

Milestone: Timekeeping: Homework 3

Due: 13 September 2021

1 Water clocks versus sundials

One major difference between sundials and water clocks is one of these has moving parts and the other does not.

- a) Describe which of these has moving parts and what they are.
- b) What issues limit the operation of machines that have moving parts? There is one possibility that applies to nearly any machine that has moving parts. Explain your answer.
- c) Would a sundial or an inflow water clock seem more like a machine to you? Explain your answer.

2 Ctesibius' water-clock

A typical inflow clepsydra (water-clock) is well suited to measuring time in equal hours and requires little modification to do this. However, Ctesibius went to great lengths to devise a mechanism that ensured that it measured temporal hours.

- a) Describe why it was difficult for a typical inflow clepsydra to measure temporal hours.
- b) What does the effort that goes into engineering this device say about the importance of temporal hours versus hours that always measure the same amount of time to ancient Greeks? If we were to construct a clock today, would we be inclined to devote any effort to ensuring that it measure temporal hours?

3 Water clocks and irrigation

It seems that water clocks were used during the middle ages to regulate irrigation of crops. This is described in the article: T. F. Gluck, *Medieval Irrigation Clocks*, Technology and Culture, Vol. 10, No. 3, pp. 424-428 (1969).

Some background to this is that most of present-day Spain had been occupied by Muslims from about the early 8th century. Christians from the north gradually pushed Muslims to the south and finally conquered the last Spanish Muslim stronghold in 1492. The part of Spain discussed in the article is along the southern coast and is generally arid; irrigation is essential to agriculture there and water is limited. Finally, a *huerta* is an orchard or vegetable patch.

- a) What devices were used by medieval Spaniards to regulate irrigation? For the types that functioned as water-clocks, briefly describe how they worked to keep time.

Now consider the role of these in society.

- b) If you were a farmer in this area at that time, would these water clocks have restricted your operations? If so, how?
- c) Would it seem that the existence of these water clocks would have partly regulated your life? Could they reduce or increase the likelihood of conflict? Explain your answers.
- d) Imagine that you were a farmer in this area at the time and there were no water clocks or any other timing devices. How would this have affected your operations positively and how would it have affected them negatively?
- e) What role did the water clocks play in the generally orderly functioning of society? How could the availability of such timing devices have impacted that society? Does it appear that clocks and timing devices can have an affect on how a society operates?

4 Use of water clocks in ancient Rome and Greece

It is often stated that water clocks were widely used in ancient Greece and Rome. The aim of this reading exercise is to gather some evidence to support these ideas. Articles that might be useful in this regard are:

- R. Hannah, *Time-Telling Devices*, Ch 55 of *A Companion to Science, Technology and Medicine in Ancient Greece and Rome*, Ed. G. I. Irby, Wiley (2016).
- J. E. Armstrong and J. McK. Camp II, *Notes on a Water Clock in the Athenian Agora*, *Hesperia: The Journal of the American School of Classical Studies at Athens*, Vol. 46, No. 2, pp. 147-161 (1977).
- J. V. Noble and D. J. de Solla Price, *The Water Clock in the Tower of the Winds*, *American Journal of Archaeology*, Vol. 72, No. 4, pp. 345-355 (1968).
- J. G. Landels, *Water-clocks and Time Measurment in Classical Antiquity*, *Endeavour*, Vol. 3, No. 1, pp. 32 - 37 (1979).

These can be found in the course D2L page. In this exercise, you should look at these articles to ultimately answer two questions. First, what evidence is there for the existence of water clocks of various types? Second, for what purposes were water clocks used and what evidence is there for this? It will be crucial to assemble pieces of evidence. In your response below you should always describe *where* you found any evidence. Note that some of these articles are very detailed and in your reading you can skip lots of the details.

- a) It appears that there were at least three large-scale water clocks in ancient Greece whose remnants have survived. Describe what these were and where they are located. What evidence exists for the dates when they may have been constructed. Where did you find this evidence?
- b) Do any of these water clocks currently look like water clocks? Does it appear that there is written evidence from the time when they were in use to support the fact that they were water clocks? If not, what sort of evidence did you find to suggest that that they were water clocks? (*Precise details are not needed, just a rough outline of the evidence.*)

- c) Is the evidence that these were used to tell time conclusive or does it appear possible that they could have had other uses?
- d) Consider the interior of the Tower of the Winds. Briefly explain what currently remains of the parts that might have formed a water clock. Explain whether the evidence for this as a water clock is conclusive.
- e) Describe the major uses of water clocks in *legal matters* in ancient Greece and Rome. What evidence can you find for these uses?