# 20-P-KM-AF-003

Rectilinear Continous Motion: Advanced

A:

A sphere is fired into a lime that forces an acceleration of $a = -At$. Where $t$ is in seconds. Determine the distance travelled, the time to stop and the expression for velocity if the initial velocity is $v = B$ m/s.

Q:

$$V(t) - V(0) = \int_0^t a(t')\,dt$$

$$v(t) - B = \int_0^t -At\,dt$$

$$v(t) = -\frac{At^2}{2} + B$$

$$v - B = -At^2/2$$

$$2v - 2B = -At^2$$

$$2B - 2v = At^2$$

$$t^2 = \frac{2B - 2v}{A}$$

$$t = \sqrt{\frac{2B - 2v}{A}}$$

when $v = 0$, the sphere stops, $t = \sqrt{\frac{2B}{A}}$

$$\int_0^s ds = \int_0^t v\,dt$$

$$s = \int_0^t \left[-\frac{At^2}{2} + B\right] dt$$

$$s = -\frac{At^3}{6} + Bt \quad \leftarrow \text{plug in } t$$

$$s = -\frac{A}{6} \cdot \frac{2B}{A} \cdot \sqrt{\frac{2B}{A}} + B\sqrt{\frac{2B}{A}} \quad \Rightarrow \quad s = -\frac{B}{3}\sqrt{\frac{2B}{A}} + B\sqrt{\frac{2B}{A}}$$