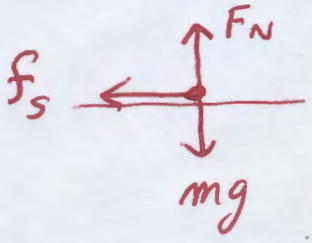
4. (30 pts.) A motorist is traveling on a road at a speed of 15 m/s and is 20 m away from a yellow traffic light when she hits the brakes and stops as rapidly as she can without skidding. (Don't worry about reaction time in this problem--the motorist is 20 m away when she actually applies the brakes.) The coefficient of friction between the tires and the road is 0.53.

a. (10 pts.) What is the magnitude of the motorists' acceleration while braking?

b. (20 pts.) Where does the motorist stop? Give a numerical answer. Does she stop before reaching the traffic light? (If you were unable to obtain an answer for part (a), you may use $5.00\ \mathrm{m/s^2}$, even though that is not the correct answer.)

4. (30 pts.) A motorist is traveling on a road at a speed of 15 m/s and is 20 m away from a yellow traffic light when she hits the brakes and stops as rapidly as she can without skidding. (Don't worry about reaction time in this problem--the motorist is 20 m away when she actually applies the brakes.) The coefficient of friction between the tires and the road is 0.53. [See ch. 4 #44]

a. (10 pts.) What is the magnitude of the motorists' acceleration while braking?



$$\Sigma F_x = ma_x$$
$$-f_s = ma_x$$
$$-\mu_K F_N = ma_x$$
$$-\mu_K mg = ma_x$$
$$a_x = -\mu_K g = (-0.53)(9.8)$$
$$a_x = -5.194\ m/s^2$$

b. (20 pts.) Where does the motorist stop? Give a numerical answer. Does she stop before reaching the traffic light? (If you were unable to obtain an answer for part (a), you may use 5.00 m/s^2, even though that is not the correct answer.)

[See P.S.2, exercise 3.]

$x_0 = 0$ m
$v_0 = 15$ m/s
$a = -5.19\ m/s^2$

$$v^2 = v_0^2 + 2a(x - x_0)$$
$$0 = (15)^2 + 2(-5.19)(x - 0)$$
$$0 = 225 - 10.388x$$
$$x = 21.66\ m.$$

Doesn't stop in time — she goes 1.66 m past the light

[Note: watch out for signs too!]