1. Distinguish between (21%)

    a) the equivalence point and the end point of a titration

    b) a primary standard and a secondary standard

    c) activity and activity coefficent

    d) thermodynamic and concentration equilibrium constants

    e) a galvanic cell and an electrolytic cell

    f) a working electrode and a counter electrode

    g) conventional and diode-array spectrophotometers

2. What is Beer's law? When are isobestic points observed? (4%)

3. What is the predominant form of ammonia in a solution at pH 7.0? What fraction is in this form?
(Note: $pK_a = 9.24$ for the ammonium ion, NH_4^+) (6%)

4. Describe the basic differences between atomic emission and atomic absorption spectroscopy.
(10%)

5. Name two general methods for improving the resolution of two substances on a chromatographic
column. (6%)

6. What is the difference between normal phase and reverse phase liquid chromatography? (8%)

7. Explain the difference between systematic and random errors. Could you give the ways to
detect systematic errors (at least three methods)? (12%)

8. Describe the principle upon which each of the following gas chromatography detectors are based:
(a) thermal conductivity (b) flame ionization (c)flame photometric (9%)

9. Please using chemical equations to show how to determine the nitrogen content in protein with
the Kjedahl nitrogen analysis. (10%)

10. Describe the principles of capillary zone electrophoresis (CZE). What is electroosmosis? If a
capillary is set up with the injector end positive and the detector end negative, in what order will
cations, anions and neutral molecules be eluted in CZE? (14%)

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