

CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN

SEMESTER END EXAMINATION

SEMESTER V OF B.SC JANUARY 2021

PHYSICAL CHEMISTRY (PAPER CHC105)

18-01-2021

Time: 2 hours

Marks: 80

Total No. of pages :03

Instructions: 1) Answers to the two sections should be written on separate answer books.

2) All questions are compulsory

3) Figures to the right indicate full marks.

4) Use of calculators is allowed.

SECTION A

Q1. ANSWER ANY FOUR OF THE FOLLOWING.

4x4=16

1. Discuss the working of a Geiger-Muller counter.
2. Explain the importance of N/P ratio in determining the stability of a nuclei.
3. Write a note on ion selective membrane.
4. Glass electrode is used to determine the pH of a solution. Explain.
5. Write a short note on Fluoride electrode.
6. Explain the main characteristics of the Liquid Drop Model.

Q2.(A) i) What is decomposition potential ? How is it measured experimentally? 3

ii) Give three differences between molten carbonate fuel cell and solid oxide fuel cell . 3

OR

Q2.(A) iii) What are the factors that affect overvoltage? 3

iv) Give three differences between hydrogen oxygen fuel cell and proton exchange membrane fuel cell. 3

Q2.(B) i) Draw a neat scintillation counter and label the different parts. 3

ii) The half life of a radioelement is 25 minutes. What amount of this element will be left behind after 5 hours if a start is made with one curie? 3

Q3.(A) i) What is the difference between ion selective electrodes and ion specific electrodes. 4

ii) Explain Tafels Equation 2

OR

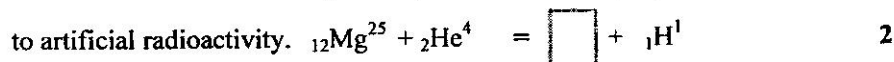
Q3.(A) iii) What are electrochemical Sensors? Give 2 applications of the same. 4

iv) What is metal overvoltage? 2

Q3.(B) i) What is binding energy? Calculate the binding Energy per nucleon for ${}^7_3\text{Li}$ given that mass of proton is 1.007277amu, mass of neutron is 1.008665amu,

mass of electron is 0.000549amu, isotopic mass of Li is 7.01820amu and 1amu is equal to 931MeV. 4

ii) What is artificial radioactivity? Complete the following equation with respect



Section B

Q4) ANSWER ANY FOUR QUESTIONS

4x4=16

- 1) (a) What is a wave function? When can it be Normalized & orthogonal
(b) What will happen to Energy if the length of the box is made larger? Why?
- 2) Calculate zero point energy and force constant of a molecule whose reduced mass is 1.2×10^{-2} g. Wave number of origin of band in IR spectrum is 3700cm^{-1}
- 3) (a) What are Selection Rules for Harmonic and Anharmonic Oscillations?
(b) State if the Operators commute or do not commute $[x, \frac{d}{dx}]$
- 4) State the four characteristics of Raman lines.
- 5) Define Degeneracy. Classify the following Ψ states as Degenerate or Non- Degenerate (121), (122), (211), (111) and (222)
- 6) Determine inter-nuclear distance in simple diatomic molecule from microwave spectra of HCl. The frequency difference between successive absorption lines is found to be 20 cm^{-1} .

- Q5. (A) i) Derive the Expression for Energy Particle in 1D Box 4
ii) To every observable there corresponds an operator- justify 2

OR

- Q5. (A) iii) Derive the Expression for Energy Particle in 3D Box 4
iv) What do you understand by Nodal properties? 2

- Q5. (B) i) Derive the expression for Rotational constant in a Rigid Rotor 4
ii) Draw Wave function and its Probability for $n=1, 2, 3$ 2

- Q6. (A) i) (a) What are the essential conditions for a molecule to be IR active?
(b) What are the essential conditions for a molecule to be microwave active? 4
ii) What gives rise to Hotbands? 2

OR

- Q6. (A) iii) Explain P Q R branching 4

iv) How food gets cooked in a microwave? 2

Q6. (B) i) Calculate the uncertainty in velocity for an electron of mass 9.1×10^{-31} kg if

(a) $\Delta x = 5$ mm (b) $\Delta x = 5$ m. 4

ii) Write the Schrodinger Equation in Cartesian and in Polar form. 2