

“Center of mass” simulation

<https://physics.bu.edu/~duffy/HTML5/centerofmass.html>

This simulation shows a system of 3 balls (red, green and blue) and the center of mass of the system (purple) and the coordinates of the center of mass. The mass of the 3 balls can be adjusted but not their positions.

1. What are the x and y positions (coordinates) of ball 1 (red)?
2. What are the x and y positions (coordinates) of ball 2 (blue)?
3. What are the x and y positions (coordinates) of ball 3 (green)?
4. What happens to the position of the center of mass of the system when you increase the mass of one of the balls?
5. Refresh the page so the mass of each ball returns to 2.0 kg. Write down the x and y positions of the center of mass. Now increase the mass of each ball to 5.0 kg. What happened to the position of the center of mass compared to when the masses were 2.0 kg? Why do you think that is?

6. Set the mass of ball 3 to 0 kg. How would you describe the position of the center of mass relative to balls 1 and 2? Refresh the page and set the mass of ball 2 to 0 kg. How would you describe the position of the center of mass relative to balls 1 and 3? With the mass of ball 2 still 0 kg, how does the center of mass move as you adjust the mass of ball 1 or 3?

7. For each the following combinations of masses, first calculate what the center of mass of the system should be, then check your answers using the simulation:

1) Mass of ball 1: 1.5 kg

Mass of ball 2: 4.3 kg

Mass of ball 3: 2.6 kg

2) Mass of ball 1: 3.2 kg

Mass of ball 2: 1.8 kg

Mass of ball 3: 4.7 kg

8. What must be true about the masses of some or all of the balls in order for the center of mass to have an x position of 5.00 m?