AP Physics C
Friction Problems

Name _____

1. The coefficient of kinetic friction between a 23 kg crate and the floor is .35.
   a. What horizontal force is required to move the box at a steady rate of 2 m/s?

F = 78.9 N

   b. What is the force necessary if someone pushes down on it with a force of 10 N?

F = 82.4 N

2. A force of 20 N is required to start a 6 kg penguin moving across the floor.
   a. What is the coefficient of static friction between the penguin and the floor?

μ = 0.34

   b. If the 20 N force is continued and the penguin accelerates at a rate of .3 m/s^2, what is the coefficient of kinetic friction between the penguin and the floor?

μ = 0.31

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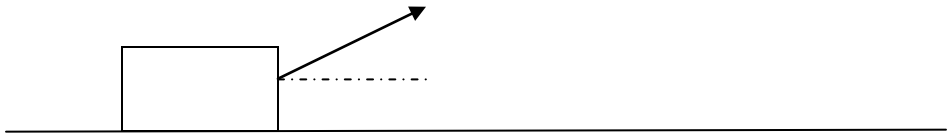
3. A car traveling at 20 m/s comes to a stop over 64 m. Assuming the acceleration of the car is uniform, what is the coefficient of friction between the tires and the road?

$\mu = 0.32$



4. A 12 kg box is sitting on the floor. The coefficient of static friction μ_s between the box and floor is .4. If $\theta=37^0$, what minimum tension must exist to get the box moving?

$T_{min} = 45.3$ N

5. Show that the minimum stopping distance for a car traveling at speed v is $v^2/(2\mu g)$. Calculate this distance for a 1200 kg car moving at 15 m/s and $\mu=.5$.

Proof:

d = 23.0 m

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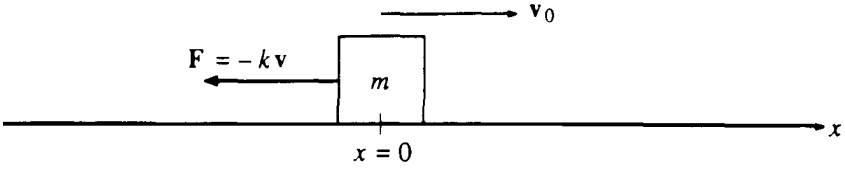
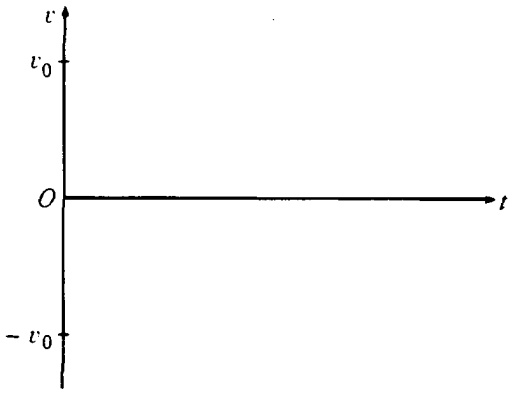


1990M1. An object of mass m moving along the x-axis with velocity v is slowed by a force F = -kv, where k is a constant. At time t = 0, the object has velocity v_o at position x = 0, as shown above.

a. What is the initial acceleration (magnitude and direction) produced by the resistance force?

b. Derive an equation for the object's velocity as a function of time t, and sketch this function on the axes below. Let a velocity directed to the right be considered positive.



$$v(t) = v_0 e^{-\frac{k}{m}t}$$

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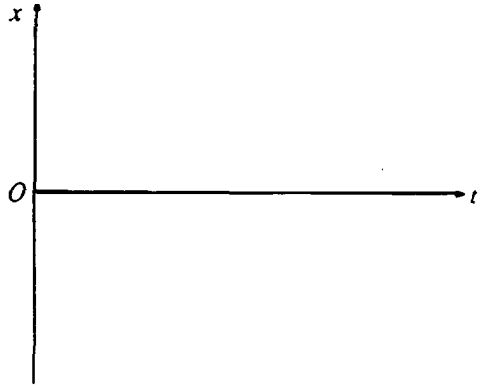
c. Derive an equation for the distance the object travels as a function of time t and sketch this function on the axes below.



$$d(t) = v_0 \frac{m}{k}(1 - e^{-\frac{k}{m}t})$$

d. Determine the distance the object travels from t = 0 to t = ∞.

$$d(0 \to \infty) = v_0 \frac{m}{k}$$