Answer on Question #72915, Physics / Mechanics | Relativity

Question. A $1600\ kg$ car driving at $80\ km/hr$ puts the brakes on. If $\mu = 0.68$, what's the stopping distance? (deceleration due to brakes $= 2.9\ m/s^2$)?

Given. $m = 1600\ kg; v_0 = 80\ km/hr \approx 22.22\ m/s; \mu = 0.68; a = -2.9\ m/s^2; v_f = 0\ m/s.$

Find. $s - ?$

Solution.

If a driver puts on the brakes of a car, the car will not come to a stop immediately. The stopping distance is the distance the car travels before it comes to a rest. It depends on the speed of the car and the coefficient of friction (μ) between the wheels and the road. This stopping distance formula does not include the effect of anti-lock brakes or brake pumping. The SI unit for stopping distance is meters.

$$s = \frac{v_f^2 - v_0^2}{2a} = \frac{0 - v_0^2}{2(-a)} = \frac{v_0^2}{2a}.$$

According to the Second Newton's Low

$$F_{fr} = ma \ \rightarrow \ \mu mg = ma \ \rightarrow \ a = \mu g$$

Finally

$$s = \frac{v_0^2}{2\mu g} = \frac{22.22^2}{2 \cdot 0.68 \cdot 9.8} = 37.044\ m.$$

Answer. $s = 37.044\ m.$