

EXAM 3

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Name: _____

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A 850. kg car is stopped at a traffic light. A 1.20×10^3 kg van traveling at speed v_0 towards the stopped car makes a perfectly inelastic collision with the car, i.e., the van and the car lock bumpers. At the instant of the collision, the wheels of the car and the van lock and the two vehicles execute a skid that covers 12.5 m. Assume the road is horizontal. The coefficient of kinetic friction between the tires and the surface of the road is $\mu_k = 0.725$.

A. [16 pts.] With what speed did the locked van and car start the skid just after the collision?

USE ENERGY CONSERVATION FOR THIS PART

$$W_{nc} = E - E_0 = -\frac{1}{2}(m_v + m_c)V^2$$

$$W_{nc} = -f_k \Delta x = -\mu_k F_N \Delta x = -\mu_k (m_v + m_c)g \Delta x$$

$$\mu_k g \Delta x = \frac{1}{2}V^2$$

$$V = \sqrt{2\mu_k g \Delta x} = \sqrt{(2)(0.725)(9.8 \text{ m/s}^2)(12.5 \text{ m})}$$

$$V = 13.3 \text{ m/s}$$

B. [16 pts.] The police cited the van for speeding based on the skid evidence. The speed limit through the intersection is 25.0 m/s. Determine v_0 to see if the police got it right.

NOW USE MOMENTUM CONSERVATION

$$P_{\text{TOT}} (\text{BEF}) = P_{\text{TOT}} (\text{AFTER})$$

$$m_v v_0 = (m_v + m_c)V$$

$$v_0 = \frac{m_v + m_c}{m_v} V = \frac{2050 \text{ kg}}{1200 \text{ kg}} (13.3 \text{ m/s})$$

$$v_0 = 22.8 \text{ m/s}$$