Important Elements of Vibration Formulas PDF

Formulas
Examples
with Units

List of 14
Important Elements of Vibration Formulas

1) Angular Frequency Formula

Evaluate Formula

Formula

$$\omega' = \sqrt{\frac{k'}{m'}}$$

Example with Units

$$2\,\text{rad/s} = \sqrt{\frac{10.4\,\text{N/m}}{2.6\,\text{kg}}}$$

2) Angular Frequency given Time Period of Motion Formula

Evaluate Formula

Formula

$$\omega' = 2 \cdot \frac{\pi}{t_p}$$

Example with Units

$$1.2566\,\text{rad/s} = 2 \cdot \frac{3.1416}{5\,\text{s}}$$

3) Damping Force Formula

Evaluate Formula

Formula

$$F_d = c \cdot V$$

Example with Units

$$5940\,\text{N} = 9000\,\text{Ns/m} \cdot 0.66\,\text{m/s}$$

4) Displacement of Body in Simple Harmonic Motion Formula

Evaluate Formula

Formula

$$d = A' \cdot \sin\left(\omega \cdot t_{sec}\right)$$

Example with Units

$$12.7765\,\text{m} = 13.2\,\text{m} \cdot \sin\left(0.2\,\text{rad/s} \cdot 38\,\text{s}\right)$$

5) Frequency given Spring Constant and Mass Formula

Evaluate Formula

Formula

$$f = \frac{1}{2 \cdot \pi} \cdot \sqrt{\frac{k'}{m'}}$$

Example with Units

$$0.3183\,\text{Hz} = \frac{1}{2 \cdot 3.1416} \cdot \sqrt{\frac{10.4\,\text{N/m}}{2.6\,\text{kg}}}$$

6) Inertia Force Formula

Evaluate Formula

Formula

$$F_{inertia} = m' \cdot a$$

Example with Units

$$1.326\,\text{N} = 2.6\,\text{kg} \cdot 0.51\,\text{m/s}^2$$

7) Magnitude of Acceleration of Body in Simple Harmonic Motion Formula

Evaluate Formula

Formula

$$a = A' \cdot \omega^2 \cdot \sin\left(\omega \cdot t_{sec}\right)$$

Example with Units

$$0.5111\,\text{m/s}^2 = 13.2\,\text{m} \cdot 0.2\,\text{rad/s}^2 \cdot \sin\left(0.2\,\text{rad/s} \cdot 38\,\text{s}\right)$$

8) Magnitude of Acceleration of Body in Simple Harmonic Motion given Displacement Formula

Evaluate Formula

Formula

$$a = \omega^2 \cdot d$$

Example with Units

$$0.5108\,\text{m/s}^2 = 0.2\,\text{rad/s}^2 \cdot 12.77\,\text{m}$$

9) Magnitude of Maximum Acceleration of Body in Simple Harmonic Motion Formula

Evaluate Formula

Formula

$$a_{max} = \omega^2 \cdot A'$$

Example with Units

$$0.528\,\text{m/s}^2 = 0.2\,\text{rad/s}^2 \cdot 13.2\,\text{m}$$

10) Maximum Velocity of Body in Simple Harmonic Motion Formula

Evaluate Formula

Formula

$$V_{max} = \omega \cdot A'$$

Example with Units

$$2.64\,\text{m/s} = 0.2\,\text{rad/s} \cdot 13.2\,\text{m}$$

11) Period of Motion in Simple Harmonic Motion Formula

Evaluate Formula

Formula

$$T = 2 \cdot \frac{\pi}{\omega}$$

Example with Units

$$31.4159\,\text{s} = 2 \cdot \frac{3.1416}{0.2\,\text{rad/s}}$$

12) Spring Force Formula

Evaluate Formula

Formula

$$P_{spring} = k' \cdot d$$

Example with Units

$$132.808\,\text{N} = 10.4\,\text{N/m} \cdot 12.77\,\text{m}$$

13) Velocity of Body in Simple Harmonic Motion Formula

Evaluate Formula

Formula

$$V = A' \cdot \omega \cdot \cos\left(\omega \cdot t_{sec}\right)$$

Example with Units

$$0.6633\,\text{m/s} = 13.2\,\text{m} \cdot 0.2\,\text{rad/s} \cdot \cos\left(0.2\,\text{rad/s} \cdot 38\,\text{s}\right)$$

14) Work Done by Harmonic Force Formula

Evaluate Formula

Formula

$$w = \pi \cdot F_h \cdot d \cdot \sin\left(\Phi\right)$$

Example with Units

$$0.0935\,\text{KJ} = 3.1416 \cdot 2.5\,\text{N} \cdot 12.77\,\text{m} \cdot \sin\left(1.2\,\text{rad}\right)$$

Variables used in list of Elements of Vibration Formulas above

- **a** Acceleration *(Meter per Square Second)*
- **A'** Vibrational Amplitude *(Meter)*
- a_{max} Maximum Acceleration *(Meter per Square Second)*
- **c** Damping Coefficient *(Newton Second per Meter)*
- **d** Displacement of Body *(Meter)*
- **f** Vibrational Frequency *(Hertz)*
- F_d Damping Force *(Newton)*
- F_h Harmonic Force *(Newton)*
- $F_{inertia}$ Inertia Force *(Newton)*
- **k'** Spring Stiffness *(Newton per Meter)*
- **m'** Mass Attached to Spring *(Kilogram)*
- P_{spring} Spring Force *(Newton)*
- **T** Time Period of Oscillations *(Second)*
- t_p Time Period SHM *(Second)*
- t_{sec} Time in seconds *(Second)*
- **V** Velocity of Body *(Meter per Second)*
- V_{max} Maximum Velocity *(Meter per Second)*
- **w** Work Done *(Kilojoule)*
- **Φ** Phase Difference *(Radian)*
- **ω** Angular Velocity *(Radian per Second)*
- **ω'** Angular Frequency *(Radian per Second)*

Constants, Functions, Measurements used in list of Elements of Vibration Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **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.*
- Functions: **sqrt**, sqrt(Number) *A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Weight** in Kilogram (kg) *Weight Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Acceleration** in Meter per Square Second (m/s²) *Acceleration Unit Conversion*
- Measurement: **Energy** in Kilojoule (KJ) *Energy Unit Conversion*
- Measurement: **Force** in Newton (N) *Force Unit Conversion*
- Measurement: **Angle** in Radian (rad) *Angle Unit Conversion*
- Measurement: **Frequency** in Hertz (Hz) *Frequency Unit Conversion*
- Measurement: **Surface Tension** in Newton per Meter (N/m) *Surface Tension Unit Conversion*
- Measurement: **Angular Velocity** in Radian per Second (rad/s) *Angular Velocity Unit Conversion*

- Measurement: **Damping Coefficient** in Newton Second per Meter (Ns/m)
  Damping Coefficient Unit Conversion
- Measurement: **Angular Frequency** in Radian per Second (rad/s)
  Angular Frequency Unit Conversion

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