

## Answer on Question 52104, Physics, Mechanics | Kinematics | Dynamics

### Question:

Which of the following is the correct unit of  $k$  in the equation of a damped harmonic oscillator given as  $-bv - kx = ma$ , where  $b$  is the damping factor and all the symbols have their usual meaning?

a)  $kgms^{-2}$

b)  $kgS^{-1}$

c)  $kgms^{-1}$

d)  $kgS^{-2}$

### Solution:

Let's consider the equation of a damped harmonic oscillator:

$$-bv - kx = ma.$$

The dimensions of both side of equation must be equal. We can see, that the term  $ma$  have the dimension of force:

$$[ma] = \left[ kg \cdot \frac{m}{s^2} \right] = [N].$$

Then, the term  $kx$  must have the same dimension as  $ma$ :

$$[kx] = [ma] = \left[ kg \cdot \frac{m}{s^2} \right].$$

Assuming that  $[x] = [m]$  we finally get the dimension of unit of  $[k]$ :

$$[k] = \left[ \frac{kg}{s^2} \right].$$

### Answer:

d)  $kgS^{-2}$