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Register Number:

DATE: **16** **-04-2018 (1 PM)**

**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27**

**M.Sc. CHEMISTRY: IV SEMESTER**

**SEMESTER EXAMINATION-APRIL 2018**

**CH DE 0517: Material Chemistry**

**Time: 2½ hours Max Marks: 70**

*This question paper contains 2 pages and 3 parts*

**PART-A**

Answer any ***SIX*** of the following questions: **6 x 2 = 12**

1. Why are solids preferred over fluids for application materials?
2. What is Peierls’ distortion in conducting polymers?
3. How are single-walled carbon nanotubes classified?
4. List any two applications of gold nanoparticles in biology.
5. Explain auger emission with the help of a labeled diagram.
6. What is quantum confinement?
7. What are the roles of capping agents in the chemistry of nanomaterials?
8. What are nanocomposites? Give any one advantage of these materials.

**PART-B**

Answer any ***FOUR*** of the following questions: **4 x 12 = 48**

1. a.Discuss the principles of hydrothermal synthesis. How are zeolites synthesized by this method?

b. Substantiate the statement “cationic clays (alumino/magnesio silicate clays) and anionic clays (layered double hydroxides) are complementary to each other” by comparing the structures of these two classes of solids. **(6 + 6)**

1. a. What is graphene? Describe any two methods by which one can prepare graphene starting from graphite oxide?

b. Discuss the use of semiconductor nanoparticles in medicine.

c. What are the different ways by which nanoparticles may get incorporated into human (or animal) body? **(5 + 4 + 3)**

**CH DE 0517-A-18**

11. a.Why is electron microscopy superior to optical microscopy? Describe the working of a scanning electron microscope. Why is it difficult to study soft materials such as polymers by transmission electron microscopy?

b.How is surface area of a material determined by nitrogen sorption-desorption? How can one measure the porosity of the sample using the same data? **(6 + 6)**

1. a. Explain any three methods of exfoliation of layered solids with suitable examples.

b.Discuss the use of (i) inverse micelles and (ii) solvothermal methods in the synthesis of nanomaterials. **(6 + 6)**

1. a. What is superparamagnetism? When is it advantageous to have particles that exhibit superparamagnetism rather than ferromagnetism? Describe any one method by which the blocking temperature of a superparamagnetic material can be increased.

b. Why are graphene-based nanocomposites quite popular? Give any two examples of graphene-based nanohybrids along with their applications. **(6 + 6)**

1. a.What are the reasons for compositing polymers with nanomaterials?Explain with specific examples.

b. What is the difference between a battery and a supercapacitor? What are the requirements of electrode materials for these two devices? Give an example of a nanomaterial suitable for supercapacitor applications. **(6 + 6)**

**PART-C**

Answer any ***TWO*** of the following questions: **2 x 5 = 10**

1. a. The binding energy of the 2p electrons of nitrogen in ammonia is 400 eV. Will this binding energy remain the same or change when ammonia is adsorbed on an acidic site in a solid? Why?

b. What would be the role(s) of the specified nanomaterial in the following composites?

(i) reduced graphene oxide (rGO) in rGO–VO2 for lithium ion battery application

(ii) CNT in CNT–polymer composite for automobile body parts **(3 + 2)**

1. Montmorillonite on sonication in water gives dispersion A. Hydrotalcite, intercalated with lactate ions, on sonication in water gives dispersion B. When dispersions A and B are mixed there is instantaneous coagulation to give solid C. What would be the nature (structure, composition) of C? What happen whenC is treated with (i) an acid and (ii) a base.
2. a. Two samples of CdSe particles E and F in solution fluoresce to give green and red emission respectively? Which of the particles is smaller in size? Why?

b.Can X-ray diffraction be used for the determination of particle size of a nanoparticle? If yes, explain how it can be determined. If no, suggest a suitable alternative method. . **(3 + 2)**

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