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Simple Harmonic Motion(SHM) Formulas

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List of 22 Simple Harmonic Motion(SHM) Formulas

Simple Harmonic Motion(SHM)

Basic SHM Equations

1) Amplitude given Position

Open Calculator

fx $$A = \frac{\sin(\omega \cdot t_p + \theta)}{X}$$

ex $$0.005\text{m} = \frac{\sin(10.28508\text{rev/s} \cdot 0.611\text{s} + 8^\circ)}{28.03238}$$

2) Angular Frequency given Constant K and Mass

Open Calculator

fx $$\omega = \sqrt{\frac{K}{M}}$$

ex $$10.28508\text{rev/s} = \sqrt{\frac{3750}{35.45\text{kg}}}$$

3) Angular Frequency given Velocity and Distance

Open Calculator

fx $$\omega = \sqrt{\frac{V^2}{S_{max}^2 - S^2}}$$

ex $$10.27994\text{rev/s} = \sqrt{\frac{(60\text{m/s})^2}{(65.26152\text{m})^2 - (65\text{m})^2}}$$

4) Angular Frequency in SHM

Open Calculator

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

ex $$10.28345\text{rev/s} = \frac{2 \cdot \pi}{0.611\text{s}}$$

5) Frequency of SHM

Open Calculator

fx $$f = \frac{1}{t_p}$$

ex $$1.636661\text{rev/s} = \frac{1}{0.611\text{s}}$$

6) Mass of Particle given Angular Frequency

Open Calculator

fx $$M = \frac{K}{\omega^2}$$

ex $$35.44997\text{kg} = \frac{3750}{(10.28508\text{rev/s})^2}$$

7) Position of Particle in SHM

Open Calculator

fx $$X = \frac{\sin(\omega \cdot t_p + \theta)}{A}$$

ex $$28.03238 = \frac{\sin(10.28508\text{rev/s} \cdot 0.611\text{s} + 8^\circ)}{0.005\text{m}}$$

8) Time Period of SHM

Open Calculator

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

ex $$0.610903\text{s} = \frac{2 \cdot \pi}{10.28508\text{rev/s}}$$

Forces and Energy in SHM

9) Acceleration given Constant K and Distance Traveled

Open Calculator

fx $$a = \frac{K \cdot S}{M}$$

ex $$6875.882\text{m/s}^2 = \frac{3750 \cdot 65\text{m}}{35.45\text{kg}}$$

10) Acceleration in SHM given Angular Frequency

Open Calculator

fx $$a = -\omega^2 \cdot S$$

ex $$6875.887\text{m/s}^2 = -(10.28508\text{rev/s})^2 \cdot 65\text{m}$$

11) Constant K given Angular Frequency

Open Calculator

fx $$K = \omega^2 \cdot M$$

ex $$3750.003 = (10.28508\text{rev/s})^2 \cdot 35.45\text{kg}$$

12) Constant K given Restoring Force

Open Calculator

fx $$K = -\left(\frac{F_{\text{restoring}}}{S}\right)$$

ex $$3750 = -\left(\frac{-243750\text{N}}{65\text{m}}\right)$$

13) Mass of Body given Distance Traveled and Constant K

Open Calculator

fx $$M = \frac{K \cdot S}{a}$$

ex $$35.45001\text{kg} = \frac{3750 \cdot 65\text{m}}{6875.88\text{m/s}^2}$$

14) Restoring Force given Stress

Open Calculator

fx $$F = \sigma \cdot A_{shm}$$

ex $$660000\text{N} = 12000\text{Pa} \cdot 55\text{m}^2$$

15) Restoring Force in SHM

Open Calculator

fx $$F_{restoring} = -(K) \cdot S$$

ex $$-243750\text{N} = -(3750) \cdot 65\text{m}$$

Velocity and Displacement in SHM

16) Distance from Start given Restoring Force and Constant K

Open Calculator

fx $$S_{max} = -\left(\frac{F_{restoring}}{K}\right)$$

ex $$65\text{m} = -\left(\frac{-243750\text{N}}{3750}\right)$$

17) Distance Traveled by Particle in SHM until Velocity becomes Zero

Open Calculator

fx $$S_{max} = \sqrt{\frac{V^2}{\omega^2} + S^2}$$

ex $$65.26126\text{m} = \sqrt{\frac{(60\text{m/s})^2}{(10.28508\text{rev/s})^2} + (65\text{m})^2}$$

18) Distance Traveled given Velocity

Open Calculator

fx $$S = \sqrt{S_{max}^2 - \frac{V^2}{\omega^2}}$$

ex $$65.00026\text{m} = \sqrt{(65.26152\text{m})^2 - \frac{(60\text{m/s})^2}{(10.28508\text{rev/s})^2}}$$

19) Distance Traveled in SHM given Angular Frequency

Open Calculator

fx $$S = \frac{a}{-\omega^2}$$

ex $$64.99994\text{m} = \frac{6875.88\text{m/s}^2}{-(10.28508\text{rev/s})^2}$$

20) Square of Different Distances Traveled in SHM

Open Calculator

fx $$D_{total} = S_{max}^2 - S^2$$

ex $$34.06599\text{m} = (65.26152\text{m})^2 - (65\text{m})^2$$

21) Total Distance Traveled given Velocity and Angular Frequency

Open Calculator

fx $$D_{total} = \frac{V^2}{\omega^2}$$

ex $$34.03197\text{m} = \frac{(60\text{m/s})^2}{(10.28508\text{rev/s})^2}$$

22) Velocity of Particle in SHM

Open Calculator

fx $$V = \omega \cdot \sqrt{S_{max}^2 - S^2}$$

ex $$60.02998\text{m/s} = 10.28508\text{rev/s} \cdot \sqrt{(65.26152\text{m})^2 - (65\text{m})^2}$$

Variables Used

- **a** Acceleration *(Meter per Square Second)*
- **A** Amplitude *(Meter)*
- A_{shm} Area *(Square Meter)*
- D_{total} Total Distance Traveled *(Meter)*
- **f** Frequency *(Revolution per Second)*
- **F** Force *(Newton)*
- $F_{restoring}$ Restoring Force *(Newton)*
- **K** Spring Constant
- **M** Mass *(Kilogram)*
- **S** Displacement *(Meter)*
- S_{max} Maximum Displacement *(Meter)*
- t_p Time Period SHM *(Second)*
- **V** Velocity *(Meter per Second)*
- **X** Position of a Particle
- **θ** Phase Angle *(Degree)*
- **σ** Stress *(Pascal)*
- **ω** Angular Frequency *(Revolution per Second)*

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.
- Function: **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: **Area** in 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: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

- Measurement: **Frequency** in Revolution per Second (rev/s)
  Frequency Unit Conversion

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- **Simple Harmonic Motion(SHM) Formulas**

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