

Questions for Exam 2

Scientific Thought I

Fall 2009

Exam 2 will consist of a selection of the following questions.

1. (a) If something comes to be hot, what was it before? (b) If something ceases to be hot, what was it before and what does it become?
2. What happens in any change, according to Aristotle? Illustrate your answer with an example.
3. What does Aristotle mean by a “substance”? How does Aristotle accommodate the creation and destruction of substances in his general model of change?
4. How did Parmenides argue that nothing can come to be? What was Aristotle’s response to Parmenides’ argument?
5. What is Aristotle’s definition of nature? Give an example of something that has a nature and something that doesn’t.
6. If a stone is thrown upwards, is its motion in accordance with nature? Explain.
7. Does Aristotle think that the nature of a thing is identifiable with its matter or its form? What reason does he have for his view?
8. How does Aristotle’s view of the subject matter of mathematics differ from Plato’s?
9. What are the four causes of an automobile?
10. State Aristotle’s definition of an element.
11. For each of the following propositions, state an argument that Aristotle gives for it and explain how a follower of Anaxagoras might have objected to the argument.
 - (a) Heavenly bodies are composed of something different to anything on Earth.
 - (b) There are elements.
 - (c) There are not infinitely many elements.
 - (d) The elements are not eternal.
12. According to Ptolemy, what are the branches of theoretical philosophy? In which of these did he believe “sure and unshakeable knowledge” is possible? What reasons did he give for this belief?
13. State two of Ptolemy’s arguments for the view that the heavens are spherical.
14. Explain how Ptolemy used astronomical phenomena to argue that the earth is spherical.

15. Give Ptolemaic arguments for the following propositions. If Ptolemy responds to objections to the argument, give that also.
 - (a) The earth is in the middle of the heavens.
 - (b) The earth has the ratio of a point to the heavens.
 - (c) The earth doesn't move, either as a whole or by rotating once/day.
16. Draw a diagram showing a deferent and an epicycle. Under what conditions will this system produce retrograde motion?
17. Explain what an eccentric is and what it can be used for in Ptolemy's astronomy.
18. What did Osiander say in the Foreword to *On the Revolutions*? Did Copernicus agree with this? Support your answer to the latter question with a quotation from Copernicus.
19. One argument against the rotation of the earth was that falling bodies are seen to fall straight down, which would not happen if the earth were rotating. How did Copernicus answer this objection?
20. How did Ptolemy argue that the earth cannot move as a whole (i.e., from place to place, as opposed to merely rotating in one place)? What was Copernicus's reason for saying that Ptolemy's argument was not conclusive?
21. State three reasons Copernicus gives for believing that it is the earth that rotates once a day, not the heavens.
22. How does Copernicus explain the following facts? How could Ptolemy explain them? Draw diagrams as appropriate.
 - (a) Mercury and Venus always appear close to the sun.
 - (b) The superior planets are closest to the earth when they are in opposition to the sun.
 - (c) The distance traveled in retrograde motion increases in the following order: Saturn, Jupiter, Mars.
 - (d) The frequency of retrograde motion increases in the following order: Mars, Jupiter, Saturn.
23. What are the qualities of Copernicus's theory that Copernicus thinks make it more probable that the earth orbits the sun rather than vice versa, as in Ptolemy's theory? Give an example to illustrate each quality that you mention.
24. Describe the methods that Bacon calls "anticipation of nature" and "interpretation of nature". Which did Bacon think was the method in use in his time? What is Bacon's attitude to these two methods?
25. What is Bacon's purpose in discussing the idols of the mind?
26. Give the names of the four types of idol that Bacon discusses and explain what these names mean.
27. Give two examples of each kind of idol.
28. State three reasons Bacon gives for thinking that the sciences in his day were in a poor state.

29. State three causes that Bacon gives for the poor state of science in his day.
30. State two reasons that Bacon gives for being hopeful that science can be improved.
31. What is induction by simple enumeration? What does Bacon think of this kind of induction?
32. Does Bacon believe that a natural history must be completely accurate? How does he support his position on this point?
33. Why is science valuable, according to Bacon? What is its greatest value?
34. Bacon says science should aim to discover (a) forms, (b) latent processes, and (c) latent configurations. Explain what he means by these three things.
35. Bacon says that for the discovery of forms, instances should be arranged in three tables. What are these tables called and what do they contain? How is each used in the exclusive part of induction?
36. What does Bacon mean by the “first vintage”? How does this differ from a hypothesis arrived at by the method Bacon calls anticipation of nature?
37. What does Bacon mean by a “crucial instance”?
38. What does Bacon propose as a crucial instance for deciding whether heavy objects (a) go to the center of the earth by their own nature, or (b) are attracted by the earth? Is Bacon’s proposal really a crucial instance for these hypotheses? Explain.
39. What does Bacon propose as a crucial instance for deciding whether touching an iron needle by a magnet (a) itself gives the needle a tendency to point north-south, or (b) only prepares the iron and it is the earth that turns the needle north-south? Is Bacon’s proposal really a crucial instance for these hypotheses? Explain.
40. Was Copernicus using what Bacon calls the method of anticipation of nature, or the method of interpretation of nature, or something else? Justify your answer by explaining the method Copernicus used and how it differs from the other method(s).
41. What did Bacon say needs to be done to determine whether it is the earth or the heavens that rotates once per day? Did Copernicus do that?
42. What did Bacon propose as a crucial instance for determining whether it is the earth or the heavens that rotates once per day? Is this really a crucial instance? Could Bacon reasonably have thought that observation might give the result he says would prove the earth is stationary? Explain.