Lesson 18

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1. General principles of titrimetric analysis. Terminology. Requirements предъявля-емыеfor reactions used in titrimetric analysis.
2. Standard solutions of titrimetric analysis. Requirements for primary standards. Examples of standard substances and standard solutions.
3. Methods for expressing the concentration of solutions in titrimetry. Titer and titer for the determined substance (titrimetric conversion factor).
4. Протонная теория The Brensted-Lowry proton theory. Brønsted acids and basesБренстеда, strength of acids and bases, examples of ampholites.
5. Classification of titrimetric analysis methods: acid-base, redox, precipitation, complexіmetric and complexometric titration.
6. Types (techniques) of titration used in titrimetric analysis - direct, reverse, indirect. Formulas for calculating the required values used in different titration methods. Methods for determining individual attachments and aliquot parts. Pipetting method.
7. Methods for determining the titration end point: visual and instrumental. Indicators in titrimetry. Requirements for indicators.
8. Acid-base titration. The method's essence. Main reactions and titrants of the method. Types кислотнof acid-o-base titration - acidimetry, alkalimetry. Titration of polyprotic acids. Application in medicine, sanitary and hygienic research and pharmacy.
9. Indicators of the acid-base titration method. Ionic, chromophore, and ion-chromophore theory of acid-base titration indicators. Interval for changing the color of the indicator. Classification of indicators (by method of preparation, application, color, mechanism of interaction with titrant, composition). Examples of typical indicators of acid-base titration (formulas for phenolphthalein and methyl orange, schemes for changing the structure of indicators in different media).
10. Titration curves and their general characteristics. Differential and integral curves. Effect of various factors on titration jump Titration jump as a function of the concentration of reactants and the accuracy of the analysis. Equivalence point and neutrality point on the curves of the neutralization method.. Rules for selecting indicators based on the titration curve. Finding the equivalence point.
11. Acid-base titration curves. Calculation, construction and analysis of typical titration curves for cases of titration of strong acid with alkali, weak acid with alkali; strong, weak base with strong acid. Selection of indicators based on the titration curve.
12. Acid-base titration errors (errors due to physical measurements; indicator errors; concentration indicator errors;
13. salt errors, their calculation and elimination. Indicator errors of acid-base titration methods. Errors and limitations of titrimetric analysis
14. Differential determination of NaOH and Na2CO3 in one solution by acid-base titration. Reaction equations that the analysis is based on. Equivalence points and titration jumps in the system under consideration. Titrant. Indicators. The order of performing the analysis and basic analytical operations. Stoichiometry of analysis. Calculation of the molar concentration of NaOH and Na2CO3 and the mass of components in 100 ml of the analyzed solution based on titration results.
15. Differential determination of NaHCO3 and Na2CO3 in one solution by acid-base titration. Reaction equations that the analysis is based on. Equivalence points and titration jumps in the system under consideration. Titrant. Indicators. The order of performing the analysis and basic analytical operations. Stoichiometry of analysis. Calculation of the mass fraction of NaHCO3 and Na2CO3 in a solid sample based on titration results.
16. Determination of ammonium salts by acid-base titration. Method and method of titration. Reaction equations that the analysis is based on. Titrant. Indicator. The order of performing the

analysis and basic analytical operations. Calculation of the mass fraction of ammonium in a solid sample and identification of ammonium salts by titration results.

17. Redox titration. The essence and classification of methods. Basic requirements for redox titration reactions.
18. Determination of the direction of redox reactions. Oxidizer and reducing agent potentials . Process EMF
19. Indicators of redox titration. Specific indicators, redox indicators, and their requirements. The main redox indicators, their choice and mechanism of action.
20. Redox titration curves. Basic principles of constructing O-V titration curves. Equivalence point.
21. Effect of pH on the redox titration process. Redox titration errors.
22. ***Permanganatometry.*** The method's essence.Aboutсновные new titrants. Preparation and standardization of titrants. Titration conditions. Zimmerman-Reinhardt mixture.. Use of the reagent. Application of permanganatometry in medicine and pharmacy.
23. ***Iodometry.*** The method's essence. Titrants, their preparation and standardization. Application of iodometric titration. Aquametry.
24. Methods (techniques) of redox titration (direct, reverse, substitution), examples from laboratory work.
25. ***Chloriodimetry.*** Essence, titrants, indicators, application.
26. ***Bromateo-and bromometry.*** The essence of methods. Titrantsand indicators. Application.
27. ***Nitritometry.*** The method's essence. Titrantsand indicators. Application, preparations analyzed by nitritometry, formulas of sulfonamide preparations.

28. The concept of precipitation titration. Entity. Titrants. Requirements for reactions. Classification.

29. Indicators in precipitation titration: Reagent indicators, adsorption indicators.

30. Construction and analysis of titration curves. Effect of the precipitator concentration on the titration jump.

31. Argentometric titration. Entity. Titrants, their preparation and standardization.

32. Classification of argentometric methods. The Mora method. The essence, conditionsfor conducting analysis, and indicators.

33. The Faience method. Essence, titrants. Adsorption indicators, formulas, and their mechanism of action. Application of the method in pharmacy.

34. Determination of iodides by the Faience method. Progress, calculations, and application of the method.

35. Метод Folgard's method. The essence of the method, titrants, indicators. Application.

36. Mercurometric titration, essence, titrants, indicators, application.

37. Sulfatometric titration method. Essence, titrants, and application.

38. The concept of complexometric titration. Entity. Requirements for reactions.

39. Complexons, composition, properties, forms of presence in solutions at different pHphs of the medium, mechanism of action. Complexonates.

40. The main indicators used in complexometry. Schemes of their interaction during definitions.

41. Кривые Complexometric titration curves and their construction. Titration errors.

42. Preparation of titrants and determination of their normality and titer. Application of complexometric titration methods in biology, medicine, and pharmacy.

43. Determination of calcium and magnesium in solutions using trilon B, progress, calculations.

44. Titration in non-aqueous media. Titrantsand indicators. Application.

45. Classification of solvents used in non-aqueous titration. Influence of the nature of the solvent on the strength of acids.

46. Application of acid-base titration in non-aqueous media.

47. General characteristics of instrumental methods of analysis, their classification, advantages and disadvantages.

48. Optical methods. Classification:

a) by the objects under study;

b) by the nature of the interaction of electromagnetic radiation;

c) by the region of the electromagnetic spectrum used.

49. Molecular spectral analysis. The method's essence. Basic laws of light absorption. Optical density and light transmission.

50. Colorimetry methods (standard series methods, color equalization, dilution.

51. Photocolorimetry. The essence of the method and its application.

52. The essence of the spectrophotometry method. The main distinguishing features of the method in comparison with photocolorimetry. Advantages and disadvantages of this method.

53. Features of electronic absorption spectra of organic and inorganic compounds.

54. Dependence of the position and intensity of the absorption band in the UV spectrum on the structure of the molecule

55. Basic calculation methods in quantitative spectrophotometric analysis.

a) метод the calibration graph method;

b) the single standard method;

c) determination of the concentration by molar (or specific) coefficient

absorption, method of standard additives.

d) determination of several thingsin prand joint presence.

e) differential spectrophotometric analysis.

56. The essence of the method, methods for determining concentrations (calculation method, calibration graph method).

57. Extraction and photometric analysis. The method's essence. Conditions for conducting the analysis. Photometric reactions in the extraction-photometric method.

58. The concept of photometric titration.

59. Application of spectrophotometry in analytical practice, medicine and pharmacy.

60. The essence of the chromatography method. The main physical and chemical processes underlying the method. Main features of the gas-liquid chromatography method.

61. Basic concepts: retention time, retained volume, number of theoretical plates.

62. The main components of a gas-liquid chromatograph and the principle of its operation.

63. Detector types and classification. Device and principle of operation of the catarometer.

64. Basic calculation methods used in gas-liquid chromatography: calibration graph method, internal standard method, and normalization method.

65. Theoretical foundations of ion exchange chromatography.

66. Ion exchange equilibrium. Anion and cationites used in analytical chemistry.

67. CIntegration of ion exchange chromatography methods with other methods.

68. Application of ion-exchange chromatography in analytical chemistry.

69. Paper and thin-layer chromatography and its application for quantitative determinations in pharmaceutical practice.

70. Features of quantitative calculations in paper, thin-layer and ion-exchange chromatography.

71. Potentiometric analysis method. Determination of the concentration of the analyte in direct potentiometry (calibration graph method, standard additive method).

72. The essence of potentiometric titration. Types of potentiometric titration. Electrodes used for various types of potentiometric titrations.

73. Construction and analysis of potentiometric titration curves. Application of potentiometry and potentiometric titration in pharmacy.

74. Conductometric analysis. Principle of the method. Direct conductometry, factors affecting the equivalent electrical conductivity of electrolytes. Application in pharmacy.

75. Conductometric titration. The method's essence. Types of conductometric titration curves and their analysis. Application of conductometric titration

76. Coulometric analysis. Principle of the method. Direct coulometry. Methods for determining the amount of electricity passed through the solution. Applying the method.

77. Coulometric titration. The method's essence. Terms of the event. Indication of the equivalence point, application of the method.

78. Polarographic analysis. General concepts. Principle of the method. Polarographic curves. Half-wave potential. Relation of the diffusion current to the concentration.

79. Quantitative polarographic analysis: determination of the concentration of the analyzed substance by the calibration graph method, by the method of additives, by the method of standard solutions. Application of polarography.