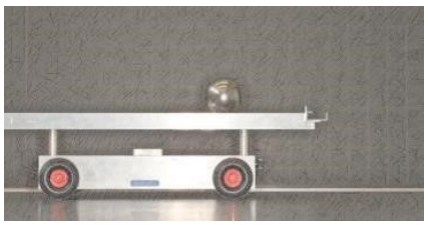
1. Inertia

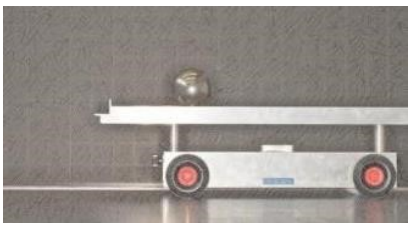
A ball is placed on top of a cart, right in the middle. Both are at rest. The cart starts moving to the right. It reaches a constant velocity and immediately slows down. What would be the correct order of these pictures so they describe the motion of the cart and the ball?

A



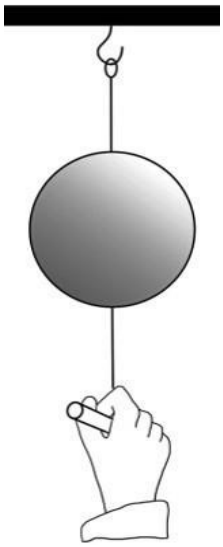
B

C



Can you explain your answer?

A heavy ball hangs on a thin thread. A second thin string with a wooden handle is connected below the ball



Which thread –the top or the bottom – breaks when (a) you pull slowly or (b) when you pull fast?

Can you explain your hypothesis?

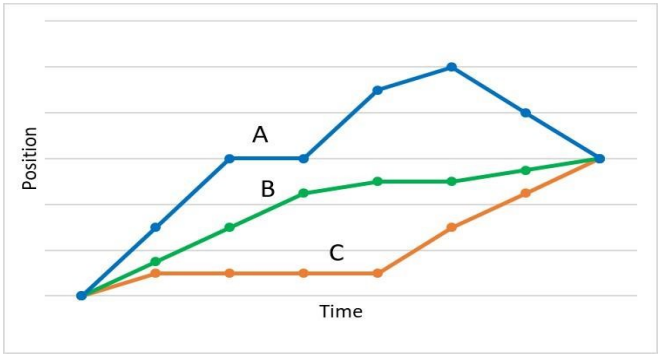
2. How can we calculate the average velocity?

In practice, most objects do not move at a constant speed. In these cases an average velocity, $\bar{v}$, can be defined. This average velocity is calculated by dividing the total distance covered by the object (s_{Total}) by the total amount of time (t_{Total}):

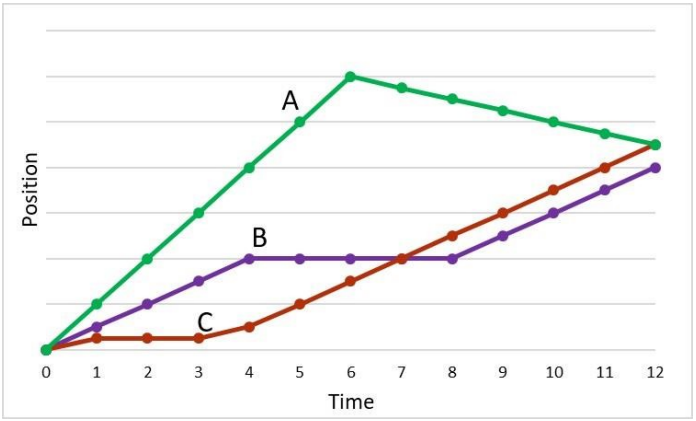
$$\bar{v} = \frac{s_{Total}}{t_{Total}}$$

Therefore, even if the object did not move at a constant velocity, one can assume that the average velocity would be the constant speed at which the object would have to move to cover that same distance (s_{Total}) in the same amount of time (t_{Total}).

The position versus time graph below shows the different paths taken by three drivers to go from city A to city B. Which of them had the highest average velocity?

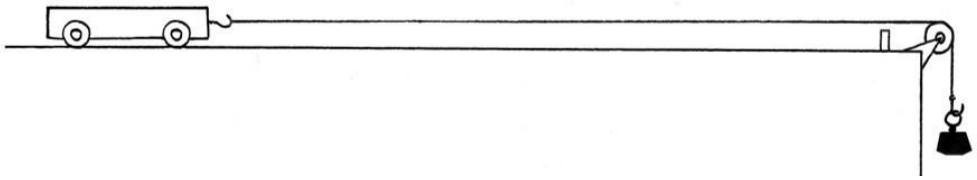


Looking at the position versus time graph below, identify for which trajectory or trajectories the result of the average velocity calculation will be the same using an arithmetic average and a weighted average:

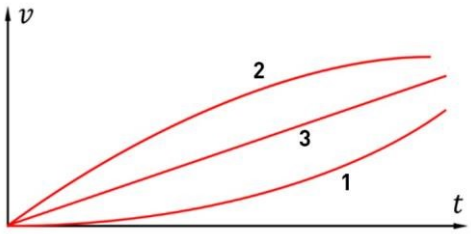


3. Forces

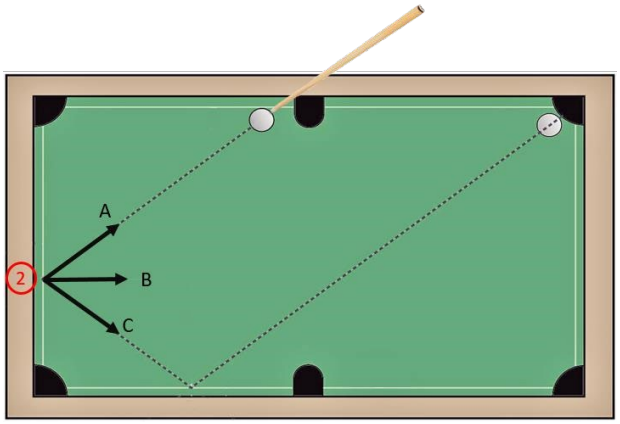
What is the effect of a constant force? In the picture bellow, a cart is connected to a suspended weight via a pulley. Because of it, the cart starts moving to the right.



Which of these curves would describe the velocity of the cart over time?

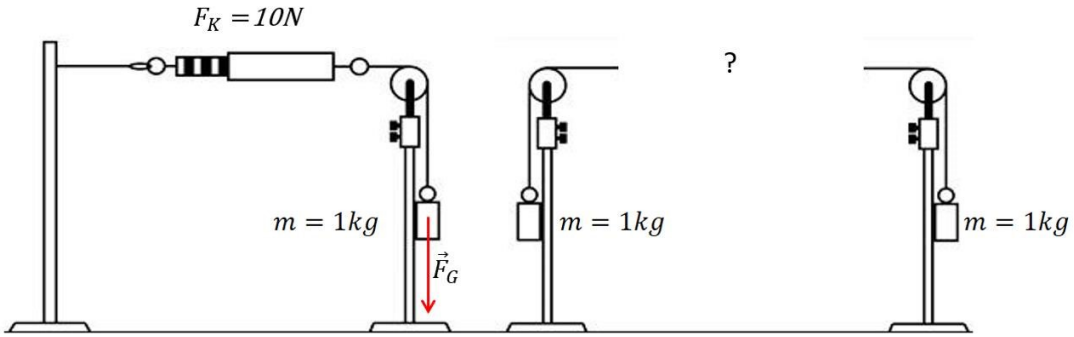


Properties and representation of forces: A pool player hits the ball so it bounces two times and goes into the hole. Which of the arrows represent the reaction force during the first rebound?



4. Action-reaction and balanced forces

What would the dynamometer indicate when there is a 1kg weight suspended from each side?



Draw the forces acting on these situations and decide if they are action-reaction forces or equilibrium forces.