G-4/415/21

Roll No. .....

M.Sc. IV Semester Examination, 2021

CHEMISTRY

Paper III

(Physcal : 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 Questions)

Note : *Attempt all the eight questions.*

1. In Hammett equation $\log \frac{K}{K_0} = \rho\sigma$ if $\rho > 1$, then the reaction :

(a) is more sensitive to substituents

(b) is less sensitive to substituents

(c) is not sensitive towards substituents

(d) builds positive charge

2. According to Taft equation σ^* represents :

(a) rate of the substituted reaction

(b) rate of the reference reaction

(c) sensitivity factor

(d) polar substituent constant

3. Acivity function H_0 is given by :

(a) $H_0 = pK_a + \log \frac{C_{BH^+}}{C_B}$

(b) $H_0 = pK_a + \log \frac{C_B}{C_{BH^+}}$

(c) $H_0 = pK_a + \log C_B \times C_{BH^+}$

(d) $H_0 = pK_a \times \log \frac{C_B}{C_{BH^+}}$

4. Correct form of Bronsted catalysis equation is :

(a) $\log k = \alpha + c \log K_a$

(b) $\log k_a = c \log K + \alpha$

(c) $\log k = \alpha \times \log K_a + c$

(d) $\log k_a = c \log K + \alpha$

5. The decay constant of a radioactive sample is λ. The half-life and mean-life of the sample are respectively given by :

(a) $\frac{1}{\lambda}$ and $\frac{(\ln 2)}{\lambda}$ (b) $\frac{(\ln 2)}{\lambda}$ and $\frac{1}{\lambda}$

(c) $\lambda (\ln 2)$ and $\frac{1}{\lambda}$ (d) $\lambda (\ln 2)$ and λ

6. In the nuclear reaction : $_{92}U^{238} \rightarrow {}_{82}Pb^{206}$, the number of α and β-particles emitted are :

(a) 7α, 5β (b) 6α, 4β

(c) 4α, 3β (d) 8α, 6β

7. The amount of energy that is liberated when 1 amu is annihilated is :

(a) 93·1 MeV (b) 1 MW

(c) 800 MeV (d) 931 MeV

8. In the following nuclear reaction :

$$_{13}Al^{27} + {}_{2}He^{4} \rightarrow {}_{15}P^{30} + X$$

X stands for

(a) e (b) e^-

(c) n (d) p

SECTION B **6×4=24**

(Short Answer Type Questions)

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

Unit I

1. What is secondary kinetic isotope effect ? Explain with example.

Or

Explain the influence of the solvent on reaction rate.

Unit II

2. What is α-effect ?

Or

Explain nucleophilic scale.

Unit III

3. What are the features of nuclear shell model ?

Or

What is a scintillation detector and how does it work ?

Unit IV

4. Write short note on nuclear cross section.

Or

Explain chain reaction multiplication factor and its significance.

SECTION C **12×4=48**

(Long Answer Type Questions)

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

Unit I

1. Derive Hammett equation and discuss its applications. Explain Taft model also.

Or

Explain the effect of solvent on reaction rate. Discuss the treatment of solvent effects on reaction rate in terms of dielectric constant.

Unit II

2. What are Acidity functions ? Discuss their applications.

Or

Write short notes on the following :

(a) Types of steric strain

(b) Curtin-Hammette principle

Unit III

3. What is smei-empirical mass equation ? Discuss its applications and limitations.

Or

Explain the principles of Geiger-Muller and scintillation counters. Discuss the similarities and differences of these two counters.

Unit IV

4. Write short notes on the following :

(a) Szilard Chalmer Reaction,

(b) Liquid drop model of nuclear fission.

Or

What are Nuclear Reactors ? How they are classified ? Discuss about homogeneous and heterogeneous reactors.

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