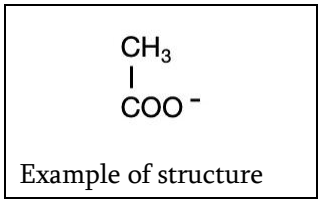
Master's Program April 2026, The Graduate School of Sciences and Technology for Innovation (Agricultural Sciences) Yamaguchi University Master`s Program Foreign Student 2nd Entrance Examination Questions (Major Subject)

【Fermentation Physiology and Engineering】

Answer the following question in essay form. You may use figures and diagrams to help explanation of your answer. Figures and diagrams alone are not sufficient; written explanations are required.

1. Answer the predominant structures of L-alanine at pH 1, pH 7, and pH 11. Answer in accordance with the structure form of the example.



Example of structure

2. Explain how ion-exchange chromatography works to separate proteins.

3. Answer the four levels of organization of protein structure and explain each level of protein structure.

4. Explain the differences between glucose, gluconic acid, and glucuronic acid.

5. Explain the properties of phospholipid bilayer upon temperature change.

6. Explain how to determine the K_M and V_{max} values by enzyme assay.

7. Answer the number of molecules of ATP that are consumed from one molecule of glucose in glycolysis (glucose to pyruvate) and the number of molecules of ATP that are produced from one molecule of glucose in glycolysis.

8. Explain two points of biological significance of the pentose phosphate pathway.

9. Answer the number of molecules of NADH that are produced during one round of citric acid cycle from acetyl-CoA and explain how NADH is re-oxidized.

10. Explain what proton motive force is and how proton motive force is generated in aerobic bacteria.

11. Explain the features of the DNA structure.

12. Explain how DNA is replicated by using the word: Okazaki fragment.

13. Explain the role of sigma factor in the initiation of the transcription in bacteria.

14. Explain what the Shine-Dalgarno sequence is and its importance in the initiation of the translation in bacteria.

15. Explain the role of CAP (catabolite activator protein) in transcriptional control of the *lac* operon.