

Answer on Question #65341, Physics / Mechanics | Relativity |

A motorist traveling at 11 m/s encounters a deer in the road 45 m ahead. If the maximum acceleration the vehicle's brakes are capable of is -7 m/s^2 , what is the maximum reaction time of the motorist that will allow her or him to avoid hitting the deer? Answer in units of s.

Solution

$$v_0 = 11 \text{ m/sec}$$

$$a = -7 \text{ m/sec}^2$$

$$L = 45 \text{ m}$$

$$t_{\text{react}} = ?$$

First we find the braking distance L_{br} . We use a formula for a velocity: $v = v_0 + a \cdot t$. In the moment of a complete stop $v = 0$, $v_0 + a \cdot t_{\text{br}} = 0$. So a vehicle needs time to brake $t_{\text{br}} = -v_0 / a = (-11) / (-7) = 1.6 \text{ (sec)}$. Therefore $L_{\text{br}} = v_0 \cdot t_{\text{br}} + (a \cdot t_{\text{br}}^2) / 2 = 11 \cdot 1.6 - 7 \cdot 1.6^2 / 2 = 8.6 \text{ (m)}$.

Before the motorist must begin a braking, the vehicle can drive yet this distance: $L - L_{\text{br}} = 45 - 8.6 = 36.4 \text{ (m)}$. But on this distance the car is moving at a constant velocity. So, now we find a time easily: $t_{\text{react}} = (L - L_{\text{br}}) / v_0 = 36.4 / 11 = 3.3 \text{ (sec)}$.

Answer: 3.3 sec

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