Water

1. Why is water so different compared to methane although they have nearly the same molecular weight?
2. What are the main differences between water and methane which has nearly the same molecular weight?
3. What happens during the dissolution of a salt in water?
4. Which properties must a compound have to dissolve in water?
5. What information do you get if you measure the conductivity of a solution?
6. Why is water and ethanol miscible whereas water and oil is not?

Isomerism

7. What is a stereoisomer?
8. What are geometric isomers and give an example?
9. What are enantiomers and give one example?
10. Which features allow an organic compund to be chiral?
11. Why is it so important that a bioactive compound has the correct stereochemistry?
12. Which descriptors are used to define an enantiomer and how do you use them?
13. Draw D-glycerinaldehyde in a Fischer-projection and explain why it is D-compound!
14. What are diastereomers and give an example?
15. What is a meso-compound and give an example?

Kinetics

16. What happens with the reaction rate if the reaction temperature is increased? Give an estimate for the relative value!
17. What happens with the reaction rate if the concentration of the reactants is increased?
18. How does a catalyst influence the reaction rate and what happens to the catalyst? Draw a simple rection coordinate diagram without and with catalyst!
19. What do you measure if you want to determine a reaction rate and explain how you obtain eventually the reaction rate?
20. What is a rate low and give an example?
21. What is the order of a reaction and describe how you determine it?

22. Give the rate law for a first order process and explain what you do to determine the rate constant!
23. Give the rate law for a second order process and explain what you do to determine the rate constant!
24. What is the half-life of a compound (reactant) and does it depend on the concentration of this compound (reactant) in a first order process?
25. What is the half-life of a compound (reactant) and does it depend on the concentration of this compound (reactant) in a second order process?
26. Under which circumstances do reactions occur? Explain all necessary features!
27. What is the activation energy? What happens with the reaction rate if the activation energy is high?
28. Draw a simple reaction coordinate diagram and explain which information is given in it in detail!
29. Why is the reaction rate higher at higher temperatures? Give an explanation based on Maxwell-Boltzmann distribution!
30. What is the Arrhenius equation? Explain the individual parts of the equation!
31. How can the activation energy be determined? Give a detailed description!
32. What is an elementary process with regard to reaction mechanisms?
33. What determines the reaction rate in a multistep mechanism?

<u>Lipids</u>

34. Which four groups of bioorganic compounds are lipids?
35. What are waxes?
36. What are fats?
37. How can a fat be analyzed and what information is obtained from these analyses?
38. What are saturated and unsaturated fatty acids? In which configuration do unsaturated fatty acids occur and what property is effected by that?
39. What is the difference between a fat and an oil how is it caused on a structural point of view? Can an oil be transformed into a fat and in case how?
40. Why are unsaturated fats less stable than saturated ones?
41. What is a saponification of a fat?
42. What is a soap and why does it have a cleaning effect? What general property must a detergent have?
43. What is a phosphoglyceride?

44. What are the special properties of phosphoric acid esters compared to carboxylic and sulfonic acid ester?
45. How does a cell membrane look like schematically?
46. What is a prostaglandin? From which compound are they derived?
47. What are the basic units of terpenes? How many basic units build a diterpene?
48. From which terpene is lanosterine, the precursor of steroids, formed?
49. Draw the chemical structure of natural rubber!
50. What is the core structure of steroids?
51. What information is given by the descriptors □ and □ in a steroid?
52. Draw the structure of testosterone!
53. Draw the structure of estradiol!
54. What are typical functions of steroids?

<u>Carbohydrates</u>

55. What is the general formula of a carbohydrate and what are its functions?
56. How is a monosaccharide characterized? Name all characteristics!
57. Give the structure of glyceraldehydes! What are the characteristics of this sugar?
58. Give the structure of dihydroxacetone! What are the characteristics of this sugar?
59. How can you determine whether a sugar has D- or L-configuration? Which one will be found in nature generally?
60. Give the structure of D-erythrose! What are the characteristics of this sugar?
61. Give the structure of D-threose! What are the characteristics of this sugar?
62. Give the structure of D-ribose! What are the characteristics of this sugar?
63. Give the structure of D-glucose! What are the characteristics of this sugar?
64. What happens if you reduce a monosaccharide? How is the product called?
65. Draw the chemical scheme for the reaction of glucose with henylhydrazine! How is the product of this reaction called?
66. What happens if you oxidize a monosaccharide with bromine? How is the product called?
67. What happens if you oxidize a monosaccharide with nitric acid? How is the product called?
68. What is the Tollens reagent and for what do you use it?
69. Are sugar stable in basic media?

70. How can you generate a pentose from a tetrose?
71. How can you generate a pentose from a hexose?
72. D-Glucose exists in 2 forms, □ and □. Give an explanation for this and draw the structure of the □-form! What is the exact name of this compound!
73. What does the term “mutarotation” mean?
74. Why does an essential part of glucose exist in equilibrium in the □-form although the □-form should be much more stable due to steric effects?
75. What happens if you react a monosaccharide with an alcohol? Do the products still mutarotate?
76. Give the structure of □-D-maltose! What are the characteristics of this sugar?
77. Give the structure of □-D-cellobiose! What are the characteristics of this sugar?
78. Of which two sugars is lactose formed? Where does it occur in nature? What are its characteristics?
79. Of which two sugars is sucrose (table sugar) formed? Where does it occur in nature? What are its characteristics?
80. What is the difference between starch and glycogen?
81. What is cellulose? Give its structure!
82. What are glycoproteins and what is a very important function of them?
83. What are cyclodextrins, how are they characterized, and for which application are they used?

<u>Amino Acids</u>

84. How do naturally occurring amino acids which form proteins look like? Give a general formula in Fischer projection and describe which configuration they have!
85. Why are amino acids zwitterions?
86. What is the isoelectric point? How can you calculate this point?
87. How do side groups effect the acid-base behaviour of amino acids?
88. Explain the principles of electrophoresis!
89. Explain the principle of ion exchange chromatography!
90. How can mixtures of amino acids be separated and what is the resolution criteria?
91. Give a defined example for an amino acid with aliphatic side chain!
92. Give a defined example for an amino acid with a hydroxyl group in the side chain!
93. Give a defined example for a sulphur containing amino acid!

94. Give a defined example for an acidic amino acid!
95. Give a defined example for a basic containing amino acid!
96. Draw the chemical structure of natural phenylalanine in Fischer projection!
97. Give an example for an amino acid with an amide group in the side chain!
98. What types of abbreviations are used to name amino acids?
99. What is the primary structure of a peptide and how do you describe it without giving the chemical structure? At which end do you begin with the description?
100. How can peptides be synthesized? Give all necessary steps!
101. How can peptides be analyzed?
102. What is the Edman degradation?
103. How can you cut a peptide at defined bonds into smaller pieces?
104. By which interactions is the tertiary structure of a protein defined?

Nucleic Acids 1

105. What is a nucleotide? Give the chemical structure of one!
106. What is a nucleoside? Give the chemical structure of one!
107. Explain in terms of chemical structure how the interaction between A and T in DNA takes place!
108. Explain in terms of chemical structure how the interaction between G and C in DNA takes place!
109. How can purines and pyrimidines be synthesized?
110. Explain the principle of chemical RNA synthesis!