KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.E./B.Sc.
Year : II

Course : CHEM 215
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

07 MAR 2025

Registration No.:

Date :

SECTION "A"
[10Q. × 1 = 10 marks]

Choose and Mark [X] in the most appropriate option from each set of choices

1. How does increasing the path length of the cuvette affect the absorbance in UV-Vis spectroscopy?
   [ ] Absorbance decreases [ ] Absorbance increases
   [ ] Absorbance remains unaffected [ ] Absorbance become negative

2. Electromagnetic radiation having energy 3.32×10^{-19} J lies in which part of the electromagnetic spectrum?
   [ ] Infra-red [ ] Ultraviolet [ ] Visible [ ] X-ray

3. What will be the molarity (in mol/L.) of 20.0 mg NaOH in 50.0 ml of solution?
   [ ] 10 [ ] 0.01 [ ] 0.04 [ ] 0.4

4. What will be the pH of the solution in which $[OH^-] = 0.4$?
   [ ] 0.4 [ ] 13.6 [ ] 4 [ ] 14

5. For the titration of 10.0 ml of 0.100M HOAc with 25.0 ml of 0.050M NaOH, what indicator will be suitable?
   [ ] Phenolphthalein [ ] Methyl Orange
   [ ] Erichrome black T [ ] Starch

6. The wavelength of the radiation source used in Atomic Absorption Spectroscopy is usually in the range
   [ ] Infra-red [ ] Radiofrequency
   [ ] Microwave [ ] Ultraviolet visible

7. Gravimetric factor of Mn (atomic weight being 55) in Mn_3O_4 is
   [ ] 0.24 [ ] 0.72 [ ] 1.38 [ ] 0.33

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

9. The potential ,at equivalence point, for the following titration reaction is
   $A^{2+} + B^{4+} \leftrightarrows A^{3+} + B^{3+}$ (E^0_A= 0.15V and E^0_B=1.44V)
   [ ] 1.18V [ ] 0.58V [ ] 1.06V [ ] 0.79V

10. Which of the following is NOT a thermal source for IR region?

[ ] The Globar [ ] The mercury arc

[ ] The Nernst glower [ ] Incandescent wire source

SECTION "B"

[10Q. × 1 = 10 marks]

Fill in the blanks with appropriate answer.

11. In IR spectroscopy, the number of normal modes for SO_2 molecule is _____ .

12. _____is an example of gas phase ion source (hard source as well).

13. The molarity (in mol/L.) of glacial acetic acid having density 1.05 g/ml and percentage purity 99.8% _____.

14. In mass spectrometry, the resolution needed to separate the ions M^+ and N^+ with masses 17.0313 and 17.0187, respectively is_____.

15. Mass spectroscopy (MS) is mainly used for the determination of _____ .

16. The tallest peak in the mass spectrum is called_____

17. 10.00 ml of 0.0500 M solution of the weak acid, HB, $Ka = 1.8\times10^{-5}$, is titrated with 10 ml of 0.100M NaOH. The pH at the start of titration is_____

18. In EDTA titration, the absolute stability constant is given as $4X10^8$ and the fraction of EDTA in the Y^{4-} form at pH 10 is given as 0.35. The effective stability constant will be _____.

19. The two main phases in chromatography are _____

20. _____instrument is used to study flame emission spectroscopy.

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Semester : I
F. M. : 55

SECTION "C"
[5Q. × 5 = 25 marks]

Attempt *ANY FIVE* questions.

1 a. 50.0 ml of 0.10 M acetic acid is titrated with 0.10 M sodium hydroxide. Calculate the pH of solution after addition of 10 ml, 50ml and 60 ml of titrant. [Given: Ka=$1.8*10^{-5}$] [3]

b. Calculate the number of moles of ammonia present in 4.9ml of ammonia solution that contains 2.3% by weight of ammonia and the density 0.99g/ml [2]

2 a. 50.0 ml of a solution which is 0.0100 M in Ca^{2+} and buffered at pH 10 is titrated with 0.0100 M EDTA solution. Calculate values of pCa at various stages of titration: (i) After addition of 20 ml titrant (ii) After addition of 50 ml titrant and (iii) After addition of 70 ml titrant. (Kabs for CaY^{2-} is 5.0×10^{10} and $\alpha4$ at pH 10 is 0.35) [3]

b. What are the differences between adsorption and partition chromatography? [2]

3 a. Draw well labeled diagram of glass electrode, write its cell representation. [3]

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

4 a. What are the different steps in flame atomization? [2]

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

5 a. Draw block diagram of Mass spectroscopy. [2]

b. 25.0 ml of 0.20 M HCl is titrated with 0.20 M NaOH. Calculate the pH of solution after addition of 5 ml, 25ml and 30 ml of titrant. [3]

6 a. 50.0ml of 0.0400M Fe^{2+} is titrated with 0.0800M Ce^{4+} in sulfuric acid solution. Calculate the potential of solution after addition of 10ml, 30ml of Ce^{4+} solution. (E^0Ce=1.44V, E^0Fe=0.68V) [2]

b. Is carbon dioxide IR active? Justify [3]

P.T.O.

SECTION "D"

[5Q. × 6 = 30 marks]

Attempt *ANY FIVE* questions.

7 a. What requirements must be satisfied for a reaction to be used in titration? [3]

b. What is von Weimarn theory of relative super saturation? What are the optimal experimental conditions for obtaining crystalline precipitates? [3]

8 What are different types of ion sources used in mass spectroscopy? What are the advantages and disadvantages of each? [3+3]

9 a. What are different types of redox indicators? Show that how much potential (at least) is needed to bring about a change in color of a true redox indicator? [4]

b. Define (i) Potentiometric titration (ii) Metallochromic indicator [2]

10 a. Write short note on sampling handling in IR spectroscopy. [4]

b. Why charge transfer absorption is important for quantitative purpose? [2]

11 a. Write short note on acid base indicators. [3]

b. What is the optimum pH for EDTA titration? What happens if the pH is low or very high? At what condition K_{eff} approaches K_{abs}? [3]

12 a. What are different types of radiation sources used in AAS? Write in detail about any one of them (with well labeled diagram). [4]

b. State Beer's law. Why iodine is sometimes introduced into a tungsten lamp? [2]

13 a. What is conductometric titration? Explain conductometric titration curve for titration of weak acid with strong base. [3]

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