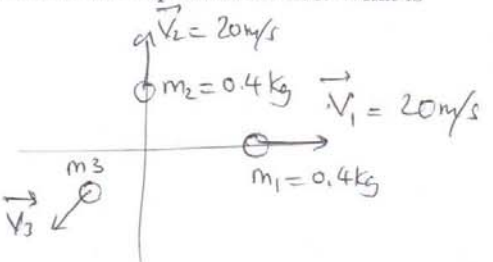
QUIZ#8- CHAPTER 9
DATE: 20/11/17

Name: Key Id#: Sect.#:

A 1.0 kg object at rest on a frictionless table explodes into three pieces of masses 0.20 kg, 0.4 kg and 0.4 kg. The two pieces having equal masses fly off perpendicular to each other, one along the positive x-axis and the other along the positive y-axis with the same speed of 20 m/s. What is the speed of the third piece (0.20 kg)?



initial

final No external forces (explosion are internal forces)

$$\vec{P_i} = \vec{P_f}$$

X-axis: $0 = m_1 V_1 + m_3 V_{3x}$

$$V_{3x} = \frac{m_1 V_1}{m_3} = -\frac{0.4 \times 20}{0.2} = -40 \text{ m/s}$$

Y-axis: $0 = m_2 V_2 + m_3 V_{3y}$

$$V_{3y} = -\frac{m_2 V_2}{m_3} = -\frac{0.4 \times 20}{0.2} = -40 \text{ m/s}$$

$$\vec{V_3} = -40\,\hat{i} - 40\,\hat{j} \text{ m/s}$$

Speed $V_3 = \sqrt{(-40)^2 + (-40)^2}$

$$\boxed{V_3 = 56.6 \text{ m/s}}$$

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Block 1 of mass $m_1 = 1.0$ kg slides from rest along a frictionless ramp from height $h = 3.0$ m and then collides with a stationary block 2 with mass $m_2 = 2.0$ kg. After the collision, block 2 slides into a rough region where $\mu_k = 0.4$ and comes to a stop in a distance d within the region. Consider this collision as completely inelastic. What is the value of the distance d?

block 1:

$$\Delta K + \Delta U_g = 0 \qquad \frac{1}{2} m_1 V_1^2 = m_1 g h$$

$$V_1 = \sqrt{2gh} = 7.7 \text{ m/s}$$

Collision:

$$m_1 V_1 + 0 = (m_1 + m_2) V$$

$$V = \frac{m_1 V_1}{m_1 + m_2} = 2.5 \text{ m/s}$$

block 1+2 together:

$$\Delta K = W_f \Rightarrow 0 - \frac{1}{2}(m_1+m_2) V^2 = -\mu_k (m_1+m_2) g d$$

$$d = \frac{V^2}{2 \mu_k g} = \boxed{0.83 \text{ m}}$$

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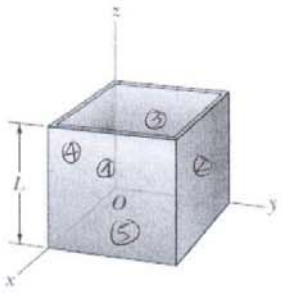
The figure shows a cubical box that has been constructed from uniform metal plate of negligible thickness. The box is open at the top and has edge length L = 50 cm. Find the x, y and z coordinates of the center of mass.



face 1 $m\left(L, \frac{L}{2}, \frac{L}{2}\right)$

face 2 $m\left(\frac{L}{2}, L, \frac{L}{2}\right)$

face 3 $m\left(0, \frac{L}{2}, \frac{L}{2}\right)$

face 4 $m\left(\frac{L}{2}, 0, \frac{L}{2}\right)$

face 5 $m\left(\frac{L}{2}, \frac{L}{2}, 0\right)$

$$X_{cm} = \frac{m\left(L + \frac{L}{2} + \frac{L}{2} + \frac{L}{2}\right)}{5m} = \frac{L + \frac{3L}{2}}{5} = \frac{5L/2}{5} = \frac{L}{2}$$

$$Y_{cm} = \frac{m\left(\frac{L}{2} + L + \frac{L}{2} + \frac{L}{2}\right)}{5m} = \frac{L + 3L/2}{5} = \frac{L}{2}$$

$$Z_{cm} = \frac{m\left(\frac{L}{2} + \frac{L}{2} + \frac{L}{2} + \frac{L}{2}\right)}{5m} = \frac{2mL}{5} = 0.4L$$

C.m. $(0.5L, 0.5L, 0.4L)$

$(25\text{cm}, 25\text{cm}, 20\text{cm})$