1544K = 10 \cdot 154.4K$$

6) Actual Volume of Real Gas using Clausius Parameter b, Reduced and Critical Parameters

Open Calculator

fx $$V_{real\_CP} = \left(b' + \left(\frac{[R] \cdot T'_c}{4 \cdot P'_c} \right) \right) \cdot V_r$$

ex $$0.023748L = \left(2.43E\hat{}\text{-}3 + \left(\frac{[R] \cdot 154.4K}{4 \cdot 4.6E\hat{}6Pa} \right) \right) \cdot 9.5L$$

7) Actual Volume of Real Gas using Clausius Parameter c, Reduced and Critical Parameters

Open Calculator

fx $$V_{real\_CP} = \left(\left(\frac{3 \cdot [R] \cdot T_c}{8 \cdot P'_c} \right) - c \right) \cdot V'_{m,r}$$

ex $$2.137343L = \left(\left(\frac{3 \cdot [R] \cdot 647K}{8 \cdot 4.6E\hat{}6Pa} \right) - 0.0002 \right) \cdot 8.96$$

8) Clausius Parameter b given Reduced and Actual Parameters

Open Calculator

fx $$b_{RP} = \left(\frac{V_{real}}{V_r} \right) - \left(\frac{[R] \cdot \left(\frac{T_{rg}}{T_r} \right)}{4 \cdot \left(\frac{p}{P_r} \right)} \right)$$

ex $$2.253431 = \left(\frac{22L}{9.5L} \right) - \left(\frac{[R] \cdot \left(\frac{300K}{10} \right)}{4 \cdot \left(\frac{800Pa}{0.8} \right)} \right)$$

9) Clausius Parameter c given Critical Parameters

Open Calculator

$$c_{CP} = \left(\frac{3 \cdot [R] \cdot T_c}{8 \cdot P_c}\right) - V_c$$

$$9.243654 = \left(\frac{3 \cdot [R] \cdot 647K}{8 \cdot 218Pa}\right) - 10L$$

10) Critical Molar Volume of Real Gas using Clausius Equation given Reduced and Actual Parameters

Open Calculator

$$V_{RP} = \frac{\left(\frac{[R] \cdot T_{rg}}{p + \left(\frac{a}{T_{rg}}\right)}\right) + b'}{V'_{m,r}}$$

$$0.348254 m^3/mol = \frac{\left(\frac{[R] \cdot 300K}{800Pa + \left(\frac{0.1}{300K}\right)}\right) + 2.43E\hat{}-3}{8.96}$$

11) Critical Molar Volume using Clausius Equation given Actual and Critical Parameters

Open Calculator

$$V_{RP} = \frac{\left(\frac{[R] \cdot T_{rg}}{p + \left(\frac{a}{T_{rg}}\right)}\right) + b'}{V_m}$$

$$0.139301 m^3/mol = \frac{\left(\frac{[R] \cdot 300K}{800Pa + \left(\frac{0.1}{300K}\right)}\right) + 2.43E\hat{}-3}{22.4 m^3/mol}$$

12) Critical Pressure of Real Gas using Actual and Reduced Pressure

Open Calculator

$$P_{CP} = \frac{p}{P_r}$$

$$1000Pa = \frac{800Pa}{0.8}$$

13) Critical Temperature given Clausius Parameter c, Reduced and Actual Parameters

Open Calculator

$$T_{c\_RP} = \frac{\left(c + \left(\frac{V_{real}}{V_r}\right)\right) \cdot 8 \cdot \left(\frac{p}{P_r}\right)}{3 \cdot [R]}$$

$$742.7987K = \frac{\left(0.0002 + \left(\frac{22L}{9.5L}\right)\right) \cdot 8 \cdot \left(\frac{800Pa}{0.8}\right)}{3 \cdot [R]}$$

14) Molar Volume of Real Gas using Clausius Equation

Open Calculator

fx $$V_{m\_CE} = \left(\frac{[R] \cdot T_{rg}}{p + \left(\frac{a}{T_{rg}} \right)} \right) + b'$$

ex $$3.120352 m^3/mol = \left(\frac{[R] \cdot 300K}{800Pa + \left(\frac{0.1}{300K} \right)} \right) + 2.43E\hat{}-3$$

15) Reduced Pressure of Real Gas using Actual and Critical Pressure

Open Calculator

fx $$P_{r\_AP\_RP} = \frac{P_{rg}}{P'_c}$$

ex $$0.002203 = \frac{10132Pa}{4.6E\hat{}6Pa}$$

16) Reduced Temperature of Real Gas using Clausius Equation given Reduced and Actual Parameters

Open Calculator

fx $$T_{r\_RP\_AP} = \frac{\left(p + \left(\frac{a}{(V_m + c)^2} \right) \right) \cdot \left(\frac{V_m - b'}{[R]} \right)}{T_{rg}}$$

ex $$7.183491 = \frac{\left(800Pa + \left(\frac{0.1}{(22.4 m^3/mol + 0.0002)^2} \right) \right) \cdot \left(\frac{22.4 m^3/mol - 2.43E\hat{}-3}{[R]} \right)}{300K}$$

17) Reduced Volume of Real Gas given Clausius Parameter c, Reduced and Actual Parameters

Open Calculator

fx $$V_{r\_RP\_AP} = \frac{V_{real}}{\left(\frac{3 \cdot [R] \cdot \left(\frac{T_{real}}{T_r} \right)}{8 \cdot \left(\frac{P_{real}}{P_r} \right)} \right) - c}$$

ex $$0.029702 = \frac{22L}{\left(\frac{3 \cdot [R] \cdot \left(\frac{300K}{10} \right)}{8 \cdot \left(\frac{101Pa}{0.8} \right)} \right) - 0.0002}$$

18) Temperature of Real Gas using Clausius Equation

Open Calculator

fx $$T_{CE} = \left(p + \left(\frac{a}{\left((V_m + c)^2 \right)} \right) \right) \cdot \left(\frac{V_m - b'}{[R]} \right)$$

ex $$2155.047K = \left(800Pa + \left(\frac{0.1}{\left((22.4m^3/mol + 0.0002)^2 \right)} \right) \right) \cdot \left(\frac{22.4m^3/mol - 2.43E\hat{}-3}{[R]} \right)$$

19) Temperature of Real Gas using Clausius Equation given Reduced and Critical Parameters

Open Calculator

fx $$T_{CE} = \left((P_r \cdot P'_c) + \left(\frac{a}{\left(((V'_{m,r} \cdot V_{m,c}) + c)^2 \right)} \right) \right) \cdot \left(\frac{(V'_{m,r} \cdot V_{m,c}) - b'}{[R]} \right)$$

ex $$4.6E\hat{}7K = \left((0.8 \cdot 4.6E\hat{}6Pa) + \left(\frac{0.1}{\left(((8.96 \cdot 11.5m^3/mol) + 0.0002)^2 \right)} \right) \right) \cdot \left(\frac{(8.96 \cdot 11.5m^3/mol) - 2.43E\hat{}}{[R]} \right)$$

Variables Used

- **a** Clausius Parameter a
- **b'** Clausius Parameter b for Real Gas
- b_{RP} Clausius Parameter b given RP
- **c** Clausius Parameter c
- c_{CP} Clausius Parameter c given CP
- **p** Pressure *(Pascal)*
- P_c Critical Pressure *(Pascal)*
- P'_c Critical Pressure of Real Gas *(Pascal)*
- P_{CP} Critical Pressure given RP *(Pascal)*
- P_r Reduced Pressure
- $P_{r\_AP\_RP}$ Reduced Pressure given RP AP
- P_{real} Real Gas Pressure *(Pascal)*
- P_{rg} Pressure of Gas *(Pascal)*
- **Pa** Pressure given a *(Pascal)*
- **Pb** Pressure given b *(Pascal)*
- **Pc** Pressure given c *(Pascal)*
- T_c Critical Temperature *(Kelvin)*
- T'_c Critical Temperature For Clausius Model *(Kelvin)*
- T_{c_RP} Critical temperature given RP *(Kelvin)*
- T_{CE} Temperature given CE *(Kelvin)*
- T_r Reduced Temperature
- $T_{r\_RP\_AP}$ Reduced Temperature given RP AP
- T_{real} Real Gas Temperature *(Kelvin)*
- T_{rg} Temperature of Real Gas *(Kelvin)*
- T_{RP} Temperature given RP *(Kelvin)*
- T_{RT} Temperature given RT *(Kelvin)*
- V_c Critical Volume *(Liter)*
- V_m Molar Volume *(Cubic Meter per Mole)*
- $V_{m,c}$ Critical Molar Volume *(Cubic Meter per Mole)*
- $V'_{m,r}$ Reduced Molar Volume for Real Gas
- V_{m_CE} Molar Volume given CE *(Cubic Meter per Mole)*
- V_r Reduced Volume *(Liter)*
- $V_{r\_RP\_AP}$ Reduced Volume given RP AP

- V_{real} Volume of Real Gas *(Liter)*
- V_{real_CP} Volume of Real Gas given CP *(Liter)*
- V_{RP} Critical Molar Volume given RP *(Cubic Meter per Mole)*

Constants, Functions, Measurements used

- Constant: **[R]**, 8.31446261815324 Joule / Kelvin * Mole
  Universal gas constant
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Volume** in Liter (L)
  Volume Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Molar Magnetic Susceptibility** in Cubic Meter per Mole (m^3/mol)
  Molar Magnetic Susceptibility Unit Conversion

Check other formula lists

- Actual Pressure of Real Gas Formulas
- Actual Temperature of Real Gas Formulas
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