

Milestone: Keeping Time: Homework 1

Due: 28 August 2020

1 Powers of ten and scientific notation

- a) A computer operates by doing a series of basic mathematical operations. The time taken to do one operation is 3.5×10^{-9} s. Determine the amount of time that it takes to do 1500000 operations. Express your answer in seconds.
- b) Determine how many milliseconds there are in 5 minutes.
- c) Determine how many microseconds there are in 10 minutes.

2 A day on Venus

The planet Venus rotates, completing one rotation in 243 (Earth) days (this is actually less than the time taken to complete one orbit around the Sun, which is 224.7 days). Suppose that the day on Venus is divided into 24 pieces; each would be a “Venus hour.”

- a) Determine how long a Venus hour is in conventional Earth hours.
- b) Determine how long a Venus hour is in seconds.

3 Rough Sun angle time measurement system on Earth

Suppose that the only way that you have of determining time is by observing the angle that the sun makes in the sky. However, you can only estimate the angle very roughly and can divide the angles at which the Sun appears as it traverses the sky *from sunrise to sunset* into 12 parts. Each part would make up a “rough hour.” So there are twelve “rough hours” in a day. This process of dividing the day into “rough hours” would be result in twelve “rough hours” at any location on Earth.

- a) Consider the “rough hours” in Grand Junction. Would the true duration of each “rough hour” be the same in the summer as it is in the winter? If not, which would be longer or shorter? Explain your answers.
- b) Consider the “rough hours” in Grand Junction (northern hemisphere) versus those in Sydney, Australia (southern hemisphere). Would the true duration of a “rough hour” in Grand Junction be the same as or different from that in Sydney? If you wanted to set up an appointment to communicate with someone in Sydney at a particular time, what difficulties would the “rough hours” system present to each of you? Explain your answers.

4 Sun based time-keeping

Suppose that the only way that you have of keeping time was to observe the angle of the Sun in the sky. Suppose that the way in which you can measure the angle the Sun makes from the horizon is only accurate up to about 10° . Consider how the resulting lack of precision would affect your typical daily life. Specifically pick one activity that you do on most days that would not be possible to do with such imprecise timing. Explain how you know that you would not be able to do that activity in the way that you currently do it and how you would have to modify your behavior to adjust for such imprecise timing. Separately describe a typical daily activity that you do that would not require much modification. Explain why it would not require much modification.

5 Effect of Moon of time keeping

Consider the situation where the only way to keep time was to observe the apparent daily motion of the Sun or the change in seasons throughout the year. Read Ch. 1 of *Time's Pendulum* and explain in one or two paragraphs the role that the Moon has played in the duration of a day or the number of days in a year.