UG Even Semester (CBCS) Exam., May—2017

CHEMISTRY

(Honours)

(8th Semester)

Course No. : BSCH–802

Full Marks : 50

Pass Marks : 20

Time : 2 hours

The figures in the margin indicate full marks for the questions

1. *(a)* Using simple Hückel approximation, calculate the -bond energy of ethene system. 5

(b) Write down the determinantal form of secular equation in butadiene system and also calculate the—

(i) total -electron energy;

(ii) delocalization energy. 5

OR

2. *(a)* Write the postulates of Hückel MO approximation theory. 5

(b) "Delocalized allyl structures are stable than the localized allyl system." Justify your answer in terms of delocalization energy. 5

3. *(a)* What is liquid junction potential? Derive an expression for liquid junction potential. 3

(b) Calculate the mean ionic activity coefficient, of—

(i) NaCl at a molality of 0·01;

(ii) Na_2SO_4 at a molality of 0·001 in aqueous solution at 25 °C. 3

(c) Calculate the EMF of the electrode concentration cell

$$Zn\text{-}Hg\ (C),\ Zn^{2}\ (aq),\ Zn\text{-}Hg(C_2)$$

at 25 °C, if the concentration of the zinc-amalgam are C_1 2 g per 100 g of mercury and C_2 1 g per 100 g of mercury. 4

OR

4. *(a)* Write the Debey-Hückel limiting law equation relating mean ionic activity to the ionic strength. Explain the experimental verification of the equation. 4

(b) Discuss the nature of potentiometric titration curve for acid-base titration between 100 ml of 0·1 *M* against 1 *M* NaOH solution. 3

(c) Discuss the principle of determination of pH of a solution using glass electrode. 3

5. *(a)* Photoelectric threshold wavelength of metallic copper is 3000 Å. Find out the maximum kinetic energy of the photoelectrons ejected when UV light of 2536 Å falls on the metal surface. 2

(b) Calculate the wavelength in Å of an electron in Bohr orbit n 2, returns to the orbit n 1 in the spectrum of H-atom. Given, R_H 109677 cm ^{1}. 3

(c) Write down the Schrödinger wave equation in three-dimensional coordinate. 1

(d) Write short notes on the following : 4

(i) Compton effect

(ii) Photoelectric effect

OR

6. *(a)* Show that the probability density for a rotating particle on a ring is independent of angle . How can you interpret the result? 4

(b) Determine the energy with energy-level diagram of a particle in three-dimensional rectangular box. 4

(c) Normalize the function

$$re^{r/2}\cos$$ 2

7. *(a)* Derive the expression for the rate constant of a reversible reaction. 4

(b) What is half-life period? The rate constant for a second-order reaction is $3{\cdot}33\times10^{2}\,dm^{3}\,mol^{1}\,sec^{1}$. If the initial concentration of the reactant is 0·05 mol dm ^{3}, calculate the half-life period. 3

(c) In a first-order reaction, it takes 40·5 min by the reactant to be 25% decomposed. Calculate the rate constant. 3

OR

8. *(a)* Using SSA, derive the expression for the rate of formation of product in acid-catalyzed reaction. Mention both the conditions—

(i) specific H ion catalysis;

(ii) general acid catalysis. 4

(b) Calculate the activation energy of a reaction whose rate constant is tripled by a 10 °C rise in temperature in the velocity of 27 °C. 3

(c) Write down the collision theory of bimolecular gas phase reaction. 3

9. *(a)* What are surfactants? Write down different types of surfactant with examples. 3

(b) How do detergents and soaps form micelles to remove darts from cloths during washing? 3

(c) Explain critical micelles concentration. Classify micelles according to their structures. 4

OR

10. *(a)* What are nematic and sematic liquid crystals? Explain with examples. 3

(b) What are lithium-ion batteries? Give example. Discuss the advantages of using lithium-ion battery. 4

(c) Define liquid-gas transition temperature and glass-transition temperature. Show how glass-transition temperature can be measured by differential scanning calorimetry giving heat capacity versus temperature curve. 3

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