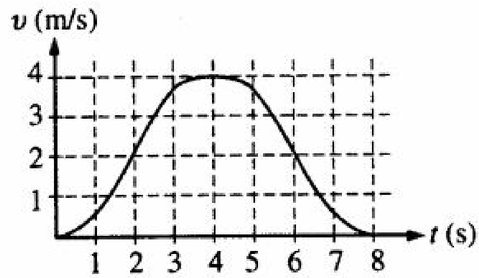
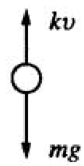


. The velocity v of an elevator moving upward between adjacent floors is shown as a function of time t in the graph above. At which of the following times is the force exerted by the elevator floor on a passenger the <u>least</u>?

(A) 1 s
(B) 3 s
(C) 4 s
(D) 5 s
(E) 6 s



. The object of mass m shown above is dropped from rest near Earth's surface and experiences a resistive force of magnitude kv, where v is the speed of the object and k is a constant. Which of the following expressions can be used to find v as a function of time t ? (Assume that the direction of the gravitational force is positive.)

(A) $\int_0^v \frac{dv}{mg - kv} = \int_0^t \frac{dt}{m}$

(B) $\int_0^t \frac{dv}{mg - kv} = \int_0^v \frac{dt}{m}$

(C) $\int_0^v \frac{dv}{kv} = \int_0^t \frac{dt}{m}$

(D) $\int_0^v (mg - kv)\, dv = \int_0^t m\, dt$

(E) $\int_0^v (mg - kv)\, dt = \int_0^t m\, dv$

A 5 kg object is propelled from rest at time $t = 0$ by a net force $\mathbf{F}$ that always acts in the same direction. The magnitude of $\mathbf{F}$ in newtons is given as a function of t in seconds by $F = 0.5t$. What is the speed of the object at $t = 4$ s?

(A) 0.5 m/s
(B) 0.8 m/s
(C) 2.0 m/s
(D) 4.0 m/s
(E) 8.0 m/s

A person holds a portable fire extinguisher that ejects 1.0 kg of water per second horizontally at a speed of 6.0 m/s. What horizontal force in newtons must the person exert on the extinguisher in order to prevent it from accelerating?

(A) 0 N
(B) 6 N
(C) 10 N
(D) 18 N
(E) 36 N

A particle of mass m starts from rest at position $x = 0$ and time $t = 0$. It moves along the positive x-axis under the influence of a single force $F_x = bt$, where b is a constant. The velocity v of the particle is given by

(A) $\frac{bt}{m}$

(B) $\frac{bt^2}{2m}$

(C) $\frac{bt^2}{m}$

(D) $\frac{b\sqrt{t}}{m}$

(E) $\frac{b}{mt}$

A certain one-dimensional conservative force is given as a function of x by the expression $F = -kx^3$, where F is in newtons and x is in meters. A possible potential energy function U for this force is

(A) $U = -\frac{1}{2}kx^2$

(B) $U = \frac{1}{2}kx^2$

(C) $U = -\frac{1}{4}kx^4$

(D) $U = \frac{1}{4}kx^4$

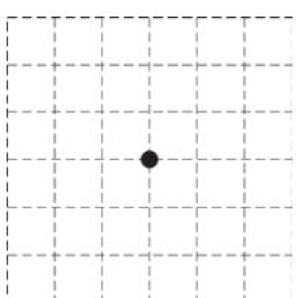
(E) $U = -3kx^2$

FR:

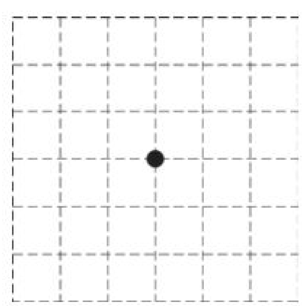
A ball of mass m and cross-sectional area A is released from rest near the surface of Earth. The ball experiences a resistive force due to the air that is proportional to the ball's velocity, $\mathbf{F}_r = -bA\mathbf{v}$, where b is a positive constant. Determine all algebraic answers in terms of m, b, A, and fundamental constants.

(a) Draw free-body diagrams for the ball for the following situations. Give each vector a descriptive label and draw them approximately to scale.

A Short Time After the Ball is Released



Once the Ball Has Reached Terminal Velocity



(b) Calculate the terminal velocity v_T of the ball.