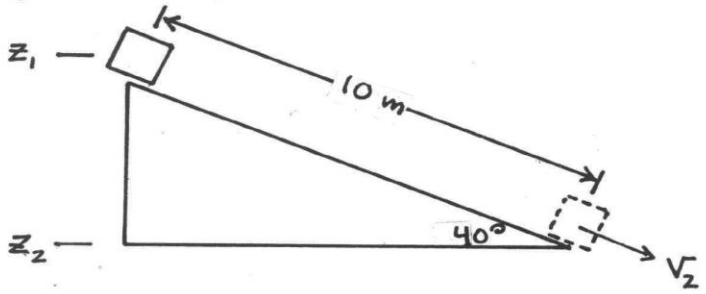
PROBLEM 2.16

KNOWN: Beginning from rest, an object of known mass slides down an inclined plane. The length of the ramp is given.

FIND: Determine the velocity of the object at the bottom of the ramp.

SCHEMATIC & GIVEN DATA:

$m = 200$ kg
$g = 9.81$ m/s^2
$V_1 = 0$



ENGR. MODEL: (1) The mass is a closed system. (2) There is no friction between the mass and the ramp, and air resistance is negligible. (3) The acceleration of gravity is constant.

ANALYSIS: By assumption (2), the only force acting on the system is the force of gravity. Thus, Eq. 2.11 applies

① $$\frac{1}{2}m(V_2^2 - V_1^2) + mg(z_2 - z_1) = 0$$

Solving for V_2

$$V_2 = \sqrt{2g(z_1 - z_2)}$$

From trigonometric relationships

$$z_1 - z_2 = (10\text{ m})\sin 40°$$

Thus

$$V_2 = \sqrt{2(9.81\text{ m/s}^2)(10\text{ m})\sin 40°}$$

$$= 11.23\text{ m/s} \leftarrow V_2$$

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1. Even though the object travels along an inclined path, the vertical distance appears in this expression.