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For 4 Stroke Engine Formulas

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List of 24 For 4 Stroke Engine Formulas

For 4 Stroke Engine 📲

1) Actual intake air volume per cylinder 📲

Open Calculator 📲

$$fx \quad V_a = \frac{m_a}{\rho_a}$$

$$ex \quad 0.004859m^3 = \frac{0.28kg}{57.63kg/m^3}$$

2) Bmep given engine torque 📲

Open Calculator 📲

$$fx \quad P_{mb} = \frac{2 \cdot \pi \cdot T \cdot N}{s_p}$$

$$ex \quad 350.9193Pa = \frac{2 \cdot \pi \cdot 60N*mm \cdot 400rev/min}{0.045m/s}$$

3) Brake Mean Effective Pressure of 4S Engines given Brake power 📲

Open Calculator 📲

$$fx \quad P_{mb} = \frac{2 \cdot BP}{L \cdot A_c \cdot (N)}$$

$$ex \quad 349.0557Pa = \frac{2 \cdot 1.93W}{8.8cm \cdot 30cm^2 \cdot (400rev/min)}$$

4) Brake power measured with dynamo meter 🔗

fx $BP = \dfrac{\pi \cdot D \cdot (N \cdot 60) \cdot (W_d - S)}{60}$

ex $1.934442W = \dfrac{\pi \cdot 0.0021m \cdot (400 rev/min \cdot 60) \cdot (10N - 3N)}{60}$

5) Combustion efficiency 🔗

fx $\eta_c = \dfrac{Q_{in}}{m_f \cdot Q_{HV}}$

ex $0.6 = \dfrac{150 kJ/kg}{0.005 \cdot 50000 kJ/kg}$

6) Connecting Rod Length to Crank Radius Ratio 🔗

fx $R = \dfrac{r}{r_c}$

ex $1.091636 = \dfrac{150.1mm}{137.5mm}$

7) Displaced volume in engine cylinder 🔗

fx $V_d = \dfrac{L_s \cdot \pi \cdot (B^2)}{4}$

ex $0.000528m^3 = \dfrac{0.100m \cdot \pi \cdot \left((0.082m)^2\right)}{4}$

8) Frictional mean effective pressure 🔗

fx $\boxed{P_{fme} = P_{ime} - P_{mb}}$

Open Calculator 🔗

ex $\boxed{50Pa = 400Pa - 350Pa}$

9) Frictional power of engine 🔗

fx $\boxed{FP = IP - BP}$

Open Calculator 🔗

ex $\boxed{138.07W = 140W - 1.93W}$

10) Fuel conversion efficiency 🔗

fx $\boxed{\eta_f = \dfrac{W}{m_f \cdot Q_{HV}}}$

Open Calculator 🔗

ex $\boxed{0.4 = \dfrac{100KJ}{0.005 \cdot 50000kJ/kg}}$

11) Fuel conversion efficiency given thermal conversion efficiency 🔗

fx $\boxed{\eta_f = \eta_c \cdot \eta_t}$

Open Calculator 🔗

ex $\boxed{0.3 = 0.6 \cdot 0.50}$

12) Horsepower of engine 🔗

fx $\boxed{HP = \dfrac{T \cdot E_{rpm}}{5252}}$

Open Calculator 🔗

ex $\boxed{0.005982 = \dfrac{60\text{N*mm} \cdot 5000rev/min}{5252}}$

13) Indicated mean effective pressure given mechanical efficiency 🔗

fx $$P_{ime} = \frac{P_{mb}}{\eta_m}$$

Open Calculator 🔗

ex $$437.5Pa = \frac{350Pa}{0.8}$$

14) Indicated Power of Four-stroke Engine 🔗

fx $$IP = \frac{k \cdot MEP \cdot L \cdot A_c \cdot (N)}{2}$$

Open Calculator 🔗

ex $$138.2301W = \frac{5000 \cdot 5Pa \cdot 8.8cm \cdot 30cm^2 \cdot (400rev/min)}{2}$$

15) Intake air density 🔗

fx $$\rho_a = \frac{P_a}{[R] \cdot T_a}$$

Open Calculator 🔗

ex $$57.63851kg/m^3 = \frac{1.5e5Pa}{[R] \cdot 313K}$$

16) Intake air mass of engine cylinder 🔗

fx $$m_a = \frac{m_{af} \cdot n_R}{E_{rpm}}$$

Open Calculator 🔗

ex $$0.003438kg = \frac{0.9kg/s \cdot 2}{5000rev/min}$$

17) Rate of heat conduction of engine wall

Open Calculator

$$fx \quad Q_{cond} = \frac{(K) \cdot A \cdot \Delta T}{\Delta X}$$

$$ex \quad 483450.2J = \frac{(235W/(m*°C)) \cdot 0.069m^2 \cdot 25°C}{0.010m}$$

18) Ratio of cylinder bore to piston stroke

Open Calculator

$$fx \quad R = \frac{r}{r_c}$$

$$ex \quad 1.091636 = \frac{150.1mm}{137.5mm}$$

19) Thermal efficiency of IC engine

Open Calculator

$$fx \quad \eta_{th} = \frac{W}{Q_{in}}$$

$$ex \quad 0.666667 = \frac{100KJ}{150kJ/kg}$$

20) Total cylinder volume of IC engine

Open Calculator

$$fx \quad V_t = n_C \cdot V_{cyl}$$

$$ex \quad 0.0132m^3 = 4 \cdot 0.0033m^3$$

21) Volumetric Efficiency for 4S engines 📈

fx $$VE = \left(\frac{2 \cdot m_{af}}{\rho_a \cdot V_s \cdot (N)} \right) \cdot 100$$

Open Calculator ⬈

ex $$37.28252 = \left(\frac{2 \cdot 0.9 \text{kg/s}}{57.63 \text{kg/m}^3 \cdot 0.002 \text{m}^3 \cdot (400 \text{rev/min})} \right) \cdot 100$$

22) Volumetric efficiency of IC engine 📈

fx $$\eta_v = \frac{m_{af} \cdot n_R}{\rho_a \cdot V_{te} \cdot N}$$

Open Calculator ⬈

ex $$0.196224 = \frac{0.9 \text{kg/s} \cdot 2}{57.63 \text{kg/m}^3 \cdot 0.0038 \text{m}^3 \cdot 400 \text{rev/min}}$$

23) Volumetric efficiency of IC engine given actual volume of engine cylinder 📈

fx $$\eta_v = \frac{V_a}{V_{te}}$$

Open Calculator ⬈

ex $$1.052632 = \frac{0.004 \text{m}^3}{0.0038 \text{m}^3}$$

24) Work done per cycle in ic engine ⤢

Open Calculator ⤢

$$fx \quad W = \frac{P \cdot n_R}{E_{rpm}}$$

$$ex \quad 100.8406KJ = \frac{26400kW \cdot 2}{5000rev/min}$$

Variables Used

- **A** Surface Area of Engine Wall *(Square Meter)*
- **A_c** Area of Cross Section *(Square Centimeter)*
- **B** Engine Cylinder Bore in Meter *(Meter)*
- **BP** Brake Power *(Watt)*
- **D** Pulley Diameter *(Meter)*
- **E_{rpm}** Engine RPM *(Revolution per Minute)*
- **FP** Frictional Power of Engine *(Watt)*
- **HP** Horsepower of Engine
- **IP** Indicated Power *(Watt)*
- **k** Number of Cylinders
- **K** Thermal Conductivity of Material *(Watt per Meter per Degree Celsius)*
- **L** Stroke Length *(Centimeter)*
- **L_s** Piston Stroke *(Meter)*
- **m_a** Mass of Air at Intake *(Kilogram)*
- **m_{af}** Air Mass Flow Rate *(Kilogram per Second)*
- **m_f** Mass of Fuel Added per Cycle
- **MEP** Mean Effective Pressure *(Pascal)*
- **N** Engine Speed *(Revolution per Minute)*
- **n_C** Total Number of Cylinders
- **n_R** Crankshaft Revolutions per Power Stroke
- **P** Indicated Engine Power *(Kilowatt)*
- **P_a** Intake Air Pressure *(Pascal)*

- P_{fme} Frictional Mean Effective Pressure *(Pascal)*

- P_{ime} Indicated Mean Effective Pressure *(Pascal)*

- P_{mb} Brake Mean Effective Pressure *(Pascal)*

- Q_{cond} Rate of Heat Conduction of Engine Wall *(Joule)*

- Q_{HV} Heating Value of the Fuel *(Kilojoule per Kilogram)*

- Q_{in} Heat Added by Combustion per Cycle *(Kilojoule per Kilogram)*

- r Connecting Rod Length *(Millimeter)*

- R Connecting Rod Length to Crank Radius Ratio

- r_c Crank Radius of Engine *(Millimeter)*

- S Spring Scale Reading *(Newton)*

- s_p Mean Piston Speed *(Meter per Second)*

- T Engine Torque *(Newton Millimeter)*

- T_a Intake Air Temperature *(Kelvin)*

- V_a Actual Volume of Intake Air *(Cubic Meter)*

- V_{cyl} Total Volume of Engine Cylinder *(Cubic Meter)*

- V_d Displaced Volume *(Cubic Meter)*

- V_s Piston Swept Volume *(Cubic Meter)*

- V_t Total Volume of an Engine *(Cubic Meter)*

- V_{te} Theoretical Volume of Engine *(Cubic Meter)*

- VE Volumetric Efficiency

- W Work Done per Cycle in IC Engine *(Kilojoule)*

- W_d Dead Weight *(Newton)*

- ΔT Temperature Difference across Engine Wall *(Celsius)*

- ΔX Thickness of Engine Wall *(Meter)*

- η_c Combustion Efficiency

- η_f Fuel Conversion Efficiency

- η_m Mechanical Efficiency of IC Engine

- η_t Thermal Conversion Efficiency

- η_{th} Thermal Efficiency of IC Engine

- η_v Volumetric Efficiency of IC Engine

- ρ_a Air Density at Intake *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[R]**, 8.31446261815324
  Universal gas constant
- Measurement: **Length** in Centimeter (cm), Meter (m), Millimeter (mm)
  Length Unit Conversion 🗗
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion 🗗
- Measurement: **Temperature** in Kelvin (K), Celsius (°C)
  Temperature Unit Conversion 🗗
- Measurement: **Volume** in Cubic Meter (m³)
  Volume Unit Conversion 🗗
- Measurement: **Area** in Square Centimeter (cm²), Square Meter (m²)
  Area Unit Conversion 🗗
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion 🗗
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion 🗗
- Measurement: **Energy** in Kilojoule (KJ), Joule (J)
  Energy Unit Conversion 🗗
- Measurement: **Power** in Watt (W), Kilowatt (kW)
  Power Unit Conversion 🗗
- Measurement: **Force** in Newton (N)
  Force Unit Conversion 🗗
- Measurement: **Heat of Combustion (per Mass)** in Kilojoule per Kilogram (kJ/kg)

Heat of Combustion (per Mass) Unit Conversion ⬀

- Measurement: **Thermal Conductivity** in Watt per Meter per Degree Celsius (W/(m*°C))
  Thermal Conductivity Unit Conversion ⬀

- Measurement: **Mass Flow Rate** in Kilogram per Second (kg/s)
  Mass Flow Rate Unit Conversion ⬀

- Measurement: **Angular Velocity** in Revolution per Minute (rev/min)
  Angular Velocity Unit Conversion ⬀

- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion ⬀

- Measurement: **Torque** in Newton Millimeter (N*mm)
  Torque Unit Conversion ⬀

Check other formula lists

- **For 4 Stroke Engine Formulas** ⬈

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