

PhyzJob: Kinetic Energy-Momentum Conundrums

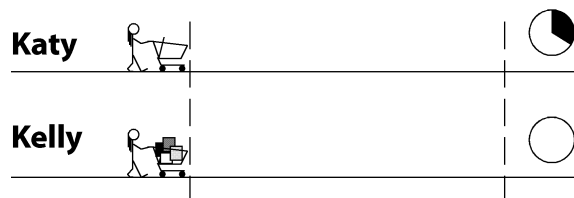


Race I: Equal Distance

1. Katy and Kelly are identical twins who enjoy grocery cart races. Suppose Katy pushes an empty cart and Kelly pushes a loaded cart, and they both push their carts through an equal distance.

a. Whose cart crosses the distance in the least time?

- Katy's
- Kelly's
- It's a tie



b. A clock showing the time it took for Katy to complete the distance is shown above. Draw a clock showing how long it took for Kelly to complete the distance.

c. Whose cart has more kinetic energy at the finish line? Whose cart has more momentum at the finish line? To assist in your decision-making process, complete the table below by placing a check mark in each column indicating whether a given quantity is greater for Katy, Kelly, or if it's the same for both.

| | F | d | Δt | ΔKE | Δp |
|--------------|---|---|------------|-------------|------------|
| Katy | | | | | |
| Kelly | | | | | |
| Same | | | | | |

d. Whose cart crosses the finish line with more kinetic energy? Justify your response *without* reference to mass or speed.

e. Whose cart has more momentum at the finish line? Justify your response without any direct reference to mass or speed.

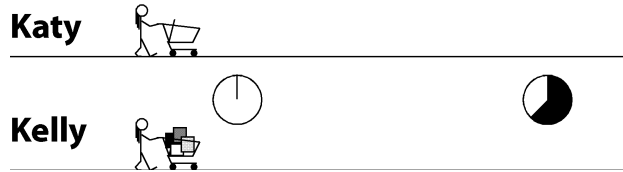
f. Upon reaching the finish line, Katy and Kelly release their respective carts. Each cart collides with a nail half driven into a wood board. Which cart—if either—will drive the nail farther into the board?

Race II: Equal Time

2. Suppose Katy pushes an empty cart and Kelly pushes a loaded cart, and they both push their carts for an equal amount of time.

a. Whose cart goes farther during the interval?

- Katy's
- Kelly's
- It's a tie



b. Draw the scene at the end of the interval by adding to the illustration above.

c. Whose cart has more kinetic energy at the end of the interval? Whose cart has more momentum at the finish line? To assist in your decision-making process, complete the table below by placing a check mark in each column indicating whether a given quantity is greater for Katy, Kelly, or if it's the same for both.

| | F | d | Δt | ΔKE | Δp |
|-------|---|---|------------|-------------|------------|
| Katy | | | | | |
| Kelly | | | | | |
| Same | | | | | |

d. Whose cart has more kinetic energy at the end of the interval? Justify your response *without* reference to mass or speed.

e. Whose cart has more momentum at the end of the interval? Justify your response without any direct reference to mass or speed.

f. When the time interval has elapsed, Katy and Kelly release their respective carts. Each cart collides with a nail half driven into a wood board. Which cart—if either—will drive the nail farther into the board?