

QUESTIONS, PHYSICAL CHEMISTRY 2

REACTION KINETICS

1. Definition of the rate of reaction with respect to amount of substance
2. Definition of the rate of reaction with respect to concentration
3. Definition of the extent of reaction
4. Definition of the rate of reaction with respect to extent of reaction
5. Definition of conversion (for reactant A)
6. Definition of the rate of reaction with respect to conversion
7. The unit of the rate of reaction
8. Give an example for a first order reaction
9. Give an example for a second order reaction.
10. What is molecularity?
11. What does reaction mechanism express?
12. Mechanism and rate equation of the decomposition of ozone
13. Mechanism and rate equation of the decomposition of nitrogen pentoxide
14. Differential form of a first order reaction
15. Integrated form of a first order reaction
16. What is the unit of the rate constant of a first order reaction?
17. Relationship between the half life and rate constant for first order reactions
18. Differential form of a second order (with respect to one component) reaction
19. Integrated form of a second order (with respect to one component) reaction
20. Relationship between the half life and rate constant for second order reactions
21. How can you decide from concentration – time data that a reaction is first order?
22. How can you decide from concentration – time data that a reaction is second order?
23. How do you determine the order of reaction and the rate constant graphically if the form of rate equation is $v = k[A]^n$?
24. Temperature dependence of the rate constant (Arrhenius equation)
25. Linearized form of the Arrhenius equation
26. The equilibrium constant of the opposing reaction $A = B$ is 2 (3, 4, 0.5, 1, etc.). Plot the concentrations [A] and [B] against time if we start from pure A.
27. In the parallel reaction $A \begin{cases} \xrightarrow{k_1} B \\ \xrightarrow{k_2} C \end{cases}$ $k_2 = 2k_1$ (3 k_1 , 0.5 k_1 , etc.). Plot the concentrations [A], [B], and [C] against time if we start from pure A.
28. Plot the concentrations [A], [B], and [C] against time in case of the consecutive reaction $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ if we start from pure A.
29. What is the role of a catalyst?
30. Definition of the rate of reaction in heterogeneous reactions
31. What are the steps of a surface reaction?
32. The unit of rate of reaction in heterogeneous reactions

33. Plot the Langmuir isotherm (fractional coverage of surface against pressure).

ELECTROCHEMISTRY

1. What is the meaning of the Faraday constant?
2. What is molarity (chemical concentration) and molality (Raoult concentration)?
3. What is the advantage of molality over molarity?
4. Define the degree of dissociation.
5. What is the relationship between the degree of dissociation and the dissociation constant in case of binary electrolytes?
6. Write down the autoionization equilibrium reaction and equilibrium constant for water.
7. What is the approximate value of the autoionization equilibrium constant of water at room temperature?
8. What is the definition of pH?
9. What is K_a and pK_a for an acid?
10. Define K_b for a base.
11. Define K_a for a base.
12. What is the relationship between K_b and K_a for a base?
13. Definition of chemical potential (in case of neutral component)
14. The dependence of chemical potential on composition
15. Definition of standard state if the composition is given in chemical concentration (molarity)
16. Definition of standard state if the composition is given in molality (Raoult concentration)
17. What is the expression for the mean activity of NaCl ($CaCl_2$, $AlCl_3$, $Al_2(SO_4)_3$, etc.)
18. Definition of mean activity
19. Definition of mean activity coefficient
20. Definition of ionic strength
21. Definition of electrochemical potential
22. Under what circumstances is the electrochemical potential equal to the chemical potential?
23. What is the condition for phase equilibrium in electrochemical systems?
24. What is the condition for equilibrium when an electrochemical reaction occurs?
25. Definition of electromotive force
26. What is the relationship between the electromotive force and the Gibbs free energy change of the electrochemical reaction?
27. What is the relationship between the electromotive force and the entropy change of the electrochemical reaction?
28. What is the relationship between the electromotive force and the enthalpy change of the electrochemical reaction?
29. Nernst equation (for electrochemical cells)
30. Relationship between the standard electromotive force and the equilibrium constant of the electrochemical reaction

31. Describe the standard hydrogen electrode
32. Definition of electrode potential
33. Nernst equation for electrode potential at room temperature
34. Expression for the electrode potential of Zn electrode at room temperature
35. Expression for the electrode potential of Cl_2 gas electrode at room temperature
36. Expression for the electrode potential of Ag/AgCl electrode at room temperature
37. Ohm's law
38. Resistance of a wire of uniform cross section
39. Definition and unit of conductance and conductivity
40. Relationship between conductance and conductivity
41. What does conductance depend on (in case of electrolyte)?
42. What does conductivity depend on (in case of electrolyte)?
43. Definition of molar conductivity
44. Dependence of molar conductivity on concentration in case of strong electrolytes

TRANSPORT

1. Definition of chemical potential
2. Definition and unit of flux (of substance)
3. Fick's first law in one dimension
4. The unit of diffusion coefficient
5. Fick's first law in three dimensions
6. Fick's second law in one dimension
7. Fick's second law in three dimensions
8. The concentration as function of distance in steady state diffusion (in one dimension)
9. Fourier's law of heat conduction in one dimension
10. What is the unit of thermal conductivity?
11. Definition and unit of heat flux
12. Fourier's law of heat conduction in three dimensions
13. What is the relationship between the time dependence and spatial dependence of temperature (in one dimension)?
14. What is the relationship between the time dependence and spatial dependence of temperature (in three dimensions)?
15. The transport of what physical quantity is the viscous flow?