STAEDTLER® No. 937 811E Engineer's Computation Pad

113 A car can be braked to a stop from the autobahn-like speed of 200 km/h in 170 m. Assuming the acceleration is constant, find its magnitude in (a) SI units and (b) in terms of g. (c) How much time T_b is required for the braking? Your *reaction time* T_r is the time you require to perceive an emergency, move your foot to the brake, and begin the braking. If T_r = 400 ms, then (d) what is T_b in terms of T_r, and (e) is most of the full time required to stop spent in reacting or braking? Dark sunglasses delay the visual signals sent from the eyes to the visual cortex in the brain, increasing T_r. (f) In the extreme case in which T_r is increased by 100 ms, how much farther does the car travel during your reaction time?

$200 \frac{km}{hr} \frac{60\ mi/hr}{96.56 \frac{km}{hr}}$

$= 124$ miles/hr

$200 \frac{km}{hr} \frac{10^3 m}{1 km} \frac{hr}{3600 s}$

$= 55.6$ m/s

$v^2 = v_0^2 + 2a(x - x_0) \Rightarrow a = \frac{v^2 - v_0^2}{2(x - x_0)}$

a) $a = \frac{0 - 55.6^2}{2(170)} = -9.09 \frac{m}{s^2} \left(\frac{1g}{9.80 m/s^2}\right)$

b) $= -0.928\ g$

$v = v_0 + at$

c) $\Rightarrow t_b = (v - v_0)/a = (0 - 55.6)/(-9.09) = 6.12$ s

$T_r = 400$ ms $\left(\frac{sec}{1000 ms}\right) = 0.400$ sec

d) $T_b = 6.12 s \frac{T_r}{0.400 s} = 15.3$ reaction time units

Total time to stop $= T_s = T_r + T_b = 0.400 + 6.125$

$T_s = 6.53$ sec $\Rightarrow \frac{T_r}{T_s} = \frac{0.400 s}{6.53 s} = 0.0613$

e) $\Rightarrow$ reaction time accounts for 6.13 % of time.

assuming a reaction time of $T_r = 0.400 + 0.100$ s

or $T_r = \frac{1}{2}$ s with Sunglasses

The car travels $x = v_0 T_r = 55.6 \frac{m}{s}\ 0.400$ s

without Sunglasses ... $= 22.2$ m

and $x = v_0(T_r = 0.500 s) = 27.8$ m with Sunglasses during the Reaction time.

$v_0(\Delta T_r = 0.100 s) = 5.56$ m further with Sunglasses on.

which might mean hitting the Little Old Lady