A person stands under an umbrella during a rainstorm. Later the rain turns to hail, although the number of "drops" hitting the umbrella per time and their speed remains the same. Which case requires more force to hold the umbrella?

1) **when it is hailing**
2) **when it is raining**
3) **same in both cases**

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When the raindrops hit the umbrella, they tend to splatter and run off, whereas the hailstones hit the umbrella and bounce back upward. Thus, the change in momentum (impulse) is greater for the hail. Since $\Delta \boldsymbol{p} = \boldsymbol{F}\,\Delta t$, more force is required in the hailstorm.

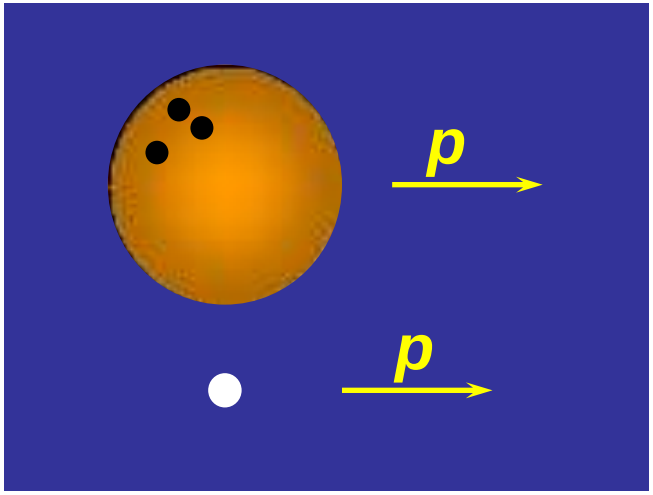
A bowling ball and a ping-pong ball are rolling toward you with the same momentum. If you exert the same force to stop each one, which takes a longer time to bring to rest?

1) the bowling ball

2) same time for both

3) the ping-pong ball

4) impossible to say



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We know: $\vec{F}_{ave} = \frac{\Delta \vec{p}}{\Delta t}$ so $\Delta p = F_{ave}\,\Delta t$

Here, ***F*** and Δp are the ***same*** for both balls! It will take the ***same amount of time*** to stop them.