

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

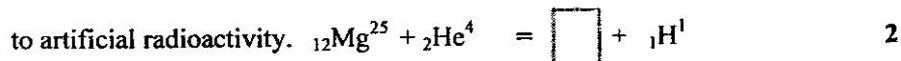
Q3.(A) iii) What are electrochemical Sensors? Give 2 applications of the same. 4

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  $1.2 \times 10^{-22}$  g. Wave number of origin of band in IR spectrum is  $3700 \text{ cm}^{-1}$
- 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  $\Psi$  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  $20 \text{ cm}^{-1}$ .

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? 4  
(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  $9.1 \times 10^{-31}$  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