【 December 2020 】

2021

Integrated Graduate School of Medicine, Engineering, and Agricultural Sciences, Master Course, University of Yamanashi

Entrance Examination

No 1/1

Course or Program	Special Educational Program for Green Energy Conversion Science and Technology	Subject	English

Describe in English the current energy situation, either in your country or in the world (approximately 200 words, but not strictly limited).

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Entrance Examination

Course or Program	Special Educational Program for Green Energy Conversion Science and Technology	Subject	Physics, Electromagnetics/Electronic Properties

1. Answer the following questions. Equations should be used as little as possible and only when essential.

1.1 Describe how the kinetic energy and the potential energy are converted to each other while a roller-coaster car is running. Ignore friction and air resistance.

図は著作権の関係上、掲載できません。

1.2 Describe the equipartition theorem (the law of equipartition of energy) in this mass and spring system on a frictionless surface. m is the mass and k is the force constant of a massless spring.

図は著作権の関係上、掲載できません。

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2. The equation below shows rotation of the vector field $\vec{A}$.

$$\mathrm{rot}\,\vec{A} = \left(\frac{\partial A_z}{\partial y} - \frac{\partial A_y}{\partial z}, \frac{\partial A_x}{\partial z} - \frac{\partial A_z}{\partial x}, \frac{\partial A_y}{\partial x} - \frac{\partial A_x}{\partial y}\right)$$

Explain the physical meaning of this equation by using one component, for example $(\mathrm{rot}\,\vec{A})_x$: do not make use of mathematical manipulations, but answer in words based on intuitive understanding.

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3. Explain the following terms. Figures may be drawn.
   3.1 Band gap
   3.2 Metal and semiconductor
   3.3 Superconductor
   3.4 n-type and p-type semiconductors
   3.5 Photoemission spectroscopy

4. Explain the temperature dependence of conductivity in metals and semiconductors. Figures may be drawn.