### Total Pages – 4 B.Sc. RNLK-/Physical Chemistry/CC-V/21

#### 2021

Physical Chemistry
[3<sup>rd</sup> Semester]
Paper - CC-V

Full Marks: 40

Time: 2 hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

### Group - A

### Answer any five from the following:

 $5 \times 2 = 10$ 

- 1. (a) Write the physical significance of chemical potential.
  - (b) Write the different forms of redox electrode.
  - (c) Find out the relation between equivalent conductance and molar conductance for a electrolyte  $B_x A_y$ .
  - (d) Draw the conductometric titration curve for magnesium sulphate by Baryta solution.
  - (e) Write the importance of Vant Hoff reaction.

(Turn Over)

- (f) Write the condition for the spontancity of a reaction.
- (g) Mention a direct and indirect method for the determination of transport number.
- (h) At 2000K,  $\Delta G^0$ =22000–2.5×T. Calculate K<sub>p</sub> at the temperature.

# Group - B

# Answer any four from the following:

 $5 \times 4 = 20$ 

- (a) Difference between molar volume and partial molar volume.
  - (b) Discuss the effect of temperature on chemical potential.  $(2\frac{1}{2}\times 2)=5$
- (a) State Le Chatelier principal and discuss its thermodynamic basis. Using this principle, explain why we observe a lowering vapour pressure when a non-volatile solute is added to it.
  - (b) In the reaction,  $N_2+3H_2=2NH_3$ , initially 0.80 moles of  $NH_3$ , 0.70 moles of  $H_2$  and 0.40 moles of  $N_2$  are present. At the later time t, 0.55 moles of  $H_2$  is present, Find advancement of the reaction and find the moles of  $NH_3$  and  $N_2$  present at time t. (2+3)=5

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(Continued)

- 4. (a) A galvanic cell is not truly reversible cell –Why?
  - (b) Why Voltmeter is not used for emf measurement.

3+2=5

- 5. (a) Calculate the quantity of electricity which would be required to reduce 9.84 gm nitrobenzene to aniline. If voltage across the electrolyte will be 2.4 volt, what energy would be consumed in the process.
  - (b) Calculate the Avogardo number from Faraday law of electrolysis? (3+2)=5
- 6. (a) A 4 molal FeCl<sub>3</sub> solution is electrolyzed between plantinum electrodes. After the electrolytes in cathode solution weighing 30 gm is 3.15 molal in FeCl<sub>3</sub> and 1 molal in FeCl<sub>2</sub>. What is the transport number of Fe<sup>+3</sup> and Cl<sup>-</sup> ions.
  - (b) Discuss the origin of electrode potential. (3+2)=5
- 7. (a) Write a short note on Glass electrode.
  - (b) Draw the potentiometric titration curve (E vs V) for the titration of a weak acid by strong base. Explain how you would get pKa of acid from the plot. Also explain the nature of  $\Delta E/\Delta V$  vs V curve in this case.

(2+3)=5

#### Group - C

# Answer any one from the following

 $(1 \times 10) = 10$ 

- 8. (a) For the reaction  $N_2O_4(g) = 2NO_2(g)$ , measurements of the composition of equilbrium mixture gives  $K_p = 0.144$  at 25°C and 0.321 at 35°C. Find  $\Delta H^0$ ,  $\Delta G^0$  and  $\Delta S^0$  at 25°C for the reaction. State any assumptions made.
  - (b) Write mechanism of Galvanic cell.
  - (c) Express chemical potential for real system.

(4+3+3)=10

- 9. (a) The emf of a reaction is given by E=E<sup>0</sup>-(0.059/n) logX. Explain how X and logX will change if the overall cell reaction is multiplied by 2. Will there be any change in E value due to such an operation?
  - (b) The thermodynamic dissociation constant of a weak acid (HA) is  $1.0 \times 10^{-5}$  at 25°C. Find the standard electrode potential (E<sup>0</sup>) for the half cell reaction.

$$HA(aq) + e = A^{-}(aq) + \frac{1}{2}H_{2}(g)$$

(c) Discuss Walden rule.

(3+3+4)=10