«ԵՐԵՎԱՆԻ ՄԽԻԹԱՐ ՀԵՐԱՑՈՒ ԱՆՎԱՆ ՊԵՏԱԿԱՆ
ԲԺՇԿԱԿԱՆ ՀԱՄԱԼՍԱՐԱՆ» ՀԻՄՆԱԴՐԱՄ

"YEREVAN STATE MEDICAL UNIVERSITY
AFTER MKHITAR HERATSI" FOUNDATION

Ֆարմացիայի ամբիոն
Department of Pharmacy

ՀՀ, 0025, Երևան, Կորյունի փ. 2 • Koryun St. 2, Yerevan, 0025, Republic of Armenia • Tel: +374 010-301-000 (4-26) • URL: www.ysmu.am • E-mail: pharmchem@ysmu.am

Questionnaire on "Pharmaceutical chemistry" state exam for master's degree students

2025-2026 academic year

1. Characteristics of electromagnetic specter. Electromagnetic radiation influence on substances, changes caused by them.
2. Characteristics of electromagnetic radiation. Frequency, wave length, energy, wave number, their interrelation, measurement, Plank's equation.
3. Description of substance and light interaction. Quantum and non-quantum effects: light absorption and light emission.
4. Types and effects of electromagnetic radiation. Devices used in spectroscopy: single beam and double beam devices and their components.
5. Absorption laws: Bouguer-lambert and Beer laws, their combined formula, its usage in spectroscopic methods. Absorption spectra expression forms: formulae of transparency, absorption, optical density; specific and molar absorptions, their interrelation.
6. Characteristics of absorption electronic specter according to organic molecule's structure. Types of electronic transitions: N→V and N→Q transitions.
7. Electronic transitions inhibiting rules. Description of electronic transitions on formaldehyde example.
8. Chromophore groups, factors influencing on chromophore groups absorption: solvent pH, polarity, groups orientation in the molecule.
9. Organic compounds separate classes' absorption electronic spectra. Aliphatic compounds: saturated and unsaturated aliphatic compounds. Cyclic alkanes and alkenes.
10. Absorption electronic spectra of saturated and unsaturated carbonyl compounds. Characteristics of n-π * transition in carbonyl compounds.
11. Spectroscopic analysis of aromatic compounds. Characteristics of benzene absorption layer, influence of substituents nature and position on aromatic ring absorption layer.
12. Organic compounds separate classes' absorption electronic spectra. Heterocyclic compounds: five-membered (furan, thiofen, pyrol) and six-membered unsaturated heterocycles (pyridine).
13. Usage of electronic spectra in drug analysis. Substances identification and quantitative analysis by UV and visible spectroscopy method.
14. Usage of UV-spectroscopy method in molecular biology and biophysics.

15. Types of luminescence, according to light emission formation reason and light back emission existence.
16. Theoretical bases of fluorescence. The mechanism of fluorescence formation. Stock's law, mirror symmetry law.
17. Quantum and energetic yields of fluorescence, their interrelation. Emission specter and its characteristics. Excitation specter and its characteristics. Factors influencing on excitation specter.
18. Usage of fluorescence methods in drugs analysis, advantages and disadvantages. Devices used in fluorimetry.
19. Fluorophore groups, their characteristics, factors influencing on them. Fluorescence quenching, the influence of various factors on fluorescence intensity.
20. Substances quantitative analysis by fluorimetry: Vavilov's law. Titration methods by usage of fluorescent indicators. Direct and indirect methods of substances analysis.
21. IR-spectroscopy. Characteristics of the method, usage sphere of IR-spectroscopy. Theoretical bases of IR-spectroscopy.
22. Vibrational spectroscopy, types of vibrations. Valence and deformation vibrations, types, Hook's equation.
23. Rule of choice in IR-spectroscopy. Usage of IR-spectra in substances structure detection. Localized and skeletal vibrations, their corresponding regions.
24. Types of vibrational spectra: main vibrations, overtones and combined lines, their formation reasons. Characteristics of vibrational spectroscopy. Intensity expression methods.
25. Quantitative analysis by IR-spectroscopy method. Optical density, transparency, Beer's law.
26. Devices used in IR-spectroscopy: double beam spectrophotometers, their components.
27. Samples preparation in IR-spectroscopy: analysis of liquid and gaseous substances in IR-spectroscopy.
28. Analysis of solid substances in IR-spectroscopy. Compression method by potassium bromide. Method for preparing samples with paraffin oil.
29. Combination scattering /Raman/ spectroscopy. Characteristics of the method, theoretical bases. Combination scattering spectra: Stock's and anti-Stock's lines.
30. Rule of choice in Raman spectroscopy. Comparative characteristics of Raman and IR-spectroscopy.
31. Atomic absorption, atomic fluorescence and flame emission spectroscopy methods. General characteristics of phenomena based on these methods.
32. Atomic absorption, atomic fluorescence and flame emission spectroscopy methods. Factors influencing on atoms excitation. Boltzmann's equation.
33. Metal containing compounds atomization at atomic absorption, atomic fluorescence and flame emission spectroscopy methods. Atomization stages.

34. Absorption and emission spectra in atomic absorption and flame emission spectroscopy methods. Their general and comparative characteristics. Linear spectra.
35. Flame emission spectroscopy. Usage limitations. Alkaline and alkaline-earth metals identification by atomic absorption and flame emission spectroscopy methods.
36. Substances analysis characteristics by atomic absorption spectroscopy method. Bouguer-Lambert-Beer law.
37. Devices used in atomic absorption spectroscopy, structural characteristics. Flame method. Gases used in atomic absorption spectroscopy.
38. Devices used in atomic absorption spectroscopy, non-flame methods in atomic absorption spectroscopy: graphite tube heaters.
39. Devices used in atomic absorption spectroscopy, non-flame methods in atomic absorption spectroscopy: hydride compounds and cold vapors method.
40. Atomic absorption spectroscopy corresponding method choice criteria. Interferences of atomic absorption spectroscopy.
41. Quality control methods for solid oral dosage forms. Quality requirements for tablets. Talc detection. Tablets hardness testing against friability.
42. Tablets average mass detection. Quantitative detection of API in tablets. The uniformity of dosage units.
43. Tablets disintegration testing, devices. Dissolution detection, used devices. Choice of dissolution environment volume and its content.
44. Dissolution test implementation. Sampling and API detection. Standard method of dissolution by WHO for easily soluble API.
45. Standard method of dissolution according to SP XI requirements. Dissolution of hardly-soluble tablets. Dissolution test usage in pharmacy.
46. Water and moisture detection methods in solid dosage forms. Water and moisture detection azeotropic method.
47. Water and moisture detection gravimetric method in pharmaceutical forms.
48. Water and moisture detection Karl Fischer method in pharmaceutical forms, advantages and disadvantages. Karl Fischer reagent and its modifications.
49. Karl Fischer titrimetric and coulometric methods. Devices used in Karl Fischer method.
50. pH-detection methods. Calculation of pH value of aqueous solutions of strong acids and bases. Colorimetric and potentiometric methods of pH-detection.
51. Devices used for pH-detection, types of used electrodes. pH-measurement. Buffers, types. Buffer capacity.
52. Principle and theoretical bases of chromatographic method. Classification of chromatographic methods according to aggregation state of phases, mechanism of separation and used technique. conducting. Inner and outer chromatograms.

53. Adsorption chromatography, description. Sorbent adsorption activity and adsorption volume. Active center, adsorption coefficient. Adsorption isotherm description.
54. Partition chromatography. Partition coefficient: Nernst's rule. Sorbents characteristics. Comparative characteristics of partition and adsorption chromatography.
55. Size-exclusion, affinity and ion exchange chromatography, their characteristics.
56. Types of physico-chemical interactions in chromatography. Reason of their choice for different mixtures division.
57. Choice of chromatographic systems: sorbent and solvents system choice.
58. Thin layer chromatography, mechanism, advantages and disadvantages, usage in pharmacy.
59. Sorbents types used in thin layer chromatography and their requirements.
60. Thin layer chromatography. Stationary phase (sorbents). Mobile phase. Procedure of chromatography, its description. Chromatogram visualization methods. Universal developers.
61. Specific methods of thin layer chromatography, their characteristics. High performance thin layer chromatography: sorbents and devices characteristics, advantages.
62. Column chromatography, theoretical bases, structure of device. Partition coefficient. Factors influencing on partition coefficient.
63. Descriptors of chromatogram: peak, baseline, peak area, peak height, width, retention time and its types, column geometric volume, free volume.
64. Qualitative analysis. Chromatogram analysis methods. Quantitative analysis, methods in column chromatography.
65. Suitability of the chromatographic system. Column efficiency.
66. Gas chromatography method. Structure of device. Types of columns used in gas chromatography.
67. High-performance liquid chromatography, theoretical bases. Development of used devices.
68. Devices used in high-performance liquid chromatography, their components, working principle. The pumps used for the HPLC.
69. High-performance liquid chromatography, gradient elution. Requirements for gradient system. Gradient optimization. Sample injection systems.
70. Columns used in HPLC. Normal-phase chromatography, conditions. Reversed-phase chromatography, advantages. Chromatographic separation.
71. Mass-spectrometry. Theoretical bases, characteristics. Types of ionization. Molecular and fragment ions.
72. The structure of device used in mass-spectrometry. Double or Tandem mass-spectrometry.
73. Extraction methods in pharmaceutical analysis, stages, purpose. Extraction by physical and chemical partition. Factors influencing on extraction: temperature, pH, electrolytes.
74. Extraction of tablets, capsules, suspensions, solutions, ointments and creams.

75. Extraction of organic bases, acids and amphoteric compounds based on their ionized and un-ionized forms.
76. Liquid-liquid extraction. Requarements to organic solvents used in extraction. Supercritical fluid extraction. Advantages and characteristics of solvents. Usage spheres.
77. Solid phase extraction. Advantages in comparison with liquid-liquid extraction. Procedure and steps of solid phase extraction.
78. Lipophilic silica gels. Polar surface-modified silica gels. Anion exchangers and cation exchangers based on surface-modified silica gels. Borate gels. Immunoaffinity gels.
79. Capillary electrophoresis, types. Application of capillary electrophoresis in pharmaceutical analysis. Advantages and disadvantages of capillary electrophoresis.
80. The principle of capillary electrophoresis. Detectors used in capillary electrophoresis.
81. Theoretical bases of capillary electrophoresis. Detection of electrophoresis speed migration. Electrophoretic mobility.
82. Capillary electrophoresis. Electro-osmotic flow.
83. Mobility of substances in capillary electrophoresis, factors influencing on it.
84. Substances separation. Capillary zone electrophoresis. Application of additives in capillary electrophoresis. Types of electrophoresis.
85. Quality control of suppositories and ointments. Melting point, liquefaction time detection, dissolution testing. Theoretical bases, characteristics.
86. Validation of analytical methods, description. The categories of analytical methods. Typical validation characteristics and requirements.
87. Validation characteristics depending on type of methods. Accuracy of analytical method. Methods of determining accuracy for active substance, medicinal product, impurities.
88. Precision of analytical methods. Repeatability, intermediate precision, reproducibility.
89. Specificity of analytical methods. Identification, assay and impurity test. Detection and quantitation limits of analytical methods.
90. Analytical methods linearity, range. Analytical methods robustness.

Literature

1. Lectures of Pharmaceutical chemistry III, V years.
2. "Pharmaceutical analysis" David G. Watson, second edition, 2005.
3. David G. Watson. Pharmaceutical analysis a textbook for pharmacy students and pharmaceutical chemists. Edinburgh London New York Oxford Philadelphia St Louis Sydney Toronto, 2005.

Head of Pharmacy department _____ associate prof. Zhamharyan A.G.