CREDIT

Combined survey

Question 1

Osmosis

Osmosis, basic concepts, terms and definitions. Correlation of the osmotic pressure value with the composition of the solution. Calculation of the osmotic pressure of the solution

Question 2

Protolytic equilibria in aqueous solutions

Electrolytic dissociation. Strong and weak electrolytes. The pH value. The protolytic theory of acids and bases. Protolytic equilibria in solutions of acids, bases and salts. Calculations involving the pH

Buffer solutions

Buffer solutions: composition, buffer action, pH interval. Calculation of the buffer pH; the Henderson–Hasselbalch equation. Buffer capacity. Biological buffer systems

Colloidal systems. Formation and coagulation. Surface tension

The task may include: the structure of ash micelles, a calculation problem on adsorption and coagulation.

Credit paper test (typical questions)

1. (6 points) 500 mL of a solution contains 0.04 mol of glucose ($C_6H_{12}O_6$) and 0.04 mol of K_2SO_4.
   a) Calculate the osmolarity of the solution. (2 points)
   b) Calculate the osmotic pressure of the solution at 25°C. (2 points)
   c) What will happen to erytrocytes in this solution? (the osmotic pressure of blood plasma is 740–780 kPa). (2 points)
2. (10 points) For 0.025M aqueous solutions of 1) H_2SO_4 and 2) aniline $C_6H_5NH_2$:
   a) Determine the type of each electrolyte, write the equations that affect the pH value in each solution. Indicate acid-base conjugated pairs in protolytic equilibria. Estimate (without calculation) the pH value in each solution. (6 points)
   b) Write the K_{eq} expressions for all equilibria. (2 point)
   c) Calculate the pH value of each solution if $pK_{BH^+}(C_6H_5NH_2) = 4.60$. (4 points)
3. (10 points) 1 L of buffer solution contains 0.05 mol of Na_3PO_4 and 0.03 mol of Na_2HPO_4. For H_3PO_4 $pKa_1 = 2.12$; $pK_{a2} = 7.2$; $pK_{a3} = 12.44$.
   a) Calculate the pH value of this buffer. (2 points)
   b) 0.005 mol of NaOH was added to the buffer. Calculate the pH value of final solution. (4 points)
   c) Write the equations that explain the buffer action mechanism of this buffer with respect to HCl and NaOH. (4 points)
4. (4 points) (A sol was prepared by mixing $CaCl_2$ and $Na_2C_2O_4$ solutions. The potential determining ions were oxalate ions.

a) Draw the formula of a micelle for this sol. Specify the signs of φ- and ζ-potentials. (2 points)

b) The coagulation of this sol was caused by the addition of NaBr solution. What ions caused coagulation? (2 points)