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

PROBLEMS OF PHYSICAL CHEMISTRY

2018-2019

LESSON 5

13. Consider the equilibrium: $C_2H_6\,(g) \rightleftarrows C_2H_4\,(g) + H_2\,(g)$

C_2H_6 is introduced into a vessel at 1000 K and 1 atm pressure. At equilibrium, the system has a 26 mol% C_2H_4 and 48 mol% of C_2H_6. Calculate:

a) K_p^0 at 1000 K.

b) K_p^0 at 298 K, knowing that $\Delta H^\circ = 137\ kJ\cdot mol^{-1}$, not modifying the value in the temperature range considered

c) ΔG° at 298 K.

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

14. In a particular reaction, we have studied the dependence of the equilibrium constant with temperature, yielding the following equation, considering Joules the units for energy:

$$\ln K = 23.78 + \frac{3407.54}{T}$$

Calculate for this reaction the value of:

a) ΔH^o
b) ΔS^o
c) ΔG^o at 35 ºC

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

15,. 0.1 moles of acetic acid, K_a is $1.75\cdot10^{-5}$, are dissolved in 1 litre of:
a) water.
b) 0.005m-KCl solution.
c) 0.005m-$MgCl_2$ solution.
d) 1m-KCl solution.
Determine the degree of dissociation of acetic acid in each solution, commenting on the results.
Data: Mean ionic activity coefficients for KCl solutions

m / (mol·kg^{-1})	0.01	0.05	0.1	0.5	1.0
$\gamma_\pm$ (KCl)	0.910	0.815	0.769	0.651	0.606