

Mid-term Examination (A-Version)

General Directions: You are to answer a total of four of the following twelve questions. You must answer one question from each of the four areas. Your answers should be as complete as possible, given the time available.

Part I: The Scientific Enterprise

1. What is the main difference between rationalism and empiricism? Give at least one example of a thinker representing each view. In general terms, how has the argument between rationalism and empiricism gone up to our day?
2. Explain the difference between deductive and inductive arguments. What roles do these types of argumentation play in scientific reasoning?
3. Karl Popper proposed “falsifiability” as a criterion of demarcation between science and non-science. Explain what this idea means and illustrate it with at least two examples from the history of science that we have so far reviewed.

Part II: Ancient and Modern Models of the Universe

4. Explain Aristotle’s view of the difference between natural and enforced motion. What kinds of causes are required to sustain the latter, according to Aristotle, and what are some of the peculiar consequences of this view?
5. Plato is said to have set the agenda for ancient cosmology with his challenge to the astronomers to “save the phenomena.” What did this mean and why did Plato and his contemporaries think it a reasonable goal for cosmology?
6. Before Brahe and Galileo began to produce observational evidence that could be used to support the Copernican model of the planetary system, what were the chief advantages and disadvantages of the Copernican system with respect to the Ptolemaic system?

Part III: The Newtonian Universe

7. Explain what is meant by the distinction between inertial mass and gravitational mass in Newtonian physics. What is problematic about asserting that they are identical?
8. Reproduce Newton’s proof that a planet moving under the influence of a central force will satisfy Kepler’s second law.
9. What was the worry that led Newton to write the famous words “*hypotheses non fingo*”? What was the point that he was trying to make with this assertion?

Part IV: A Perspective

10. What was the view of the relationship between science and faith that Galileo argued for in his *Letter to the Grand Duchess*?

11. What was Newton's view on the distinction between absolute and relative space? How was the "bucket" thought experiment supposed to prove the reality of absolute space? What was Mach's reply?

12. Why is it necessary to distinguish a physical theory's being deterministic from its being able to give us stable predictions?