NS01 Dynamics: Futher Applications of Newton's Laws (Ohanian, Chapter 6)

17. A girl pulls a sled along a level dirt road by means of a rope attached to the front of the sled. The mass of the sled is 40 kg, the coefficient of kinetic friction is μ_k=0.60, and the angle between the rope and the road is 30°. What pull must the girl exert to move the sled at constant velocity?

*19. During braking, a truck has a steady deceleration of 7.0m/s^2. A box sits on the platform of this truck. The box begins to slide when the braking begins and, after sliding a distance of 2.0m (relative to the truck), it hits the cab of the truck. With what speed (relative to the truck) does the box hit? The coefficient of kinetic friction for the box is μ_k=0.50.

**26. Show that the speed as a function of time of a particle falling from rest under the influence of gravity and a viscous force of the form $\mathbf{f}_{viscous} = -bv$ is given by

$$v = \frac{mg}{b}(1 - e^{-bt/m})$$

[Hint: Integrate Newton's law in the form $m(dv/dt) = mg - bv$]

**33. Two masses $m_1 = 1.5kg$ and $m_2 = 3.0kg$ are connected by a thin string running over a massless pulley. One of the masses hangs from the string; the other mass slides on a 35°ramp with a coefficient of kinetic friction $\mu_k = 0.40$. What is the acceleration of the masses?

**75 A pendulum hangs from the edge of a horizontal disk which rotates around its axis at a constant rate. The angle α that the rotating pendulum makes with the vertical increases with the speed of rotation, and can therefore be used as an indicator of this speed. Find a formula for the speed v_0 of the edge of the disk in terms of the angle α, the radius R of the disk, and the length l of the pendulum. If $R = 0.20m$ and $l = 0.30m$, what is the speed when $\alpha = 45°$?