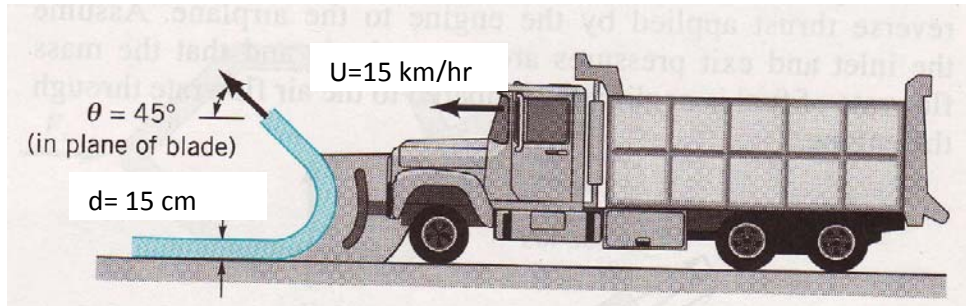


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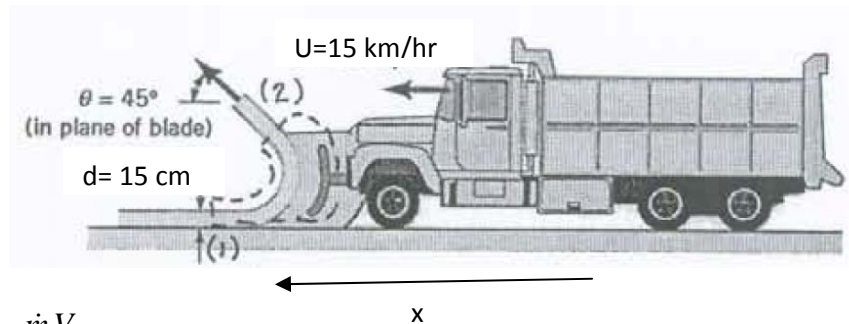
Quiz: No. 4
Course: 58:160, Fall 2009

Time: 15 minutes

A snowplow mounted on a truck clears a path 3 m through heavy wet snow, as shown in figure. The snow is 15 cm deep and its density is 160 kg/m^3 . The truck travels at 15 km/hr (4.17 m/s). The snow is discharged from the plow at an angle of 45 deg from the direction of travel, as shown in figure. Estimate the force required to push the plow.



Solutions:



$$\sum F_x = \dot{m}_2 V_{2_x} - \dot{m}_1 V_{1_x}$$

$$\dot{m}_2 = \dot{m}_1 \Rightarrow V_2 = V_1 = U$$

$$V_{2_x} = V_2 \cos 45 = U \cos 45$$

$$V_{1_x} = -V_1 = -U$$

$$\sum F_x = F$$

$$\Rightarrow F = \dot{m}_2 V_{2_x} - \dot{m}_1 V_{1_x} = \dot{m}(U \cos 45 - (-U)) = \rho b d U (U \cos 45 + U) = \rho b d U^2 (1 + \cos 45)$$

$$\Rightarrow F = 160 \times 3 \times 0.15 \times 4.17^2 (1 + \cos 45) = 2137.3 \text{ N}$$