

H-4/11/22

Roll No.

IV Semester Examination, 2022

M.Sc.

CHEMISTRY

Paper III

(Physical-Organic and Nuclear Chemistry)

Time : 3 Hours]

[Max. Marks : 80

Note : All questions are compulsory. Question Paper comprises of 3 sections. Section **A** is objective type/multiple choice questions with no internal choice. Section **B** is short answer type with internal choice. Section **C** is long answer type with internal choice.

SECTION A

1×8=8

(Objective Type/Multiple Choice Questions)

Note : Attempt all the *eight* question.

Choose the correct answer :

1. When C — H bond is broken in the rate limiting step with a synchronous transition state, the value of k_H/k_D is close to :

- (a) 2 (b) 4
(c) 7 (d) 14

P.T.O.

[2]

2. Hammett equation is applicable directly to :

- (a) *o*- & *p*-substituted benzene derivatives
(b) *m*- & *p*-substituted benzoic acid
(c) *o*- & *m*-substituted benzoic acid
(d) *o*, *p*, *m* substituted benzene derivatives

3. The relationship between the apparent rate constant and equilibrium constant is known as :

- (a) Hammond equation
(b) Bronsted equation
(c) Curtin-Hammett equation
(d) Winstein-Holness equation

4. Which of the following has the highest nucleophilicity ?

- (a) F^- (b) OH^-
(c) CH_3^- (d) NH_2^-

5. Which of the following acts as ionising gas in GM counter ?

- (a) Alcohol (b) Argon
(c) Krypton (d) Hydrogen

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6. According to the shell model, the nuclear properties vary periodically when the number of protons or neutrons in the nuclear equals 2, 8, 20, ∞ , ∞ , ∞ .

- (a) 38, 56, 90 (b) 42, 80, 120
(c) 40, 92, 100 (d) 50, 82, 126

7. The Q -value for the ${}^7\text{Li} (p, n), {}^7\text{Be}$ reaction is (${}^7\text{Li} = 7.01822$ & ${}^7\text{Be} = 7.019465$)

- (a) 1.64 eV (b) -1.64 MeV
(c) 1.64 MeV (d) -16.4 eV

8. Water used as moderator in nuclear reactor is called :

- (a) hard water (b) nucleated water
(c) heavy water (d) critical water

SECTION B

6×4=24

(Short Answer Type Questions)

Note : Attempt any *four* questions, Selecting *one* question from each unit.

Unit-I

1. What is meant by Tunneling effect ? Explain giving suitable example.

Or

Discuss solvent effect in terms of dielectric constant and E_T & Z parameters.

Unit-II

2. Explain Curtin-Hammett principle and its applications.

Or

Define Acidity function. Discuss Hammett acidity function and its application.

Unit-III

3. What are the various types of counters and their corresponding principles ?

Or

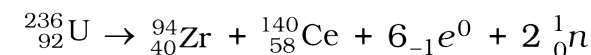
Discuss the various modes of radioactive decay giving suitable examples.

Unit-IV

4. Discuss Szilard chalmers reaction.

Or

Consider the fission of ${}^{236}_{92}\text{U}$ represented by overall reaction



Calculate the total energy released in the fission reaction. The masses in 'amu' are

$${}^{236}\text{U} = 236.0457$$

$${}^{94}\text{Zr} = 93.90610; \quad {}^0_{-1}e = 0.00055$$

$${}^{140}\text{Ce} = 139.9054; \quad {}^1_0n = 1.00867$$

SECTION C

12×4=48

(Long Answer Type Questions)

Note : Attempt any *four* questions, Selecting *one* question from each unit.

Unit-I

1. Explain the theory of isotope effect and in detail describe primary kinetic isotope effect. Discuss secondary isotope effect briefly.

Or

What is meant by LFER ? Derive Hammett equation and discuss deviation from Hammett equation.

Unit-II

2. What is α -effect ? Describe general and specific acid catalysis.

Or

Discuss various types of steric strain and its effect on reactivity and rate of reaction.

Unit-III

3. What is the analogy of a nucleus with a liquid drop ? Describe the merits of liquid drop model and semi-empirical mass equation & its significance.

Or

Describe radioactive decay kinetics. Discuss secular and transient equilibrium and its features.

Unit-IV

4. What are the various types of nuclear reactions ? Define reaction cross section and discuss its relation rate and neutron energy.

Or

Define delayed & prompt neutrons. Discuss liquid drop model of nuclear fission and controlled chain reaction using reactor.

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