

2015

Interdisciplinary Graduate School of Medicine and Engineering, Doctoral Course, University of Yamanashi

Entrance ExaminationNo. 1/2

Course or Program	Special Doctoral Program for Green Energy Conversion Science and Technology	Subject	Surface science
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Question 1

Hydrogen (H_2) is expected to be the fuel of the future. List the hydrogen production technologies currently in use over the world, express the processes by chemical equations and discuss the merits and demerits of each technology.

Question 2

Answer the following questions about Langmuir adsorption.

- (1) Explain the basic assumptions of Langmuir adsorption.
- (2) Derive the Langmuir adsorption isotherm.
Use the following symbols if necessary.
 R_a : rate of adsorption, R_d : rate of desorption, θ : surface coverage
 k_a : rate constant of adsorption, k_d : rate constant of desorption, P : gas pressure
- (3) Explain the Langmuir isotherm behavior at two limiting pressures.

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Entrance ExaminationNo 2/2

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Question 3

Chose one of the analytical methods listed below and explain the method. Explain the importance of the method to surface science.

X-ray Photoelectron Spectroscopy, Extended X-ray Absorption Fine Structure,
Low Energy Electron Diffraction, Surface Enhanced Raman Spectroscopy,
Auger Electron Spectroscopy, Ion Scattering Spectroscopy,
Infrared Reflection Absorption Spectroscopy

Question 4

- 1) Draw a face-centered-cubic (fcc) lattice structure. Give an example of a metal with fcc structure.
- 2) Draw fcc(111), fcc(100), and fcc(110) planes.