Important Ideal Gas Law Formulas PDF

Formulas
Examples
with Units

List of 25
Important Ideal Gas Law Formulas

1) Amount of Gas taken by Ideal Gas Law Formula

Evaluate Formula

Formula

$$m_{gas} = \frac{M_{molar} \cdot P_{gas} \cdot V}{[R] \cdot T_{gas}}$$

Example with Units

$$44.0067\,\text{g} = \frac{44.01\,\text{g/mol} \cdot 101325\,\text{Pa} \cdot 22.4\,\text{L}}{8.3145 \cdot 273\,\text{K}}$$

2) Density of Gas by Ideal Gas law Formula

Evaluate Formula

Formula

$$\rho_{gas} = \frac{P_{gas} \cdot M_{molar}}{[R] \cdot T_{gas}}$$

Example with Units

$$1.9646\,\text{g/L} = \frac{101325\,\text{Pa} \cdot 44.01\,\text{g/mol}}{8.3145 \cdot 273\,\text{K}}$$

3) Final Density of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$d_f = \frac{\frac{P_{fin}}{T_2}}{\frac{P_i}{d_i \cdot T_1}}$$

Example with Units

$$0.7014\,\text{g/L} = \frac{\frac{13\,\text{Pa}}{313\,\text{K}}}{\frac{21\,\text{Pa}}{1.19\,\text{g/L} \cdot 298\,\text{K}}}$$

4) Final Pressure of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$P_{fin} = \left(\frac{P_i \cdot V_i}{T_1}\right) \cdot \left(\frac{T_2}{V_2}\right)$$

Example with Units

$$13.002\,\text{Pa} = \left(\frac{21\,\text{Pa} \cdot 11.2\,\text{L}}{298\,\text{K}}\right) \cdot \left(\frac{313\,\text{K}}{19\,\text{L}}\right)$$

5) Final Pressure of gas given Density Formula

Evaluate Formula

Formula

$$P_{fin} = \left(\frac{P_i}{d_i \cdot T_1}\right) \cdot \left(d_f \cdot T_2\right)$$

Example with Units

$$13.0118\,\text{Pa} = \left(\frac{21\,\text{Pa}}{1.19\,\text{g/L} \cdot 298\,\text{K}}\right) \cdot \left(0.702\,\text{g/L} \cdot 313\,\text{K}\right)$$

6) Final Temperature of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$T_2 = \frac{P_{fin} \cdot V_2}{\frac{P_i \cdot V_i}{T_1}}$$

Example with Units

$$312.9507\,\text{K} = \frac{13\,\text{Pa} \cdot 19\,\text{L}}{\frac{21\,\text{Pa} \cdot 11.2\,\text{L}}{298\,\text{K}}}$$

7) Final Temperature of Gas given Density Formula

Evaluate Formula

Formula

$$T_2 = \frac{\frac{P_{fin}}{d_f}}{\frac{P_i}{d_i \cdot T_1}}$$

Example with Units

$$312.716\,\text{K} = \frac{\frac{13\,\text{Pa}}{0.702\,\text{g/L}}}{\frac{21\,\text{Pa}}{1.19\,\text{g/L} \cdot 298\,\text{K}}}$$

8) Final Volume of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$V_2 = \left(\frac{P_i \cdot V_i}{T_1}\right) \cdot \left(\frac{T_2}{P_{fin}}\right)$$

Example with Units

$$19.003\,\text{L} = \left(\frac{21\,\text{Pa} \cdot 11.2\,\text{L}}{298\,\text{K}}\right) \cdot \left(\frac{313\,\text{K}}{13\,\text{Pa}}\right)$$

9) Initial Density of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$d_i = \frac{\frac{P_i}{T_1}}{\frac{P_{fin}}{d_f \cdot T_2}}$$

Example with Units

$$1.1911\,\text{g/L} = \frac{\frac{21\,\text{Pa}}{298\,\text{K}}}{\frac{13\,\text{Pa}}{0.702\,\text{g/L} \cdot 313\,\text{K}}}$$

10) Initial Pressure of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$P_i = \left(\frac{P_{fin} \cdot V_2}{T_2}\right) \cdot \left(\frac{T_1}{V_i}\right)$$

Example with Units

$$20.9967\,\text{Pa} = \left(\frac{13\,\text{Pa} \cdot 19\,\text{L}}{313\,\text{K}}\right) \cdot \left(\frac{298\,\text{K}}{11.2\,\text{L}}\right)$$

11) Initial Pressure of Gas given Density Formula

Evaluate Formula

Formula

$$P_i = \left(\frac{P_{fin}}{d_f \cdot T_2}\right) \cdot \left(d_i \cdot T_1\right)$$

Example with Units

$$20.9809\,\text{Pa} = \left(\frac{13\,\text{Pa}}{0.702\,\text{g/L} \cdot 313\,\text{K}}\right) \cdot \left(1.19\,\text{g/L} \cdot 298\,\text{K}\right)$$

12) Initial Temperature of Gas by Ideal Gas law Formula

Evaluate Formula

Formula

$$T_1 = \frac{P_i \cdot V_i}{\frac{P_{fin} \cdot V_2}{T_2}}$$

Example with Units

$$298.047\,\text{K} = \frac{21\,\text{Pa} \cdot 11.2\,\text{L}}{\frac{13\,\text{Pa} \cdot 19\,\text{L}}{313\,\text{K}}}$$

13) Initial Temperature of Gas given Density Formula

Evaluate Formula

Formula

$$T_1 = \frac{\frac{P_i}{d_i}}{\frac{P_{fin}}{d_f \cdot T_2}}$$

Example with Units

$$298.2706\,\text{K} = \frac{\frac{21\,\text{Pa}}{1.19\,\text{g/L}}}{\frac{13\,\text{Pa}}{0.702\,\text{g/L} \cdot 313\,\text{K}}}$$

14) Initial Volume of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$V_i = \left(\frac{P_{fin} \cdot V_2}{T_2}\right) \cdot \left(\frac{T_1}{P_i}\right)$$

Example with Units

$$11.1982\,\text{L} = \left(\frac{13\,\text{Pa} \cdot 19\,\text{L}}{313\,\text{K}}\right) \cdot \left(\frac{298\,\text{K}}{21\,\text{Pa}}\right)$$

15) Molecular Weight of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$M_{molar} = \frac{m_{gas} \cdot [R] \cdot T_{gas}}{P_{gas} \cdot V}$$

Example with Units

$$44.0033\,\text{g/mol} = \frac{44\,\text{g} \cdot 8.3145 \cdot 273\,\text{K}}{101325\,\text{Pa} \cdot 22.4\,\text{L}}$$

16) Molecular Weight of Gas given Density by Ideal Gas Law Formula

Evaluate Formula

Formula

$$M_{molar} = \frac{\rho_{gas} \cdot [R] \cdot T_{gas}}{P_{gas}}$$

Example with Units

$$43.9073\,\text{g/mol} = \frac{1.96\,\text{g/L} \cdot 8.3145 \cdot 273\,\text{K}}{101325\,\text{Pa}}$$

17) Number of Moles of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$N_{moles} = \frac{P_{gas} \cdot V}{[R] \cdot T_{gas}}$$

Example with Units

$$0.9999 = \frac{101325\,\text{Pa} \cdot 22.4\,\text{L}}{8.3145 \cdot 273\,\text{K}}$$

18) Pressure by Ideal Gas Law Formula

Evaluate Formula

Formula

$$P_{gas} = \frac{N_{moles} \cdot [R] \cdot T_{gas}}{V}$$

Example with Units

$$100319.188\,\text{Pa} = \frac{0.99 \cdot 8.3145 \cdot 273\,\text{K}}{22.4\,\text{L}}$$

19) Pressure of Gas given Density by Ideal Gas law Formula

Evaluate Formula

Formula

$$P_{gas} = \frac{\rho_{gas} \cdot [R] \cdot T_{gas}}{M_{molar}}$$

Example with Units

$$101088.4494\,\text{Pa} = \frac{1.96\,\text{g/L} \cdot 8.3145 \cdot 273\,\text{K}}{44.01\,\text{g/mol}}$$

20) Pressure of Gas given Molecular Weight of Gas by Ideal Gas law Formula

Evaluate Formula

Formula

$$P_{gas} = \frac{\left(\frac{m_{gas}}{M_{molar}}\right) \cdot [R] \cdot T_{gas}}{V}$$

Example with Units

$$101309.4883\,\text{Pa} = \frac{\left(\frac{44\,\text{g}}{44.01\,\text{g/mol}}\right) \cdot 8.3145 \cdot 273\,\text{K}}{22.4\,\text{L}}$$

21) Temperature of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$T_{gas} = \frac{P_{gas} \cdot V}{N_{moles} \cdot [R]}$$

Example with Units

$$275.7371\,\text{K} = \frac{101325\,\text{Pa} \cdot 22.4\,\text{L}}{0.99 \cdot 8.3145}$$

22) Temperature of Gas given Density by Ideal Gas Law Formula

Evaluate Formula

Formula

$$T_{gas} = \frac{P_{gas} \cdot M_{molar}}{[R] \cdot \rho_{gas}}$$

Example with Units

$$273.6388\,\text{K} = \frac{101325\,\text{Pa} \cdot 44.01\,\text{g/mol}}{8.3145 \cdot 1.96\,\text{g/L}}$$

23) Temperature of Gas given Molecular Weight of Gas by Ideal Gas law Formula

Evaluate Formula

Formula

$$T_{gas} = \frac{P_{gas} \cdot V}{\left(\frac{m_{gas}}{M_{molar}}\right) \cdot [R]}$$

Example with Units

$$273.0418\,\text{K} = \frac{101325\,\text{Pa} \cdot 22.4\,\text{L}}{\left(\frac{44\,\text{g}}{44.01\,\text{g/mol}}\right) \cdot 8.3145}$$

24) Volume of Gas from Ideal Gas Law Formula

Evaluate Formula

Formula

$$V = \frac{N_{moles} \cdot [R] \cdot T_{gas}}{P_{gas}}$$

Example with Units

$$22.1776\,\text{L} = \frac{0.99 \cdot 8.3145 \cdot 273\,\text{K}}{101325\,\text{Pa}}$$

25) Volume of Gas given Molecular Weight of Gas by Ideal Gas Law Formula

Evaluate Formula

Formula

$$V = \frac{\left(\frac{m_{gas}}{M_{molar}}\right) \cdot [R] \cdot T_{gas}}{P_{gas}}$$

Example with Units

$$22.3966\,\text{L} = \frac{\left(\frac{44\,\text{g}}{44.01\,\text{g/mol}}\right) \cdot 8.3145 \cdot 273\,\text{K}}{101325\,\text{Pa}}$$

Variables used in list of Ideal Gas Law Formulas above

- d_f Final Density of Gas *(Gram per Liter)*
- d_i Initial Density of Gas *(Gram per Liter)*
- m_{gas} Mass of Gas *(Gram)*
- M_{molar} Molar Mass *(Gram Per Mole)*
- N_{moles} Number of Moles
- P_{fin} Final Pressure of Gas *(Pascal)*
- P_{gas} Pressure of Gas *(Pascal)*
- P_i Initial Pressure of Gas *(Pascal)*
- T_1 Initial Temperature of Gas for Ideal Gas *(Kelvin)*
- T_2 Final Temperature of Gas for Ideal Gas *(Kelvin)*
- T_{gas} Temperature of Gas *(Kelvin)*
- V Volume of Gas *(Liter)*
- V_2 Final Volume of Gas for Ideal Gas *(Liter)*
- V_i Initial Volume of Gas *(Liter)*
- ρ_{gas} Density of Gas *(Gram per Liter)*

Constants, Functions, Measurements used in list of Ideal Gas Law Formulas above

- constant(s): **[R]**, 8.31446261815324
  Universal gas constant
- Measurement: **Weight** in Gram (g)
  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: **Density** in Gram per Liter (g/L)
  Density Unit Conversion
- Measurement: **Molar Mass** in Gram Per Mole (g/mol)
  Molar Mass Unit Conversion

Download other Important Gaseous state PDFs

- Important Graham's Law Formulas
- Important Ideal Gas Law Formulas

Try our Unique Visual Calculators

- Percentage of number
- LCM calculator
- Simple fraction

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

English Spanish French German Russian Italian Portuguese Polish Dutch

7/8/2024 | 11:19:22 AM UTC