Exercise 64

Kinetic energy The kinetic energy K of a mass is proportional to the square of its velocity v. If $K = 12{,}960$ joules when $v = 18$ m/sec, what is K when $v = 10$ m/sec?

Solution

The kinetic energy is proportional to the square of its velocity:

$$K \propto v^2.$$

Make this proportionality an equation we can use by introducing a proportionality constant A.

$$K = Av^2 \tag{1}$$

Use the fact that $K = 12{,}960$ joules when $v = 18$ m/sec to determine A.

$$12{,}960 = A(18)^2$$

$$\frac{12{,}960}{18^2} = A$$

$$A = 40$$

Equation (1) then becomes

$$K = 40v^2.$$

Therefore, when $v = 10$ m/sec,

$$\begin{aligned} K &= 40(10)^2 \\ &= 40(100) \\ &= 4{,}000 \text{ joules.} \end{aligned}$$