

[4]

SECTION 'C' $4 \times 10 = 40$

Long Answer questions (Word limit 400-450 words.)

Unit I

Q.1. What are acidity functions? Discuss the applications of acidity function in studying kinetics and mechanism of a chemical reaction.

OR

- (a) Differentiate between nucleophilicity and basicity.
- (b) Discuss salt effect in acid-base catalysis.

Unit II

Q.2. Write notes on

- (a) Sol- gel methods
- (b) Application of nano particles

OR

- (a) Discuss ceramics having sulphides and nitrides.
- (b) Explain magnetic properties of nano particles.

Unit III

Q.3 Explain how nuclear cross section plays an important role in nuclear fission.

OR

Describe Nuclear Potential and simple harmonic oscillator potential and mention its application with limitations.

Unit IV

Q.4. Write notes on:-

- (a) Scintillation counter
- (b) Explain principle, construction and working of GM counter.

OR

Calculate the age in the following cases -

- (a) A piece of hair in which C-14 activity is 60% of the activity found
- (b) A vegetarian beverage whose tritium content is only 5% of level in living plants ($t_{1/2} = 12.3$ years)
- (c) A uranium rock has uranium-238 and lead-206 in mass ratio of 1.50 to 1.00 ($\lambda = 1052 \times 10^{-10}$ years⁻¹)

[1]

ROLL NO.....

CHE. 402/21

IV SEMESTER EXAMINATION, 2021

M.Sc. (CHEMISTRY)

PAPER-II

CATALYSIS, MATERIAL & NUCLEAR CHEMISTRY

TIME: 3 HOURS

MAX.- 80

MIN.- 16

Note: The question paper consists of three sections A, B & C. All questions are compulsory.

Section A- Attempt all multiple choice questions.

Section B- Attempt one question from each unit.

Section C- Attempt one question from each unit.

SECTION 'A' $2 \times 8 = 16$

Multiple Choice Questions

(1) In general, soft acids or bases have

- (a) Low charge density, more polarizable, more covalent
- (b) Low charge density, less polarizable, more covalent
- (c) High charge density, more polarizable, more covalent
- (d) Low charge density, more polarizable, less covalent

(2) Enzymes catalyze a biological reaction by

- (a) Increasing the activation energy
- (b) Decreasing the activation energy
- (c) Both (a) and (b)
- (d) None of the above

[2]

- (3) Porcelain is a type of ----- ceramic
- (a) Abrasive (b) Cement
(c) Stone (d) Whiteware
- (4) By adding nano - particles to water, the electrical conductivity
- (a) Increase (b) Decreases
(c) Remains constant (d) None of these
- (5) The liquid drop model of nucleus is given by
- (a) Heisenberg (b) Rutherford
(c) Niels Bohr (d) Thomson
- (6) The more tightly bound a nucleus, the ----- is the binding energy per nucleon
- (a) Smaller (b) Greater
(c) May be greater or smaller (d) None of these
- (7) A compound containing some amount of radio isotope is
- (a) Non- radioactive compound (b) Linear active compound
(c) Radio-active (d) Tracer
- (8) Which statement about the half-life of a substance is correct
- (a) It is half the time for the radioactive source to become safe
(b) It is half the time it takes for an atom to decay
(c) It is half the time it takes the activity of the source to decrease to zero
(d) It is half the time it takes the activity of the source to decrease to half

[3]

SECTION 'B'

4 × 6 = 24

Short Answer Type Questions (Word limit 200-250 words.)

Unit I

- Q.1. Explain Hard and soft acids and bases.

OR

Write short notes on the following :-

- (a) Ambivalent nucleophile (b) Enzyme catalysis

Unit II

- Q.2. How does the charge get appeared on nanoparticles? Explain with examples.

OR

Write short note on semiconductors.

Unit III

- Q.3. Write a brief account on magic numbers.

OR

Calculate the number of α and β particles emitted in the thorium series in reaching lead- 208 from thorium - 232.

Unit IV

- Q.4. Describe Counting Statistics.

OR

A piece of wood was found to have C^{14} / C^{12} ratio 0.7 times that in a living plant. Calculate the period when the plant died. Half life of C^{14} is 5760 years.