

Sample Exam Questions - Module 7

- 1) Ørsted's 1820 report of his celebrated experiment marks the beginning of electromagnetism. What are the main observations reported by Ørsted in this paper? What explanations does he provide for the phenomena described?
- 2) Ørsted's experiment had a major impact in André-Marie Ampère's scientific career. a) Describe some of the important modifications/additions made by Ampère's experiments. b) What was Ampère's conception of magnetism and how well was it accepted at his time? c) What are the core characteristics of Ampère's force law between current elements?
- 3) Figure 1 stems from Faraday's rotation experiment of 1822. What are the main features of this experiment and why did it have such a major impact at the time?

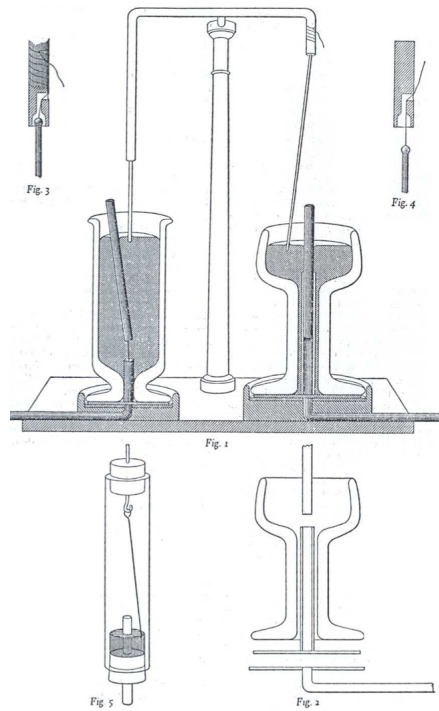


Figure 1: Faraday's continuous rotation

- 4) Compare Faraday's and Ampère's explanations of Ørsted's experiment. What are the arguments given by each of them against the explanation of the other?
- 5) In 1822 Faraday wrote in his diary "Convert magnetism into electricity". The discovery of induction came 9 years later and is registered in his diary by the description of two experiments. Describe Faraday's experiments and his observations registered in 1831.
- 6) It took about 20 years from the discovery of induction until Faraday proposed an explanation for the phenomenon based on the idea of lines of force. The quantitative experiments of the "moving wire" and "revolving rectangle" (Figure 2) were crucial in Faraday's conceptual framework. Describe the quantitative measurements made in these experiments and their conceptual role in Faraday's explanation of induction.

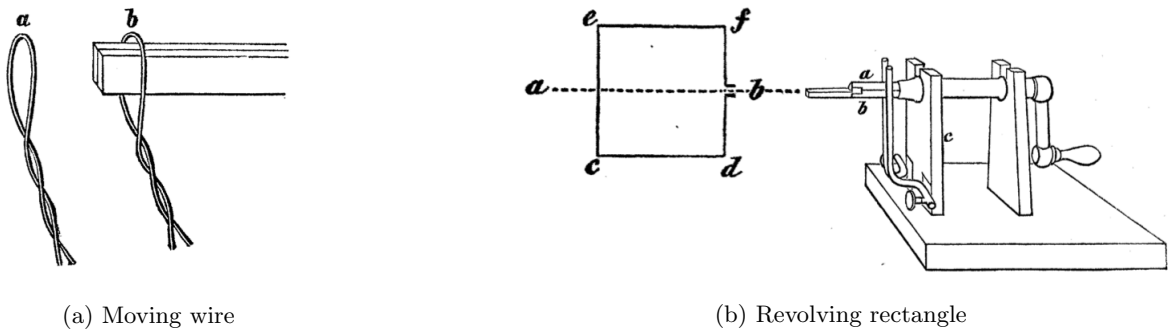


Figure 2: Faraday's quantitative experiments

- 7) In electromagnetism courses it is common to call $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$ by Ampère's law and $\oint \vec{E} \cdot d\vec{l} = - \iint \frac{\partial \vec{B}}{\partial t} \cdot d\vec{A}$ Faraday's law. How faithful are these references compared to the achievements of these two physicists?