Ex/M.Sc./CH/4/A&B-4161A+B/109/2017

M. Sc. Chemistry Examination, 2017

(4th Semester)

Analytical Chemistry Special

Paper - XVI-A

Time : Two hours Full Marks : 50

(25 Marks for each Unit)

Use a separate answerscript for each unit.

UNIT – A- 4161

1. a) What are Optoelectronic materials and where they are used ?

   b) What are the functionalized metal nanoparticles ? Explain the sensing properties of Au-nanoparticles for alkali metal ions.

   c) What are the different patterns of TEM studies and how it helps to understuad the crystallinity of the samples ?

   d) What do you mean by elastic scattering and inelastic scattering of electrons during electro micrograph studies?

   e) Write the Scherrer's equation. How it relates to dislocation density of a particular sample ?

$1+2+1\frac{1}{2}+1\frac{1}{2}+1$

2. a) What are wet and dry methods for the synthesis of nanomaterials ? How is it influence the properties of materials ?

   b) Define MEMs. What are the applications of MEMs ?

   c) What is the difference between SEM and TEM studies ?

   $1\frac{1}{2}+1\frac{1}{2}+1$

3. a) Write the full form of common analytical tools used for the characterization of materials : (i) LVSEM ; (ii) EDX ; (iii) PXRD ; and (iv) DLS ; Mention the utility of these tools in the field of material characterization.

   b) Why electrochemical technique is called "green-method" for the synthesis of nano-materials ?

   c) Explain the mechanical ball milling process for the synthesis of nano structured materials. Give one example of it. Explain their catalytic behaviour towards hazardous chemicals. 3+1+2=6

4. a) Define Janus particle. How core-shell nanoparticles differ from an ordinary system ?

   b) Explain AFM technique and the choice of AFM tips for material characterization.

   c) What are Nano-Sensors ? Why most of the studies were donw with the help of Au NPs ? $2+2+1\frac{1}{2}=5\frac{1}{2}$

You are asked to determine the initial concentrations of A and B by following the rate of change of [R] with time, the initial condition is $[A]_0 + [B]_0 >> [R]_0$ and k_A, k_B are the second-order rate constants.

Show that the error associated with the determination of $[A]_0$ or $[B]_0$ will be minimum when $[R]_0/[R]_t = e$, where e is the base of the natural logarithm. 5

5. a) What is "electron-beam" damage ? Why Au or Pt coatings are necessary for biological samples during SEM studies?

   b) Give two examples of each : ***(any two)***

      i) Met-Cars.

      ii) Metal-Chalcogenides thin-films.

      iii) Nano-Clusters. $1\frac{1}{2}+1=2\frac{1}{2}$

UNIT – A- 4162

Answer ***any five*** questions

6. An analytical chemist prefers initial rate measurements for the determination of a species rather than going through the entire reaction. Comment. 5

7. Ce(IV) oxidation of Fe^{2+} is extremely fast but Ce(IV) oxidation of T*l*(I) is extremely slow although both the redox reactions are thermodynamically favourable. Explain. 5

8. How will you determine trace of iodide present in a sample of NaCl ? Discuss in detail. 5

9. What are the basic differences between an enzyme and an inorganic catalyst ? What do you mean by inhibitor ? How does it work ? 5

10. With the initial condition $[A]_0 >> [R]_0$ you are following the kinetics of the following reaction

    $A + R \xrightarrow{k_A}$ Products, where k_A is the second-order rate constants. Write down the rate expression. What will be the analytical expression for observed rate ? Hence, how will you determine $[A]_0$? 5

11. Consider the following parallel reactions :

    $A + R \xrightarrow{k_A}$ Products

    $B + R \xrightarrow{k_B}$ Products