

9.3.2: Time



Figure 9.3.2.1: The motion of these racing snails can be described by their speeds and their velocities. (credit: tobitasflickr, Flickr)

There is more to motion than distance and displacement. Questions such as, “How long does a foot race take?” and “What was the runner’s speed?” cannot be answered without an understanding of other concepts. In this section we add definitions of time, velocity, and speed to expand our description of motion.

Time

The most fundamental physical quantities are defined by how they are measured, including time. Every measurement of time involves observing a change in some physical quantity, whether it's a digital clock ticking, a heartbeat, or the position of the Sun in the sky. In physics, **time** is defined simply as change or the interval over which change occurs; it's impossible to perceive the passage of time without some form of change.

Time or change is calibrated by comparison with a standard, with the SI unit for time being the second (s). For instance, we might observe a pendulum completing one swing every 0.75 seconds and use this to measure time by counting its swings or connecting it to a clock mechanism. This not only allows us to measure time but also to establish a sequence of events. When considering time in relation to motion, we typically focus on elapsed time for a particular motion, such as the time it takes for an airplane passenger to move from one seat to another. For example, a lecture may start at 11:00 A.M. and end at 11:50 A.M., so that the elapsed time would be 50 min. **Elapsed time Δt** is the difference between the ending time and beginning time,

$$\Delta t = t_f - t_0,$$

where Δt is the change in time or elapsed time, t_f is the time at the end of the motion, and t_0 is the time at the beginning of the motion. (As usual, the delta symbol, Δ , means the change in the quantity that follows it.)

Section Summary

- Time is measured in terms of change, and its SI unit is the second (s). Elapsed time for an event is

$$\Delta t = t_f - t_0,$$

where t_f is the final time and t_0 is the initial time.

Glossary

time

change, or the interval over which change occurs

model

simplified description that contains only those elements necessary to describe the physics of a physical situation

elapsed time

the difference between the ending time and beginning time

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