

## Topics for the differential credit in General Chemistry

### Thermodynamics

1. Types of systems in thermodynamics.
2. Human body as an open thermodynamic system.
3. The first law of thermodynamics in isothermal conditions.
4. The first law of thermodynamics in isochoric conditions
5. The first law of thermodynamics in isobaric conditions.
6. Relationships between enthalpy and heat effect of a chemical reaction in normal conditions.
7. The Hess's law: the principle of conservation of energy.
8. Standard enthalpy of formation, standard enthalpy of combustion.
9. The second law of thermodynamics.
10. Entropy: statistical (Boltzmann equation) and thermodynamic definitions.
11. Thermodynamically reversible and irreversible processes.
12. Gibbs' energy: its definition and calculation.
13. The third law of thermodynamics.
14. The structure of matter at absolute zero according to the third law of thermodynamics.

### Kinetics

15. The constant of chemical equilibrium.
16. The law of mass action.
17. Shifts of chemical equilibrium caused by the change of temperature, the change of pressure, the change of volume and the change in reactants or products concentration.
18. Le Chatelier's principle (The Equilibrium Law).
19. How can the change in rates of chemical reaction be predicted according to the law of mass action?
20. Van't Hoff coefficient (Q<sub>10</sub>).
21. Catalytic reactions. Catalysts (positive and negative ones).
22. Homogenous and heterogeneous catalysis.
23. Enzymes as catalysts.
24. Arrhenius equation.
25. Collision theory.
26. Transition state theory.

### Colligative properties of solutions

27. Osmosis and osmotic pressure.
28. Structure and properties of cell membranes.
29. Isotonic, hypotonic and hypertonic solutions relative to the osmolarity of blood plasma.
30. Hemolysis and plasmolysis.
31. Isotonic (Van't Hoff) factor.
32. Osmolarity and osmolality.
33. The pressure of the saturated vapor upon the solution.
34. Depression of the freezing point of the solution.
35. Cryoscopy as a method for molecular mass estimation.
36. Elevation of the boiling point of the solution.
37. Ebullioscopy as a method for molecular mass estimation.
38. Oncotic pressure as a part of osmotic pressure.

### Complex compounds

39. The structure of complex compounds.
40. Classification of complex compounds.
41. Nomenclature of complex compounds.
42. What elements are prone to formation of complex compounds?
43. Polydentate ligands.

### **pH and buffering systems**

44. pH as an index for measuring the level of acidity.
45. pH levels of biological fluids.
46. Different kinds of acidity.
47. The ways to measure acidity of a biological fluid.
48. Buffering systems, their classification.
49. Proteins as buffering systems.
50. Buffer capacity.

### **Heterogeneous equilibriums**

51. Heterogenic equilibriums.
52. Solubility of an electrolyte.
53. The constant of solubility of an electrolyte (concentration and thermodynamic ones).

### **Titrimetric analysis**

54. Molarity, molality, mass percentage and mole percentage as indices to express the content of solution.
55. The law of equivalence. Normality.
56. Methods used for balancing redox reactions.
57. Standard reduction potentials.
58. The influence of pH on the reduction potential of  $\text{KMnO}_4$ .
59. Neutralization method in titrimetric (volumetric) analysis.
60. Permanganometry.
61. Iodometry.

### **Colloid chemistry**

62. Adsorption on the surface of liquid.
63. Adsorption of substances by solid sorbents.
64. The influence of pH on the total charge of a protein. Isoelectric point of protein.
65. Colloid solutions prepared by condensation.
66. Diameter of particles in colloid solutions. Tyndall's effect.
67. "Oil-in-water" and "water-in-oil" types of emulsion.
68. Steps in the process of protein solution formation.
69. Hoffmeister series (or lyotropic series) of ions.

### **Electrochemistry**

70. Conductivity of an electrolyte solution.
71. Conductivity of acids and bases. Conductometric titration.

### **Hydrolysis**

72. Hydrolysis of salts formed by weak acid and strong base.
73. Hydrolysis of salts formed by strong acid and weak base.

### **Electron configurations**

74. Electron configurations of s- and p-elements.
75. Electron configurations of d-elements.

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