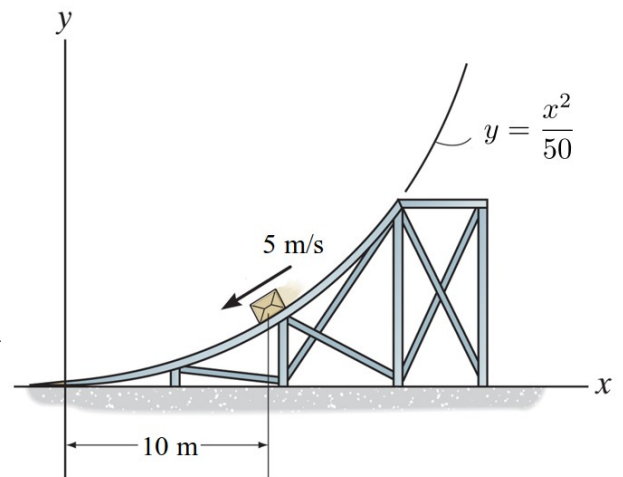


1. When $x = 10$ m the crate has a speed of 5 m/s which is increasing at 1 m/s^2 . Determine the direction of the crate's velocity (as an angle below horizontal) and the magnitude of the crate's acceleration at this instant.

answers:

$\theta =$ _____

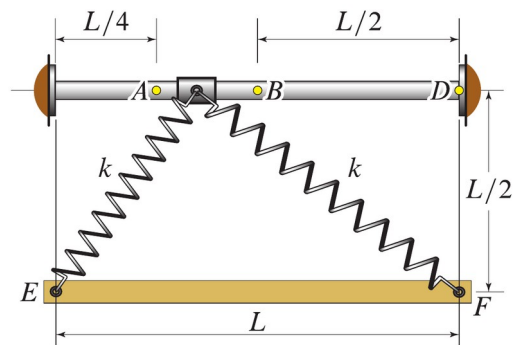
$a =$ _____



2. The collar has a mass of 3.0 kg and can slide frictionlessly on the rod of length $L = 2.0$ m. The springs (fixed at points E and F) are identical and are relaxed when the collar is at B . The collar is released from rest at D and has a speed of 2.0 m/s toward the left when passing point A .

Determine the spring constant k . *Hint:* consider using energy conservation.

A free-body diagram for the collar must be part of your solution.

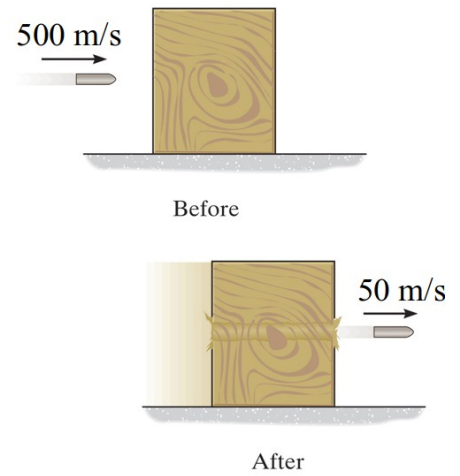


answer: _____

3. The 200-g projectile is fired with a velocity of 500 m/s towards the center of the 20-kg wooden block, which rests on a rough surface. The projectile penetrates and emerges from the block with a velocity of 50 m/s.

(a) Determine the velocity of the block just after the projectile emerges.

(b) How long does the block slide on the rough surface after the projectile emerges, before it comes to rest again? The coefficient of kinetic friction between the surface and the block is $\mu_k = 0.5$.



answers:

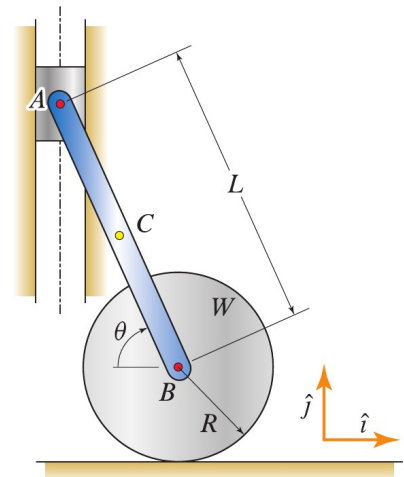
$v =$ _____

$t =$ _____

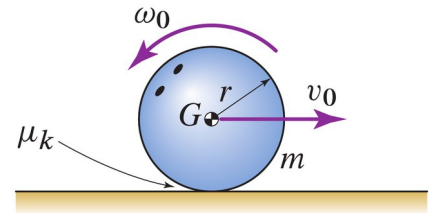
4. The figure shows a wheel of radius $R = 1.5$ m rolling without slip on a horizontal surface. A bar AB of length $L=4.0$ m is pin-connected to the center of the wheel and to a slider A constrained to move along a vertical guide. Point C is the bar's midpoint.

If the slider A is moving downward with a constant speed 3 m/s, determine the angular acceleration of the wheel when $\theta = 50^\circ$.

answer:



5. A 14 lb bowling ball is thrown onto a lane with a backspin at initial angular speed $\omega_0 = 8 \text{ rad/s}$ and initial forward speed $v_0 = 25 \text{ ft/s}$, as shown. After a short time the ball starts to roll without slip. If the ball has a radius of $r = 4.0 \text{ in.}$ and a radius of gyration of $k = 2.5 \text{ in.}$, determine the speed of the ball when it begins to roll without slip. The coefficient of kinetic friction between the ball and the lane is $\mu_k = 0.1$.



answer: _____