Sample Exam Questions - Module 9

1) The Michelson-Morley experiment of 1887 (and other of Michelson's interferometer experiments) has an important place in the history of relativity theory. But was it really of importance to Einstein? Discuss this question in relation to the somewhat conflicting sources in which Einstein comments on it.

2) Einstein's energy-mass equivalence formula has today an iconic, almost magical status, but in the years following 1905 it did not create a sensation and was not considered a radical novelty. How is that? Despite other proposals of energy-mass relations in the period, Einstein's version of $E = mc^2$ was different. In which ways did it differ from those of contemporary physicists subscribing to the idea of electromagnetic mass?

3) In the early 20th century German physicists performed experiments with high-speed electrons (β-rays) in order to test various predictions of the increase of mass with velocity. What was the outcome of these experiments? How did people such as Abraham, Bucherer, Lorentz and Einstein respond to the early experiments? Did the experiments eventually prove the correctness of Einstein's theory of relativity?

4) Historians of science speak of "the electromagnetic world view." What do they refer to? Is a world view the same as a theory? Discuss the essence of this idea and the impact it had on fundamental physics in the early 20th century. How does Einstein?s relativity theory fit into this world view?

5) Einstein starts his 1905 relativity paper with a "definition of simultaneity" which he relates to his second postulate concerning the velocity of light in vacuum. Give an account of Einstein's argument and his reason for starting the paper with this issue. Why is it important for the rest of the paper?

6) Einstein refers several times in his 1905 paper to the "electron", but he does it in an unusual way. How does Einstein's electron differ from the particle with the same name occurring in the theories of, for example, Lorentz and Abraham? And how do these early conceptions of "electron" (Einstein's and others') compare to what we today speak of as an electron?