2nd, 2015

Biological Chemistry I

I Read the following sentences and answer the questions below.

An ultracentrifugal analysis revealed that protein X had a sedimentation coefficient similar to that of a protein with a molecular weight of 90,000. In polyacrylamide gel electrophoresis, protein X treated with sodium dodecyl sulfate migrated giving two bands corresponding to molecular weights of 60,000 and 30,000, whereas protein X treated with sodium dodecyl sulfate and 2-mercaptoethanol showed a single band corresponding to a molecular weight of 30,000. On the other hand, in a gel filtration chromatographic analysis, protein X exhibited an elution time similar to that of a protein with a molecular weight of 10,000.

(1) Explain molecular properties of protein X based on the results of gel electrophoretic analyses.
(2) Explain a possible cause for the discrepant results between the ultracentrifugal and gel filtration analyses.
(3) Give another example of method to determine molecular weights of proteins and explain its principle.
(4) Give two examples of non-covalent interactions that mediate protein complex formation and explain their properties.

Biological Chemistry II

II Solve the problems from（1）to（4）for the following enzyme reaction (E, S, ES and P indicate the enzyme, substrate, enzyme-substrate complex, and product, respectively).

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftarrows}} ES \xrightarrow{k_2} E + P$$

（1） Under the steady-state assumption, d[ES]/dt = 0, derive the Michaelis-Menten equation expressing the reaction velocity, v, by using the substrate concentration, [S], the maximal reaction velocity at saturating substrate concentration, V_{max}, and the Michaelis constant, $K_M = (k_2 + k_{-1})/k_1$.

（2） Draw the graph of the Michaelis-Menten equation with [S] and v.

（3） Express the substrate concentration, [S], using K_M, when v is the half of V_{max}.

（4） k_2/K_M is a measure of enzyme's catalytic efficiency. Explain what determines the upper limit of the catalytic efficiency.