

**UNIVERSITY CEU SAN PABLO
SCHOOL OF PHARMACY
DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY**

COMPLEMENTARY PROBLEMS OF PHYSICAL CHEMISTRY

2018-19

LESSON 5

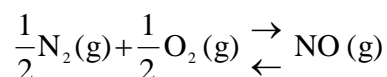
29. ΔG° at 298 K for the decomposition reaction of NH_4Cl is $21,8 \text{ kcal}\cdot\text{mol}^{-1}$, calculate the equilibrium constant K_p° and K_x at 25°C and 1 atm

Data: $R = 0.082 \text{ l}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 1.987 \text{ cal}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.314 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$



Solution: $K_{p,298}^\circ = 1.025210^{-16}$; $K_{x,298} = 1.025210^{-16}$

30. The equilibrium constant for the process:



can be approximately calculated by the expression:

$$\log K_p^\circ = -\frac{10872.463}{T} + 1.2574 \text{ (J)}$$

Determine:

- a) the equilibrium constant at 1000 K and 1200 K.
- b) ΔH° , ΔS° and ΔG° at 1000K

Data: $R = 0.082 \text{ l}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 1.987 \text{ cal}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.314 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$

Solution: a) $K_p^\circ(1000\text{K}) = 6.67 \cdot 10^{-5}$; $K_p^\circ(1200\text{K}) = 4.08 \cdot 10^{-4}$

b) $\Delta H^\circ = 90393.657 \text{ J}\cdot\text{mol}^{-1}$; $\Delta S^\circ = 10,454 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$;
 $\Delta G^\circ(1000\text{K}) = 79939.11 \text{ J}\cdot\text{mol}^{-1}$

31. Calculate the pH of an aqueous solution of an acid type 1: 1 in a concentration 0.010 m, knowing that its dissociation constant is $6.6 \cdot 10^{-5}$.

Solution: $\text{pH} = 3.108$

32. For AgCl, the solubility product is $1.78 \cdot 10^{-10}$ at 25 ° C. Calculate the solubility, at 25 ° C, in the following solvents

- a) pure water
- b) 0.01 m-KNO₃ solution
- c) 0.01 m-KCl solution

Explain your answer using the appropriate equations.

Solution: $s = 1.33 \cdot 10^{-5} \text{ mol} \cdot \text{kg}^{-1}$; **b)** $s = 1.50 \cdot 10^{-5} \text{ mol} \cdot \text{kg}^{-1}$; **c)** $s = 2.55 \cdot 10^{-8} \text{ mol kg}^{-1}$