KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.Sc./B.Tech.
Year : II
Course : CHEM 215
Semester : I & II

Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration No.:
Date : 05 DEC 2023

SECTION "A"
[20 Q. × 1 = 20 marks]

Choose and mark [X] the most appropriate option

1. The transducer for Atomic absorption spectrophotometer is
[ ] Filter [ ] Mass analyzer [ ] Monochromator [ ] Photomultiplier tube

2. Electromagnetic radiation having wave number 3.75×10^3 cm^{-1} lies in which part of the electromagnetic spectrum?
[ ] Infra-red [ ] Ultraviolet [ ] Visible [ ] X-ray

3. What will be the number of moles of NaCl in 2 litres of 0.5 mol/L solution?
[ ] 58 [ ] 23 [ ] 35 [ ] 1

4. The hydrogen ion concentration of a solution having pOH 12.70 is
[ ] 0.05 [ ] 1.99 [ ] 0.01 [ ] 1.3

5. For the titration of 50.0 ml of 0.100M Oxalic acid with 50.0 ml of 0.100M NaOH, what indicator will be suitable?
[ ] Phenolphthalein [ ] Methyl Orange
[ ] Erichrome black T [ ] Starch

6. Which of the following is **NOT** a thermal source for IR region?
[ ] The Globar [ ] The mercury arc
[ ] The Nernst glower [ ] Incandescent wire source

7. Which one of the following is a gas phase source?
[ ] Field ionization [ ] Electrospray ionization
[ ] Field desorption [ ] Matrix assisted desorption ionization (MALDI)

8. A titration where the end point is found by observing the effect of titrant addition upon a measured electrode potential is termed as
[ ] Potentiometric titration [ ] Coulometric titration
[ ] Conductometric titration [ ] Amperometric titration

9. The potential ,at equivalence point, for the following titration reaction is
$A^{2+} + 2B^{4+} \leftrightarrows A^{4+} + 2B^{3+}$ (E^0_A= 0.11V and E^0_B=1.22V)
[ ] 0.85V [ ] 0.48V [ ] 0.66V [ ] 0.44V

10. Which of the following statement is **TRUE**?
    [ ] In a flame atomizer, when gas flow rate is equal to burning velocity there is stable flame.
    [ ] Hollow cathode lamp is used in IR spectroscopy
    [ ] Sputtered metal atoms do not diffuse back to the cathode surface in hollow cathode lamp
    [ ] Hydride generation technique can be used for the analysis of Mercury

Fill in the bank by most appropriate VALUE or WORD

11. In IR spectroscopy, the number of absorption maxima exhibited by CO_2 molecule is _____.

12. The gravimetric factor for MgO in $Mg_2P_2O_7$ is commonly written as _____

13. 25 % amount of light is transmitted through the sample when it has absorbance value _____.

14. The resolution required separating the ions M^+ and N^+, with masses of 23.0313 and 23.0187, respectively is _____.

15. A weak absorption band in the region of 280nm -290nm, which is displaced towards shorter wavelengths with increased solvent polarity, strongly indicated the presence of a carbonyl group. Such a shift is termed as _____

16. The tallest peak in the mass spectrum is called_____

17. 20.00 ml of 0.100 M solution of the weak acid, HB, $Ka = 1.8\times10^{-5}$, is titrated with 20.00ml of 0.100M NaOH. The pH at the start of titration is _____

18. 300μm wavelength is equal to_____cm^{-1} wave number.

19. The two main phases in chromatography are _____

20. _____instrument is mostly used for the qualitative and quantitative analysis of metals and metalloids.

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SECTION "B"
[5Q × 5 = 25 marks]

Attempt *ANY FIVE* question.

1. a. Give reasonable answer [3 ×1=3]
   (i) Colloidal particles are electrically charged
   (ii) The appearance of mass spectra for a given molecular species strongly depends on ion source
   (iii) Trien is used for estimation of Cu^{++} rather than monodentate ligand NH_3

   b. What size sample containing 14.0% chlorine should be taken for analysis if the chemist wishes to obtain a precipitate of AgCl which weighs 0.400gram? (MW AgCl=143.32) [2]

2. a. 50ml of 0.40M Fe^{2+} is titrated with 0.80M Ce^{4+} in sulfuric acid solution. Calculate the potential of solution after addition of 15ml, 25ml, 60ml of Ce^{4+} solution. (E^0Ce=1.44V , E^0Fe=0.68V) [3]

   b. What are the differences between gas-liquid chromatography and gas-solid chromatography? [2]

3. a. What are the methods for end point detection in potentiometric titration? [3]

   b. Write different techniques for the disposal of chemical waste generated from a laboratory? [2]

4. a. What are lyophobic and lyophilic precipitates? Write examples of each. [2]

   b. 50.0 ml of 0.20 M HCl is titrated with 0.20 M NaOH. Calculate the pH of solution after addition of 15 ml, 50ml and 75 ml of titrant. [3]

5. a. Why is an electrothermal atomizer more sensitive than a flame atomizer? [2.5]

   b. How many fundamental modes of vibration are expected to observe in IR absorption spectrum of water? [2.5]

6. a. What are different good laboratory practices? [2]

   b. What are the ways to visualize colorless samples in TLC? [3]

SECTION "C"

[5Q × 6 = 30 marks]

Attempt *ANY FIVE* questions.

7. a. What are the characteristics for a substance to be a primary standard? Give two examples each for the primary standard of acid and base. [3]

   b. How precipitates can be dried? When it is required to ignite the precipitate? What are the errors during ignition? [3]

8. Write the principle of flame emission spectrometry. Write in detail about hollow cathode lamp. [2+4]

9. a. What is the significance of molar absorptivity constant? [3]

   b. Write about tungsten lamp used in UV Visible spectroscopy. [3]

10. a. Explain about absorption by inorganic species in UV Visible region. [3]

    b. Is EDTA titration pH dependent? Write about the indicators used in complexometric titration. [3]

11. a. What is coprecipitation? How it can be minimized? [3]

    b. Describe the differences between hydrogen and deuterium lamps as source for ultraviolet radiation and list any particular advantage possessed by one over the other. [3]

12. Describe different types of ion sources used in Mass Spectroscopy, with advantages and disadvantages of each. [6]

13. a. What is the theory of acid base indicator? How the indicators are selected for titration? [3]

    b. Differentiate between planar chromatography and column chromatography. [3]