

Department of Advanced Energy,
Graduate School of Frontier Sciences,
The University of Tokyo

H.28 (2016) Entrance Examination
For Master Course

Special Education Subjects (Essay)

Write an essay on the following theme on the next page. Use one answer sheet (front and back sides) enclosed. It must be your autograph in Japanese or in English. You may draw figures, but do not attach another sheet. Here enclosed two answer sheets, one of which is for a spare.

Applicants must send their essay written on the sheet no later than August 5, 2015 (postmarked on or before August 5, 2015) via a registered mail (Tokutei-Kiroku mail of Japan Post service is fine) to the address written below. You may fold the answer sheet. All the applicants are requested to attend the examination (August 25, 2015) with a copy of essay against a postal failure.

Mailing Address: Kashiwanoha 5-1-5, Kashiwa, Chiba 277-8561
Graduate School of Frontier Sciences, Kyoumu-Kakari
Write “Essay, Advanced Energy” in red ink on the envelope.

Problem

The following is a quote from an article on geometric mechanics:

“Physical theories which are written in terms of variables that are not canonical sometimes lack a mathematical elegance possessed by canonical theories. However, physics, rather than the elegance of canonical variables is the final test.”

[R.F. Dashen and D.H. Sharp, Currents as coordinates for hadrons, *Phys. Rev.* **165** (1968), 1857—1866]

While the authors are speaking of theories written in canonical variables and otherwise formulated ones (noncanonical Hamiltonian systems), one may apply the argument in different contexts, for example, a relation between linear equations and nonlinear equations, or a relation between normal distributions and non-normal distributions. More generally, one may interpret “mathematical elegance” as “clearness of model”, and “physics” as “reality”, to read this as a comment on the relation between theories and phenomena. Bearing this aphorism in mind, propose a concrete example of dichotomy between some phenomenon and its model, and write a short essay answering the following questions.

- 1) Describe your example, and explain the phenomenon and its model.
- 2) Explain how the “clearness of the model” is valuable in your example.
- 3) Explain the concrete process by which the “reality” conducts the final test in your example.
- 4) When the “clearness of the model” imposes a limitation to the theory, what should be the next aim of the theory?

Remark

- (1) This examination is not intended to ask about only knowledge, but is to evaluate the abilities of logical consideration and description, as well as originality.
- (2) Make the sources clear when you cite materials from references.