



Mechanics of Train Movement Formulas

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Examples!

Conversions!

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List of 13 Mechanics of Train Movement **Formulas**

Mechanics of Train Movement (7)

1) Accelerating Weight of Train

fx $W_{
m e}=W\cdot 1.10$

Open Calculator

 $\mathbf{ex} \ 33000 \mathrm{AT} \ (\mathrm{US}) = 30000 \mathrm{AT} \ (\mathrm{US}) \cdot 1.10$

2) Aerodynamic Drag Force

 $\left| \mathbf{F}_{\mathrm{drag}} = C_{\mathrm{drag}} \cdot \left(rac{
ho \cdot V_{\mathrm{f}}^2}{2}
ight) \cdot A_{\mathrm{ref}}$

Open Calculator

 $ext{ex} \ 1091.374 ext{N} = 1.39 \cdot \left(rac{98 ext{kg/m}^3 \cdot \left(6.4 ext{km/h}
ight)^2}{2}
ight) \cdot 5.07 ext{m}^2$

3) Coefficient of Adhesion

Open Calculator

 $\mathbf{ex} \ 0.622857 = rac{545 \mathrm{N}}{30000 \mathrm{AT} \ \mathrm{(US)}}$



4) Crest Speed given Time for Acceleration

fx $V_{\mathrm{m}}=t_{\alpha}\cdot lpha$

Open Calculator

= 20 = 20

5) Gradient of Train for Proper Movement of Traffic

fx $G = \sin(\angle D) \cdot 100$

Open Calculator

Open Calculator

Open Calculator 2

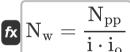
 $ext{ex} \ 0.523596 = \sin(0.3^\circ) \cdot 100$

6) Retardation of Train

 $\beta = \frac{V_{m}}{t_{\beta}}$

 $ag{10.36354 ext{km/h}^{*} ext{s} = rac{98.35 ext{km/h}}{9.49 ext{s}}}$

7) Rotating Speed of Driven Wheel



 $oxed{ex} 956.6667 ext{rev/min} = rac{4879 ext{rev/min}}{2.55 \cdot 2}$



8) Schedule Speed

 $m V_s = rac{
m D}{T_{run} + T_{stop}}$

Open Calculator

Open Calculator 2

Open Calculator G

Open Calculator

 $\mathbf{ex} = 25.12987 \mathrm{km/h} = rac{258 \mathrm{km}}{10 \mathrm{h} + 16 \mathrm{min}}$

9) Schedule Time

fx $T_{
m s} = T_{
m run} + T_{
m stop}$

= 10.26667h = 10h + 16min

10) Time for Acceleration

 $oxed{ex} 6.829861 ext{s} = rac{98.35 ext{km/h}}{14.40 ext{km/h*s}}$

11) Time for Retardation

 $= 9.493243s = \frac{98.35 \text{km/h}}{10.36 \text{km/h*s}}$





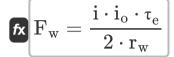
12) Translational Speed of Wheel Center 🗗

 $V_{
m t} = rac{\pi \cdot r_{
m d} \cdot N_{
m pp}}{30 \cdot {
m i} \cdot {
m i}_{
m o}}$

Open Calculator

$$ag{162.2947 ext{km/h}} = rac{\pi \cdot 0.45 ext{m} \cdot 4879 ext{rev/min}}{30 \cdot 2.55 \cdot 2}$$

13) Wheel Force Function



Open Calculator

$$= \frac{2.55 \cdot 2 \cdot 4N^*m}{2 \cdot 1.89m}$$



Variables Used

- ∠D Angle D (Degree)
- A_{ref} Reference Area (Square Meter)
- Cdrag Drag Coefficient
- D Distance Travelled by Train (Kilometer)
- F_{drag} Drag Force (Newton)
- Ft Tractive Effort (Newton)
- F_w Wheel Force Function (Newton)
- G Gradient
- i Gear Ratio of Transmission
- i_o Gear Ratio of Final Drive
- N_{DD} Speed of Motor Shaft in Powerplant (Revolution per Minute)
- N_w Rotating Speed of Driven Wheels (Revolution per Minute)
- r_d Effective Radius of Wheel (Meter)
- r_w Radius of Wheel (Meter)
- T_{run} Running Time of Train (Hour)
- T_s Schedule Time (Hour)
- T_{stop} Stop Time of Train (Minute)
- t_a Time for Acceleration (Second)
- t_B Time for Retardation (Second)
- **V**_f Flow Velocity (Kilometer per Hour)
- V_m Crest Speed (Kilometer per Hour)





- **V**_s Schedule Speed (Kilometer per Hour)
- V_t Translational Speed (Kilometer per Hour)
- W Weight of Train (Ton (Assay) (US))
- We Accelerating Weight of Train (Ton (Assay) (US))
- α Acceleration of Train (Kilometer per Hour Second)
- β Retardation of Train (Kilometer per Hour Second)
- µ Coefficient of Adhesion
- P Mass Density (Kilogram per Cubic Meter)
- Te Engine Torque (Newton Meter)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: sin, sin(Angle)
 Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Measurement: Length in Kilometer (km), Meter (m)
 Length Unit Conversion
- Measurement: Weight in Ton (Assay) (US) (AT (US))
 Weight Unit Conversion
- Measurement: Time in Second (s), Hour (h), Minute (min)
 Time Unit Conversion
- Measurement: Area in Square Meter (m²)
 Area Unit Conversion
- Measurement: Speed in Kilometer per Hour (km/h)
 Speed Unit Conversion
- Measurement: Acceleration in Kilometer per Hour Second (km/h*s)
 Acceleration Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Mass Concentration in Kilogram per Cubic Meter (kg/m³)
 Mass Concentration Unit Conversion
- Measurement: Angular Velocity in Revolution per Minute (rev/min)
 Angular Velocity Unit Conversion





• Measurement: **Torque** in Newton Meter (N*m) *Torque Unit Conversion*





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