Question #80828, Chemistry / General Chemistry | for completion

115 grams of KCl is dissolved in 750 ml of water (assume density = 1.005 g/ml). What are the molality, molarity, mole fraction, mole percent, % mass, ppm by mass? What would be the freezing point and boiling point of that solution assuming the Kf of water is 1.86 oC/m and Kb is 0.512 oC/m (assume that KCl fully dissociates with no pairing of ions)?

m(KCl)= 115g

V(H2O)= 750 ml

p(solution)= 1,005g/ml

Cm-?

Mu -?

X-?

W-?

Kf=1.86oC/m

Kb=0.512oC/m

Solution:

m(H2O)= 750 g

n(KCl) = m(KCl)/M(KCl)= 115/ 74= 1.55 mol

n(H2O)= m(H2O)/M(H2O) = 750/18= 41.6 mol

X(KCl)=n(KCl)/(n(KCl)+n(H2O))=1.55/(1.55+41.6)=1.55/43.15=0.036= 3.6%

Mu = n/m(solvent) = 1.55/750=0.002mol/g= 2 mol/kg

Cm= n/V(solution)

V= m/p= (750+115)/1.005= 860 ml=0.86 l

Cm= 1.55/0.86=1.8 mol/l

W= m(soluted)/m(solution)= 115/(750+115)=0.132=13.2%

ΔT=k*Mu

ΔTf=Kf*Mu= 1.86*2= 3.75

ΔTb= Kb*Mu= 0.512*2=1.024

Answer: Cm= 1.8 mol/l, Mu=2 mol/kg, x= 0.036= 3.6%, w=13.3%, ΔTf=3.75, ΔTb=1,024