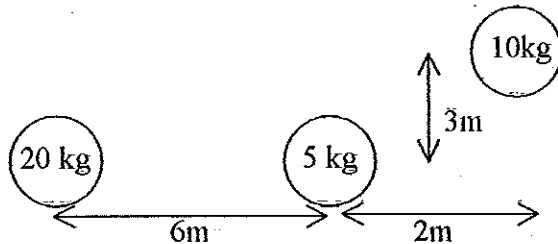


Center of Mass

1. Find the center of mass (relative to (0,0)) for the spheres with the following masses and locations : $m_1 = 5\text{kg}, (1,1)$ $m_2 = 10\text{kg}, (3,1)$ $m_3 = 15\text{kg}, (1,6)$.

$$(1.67, 3.5)$$

2. Find the center of mass of the following particles (drawn large so they can be seen):



$$x_{\text{com}} = 3.17\text{m}$$

$$y_{\text{com}} = 0.86\text{m}$$

(from 20kg)

3. An old go-kart with a mass of 300 kg is traveling in a straight line at 80 m/s. It is followed by a 4-wheeler with mass of 200 kg moving at 60 m/s. How fast is the center of mass moving?

$$v_{\text{com}} = 72\text{m/s}$$

4. A 1500 kg VW is heading 40 m/s in a straight line. A 4000 kg Cadillac is heading directly for it at 60 m/s. Find the velocity (magnitude and direction) of the center of mass.

$$v_{\text{com}} = -32.73\text{m/s}$$

5. A 1500 kg car is at rest. At the instant it starts to move (with an acceleration of 3.5m/s^2), a truck ($m = 3000\text{kg}$) traveling at a constant speed of 12 m/s passes it. At $t = 3$ seconds:

29.25m a. How far is the center of mass of the vehicles, relative to the starting point of the car?

11.5m/s b. What is the speed of the center of mass of the vehicles?

6. A rock, of mass M , is dropped at $t = 0$ seconds. Two seconds later a stone, of mass $2M$, is dropped. At $t = 3$ seconds (assume neither hits the ground):

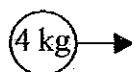
a. What is the center of mass of the rock and stone relative to the drop point?

b. How fast is the center of mass going at this time?

$$17.97\text{m}$$

$$16.3\text{m/s}$$

7. Calculate the V_{cm} before the collision and then calculate the V_{cm} after the collision. (Show all work for this problem)



Before collision:

$$V_0 = 5\text{ m/s}$$

$$V_0 = 0$$

After collision:

$$V_f = 1\text{ m/s}$$

$$V_f = ?$$

$$(1.6\text{m/s})$$

$$V_{\text{com}} = 1.43\text{m/s}$$

after

$$V_{\text{com}} = 1.43\text{m/s}$$

before