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Total No. of Pages : 02

Total No. of Questions : 19

M.Sc. (Chemistry) (Campus) (2015 to 2017) (Sem.-2)

**ADVANCED CHARACTERIZATION TECHNIQUES**

Subject Code : CHL-414

M.Code : 51151

Time : 3 Hrs.

Max. Marks : 70

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying FIVE marks each and students have to attempt ALL questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A**

1. Why do we require coating in the analysis of samples in SEM?
2. Describe the factors that affect TGA analysis of sample.
3. Explain EDS and SADP processes in the case of SEM and TEM and discuss their brief applications.
4. How rotating sample method is different from powder X-ray diffraction method? Explain.
5. What do you mean by secondary, backscattered and auger electron in SEM? Which information we get from analysis of signal from such electrons?
6. Which materials are currently used as electron gun in TEM and why?
7. HgCl<sub>2</sub> crystallizes in orthorhombic system. Using radiation with  $\lambda = 154$  pm, the (100) (010) and (001) reflections (first order) from HgCl<sub>2</sub> in an X-ray diffractometer occurs at 70° 2 $\theta$ , 30° 2 $\theta$  and 100° 2 $\theta$ , respectively. If the density of the crystal is 5.42 cm<sup>-3</sup>, calculate the dimensions of unit cell and the number of HgCl<sub>2</sub> molecules in the unit cell. M (HgCl<sub>2</sub>) = 271.5 g/mol.
8. Differentiate between thermionic emission gun and field emission gun in respect to TEM.
9. Explain SAED and EDX process in respect to TEM and FESEM respectively.
10. How DTA technique is different from DSC? Write the main application of both the techniques.

**SECTION-B**

11. What do you mean by electron microscopy? How you can improve magnification? Discuss the main limitations of electron microscopy.
12. What are the different types of atomization methods? Describe the graphite furnace method.
13. Explain the working of Atomic Force Microscopy (AFM) with neat sketch. What was the need of AFM when Scanning Electron Microscope was available?
14. Explain the process occurs to determine the elemental composition of materials when high-energy electron falls on to it. Which compounds are used as electron gun in electron microscopy? Give examples.
15. Derive Bragg's equation and also write the applications of this equation.
16. Write four differences between Scanning Tunneling microscope (STM) and Atomic force microscope (AFM).

**SECTION-C**

17. Explain working principle and instrumentation of the Scanning electron microscopy (SEM) technique with neat diagram. How we can predict type of element present with the help of SEM? Write four main applications of FESEM.
18. Explain working principle and instrumentation of the Atomic Absorption spectrometer (AAS) technique with neat diagram. Also write main applications of AAS. Which lamp is generally used in AAS and why?
19. How would you estimate the size of any powder sample using X-ray diffraction? The density of Li metal is  $0.53 \text{ g cm}^{-3}$  and the separation of the (100) planes of the metal is 350 pm. Determine whether the lattice is f.c.c. or b.c.c.  $M(\text{Li}) = 6.941 \text{ g mol}^{-1}$ .

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**