
Answer all the parts of a question together.

Marks will be awarded only for completely correct answers.

PART A

1) Showing the similarities of the basic features of the optical microscope, transmission electron microscope, and scanning electron microscope draw the schematic diagrams of their basic designs (with labelling). (note: draw the diagram of each system separately) [9]

2a) Showing different steps of the mechanism of formation of nanoparticle in the microemulsion technique, present a schematic illustration of Pathway-1. In this illustration indicate the appropriate rate constants which are associated in each step. [6]

2b) Present the liquid crystal templating mechanism (pathway 1 and pathway 2), which was postulated by Mobil researchers for the formation of mesoporous silica (such as M41S). [10]

2c) Present the reaction mechanism of Modified Hummer's method of synthesis of Graphene Oxide. [10]

3) Draw a schematic presentation of setup for wet impregnation technique, which is used for the synthesis of solid support based heterogeneous catalysts [5]

PART B

Q1 Define following [2x5=10]

(i) Meissner effect

(iv) Bingham Plastics

(ii) Reflectivity

(v) Halochromic Materials

(iii) Poisson's Ratio

Q2 (i) Why the color of the sky is blue in day time whereas reddish in morning and evening? [4]

(ii) What do you understand by numerical aperture of the optical fibre? Derive an expression for numerical aperture in terms of refractive indices of core (n_1) and cladding (n_2) of optical fibre. [4]

Q3 Draw the diagram for Zener Model of viscoelasticity by clearly identifying the components [4]

(i) Which of the models, Kelvin Voight or Maxwell explain the stress relaxation of materials? Derive the equation for variation of stress with strain in form of Generalized Hooke's Law for this model. [4]

(ii)

(iii) Derive the expression for stress relaxation and plot the curve for stress relaxation for the model which explains the stress relaxation of materials satisfactorily. [4]

Q4 Fill in the blanks and True or false [10]

(i) Translucent materials _____ (follow/ may follow/ do not follow) Snell's Law.

(ii) The reflection of light on a wet road is _____ whereas on the dry road is _____ (Specular/ Diffuse/No reflection)

(iii) Except for some exceptions the band gap in semi-conductors in eV is generally _____

(iv) In butane lighters..... (Magnetostrictive/ piezoelectric) materials are used.

(v) Toughness is the total _____ whereas hardness is _____

(vi) Curie temperature is the temperature at which _____ changes to _____ or vice versa

(vii) For pseudoplastics viscosity _____ (increases/decreases) with increase in shear rate.
