

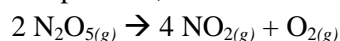
Admission Exam of the Post Graduation Program in Chemistry
Federal University of São Carlos
Academic Master Degree and Doctoral Degree, 01/2014

Question 01

A sample of perfect gas that occupied initially 11,0 L at 270 K and 1,20 atm was compressed isothermically until the final volume of 6,0 L. Calculate the change in the entropy of this gas.

Question 02

Considering the pre-exponential factor $A = 4,94 \times 10^{13} \text{ s}^{-1}$ and the activation energy $E_a = 103,4 \text{ kJ/mol}$ of the N_2O_5 decomposition, calculate the half-life of this chemical reaction at $75,0^\circ\text{C}$.



Question 03

Calculate the fluoride-ion concentration and pH of a solution containing $1.0 \times 10^{-1} \text{ mol/L}$ of HCl and $2.0 \times 10^{-1} \text{ mol/L}$ HF in 1.0 L of solution. ($K_a \text{ HF} = 6.8 \times 10^{-4}$).

Question 04

One (1.0) liter of saturated solution of silver chromate at 25°C contains 0.0435 g of $\text{Ag}_2\text{CrO}_{4(aq)}$. Calculate its solubility product constant. (Molar mass: $\text{Ag}_2\text{CrO}_4 = 332 \text{ g/mol}$)

Question 05

The complexes a) $[\text{NiCl}_2(\text{PPh}_3)_2]$ and b) $[\text{PdCl}_2(\text{PPh}_3)_2]$ are paramagnetic and diamagnetic, respectively. Give the structures of the complexes a) and b). (Data: ^{28}Ni ; ^{46}Pd)

Question 06

Give the hybrid orbital for the central atom in each of the species: (Data: ^5B ; ^7N ; ^8O)

- a) $[\text{NH}_4]^+$
- b) H_3O^+
- c) BBr_3

Question 07

Considering your knowledge in the physical and chemical properties of organic compounds, explain why is acetic acid a stronger acid than ethanol?

Question 08

Give the major products for each of the reactions below:

