Roll No:

Total Number of Pages : 2   AR-18   M. Sc

M.Sc 3rd SEMESTER REGULAR EXAMINATIONS, NOV/DEC 2019-20

Subject code: CHE-502

Subject: Analytical Chemistry-I

Time: 3 Hours   Max Marks: 80

The figures in the right hand margin indicate marks.

SECTION A

Q.1 Answer **ANY FOUR** of the following: (4×4=16)

a   Calculate the volume of air required for complete combustion of 1 m^3 of a gaseous fuel having he composition CO=46%, CH_4=10%, H_2=40%, C_2H_2=2%, N_2=1% and the remaining being CO_2.

b   Differentiate between (a) population mean and sample mean, (b) random and systematic error

c   Distinguish between (a) voltammetry and amperometry, (b) linear-scan voltammetry and pulse voltammetry.

d   Explain advantages of HPLC over TLC.

e   What is the common source of nitrogen in soil? How can you control the nitrogen content in Soil?

f   A 0.6025 g sample was dissolved, and the Ca^{2+} and Ba^{2+} ions present were precipitated as BaC_2O_4-H_2O and CaC_2O_4-H_2O. The oxalates were then heated in a thermogravimetric apparatus leaving a residue that weighed 0.5713 g in the range of 320°C to 400°C and 0.4673 g in the range of 580°C to 620°C. Calculate the percentage Ca and percentage Ba in the sample.

OR

2. Answer **ALL** the questions   [2 x 8 =16]

a   Why is the reference electrode placed near the working electrode in a three-electrode cell?

b   Why powder sample preferred for thermal analysis?

c   What are retention indexes? How they are determined?

d   What kind of systematic errors are detected by varying the sample size?

e   What is Aniline point and its significance?

f   What will happen to the TGA plot if heating rate increased?

g   What is a producer Gas and state its uses?

h   List the advantages and disadvantages of the hanging mercury drop electrode compared with platinum or carbon electrodes.

SECTION-B

3. Answer all Questions: [16 x4 =64]

a   With a representative, each, explain the effects of (a) sample Form, (b) Atmosphere, (c) gas flow pressure and (d) heating rate on TGA curve.   16

OR

b   With a schematic diagram, explain the working principle of DTA. How DTA is   16

different from DSC? Explain how can you prepare a binary phase diagram containing a eutectic reaction by DTA

4.

a   Explain advantages of Pulse Voltammetry over liner sweep voltammetry.   16
Explain the role of supporting electrolyte for voltammetric determination of iron and copper in a aqueous solution of iron(III) and Cu(II). Explain the role of pH for organic voltammetric analysis.

OR

b   (i)Quinone undergoes a reversible reduction at a voltammetric working electrode. The   16
reaction is

Quinone   Hydroquinone
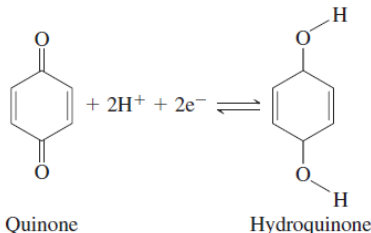
Assume that the diffusion coefficient for quinone and hydroquinone are approximately the same and calculate the approximate half-wave potential (versus SCE) for the reduction of hydroquinone at a rotating disk electrode from a solution buffered to a pH of 7.0.
(ii) Explain the sources and implications of residual current?

5.

a   Give three general requirements for HPLC column packing materials. Describe and   16
distinguish among porous silica, bonded phases, pellicular, and polymeric column packings, including the advantages and disadvantages of each type.

OR

b   What is Van Deemter equation and its significance?   16
Using the Van Deemter equation, HETP (height equivalent to a theoretical plate), and N (number of theoretical plates) as appropriate, explain why the following changes may increase the efficiency of separation in column chromatography:
(a) Changing the flow rate of the mobile phase
(b) Increasing the length of the column
(c) Reducing the inner diameter of the column

6.

a   Write short notes on: 16
   a) Knocking
   b) Ultimate Analysis
   c) Bomb Calorimeter
   d) Fixed Bed Catalytic cracking

OR

b   Explain in detail the determination process of total phosphorous and nitrogen in soil.   16