

CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN, NUVEM GOA
B.SC. CBCS SEMESTER V (REGULAR) EXAMINATION, JANUARY 2022
PHYSICAL CHEMISTRY (PAPER CHC105)

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.

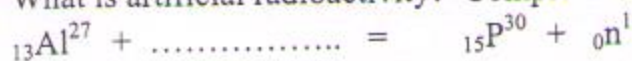
4) Use of calculators is allowed.

SECTION A

QI. ANSWER ANY FOUR OF THE FOLLOWING.

(4x4=16)

1. Draw and explain the Photo multiplier tube in nuclear chemistry.
2. What is saturation current? Explain with the graph.
3. Give the advantages of the glass electrodes.
4. Write a note on electrochemical sensors.
5. How is mass defect converted into energy.
6. What is artificial radioactivity? Complete the following nuclear equation:



QII.(A) i) Give 3 characteristics of an ideal Geiger Muller counter.

3

ii) Calculate the mass defect, binding energy and BE/nucleon of ${}^4_2\text{He}$ which has an isotopic mass of 4.0026amu. (${}_1\text{H}^1 = 1.0081\text{amu}$ and ${}_0\text{n}^1 = 1.0089$)

3

OR

QII.(A) iii) Give 3 similarities of the liquid drop model of a nucleus and the liquid drop

3

iv) One gram of a radioelement decays to 0.125g in 100 hours. How much more time should elapse so that 0.15g of the element is left?

3

QII.(B) i) What are fuel cells? Explain the molten carbonate fuel cell.

3

ii) Give three differences between hydrogen oxygen fuel cell and proton exchange membrane fuel cell

3

QIII.(A) i) Explain the effect of current density and pH of the solution on overvoltage.

4

ii) Briefly explain the fluoride electrode. 2

OR

QIII.(A) iii) Write a note on ion selective membrane 4

iv) What is hydrogen overvoltage 2

QIII.(B) i) What is decomposition potential? How is it measured experimentally? 4

ii) What is back emf? 2

SECTION - B

QIV. 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 force constant of HCl, having a fundamental frequency $8.667 \times 10^{13} \text{ s}^{-1}$

3) (a) State the Mutual Exclusion principle?

(b) State if the Operators commute or do not commute $[x, \frac{d}{dx}]$

4) State the characteristics of Raman lines and Rayleigh lines. Support with a diagram.

5) Define Degeneracy. Classify the following Ψ states as Degenerate or

Non- Degenerate (121), (122), (211), (111), (222)

6) State four points of difference between IR and Raman Spectroscopy

QV.(A) i) Derive the Expression for Energy Particle in 1D Box 4

ii) To every observable there corresponds an operator- justify 2

OR

QV(A) iii) Derive the Expression for Energy Particle in 3D Box 4

iv) What information of orbitals can be drawn from the values of $(R \theta \psi)$ 2

QV.(B) i) The pure rotational spectrum of HCl has lines separated by 20.0 cm^{-1}

Calculate Moment of inertia and internuclear distance.

4

ii) Draw the Wave function and its Probability for $n = 1, 2, 3$

2

QVI.(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

QVI.(A) iii) Explain P Q R branching

4

iv) How food gets cooked in a microwave?

2

QVI.(B) i) Calculate the Uncertainty in velocity for an electron of mass $9.1 \times 10^{-31} \text{ kg}$ if

(a) $\Delta x = 5 \text{ mm}$ (b) $\Delta x = 5 \text{ m}$.

4

ii) Write all the Postulates of Quantum Mechanics

2