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Average velocity of gas and Acentric factor Formulas

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List of 11 Average velocity of gas and Acentric factor Formulas

Average velocity of gas and Acentric factor

1) Acentric Factor

$$fx \quad \omega_{vp} = -\log_{10}(\text{Pr}^{\text{saturated}}) - 1$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad -1.70757 = -\log_{10}(5.1\text{Pa}) - 1$$

2) Acentric Factor given Actual and Critical Saturation Vapor Pressure

$$fx \quad \omega_{vp} = -\log_{10}\left(\frac{P^{\text{saturated}}}{P_c^{\text{saturation}}}\right) - 1$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$ex \quad -1.455932 = -\log_{10}\left(\frac{6\text{Pa}}{2.1\text{Pa}}\right) - 1$$


3) Average Velocity of Gas given Pressure and Density

$$fx \quad v_{\text{avg_P_D}} = \sqrt{\frac{8 \cdot P_{\text{gas}}}{\pi \cdot \rho_{\text{gas}}}}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$ex \quad 20.68161\text{m/s} = \sqrt{\frac{8 \cdot 0.215\text{Pa}}{\pi \cdot 0.00128\text{kg/m}^3}}$$




4) Average Velocity of Gas given Pressure and Density in 2D 

$$\text{fx } v_{\text{avg_P_D}} = \sqrt{\frac{\pi \cdot P_{\text{gas}}}{2 \cdot \rho_{\text{gas}}}}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)


$$\text{ex } 16.2433\text{m/s} = \sqrt{\frac{\pi \cdot 0.215\text{Pa}}{2 \cdot 0.00128\text{kg/m}^3}}$$

5) Average Velocity of Gas given Pressure and Volume 

$$\text{fx } v_{\text{avg_P_V}} = \sqrt{\frac{8 \cdot P_{\text{gas}} \cdot V}{\pi \cdot M_{\text{molar}}}}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{ex } 0.527883\text{m/s} = \sqrt{\frac{8 \cdot 0.215\text{Pa} \cdot 22.4\text{L}}{\pi \cdot 44.01\text{g/mol}}}$$


6) Average Velocity of Gas given Pressure and Volume in 2D 

$$\text{fx } v_{\text{avg_P_V}} = \sqrt{\frac{\pi \cdot P_{\text{gas}} \cdot V}{2 \cdot M_{\text{molar}}}}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$\text{ex } 0.414598\text{m/s} = \sqrt{\frac{\pi \cdot 0.215\text{Pa} \cdot 22.4\text{L}}{2 \cdot 44.01\text{g/mol}}}$$



7) Average Velocity of Gas given Root Mean Square Speed 

$$\text{fx } v_{\text{avg_RMS}} = (0.9213 \cdot C_{\text{RMS_speed}})$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 9.67365\text{m/s} = (0.9213 \cdot 10.5\text{m/s})$$

8) Average Velocity of Gas given Root Mean Square Speed in 2D 

$$\text{fx } v_{\text{avg_RMS}} = (0.8862 \cdot C_{\text{RMS_speed}})$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)


$$\text{ex } 9.3051\text{m/s} = (0.8862 \cdot 10.5\text{m/s})$$

9) Average Velocity of Gas given Temperature 

$$\text{fx } C_{\text{av}} = \sqrt{\frac{8 \cdot [R] \cdot T_g}{\pi \cdot M_{\text{molar}}}}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 120.1357\text{m/s} = \sqrt{\frac{8 \cdot [R] \cdot 30\text{K}}{\pi \cdot 44.01\text{g/mol}}}$$

10) Average Velocity of Gas given Temperature in 2D 

$$\text{fx } v_{\text{avg_T}} = \sqrt{\frac{\pi \cdot [R] \cdot T_g}{2 \cdot M_{\text{molar}}}}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$\text{ex } 94.35436\text{m/s} = \sqrt{\frac{\pi \cdot [R] \cdot 30\text{K}}{2 \cdot 44.01\text{g/mol}}}$$



11) Terminal Velocity given Angular Velocity

[Open Calculator !\[\]\(bd1a142de767a21e5362c595f844a4ff_img.jpg\)](#)

$$\text{fx } v_{\text{ter}} = \frac{m \cdot r_m \cdot (\omega)^2}{6 \cdot \pi \cdot \mu \cdot r_0}$$

$$\text{ex } 0.000642\text{m/s} = \frac{1.1\text{kg} \cdot 2.2\text{m} \cdot (2\text{rad/s})^2}{6 \cdot \pi \cdot 80\text{N*s/m}^2 \cdot 10\text{m}}$$











Variables Used



- C_{av} Average Velocity of Gas (Meter per Second)
- C_{RMS_speed} Root Mean Square of Speed (Meter per Second)
- m Mass of Particle (Kilogram)
- M_{molar} Molar Mass (Gram Per Mole)
- P_{gas} Pressure of Gas (Pascal)
- $P^{saturated}$ Saturation Vapour Pressure (Pascal)
- $P_C^{saturation}$ Critical saturation vapour pressure (Pascal)
- $P_r^{saturated}$ Reduced saturation vapour pressure (Pascal)
- r_0 Radius of Spherical Particle (Meter)
- r_m Radius of molecule (Meter)
- T_g Temperature of Gas (Kelvin)
- V Volume of Gas (Liter)
- $V_{avg_P_D}$ Average Velocity given P and D (Meter per Second)
- $V_{avg_P_V}$ Average Velocity given P and V (Meter per Second)
- V_{avg_RMS} Average Velocity given RMS (Meter per Second)
- V_{avg_T} Average Velocity given Temperature (Meter per Second)
- V_{ter} Terminal Velocity given Angular Velocity (Meter per Second)
- μ Dynamic Viscosity (Newton Second per Square Meter)
- ρ_{gas} Density of Gas (Kilogram per Cubic Meter)
- ω Angular Velocity (Radian per Second)
- ω_{vp} Acentric Factor VP



Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Constant:** **[R]**, 8.31446261815324 Joule / Kelvin * Mole
Universal gas constant
- **Function:** **log10**, log10(Number)
Common logarithm function (base 10)
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Weight** in Kilogram (kg)
Weight Unit Conversion 
- **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:** **Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement:** **Dynamic Viscosity** in Newton Second per Square Meter (N*s/m²)
Dynamic Viscosity Unit Conversion 
- **Measurement:** **Angular Velocity** in Radian per Second (rad/s)
Angular Velocity Unit Conversion 



- **Measurement: Density** in Kilogram per Cubic Meter (kg/m^3)
Density Unit Conversion 
- **Measurement: Molar Mass** in Gram Per Mole (g/mol)
Molar Mass Unit Conversion 



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