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1st exam			
2008 - XI - 26			
Name:			

1. Aluminum is obtained from bauxite (aluminum oxide). Here is the balanced chemical equation:



- Determine if the reaction is exothermic or endothermic
- Determine if the entropy change is positive or negative
- Draw an ΔG -T diagram and study (qualitatively) the spontaneity of this reaction
- Determine the formation enthalpy-change of aluminum oxide
- Suppose that a beer can that contains 30 grams of aluminum is fabricated: Determine
 - the volume of oxygen produced at normal conditions (STP)
 - the energy cost of its fabrication if the price of a kWh is 0.107 euros

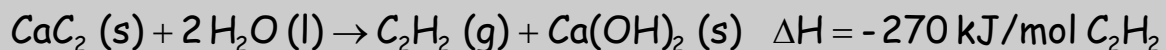
DATA:

$$1 \text{ kWh} = 1 \text{ kW} * 1 \text{ h} = 1000 \text{ W} * 1 \text{ h}; \quad 1 \text{ W} = 1 \text{ J/s}$$

Atomic weights: Al = 27

2.5 POINTS

2. A century ago "carbide lamps" were very commonly used by miners and speleologists. First, acetylene was obtained by the reaction between calcium carbide and water:



Then acetylene was burned and a very bright flame was obtained. Determine:

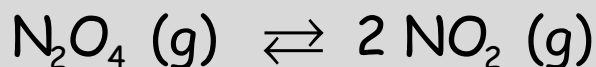
- the formation enthalpy-change of acetylene
- the combustion enthalpy-change of acetylene

DATA:

	$\text{Ca}(\text{OH})_2$	H_2O	CaC_2	CO_2
ΔH_f° (kJ/mol)	-986	-286	+83	-395

2.5 POINTS

3. At 100 °C, a 2 L-vessel is charged with 120 g N₂O₄. When the equilibrium of this reaction is reached



the pressure is 33.8 atm. Determine:

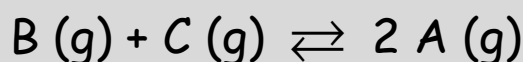
- dissociation percent
- mole fractions
- partial pressures
- concentrations at equilibrium
- equilibrium constants K_c and K_p
- Knowing that the process is endothermic, determine which direction will the system shift if the equilibrium is disturbed by:
 - increasing N₂O₄
 - decreasing NO₂
 - decreasing pressure
 - decreasing the volume
 - increasing the temperature
 - adding a catalyst

DATA:

Atomic weights N=14; O=16

3 POINTS

4. We have this theoretical reaction:



and a container is charged with 0.5 mol B and 0.3 mol C at 400 K. When equilibrium is reached 0.2 moles of A are found in the vessel. Determine:

- the equilibrium constants K_c and K_p
- if equilibrium is disturbed by adding 1 mole of A, the number of moles of each component when equilibrium is reached again.

R = 0,082 atm.L/K.mol

2 POINTS