**Cracow University
of Technology**

Issues competence test for candidates for second degree (3 semesters)
Chemical Technology
Specialties: Innovative Technologies in Chemistry

1. Which of the following devices are input devices, i.e. devices for transferring data by a user to a computer?
2. What is the smallest addressable unit of information of a computer memory?
3. What is eduroam?
4. What this abbreviation stands for: FLOPS?
5. The minimum illuminance required in office rooms and in laboratories is equal to: ?
6. The controlled substances are the substances: ?
7. Positive economics deal with: ?
8. Vertical and horizontal production relations are specific for: ?
9. GDP is measure of: ?
10. Global demand is the sum of …?
11. Axiom is: ?
12. According K. Poppera (1902-1994) falsification of scientific theory is: ?
13. One of the postulates of methodological Galileo (1564-1642) proclaimed that the science of nature should: ?
14. Generally recognized set of achievements and scientific theories which, in a given historical period, it provides a model solutions is: ?
15. The classic definition of truth says, the sentence p is true if: ?
16. The Scientific Revolution by T. Kuhn (1922-1996): ?
17. In the code of engineering ethics the key role is played by the principle of ..?
18. Acting within the framework of corporations and organizations, an individual may act in a different way than within the framework of the private relations. These differences are the result of ..?
19. The three most important types in contemporary ethics are ..?
20. Some of the engineer's projects or actions may lead to some unexpected and negative consequences. In such cases the engineer ..?
21. Within the framework of deontological theories of ethics duties are ..?
22. Within the framework utilitarianism the right action is determined by ..?
23. The agreement of companies that cooperate in the production and / or research and development activities and / or distribution is: ..?
24. When schemes businesses do not belong to the same industry, the analysis focuses on organizational solutions (systems, methods, processes and functions) standard for benchmarking: ?
25. The principle of delegation of permissions is: ?
26. The activity related with the formation of the offer, and image of the company, leading to take a clear significant place in the minds of the target audience, unlike the competition is: ?
27. Which statement regarding the properties of mathematical functions is true?
28. A numerical sequence is strongly decreasing if ?
29. Is the numerical sequence of the general expression $a_n = \left(\frac{-1}{2}\right)^n$ has limit?
30. Indicate the correct statement regarding number $-2 - 3i$ is ..?
31. Does the equation $z^2 + 1 = 0$ have a solution?
32. If the function f is differentiable at a point x_0 that belongs to its domain, then ..?
33. Which of the following functions is not a differentiable function throughout its domain
34. If the derivative f' of the function f is negative in the interval P, then ..?

35. If the derivative of the function f is equal to zero in x_0 that belongs to its domain, then the function f ?

36. The derivative of the function $f(x) = \operatorname{arctg} x$ is ?

37. A definite integral $\int_0^\pi \sin x$ is equal to ?

38. The function $f(x) = e^x$ is a solution of equation ?

39. The particular solution of the differential equation $y' - y = \frac{e^x}{x}$ is ?

40. The differential equation $y' + xy = \sin x$ is equation.. ?

41. The volume of the solid formed by rotating the curve $y = \sqrt{1-x^2}$ around the Ox axis for $x \in [-1,1]$ is equal to ..?

42. Partial fractions resulting from the decomposition of the rational function $\frac{3x^2+2}{x^3+x}$ are ..?

43. A homogeneous linear system of equations ..?

44. The determinant of a matrix A^{-1} is ..?

45. Two vectors are perpendicular if .. ?

46. The cross product $[2, -1, 1] \times [3, 0, -1]$ is equal to ..?

47. If A is an $n \times n$, $(n > 1)$ singular square, then the rank of matrix A ?

48. If the coefficient matrix of a system of linear equations is non singular, then the system ..?

50. Which of the following fundamental interactions is a strong interaction: ..?

51. A body with a mass m = 2 kg, initially at rest, is being accelerated at time t = 5 s by a constant force F = 8 N. The final velocity of the body is: ..?

52. A compact disc with a diameter d = 12 cm is performing about f = 10 rotations/s. What is the value of the linear velocity of a point at the circumference of the disc?

53. A ball was thrown vertically up (motion resistances are neglected). At the highest position: ..?

54. A ball with a mass m and a radius r, moving with a velocity v = 2 m/s elastically collide another, identical ball, but motionless. What will happen after the collision: ..?

55. Skater is spinning at the top of the skate (is performing a pirouette) with hands raised vertically with an angular velocity ω. What will happen with that velocity when the skater lowers downs the hands to the horizontal position?

56. Two point charges with the same sign generate electrostatic field. At how many points in space, the field intensity is equal to zero?

57. A flat plate with very large dimensions, uniformly electrically charged, attracts a small charged dust particle. When the particle is at the distance d1 = 2 mm from the plate, the attractive force equals to F = 2 μN. When the particle will be at the distance d2 = 1 mm from the plate then the attractive force will be equal to: ..?

58. A circular circumference by which current flows with intensity I, generates a magnetic field whose direction is: ..?

59. In which of the following cases, the particle is subject to non-zero Lorenz force: ..?

60. Unit of electromotive force (SEM) of electromagnetic induction is: ..?

61. Wavelength of blue light in air is: ..?

62. Ability to reflect the radiation by an ideal black body is: ..?

63. Electronic subshells of an atom are determined by: ..?

64. Spin projection to chosen direction has maximally: ..?

65. $1s^2 2s^2 2p^2$ is an electronic configuration in fundamental state of a certain element. This element is the: ?

66. A variable „ro" is a row vector containing densities of seven components. A variable „V" is a row vector containing volumes of these seven components. In order to determine in the „Scilab" software („Matlab") a row vector „m" containing seven values of a mass of the components one should use a command: ?

67. Which of the following entries is invalid in the „Scilab" software („Matlab") ?

68. Which of the following operation is illegal in the „Scilab" software („Matlab")?

69. What value will appear in a cell A11 in the Excel software if cells from A1 to A10 contain numerical values and the cell A11 contains a formula: =srednia(A1:A15)?
70. Electron configuration: $1s^22s^2p^63s^2p^6d^{10}4s^2p^6d^{10}f^{14}5s^2p^6d^{10}6s^2p^2$ corresponds to the atom belonging to:?
71. Mass defect is called: ..?
72. The Heisenberg uncertainty principle applies: ?
73. Artificial radioactivity is associated with: ..?
74. The density of a gas under certain conditions amount 1.34 kg/m^3. What is the density at the same conditions of gas that has a molecular weight half greater then this mensioned above?
75. Bond in homonuclear molecules is always: ..?
76. Hybridization is: ..?
77. The hydrogen bond is formed, when: ?
78. With an increase in water vapor content in air the density of the air ..?
79. Electronegativity element is: ..?
80. High-spin complexes are formed when: ..?
81. By definition mol follows that: ..?
82. The unit of atomic mass is: ..?
83. The molar concentration of a substance in a solution of a liquid depends on: ..?
84. Electrolysis is: ..?
85. The dissociation degree of the weak electrolyte: ?
86. Hydrolysis in aqueous solutions of electrolytes refers to: ..?
87. The constant value of the self-ionization constant of water refers to: ..?
88. Solubility equilibrium of poorly soluble AB electrolyte is: ?
89. The acidity of the aqueous electrolyte is defined stating: ?
90. Buffering capacity of the solution: ?
91. To an aqueous solution containing a soluble salt of Fe^{3+} ions is added successively NH_4SCN, NaF, KOH. We observe successive changes:
92. Adding a strong base to an aqueous solution of a weak base results in: ?
93. Which of the following is a protolysis reaction in Brönsted theory:
94. The reaction rate constant depends on the
95. Hydrogen half-cell potential
96. The carbon atoms in the alkanes has hybridization
97. π bonds in alkenes are form from orbitals …
98. Nucleophile is a reagent having affinity to
99. Which pair of reactants most often create a new chemical bond
100. Demianov reaction is
101. Class of aromatic amines is determined by reaction with an acid
102. The Diels-Alder belongs to the group of
103. In aromatic systems aluminum chloride catalyzes some types of
104. Hybridization of oxygen in ethers is
105. Addition of HCl to the double bond of propene will be realized according to the
106. Dewar structure is proposed for the mesomeric forms of
107. In the process of electrophilic substitution in arenes, alkoxy group directs the next substituent at position(s)
108. The highest boiling point of the following compounds has
109. Henry reaction is condensation of…
110. The body was weighed on an analytical balance using the corroded weights. The actual weight of the body is

111. Correction to weigh in a vacuum due

112. The sample of HCl solution taken to analyze was quantitatively transferred to a flask with a volume of X mL and diluted with distilled water to the mark. After mixing the contents of the flask, the Y mL portion of solution was taken from flask with a pipette, transferred to Erlenmajer flask and indicator "5.1" was added. For titration of this portion Q mL of 0.1082 mol/L NaOH solution was used. Mass [g] HCl (molecular weight of 36.46 g / mol for HCl) in the original sample is calculated as follows:

113. $NiSO_4$ solution was acidified with HCl before addition of dimethylglyoxime HL in excess and precipitate nickel dimetyloglioxime NiL_2 with NH_3. Acidification is intended to:

114. For the gravimetric analysis of a sample of oxide Fe_2O_3 x FeO to Fe content by precipitation of $Fe(OH)_3$ it is necessary to prepare the set of aqueous solutions of the following components:

115. The concentration balance for C mol/L Br2 has the form:

116. Thermal effect of reaction (enthalpy change of the reaction):

117. The state function is:

118. I law of thermodynamics can be formulated as follows:

119. The enthalpy change ∆H is equal to the heat that closed system exchanges with the environment in transition:

120. The equilibrium constant for the reaction $Fe_3O_4 + CO \leftrightarrow 3FeO + CO_2$ depends... and describes it….:

121. In the synthesis reaction of the phosgene $CO(g) + Cl_2(g) \leftrightarrow COCl_2(g)$ equilibrium moves to the right as:

122. The two liquids of limited mixability form…:

123. Colligative properties, i.e. boiling point elevation, freezing point depression and osmotic pressure depend:

124. Negative azeotrop can be separated from the mixture …?

125. The reaction order is equal to ..?

126. The activation energy is… and depends... :

127. The catalyst is a substance which:

128. The advantages of homogeneous catalysis in comparison with heterogeneous catalysis:

129. What is electrolysis and what is its course?:

130. Spectroscopy is the science:

131. What magnitude is shown on the x-axis of MS spectra?

132. Monochromator in Spekol spectrometer is:

133. The AAS, flame or graphite cuvette is essentially a center conducting the analyte atoms in state

134. The ICP-OES, argon plasma is essentially a center conducting the analyte atoms in state

135. In the presence of the respective analyte, the signal in the form of current intensity

136. To accelerate ions in a standard mass spectrometer is used:

137. With a pH increase by one, the potential of the glass electrode in terms of its linear characteristic

138. What compounds include in the organometallic compounds?

139. Are popular in organometallic chemistry cyclopentadienyl ligand Cp is aromatic?

140. SEM microscopy allows:

141. Mass spectrometry allows to determine ..?

142. Infrared spectroscopy (IR) and Raman spectroscopy are ..?

143. Conducting research using nuclear magnetic resonance spectroscopy:

144. The basic drawing sheet is denoted:

145. The basic unit of length used for technical drawings dimensioning is:

146. The cross-section (intersection, cut, section) on the technical drawing we mark by:

147. The curve radiuses we dimensioning by prefixing the dimensional number by dimensional mark:

148. The most common type of projection in technical drawing is:

149. Fine continuous line is not designated to:

150. Which of the following views is appropriate to supplement this picture:

151. When drawing objects in rectangular plan views following principle should be applied:
152. Fundamental property of electric signal: analog and digital is:
153. Elementary laws in electrotechnics are:
154. Code converter is the:
155. Converters ADC and DAC nowadays realize very import ant operations. Those operations are the:
156. Steel is a ..?
157. The composition of acid-resistant cast iron:
158. Electrochemical corrosion:
159. Formation rates of porous scale at high temperature describes:
160. The term environmental monitoring refers to:
161. The first basic act of Environmental Protection and Development (Architecture) has been adopted:
162. For the basic principles of the environment protection as a whole not enters:
163. The anaerobic process of physical and chemical degradation of organic mass runs in a thermal way (500-800°C) it is:
164. According to REACH Regulation a registration process of chemical products comprises:
165. Globally Harmonized System of classification and labelling of chemicals introduces:
166. According to REACH Regulation a multi-constituent substance is:
167. GHS label pictograms have the shape, the background colour and the drawing colour respectively:
168. Diathermic wall has following properties:
169. In what direction a specific heat of an ideal gas changes with temperature increase:
170. A specific heat of isentropic process has a value of:
171. Diesel cycle consists of:
172. Vapour quality is:
173. Heat of combustion:
174. Products of electrolysis of sodium chloride solutions is:
175. Impregnation brine solution by carbon dioxide is an essential stage in the preparation of:
176. Due to the hydraulic module and the silicate module cement, which describe clinker parameters, the most important of its components are:
177. The technology that includes steps: preparing a neat gas mixture, compressing the mixture, conducting the compressed gaseous mixture by contact converters, removing the product from the reacted gas mixture, recycling the unreacted portion of the gas mixture to:
178. Synthesis gas is a mixture of:
179. The pyrolysis olefin most frequently used raw material is:
180. Catalytic cracking is carried out on the catalyst:
181. Which hydrocarbons have the highest cetane numbers:
182. Third-party certification bodies provide independent confirmation that organizations meet the requirements of quality management on the base of the standard:
183. The Pareto-Lorenz principle states that for many events in the nature, technique and in human activities:
184. How many reactions occur in the case of fixed beam?
185. To any coplanar force system was in equilibrium, that;
186. The friction does not depend on;
187. Select the false sentence concerning the impact of two forces.;
188. The figure shows cycle of mechanical stress. Name this cycle.
189. The steel rod having a diameter of X mm is stretched axial forces Y kN. The stresses in the cross-section of the rod are:
190. The maximum bending moment in the free-ends beam length L and loaded in the middle with a concentrated force F is

191. Determination of the critical force from the Euler formula for buckling concerns
192. The highest torque which can transfer a steel shaft with a diameter of 40mm, assuming that ks = 30MPa, is
193. Mark the true sentence concerning shafts and axles.
194. Notch is called:
195. For the power transmission from shaft to shaft with different symmetry axes is used:
196. The gear wheel shown in the drawing is mounted on the shaft by the help of an element marked 1 and form a connection. What do you call that kind of connection?
197. Transmission ratio for the belt or gear transmission is quotient:
198. For dedusting gases can be used:
199. In the granulators agglomeration of the material is usually placed under the influence of:
200. The efficiency of the separation in the sedimentation chamber can be increased by mounting:
201. Number of balls in conventional ball mills must be such that:
202. Centrifugal pumps are used most often when you need:
203. The work point of the compressor is:
204. Which unit operation can be industrially carried out using material counterflow:
205. In the resistance ovens heat can be produced by current flow through:
206. What is called a stable focus in the phase portrait?
207. What is called the Nyquist frequency graph?
208. What is called the time overtake of the PID controller?
209. What measuring device is called a pyrometer?
210. A contractual name of an European directive dedicated to the management of serious industrial accidents is:
211. A hazardous area where the flammable atmosphere of gas, vapour or mist is present continuosly or for long periods or frequently is marked with a number of: