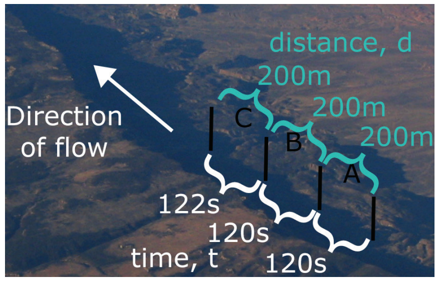
…and the time is listed in the "time column." For Day 1 in 2017, we know that the logs moved through each 200m section with the following times—section A in an average of 120s, section B in 120s and section C in 122s.



So, with that information, we have all we need to determine the speed in each section, using the formula S = d/t:

- Day 1, section A, the distance is 200m and the time is 120s. S = d/t = 200m/120s = 1.67m/s.
- Day 1, section B, the distance is 200m, the time is 120s. S = d/t = 200m/120s = 1.67m/s.
- Day 1, section C, the distance is 200m and the time is 122s. S = d/t = 200m/122s = 1.64m/s.

These calculated speeds just make it easier for us to determine if acceleration is present. It is present on Day 1 because the speeds are not the same in all three sections. Since speed is the magnitude component of velocity, that means the velocity changes, indicating acceleration of the logs is present on Day 1. If we do the same analysis for Days 2-5, we find the same thing; there is acceleration present on each day. We can further confirm this by average velocity column, which shows that there is a progressive decrease in the velocity from 1.66m/s on Day 1 to 1.57m/s on Day 5. The velocity decreases from Day 1 to Day 5, indicating the logs experience an acceleration force in the opposite direction to which they are traveling; they are slowing down.

Oftentimes in physics, "speed" and "velocity" are used somewhat interchangeably during a discussion because speed is the magnitude component of velocity. When the terms are used interchangeably, it isn't because the directional component is ignored; rather, it is understood that the overall measurement is still velocity and "speed" simply refers to the magnitude component of the velocity. Since it is the speed component of the velocity that changes, when we say "speed," we clearly mean the speed component of velocity. So, in this example, even though we only calculated the speed, we should understand that the speed is the magnitude component of velocity.

By understanding the observational study design and the relationship between speed, distance, time and acceleration, we were able to logically think through what the data was telling us and confirm it with the additional data supplied by the study.

7.4 DON'T FORGET ABOUT DIRECTION!

Just a brief note not to forget about direction. We often become overly involved in the speed component of velocity when assessing the presence of acceleration. Direction is important, too, since velocity is composed of both speed and direction; therefore, any change in direction, even if speed remains the same, also indicates acceleration has occurred. The key to an object being accelerated is that an external force is applied to it. An external force can change an object's speed and/or direction. Both velocity components are important.