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University Examinations 2023/2024

FOURTH YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE CHEMISTRY

SCH 3404: SURFACE AND COLLOID CHEMISTRY

DATE: DECEMBER 2023

TIME: 2 HOURS

INSTRUCTIONS: *answer question one and any other two questions*

QUESTION ONE (30 MARKS)

- a) Explain what colloid science is (4 marks)
- b) List down four examples of systems which are colloidal (at least in some respects) (6 marks)
- c) Any solid such as charcoal and silica gel can adsorb a certain amount of gas. The extent of adsorption at equilibrium depends on three factors. List them. (3 marks)
- d) Classification of adsorption isotherms in the solid-gas interface involves three phenomena in physical adsorption. List them (3 marks)
- e) Define the following terms
 - i. dispersion phase (2 marks)
 - ii. dispersion medium (2 marks)
 - iii. rheology (3 marks)
 - iv. viscosity of a liquid (3 marks)
- f) Draw a sketch graph depicting the particle diameter distribution for a polydispersed colloidal dispersion expressed (i) in histogram form, and (ii) as a cumulative distribution (4 mark)

QUESTION TWO

- a) Draw sketches of at least three model representations for non-spherical colloidal particles (6 marks)
- b) There are several experimental techniques (for example, the Wiegner tube and the Oden balance) which make use of sedimentation under gravity for fractionating or determining particle-size distributions in systems that contain relatively coarse suspended material such as soils and pigments. Discuss the advantages of employing centrifugal forces instead of gravity for fractionating or determining particle-size distributions in systems. (8 marks)
- c) Give a brief comment on the term “electric double layer” (6 marks)

QUESTION THREE

- a) State and explain three general classification colloidal systems may be grouped into (5 marks)
- b) Explain what wetting is in solid-liquid interface. (3 marks)
- c) List and distinguish three types of wetting (12 marks)

QUESTION FOUR

- a) List down the factors which contribute most to the overall nature of a colloidal system (5 marks)
- b) Numerous attempts have been made at developing mathematical expressions from postulated adsorption mechanisms to fit the various experimental isotherm curves. The three isotherm equations which are most frequently used are those due to Langmuir, to Freundlich, and to Brunauer, Emmett and Teller (BET). Discuss briefly and give the general equations for each of these isotherm equations. (15 marks)