Answer on Question #43221 – Physics – Mechanics | Kinematics | Dynamics

Question.

The force f acting on a body depends upon its 1.mass 2. acceleration. Find the expression for the force f using the method of dimensions.

Solution.

Let define three basic units:

- l is the length or displacement (in meters - m);
- m is the mass (in kilograms - kg) ;
- t is the time (in seconds - s).

Therefore, acceleration a (its unit is $\frac{m}{s^2}$) can be represented by:

$$a = \frac{length}{time^2} = \frac{l}{t^2}$$

We know, that the unit of the force is Newton:

$$N = \frac{kg \cdot m}{s^2}$$

And the force f (its units is N) can be represented by:

$$f = mass \cdot acceleration = mass \cdot \frac{length}{time^2} = m\frac{l}{t^2} = ma$$

So, we obtained $f = ma$, using the method of dimensions, because:

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

$$m = [kg]$$

$$a = [\frac{m}{s^2}]$$

Answer.

$f = ma$