

Sample „Chemistry” exam questions

In all answers please **do not write more than five sentences**.

In calculation problems please provide all necessary calculations (if you use any symbols, explain them) and explain shortly, what do you calculate and what for.

Sample questions for I test:

1. Particles in the air below 2.5 μm size are considered dangerous for lungs. On the evening of the day that had a smog alert announced, you can see under the lantern clearly indicated beam light. Explain, is it better to wear dust mask or not? (3 pts)
2. Your neighbor asked you to water his plant that is very sensitive to the soil acidity – it cannot be out of the 7-9.1 pH range. Water for watering can be taken from the tap, but before watering it has to be set aside for few hours (in order for the chlorine and ozone to volatilize). Explain, should you add pinch of calcium carbonate (additive to increase alkalinity of water) to water or not? (5 pts)
3. How many kg of NaCl salt does one need to produce 100 liters of that salt water solution of molality $m = 2 \text{ mol/kg}$. $M_{\text{NaCl}} = 58.5 \text{ g/mol}$; $d_{\text{water}} = 1 \text{ g/cm}^3$. (4 pts)
4. Hexavalent chromium is very carcinogenic, but chromium compounds at other oxidation states are relatively harmless. Chrome plating of the car rims (plated surface 8000 cm^2 , thickness 25 μm) takes place in the 100 A electrolyzer ($\eta \sim 10\%$) for ca. 44 hours. $\rho_{\text{Cr}} = 7.1 \text{ g/cm}^3$. $M_{\text{Cr}} = 52 \text{ g/mol}$. Calculate if with given conditions should you protect yourself in a special way (full chemical suit, gas mask) when staying around the electrolyzer or standard protection measures (gloves and goggles) will be enough? (8 pts)

Sample questions for II test:

1. Why the foehn wind (or any other wind coming from the mountains) is dry and warm – explain using rules of thermodynamics? (4 pts)
2. How can you separate to single components mixture consisting of water, ethanol (boils at 78°C), organic salt (that decomposes at 90°C) and polymer filaments insoluble in both water and ethanol? (4 pts)
3. Can one vaporize pyridine using water bath (water boiling point is 100°C) and water pump that can achieve minimum pressure of 1200 Pa (pyridine boiling point is 115°C)? (5 pts)
4. How many kg of coal that has 22 MJ/kg calorific value one has to burn in power plant furnace ($\eta = 40\%$), to power electrolyzer ($\eta = 90\%$) during electrorefining process of 1 ton of copper ($M_{\text{Cu}} = 64 \text{ g/mol}$, $U_{\text{el}} = 0.5 \text{ V}$). (7 pts)

Additional sample questions for II test:

Reaction of $A_{(g)} \rightarrow B_{(g)} + C_{(g)}$ type occurs under certain conditions. How and why we need to change the pressure so the reaction yield would increase (if all other parameters are kept the same)? (4 pts)