

Important Turbojets Formulas PDF



Formulas Examples with Units

List of 14 Important Turbojets Formulas

1) Exhaust Velocity given Gross Thrust in Turbojet Formula ↻

Formula

$$V_e = \frac{T_G - (p_e - p_\infty) \cdot A_e}{m_a \cdot (1 + f)}$$

Example with Units

$$212.7201 \text{ m/s} = \frac{1124 \text{ N} - (982 \text{ Pa} - 101 \text{ Pa}) \cdot 0.0589 \text{ m}^2}{5 \text{ kg/s} \cdot (1 + 0.008)}$$

Evaluate Formula ↻

2) Exhaust Velocity given Thrust in Turbojet Formula ↻

Formula

$$V_e = \frac{T - A_e \cdot (p_e - p_\infty)}{m_a \cdot (1 + f)} + V$$

Evaluate Formula ↻

Example with Units

$$212.7597 \text{ m/s} = \frac{469 \text{ N} - 0.0589 \text{ m}^2 \cdot (982 \text{ Pa} - 101 \text{ Pa})}{5 \text{ kg/s} \cdot (1 + 0.008)} + 130 \text{ m/s}$$

3) Flight Speed given Thrust in Turbojet Formula ↻

Formula

$$V = V_e - \frac{T - A_e \cdot (p_e - p_\infty)}{m_a \cdot (1 + f)}$$

Evaluate Formula ↻

Example with Units

$$130.2403 \text{ m/s} = 213 \text{ m/s} - \frac{469 \text{ N} - 0.0589 \text{ m}^2 \cdot (982 \text{ Pa} - 101 \text{ Pa})}{5 \text{ kg/s} \cdot (1 + 0.008)}$$

4) Gross Thrust of Turbojet given Net Thrust Formula ↻

Formula

$$T_G = T + D_{\text{ram}}$$

Example with Units

$$1124 \text{ N} = 469 \text{ N} + 655 \text{ N}$$

Evaluate Formula ↻



5) Mass Flow Rate in Turbojet given Thrust Formula

Formula

$$m_a = \frac{T - A_e \cdot (p_e - p_\infty)}{(V_e - V) \cdot (1 + f)}$$

Example with Units

$$4.9855 \text{ kg/s} = \frac{469 \text{ N} - 0.0589 \text{ m}^2 \cdot (982 \text{ Pa} - 101 \text{ Pa})}{(213 \text{ m/s} - 130 \text{ m/s}) \cdot (1 + 0.008)}$$

Evaluate Formula 

6) Mass Flow Rate of Exhaust Gases Formula

Formula

$$m_{\text{total}} = m_a + m_f$$

Example with Units

$$5.033 \text{ kg/s} = 5 \text{ kg/s} + 0.033 \text{ kg/s}$$

Evaluate Formula 

7) Mass Flow Rate of Exhaust Gases given Fuel Air Ratio Formula

Formula

$$m_{\text{total}} = m_a \cdot (1 + f)$$

Example with Units

$$5.04 \text{ kg/s} = 5 \text{ kg/s} \cdot (1 + 0.008)$$

Evaluate Formula 

8) Mass Flow Rate of Turbojet given Gross Thrust Formula

Formula

$$m_a = \frac{T_G - (p_e - p_\infty) \cdot A_e}{(1 + f) \cdot V_e}$$

Example with Units

$$4.9934 \text{ kg/s} = \frac{1124 \text{ N} - (982 \text{ Pa} - 101 \text{ Pa}) \cdot 0.0589 \text{ m}^2}{(1 + 0.008) \cdot 213 \text{ m/s}}$$

Evaluate Formula 

9) Net Thrust of Turbojet given Gross Thrust Formula

Formula

$$T = T_G - D_{\text{ram}}$$

Example with Units

$$469 \text{ N} = 1124 \text{ N} - 655 \text{ N}$$

Evaluate Formula 

10) Net Thrust Produced by Turbojet Formula

Formula

$$T = m_a \cdot (1 + f) \cdot (V_e - V) + A_e \cdot (p_e - p_\infty)$$

Example with Units

$$470.2109 \text{ N} = 5 \text{ kg/s} \cdot (1 + 0.008) \cdot (213 \text{ m/s} - 130 \text{ m/s}) + 0.0589 \text{ m}^2 \cdot (982 \text{ Pa} - 101 \text{ Pa})$$

Evaluate Formula 

11) Nozzle Exit Area in Turbojet Formula

Formula

$$A_e = \frac{T - m_a \cdot (1 + f) \cdot (V_e - V)}{p_e - p_\infty}$$

Example with Units

$$0.0575 \text{ m}^2 = \frac{469 \text{ N} - 5 \text{ kg/s} \cdot (1 + 0.008) \cdot (213 \text{ m/s} - 130 \text{ m/s})}{982 \text{ Pa} - 101 \text{ Pa}}$$

Evaluate Formula 



12) Ram Drag of Turbojet given Gross Thrust Formula

Formula

$$D_{\text{ram}} = T_G - T$$

Example with Units

$$655 \text{ N} = 1124 \text{ N} - 469 \text{ N}$$

Evaluate Formula 

13) Thermal efficiency of turbojet engine Formula

Formula

$$\eta_{\text{th}} = \frac{P}{m_f \cdot Q}$$

Example with Units

$$0.6827 = \frac{980 \text{ kW}}{0.033 \text{ kg/s} \cdot 43500 \text{ kJ/kg}}$$

Evaluate Formula 

14) Turbojet Gross Thrust Formula

Formula

$$T_G = m_a \cdot (1 + f) \cdot V_e + (p_e - p_\infty) \cdot A_e$$

Example with Units

$$1125.4109 \text{ N} = 5 \text{ kg/s} \cdot (1 + 0.008) \cdot 213 \text{ m/s} + (982 \text{ Pa} - 101 \text{ Pa}) \cdot 0.0589 \text{ m}^2$$

Evaluate Formula 



Variables used in list of Turbojets Formulas above

- **A_e** Nozzle Exit Area (Square Meter)
- **D_{ram}** Ram Drag of Turbojet (Newton)
- **f** Fuel Air Ratio
- **m_a** Mass Flow Rate Turbojet (Kilogram per Second)
- **m_f** Fuel Flow Rate (Kilogram per Second)
- **m_{total}** Total Mass Flow Rate Turbojet (Kilogram per Second)
- **P** Propulsive Power (Kilowatt)
- **p_∞** Ambient Pressure (Pascal)
- **p_e** Nozzle Exit Pressure (Pascal)
- **Q** Fuel Calorific Value (Kilojoule per Kilogram)
- **T** Net Thrust of Turbojet (Newton)
- **T_G** Gross Thrust of Turbojet (Newton)
- **V** Flight Speed (Meter per Second)
- **V_e** Exit Velocity (Meter per Second)
- **η_{th}** Turbojet Thermal Efficiency

Constants, Functions, Measurements used in list of Turbojets Formulas above

- **Measurement: Area** in Square Meter (m^2)
Area Unit Conversion 
- **Measurement: Pressure** in Pascal (Pa)
Pressure Unit Conversion 
- **Measurement: Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement: Power** in Kilowatt (kW)
Power Unit Conversion 
- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Mass Flow Rate** in Kilogram per Second (kg/s)
Mass Flow Rate Unit Conversion 
- **Measurement: Specific Energy** in Kilojoule per Kilogram (kJ/kg)
Specific Energy Unit Conversion 



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