1. Valuable reagents. The following reagents are often used in protein chemistry:

- CNBr
- Trypsin
- Ninhydrin
- Urea
- Performic acid
- Phenyl isothiocyanate
- Mercaptoethanol
- 6 N HCl
- Chymotrypsin

Which one is the best suited for accomplishing each of the following tasks?
(a) Determination of the amino acid sequence of a small peptide.
(b) Reversible denaturation of a protein devoid of disulfide bonds. Which additional reagent would you need if disulfide bonds were present?
(c) Hydrolysis of peptide bonds on the carboxyl side of aromatic residues.
(d) Cleavage of peptide bonds on the carboxyl side of methionines.
(e) Hydrolysis of peptide bonds on the carboxyl side of lysine and arginine residues.

3. Crafting a new breakpoint. Ethyleneimine reacts with cysteine side chains in proteins to form S-aminoethyl derivatives. The peptide bonds on the carboxyl side of these modified cysteine residues are susceptible to hydrolysis by trypsin. Why?

4. Spectrometry. The absorbance $A$ of a solution is defined as

$$A = \log_{10}(I/I_0)$$

in which $I_0$ is the incident-light intensity and $I$ is the transmitted-light intensity. The absorbance is related to the molar absorption coefficient (extinction coefficient) $\varepsilon$ (in M$^{-1}$ cm$^{-1}$), concentration $c$ (in M), and path length $l$ (in cm) by

$$A = \varepsilon cl$$

The absorption coefficient of myoglobin at 580 nm is 15,000 M$^{-1}$ cm$^{-1}$. What is the absorbance of a 1 mg ml$^{-1}$ solution across a 1-cm path? What percentage of the incident light is transmitted by this solution?


10. Size estimate. The relative electrophoretic mobilities of a 30-kd protein and a 92-kd protein used as standards on an SDS-polyacrylamide gel are 0.80 and 0.41, respectively. What is the apparent mass of a protein having a mobility of 0.62 on this gel?

14. Power(ful) tools. Monoclonal antibodies can be conjugated to an insoluble support by chemical methods. Explain how these antibody-bound beads can be exploited for protein purification.

21. Quaternary structure. A protein was purified to homogeneity. Determination of the mass by gel-filtration chromatography yields 60 kd. Chromatography in the presence of 6 M urea yields a 30-kd species. When the chromatography is repeated in the presence of 6 M urea and 10 mM $\beta$-mercaptoethanol, a single molecular species of 15 kd results. Describe the structure of the molecule.