From reaction equation:

$$H_2(g) + \frac{1}{2}O_2(g) \longleftrightarrow H_2O(g)$$

@ 1500°K (remember 1 cal = 4.18 J)

$$\Delta G^{\circ}_{H_2O} = -58.9 + 13.1 \bullet 1.5 = -39.2 \frac{kcal}{mole}$$

but, $\Delta G^{\circ}_{H_2O} = -RT \ln K_{H_2O}$

$$\Delta G^{\circ}_{H_2O} = -RT \ln \left[\frac{\Pi_{H_2O}}{\Pi_{H_2} \sqrt{\Pi_{O_2}}} \right]$$

$$\left[\frac{\Pi_{H_2O}}{\Pi_{H_2}} \right] = 1 \quad \text{equal partial pressures}$$

$$RT \ln \Pi_{O_2} = 2\Delta G^{\circ}_{H_2O} = -78.4 \text{ kcal/mole} \quad (1)$$

Now, above UO_{2+x} **at 1500°K**

$$\overline{\Delta G_{O_2}} = RT \ln \Pi_{O_2} = \overline{\overline{\Delta H_{O_2}}} - \overline{\overline{\Delta S_{O_2}}} \left(\frac{T}{1000} \right) \frac{kcal}{mole}$$

Using $RT \ln \Pi_{O_2}$ **from eq.1, and** $\Delta H_{O_2}, \Delta S_{O_2}$ **from. problem**

-78.4 = -125+16,000x-1.5(-29+6,600x) = -81.5+6,100x

x=0.00051 and $UO_{2.0005}$