Answer on Question 59230, Physics, Mechanics, Relativity

Question:

The joule (J) is the same as?

a) $kg \cdot m^{-1} \cdot s^{-2}$

b) $kg \cdot m^{-2} \cdot s^{-1}$

c) $kg \cdot m^{2} \cdot s^{-2}$

d) $kg \cdot m \cdot s^{-1}$

Solution:

As we know, the joule (J) is a derived unit of energy in the International System of Units. It is equal to the energy transferred (or work done) to an object when a force of one newton acts on that object in the direction of its motion through a distance of one meter. By the definition of the work done we have:

$$W = F \cdot s,$$

here, W is the work done and the dimension of the work is joule (J), F is the force and the dimension of the force is newton (N), s is the distance and the dimension of the distance is meter (m).

Let's write the dimension of newton. By the definition of the Newton's second law of motion we have:

$$F = ma,$$

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

Finally, we get:

$$W = F \cdot s = kg \cdot \frac{m}{s^2} \cdot m = kg \cdot m^2 \cdot s^{-2}.$$

Answer:

c) $kg \cdot m^{2} \cdot s^{-2}$