Pf

en Pi

3. Autoclaves **that** are used to sterilize surgical tools require a temperature **of** 120.°**C** to kill some bacteria. If water is used for this purpose for this purpose, at what pressure must **the** autoclave operate? **(8%**) Find the necessary data in **the** given tables.

**shuaponization**

(+-++), 4 = 393,15 k

Ti

R

Ti **= 393.** 15K

40.656x10°

8314

( 393,

393,15

·393,15)

3

0.6667 → P=1.95 atm

4. Find *AH*, AS**,** and AG° **for reaction** Cl2(g) + 2 Br *(aq)* → Br2**(**g) +2 Cl(*aq)* **at** 298 K using **the**

table provided. **Write the** full expression for **the** equilibrium constant (including **activity.**

coefficient and using molarity expression **for** concentrations) and calculate **the** value of the

equilibrium constant**. (8%**)

Substance

Cl= 191

sHp (J)

OG p° (3) osm (J/k)

*9*

223.

al (aɛ)

-167.2×103

-131.2x103 *56.5*

Br208

30.9×103

31x103

245.5

Br **(aq)**

**-121.6**×103

-104×103 82.4

⇒ Reaction OH= -60.3×103]

AG= **-51-3×103** J ob=-294 J/k

⇒ AG = -RIINK = k = exp(51.3×103 ÷8-314÷298.15*)*

rBr

K=

=9-12x 108

**2**

2-

PBL po oco Mcé

ро

Рев

2

Judo (pet) For Mor

**Br**

MBE

5. **Write expression** for y± and ***m****+* **for** Mg3(PO4)*2* in terms of *m****,* the** stoichiometric molality and **the**

activity coefficients **of the** ions. Write **expression of** μt in **terms** of u+ and **u for the same**

molecule**.** Calculate the ionic strength of the solution for ***m*** = 0.01 mol kg1. Calculate the

using **the** D-H limiting **law**. **(8%**)

r

Note that A+ = m of a = mod

***m°***

where M+= Vt M+ M- =V-M\_, mo

2

Thas yield at = [a\* ak]+, wher V = VG+ V-

***а***

V+

に

= [(m =)" (m =)" ), "\_" ] + jo

Mg3 (PO4)2

in this case :

By 1+= 3, V-=2

Y+

**similar** for mir

similar:

**3-**

3Mg2+ + 2 P043

[2+3 |\_2]/5, m = [(3m)3 (2m)=J25

1/5

= **108** \*m = 2,55m

M2 = (Bell+ + 21-)/5

Χ

What's the Value of r? starts from I and logr±=-0.5092|2+2-|√I

2

and I = = [(Mit Zi2++ ***M2***-*Zi-)*

**"J**

++ × 10,03 × 22 + 0.02× 32) =

= 0.15

so logɣ== -0.5092 | 2+ (-3) | | 0.15

J+= 0.065 **#**

6. The partial vapor pressure of a 5.00 mol kg1 aqueous solution **of** HCl at **298.15** K is equal to

6.97×10-5 bar. The mean ionic activity coefficient is equal to **2.38.** Find **the** value **of** u°(H+)+

μ°(CI) **- μo**(HCl, g). (8%)

About cľ

Hal »Ht+ cl, sll= m2(H+) tul°(4*) - M***° (Hally**

K=

M+ J + x M-X

(PHC)

лесся)-маниет

53x2382 =2.04×106

6.97×*105*

⇒ <M= -RT INK = -8.314x298x In (2.04*×18%)*

= -35995 J-36 KJ #

7. **The** normal freezing temperature of CH2OHCH2OH, ethylene glycol, is -11.5°C. Its density is

**1.1088** g cm3, and its enthalpy change of fusion is 11.23 kJ mol1. **(a) Derive the freezing** point

**depression** in terms of these parameters described. (b**)** Find the freezing point depression constant for solutions with ethylene glycol **as** the solvent. (c) Find **the** freezing temperature of a solution of 10.0 g of **water** in 1.000 **kg of** ethylene glycol. (d) Find **the freezing** temperature **of a** solution of 10.0 g **of ethylene** glycol in 1.000 kg of water. *Kr* (water) = **1:86** K kg mol1. (**e)** Assuming an ideal liquid solution**,** draw roughly **the** water ethylene glycol **temperature-** composition phase diagram, using the colligative properties to calculate the curves. (18%)

(a) solution is in equilibrium with pure solid solvent

\*

Mzantion= Msorit » $ \* % RI‡ 出發點最重要

\*

\*

=) Msolvenz + Rien Isolvent = Msolid

\*

In X solvent = Matid - Matwort = -8G fashion

Inxsavent

RT

RT

2 **&** # X salvare $24π : ( Mrkevent ) = = =+ (2 (07/1)) (231) p

2 Комар

эт

JHfusion *(27*

2X solvent P

'savent

Under Constant P

Xsolvent RT2

A

2(OG/T)

**(3449**), - DG

dG = -sdt+vdp

эт

T2

- TS-8G-SH

:)

(247) = -3 (~~+40)px T *=* -TS

AG=SH-OST

T2

T2

不用寫但要知道

↑

Recall [2 (4/7)

эт

**P**

**Continued**

Under constant

P =

dXsulvert a Haution dy = BER BJ 7 PQ√ √ #22 #5

Isolvent

Xsaven't dx

RTZ

Hasion dT

χ

Trusson R Tiz

1

2)

T

Trusion

RINX SOLONY oHlusion

Substitue X solvent

Nsalvart

m為溶質 molality

=

X

| solvent +M salute XM savant A solvent Moses se to ne molar mass

It Msolute XM solvent

*=)* enx solvent = -en (it msolute M solvent

2

-RM servent Tfusion

эотр= sHfusion

2

2

M solute

\*en (itx)=-7

(b) k= RM solvent Tfusion = 8,314 x 62 × 10 3 x **261.5**°

JHfusion

11.23×103

-3.14 (K/(mol kg"))

10/18=

동 5 molkgy

(c) the molality of water: MH2O=""

OT=-3, 14 x 5 == -1.74 k

So the freezing temperature -11.5-1.74 = -13.2**°**

S

(D) the molality of ethylene glycol Meg=

5

OT=-1.86*×* 34 =-0.3 k

**So** the

freezing temperature: -0.3°C #

(e) == Trusion

10/62

**5**

w/ñ

Ren Tseuni,找T-X的關係圖,由

OHfusion

\* 22J 150. EG solvent*-*solute

身份互換繪圖? 微積分法,找一階導权

⇒

(微積分不行就**自己吃**自己吧

find T-X graph from ==

**1**

***Tf***

dT

⇒

d(vt) dT

d(1/T)

1

=

=

dx

**dx** d(1/1)

dx **d(**VT)

dx

Renx solvent

она

d2(1/T) x *(-T2*)

d(1/7)

R

⇒

=

dx

онах

**dx**

**d7** RT2

онf Xsolvent

when H2O is solvent,

ז

T

Э

\* solute

Xlunt

前園向

Same scenario happen when EG is solvent

⇒ Hence, Graph will be

TE

純水

EG

Percent of EG

(*a*)

*P2*

8. At 35.2°C**, the** vapor pressure of pure acetone **is** equal **to** 344.5 **torr**, and that **of pure chloroform**

**is** equal to 293 torr. **At** this temperature, a solution of 0.7090 **mol** of acetone **and** 0.2910 mole

chloroform has a **vapor** pressure of **286** torr and a mole fraction of acetone **in the** vapor of

0.8062. **(a) Using the** Raoult's **law** as the standard state**,** find activity and activity coefficient of

each component. (b) Henry's law constant for chloroform in acetone **at** this temperature is equal

to 145 torr. **Considering** acetone to be **the** solvent, find the activity and activity coefficient for

each component according to Henry's **law** as the standard state. **(8%**)

**acetone** = 344.5 torn = a

**Pe**

chloroform **=** 293 Toth = b

*Now* in Solution, Xa= 0-709, Xp=0.291 Ptotor **=**286 torr, Ya**=**0.8062, Yb= 0.1938 Pa = Ptotal × 0,8062=230.57 torr

=>

*=* Aa = **239.57** =

**3445**

X

52 = 0.669, Ja

0.669

=

= 0.944

0.709

Pb = Prozaj **× 0**, 1938 = 55.42 torr

*⇒* Ab**=**

55.42

*9.189*

= 0.189, Əb2

2

= 0,650

293

**0.291**

Pé

(b) Base on Henry's law: Ali=

Ki

⇒ Achloroform

**286*×***0.1938

=

145

=0382

=

0.382

=

= 1.31

0.291

(前面那麼難中間出一題智障?)

9. One component in **a** solution follows Raoult's law,

*solution*

*th*

=μ+***RT* ln** x, over the entire range

(xit

0≤ ***x*** ≤1. Using **the** Gibbs-Duhem **equation, show** that **the second** component must also follow

**Raoult's law.** (6%)

*Xi*

*x,* du1 + xx du2 = 0 = du2 = -xidm1 = \_X1 dluit +RTINx1)

1 X1 + x2 = | = X

1-X2

=> dx1 = -dxz

zO della

Xz

Xz

x+ RT dx,

Xz 1-7/2

dxz

Xz

RT

RT T-X2

Z

dxz

12

K=

integrate both side: Mzż kten xz + c

And *by* lim (RTlNxz +C)=C, Cz M\* Pune naz

)

→ M22

Solution

= M2\*+ RTMM xz #

10. **The** base dissociation constant of **dimethylamine,**

☆ I = = =

= [ { Mi **+** Z **j** + **Mi**-212")

I

(CH)2NH (aq) + H2O(aq) → (CH3)2NH;\* (aq) + OH(aq) & \_log T += -0-5 | | 2+2-| (11711/5 **- 031)**

**is** 5.12×10-5. **Calculate the extent** of hydrolysis for a 0.200 mol kg solution of (CH3)2NH in **water** using an iterative calculation until **the** answer **is within 5%** error. Use **Davies** equation to

estimate y. (10%) blog (m*/****no*)** you to 85 kom

2

0,2**-m**

=5.12×10-5 = m2 83 +5, 12x105M-1-924x165*=0*

(1) when O+= 1 = M += 3.11 X 10-3 mol/kg =I= 3.17×12 3 × 2=3,17 × 10-3

**2**

⇒ logT± = −0.9267 = = 0.940

<2) when ɣ+=0.94 = *M +* = 3.38 × 10-3, error=6.2% ⇒ 1= 3.38× 10 3 = logo== -0.0275 = = = 0.939 (3) when 8+=9,939 = M + = 3.38 x 103*,* same as <2), ⇒ M± = 3,38×10-3 ⇒ hydrolysis degree = 3.38×163

=

**0.2**

= 1.69%

**1+ 14**

11. A **regular** binary solution is **defined** as one for which

**μ12** = μ1 + ***RT* Inx1** + *wx2*

0

μ2 = *μ2* + ***RT*** ln *x2* + *wx2*

Derive the expressions **for the** activity coefficients y1 **and** y2 in **terms of** *w*. **(8%)**

由定義

M1 *= Mi*+RTlna,

M2 + RT ln x, X

= Mit Rtenx, +WxzZ

So = M,°+ RTINX +Riene

**wx 23/RT**

- M2 + RTMM X1 (e xx; /RT)

X1

→ J1 = exp(WX = /RT)

эб

*=>* same for r2 = exp (wxi/RT)

12. **The** reaction **CaCO3**(s) = CaO(s**)** + CO2(g) is at equilibrium. **How** many degrees of **freedom**

(number of **intensive variables)** are there when **all** three components are present **at** equilibrium?

The reaction **at** equilibrium represents **a** relation among these **components**. (4%)

P+F = C+2

"

一週反應要扣一個C,起来是3,其質2

P=2 (3**¢** g) =) F=2+2-2 = 2#

後記

Ø 1st production ends at 2021/01 109,2:34 am

written by Chemistry 23:334

**phoblem** II is left **blank,** both of us **don't** know How to do it

borty QQ

© 2nd **production** ends at 2021/01/11 9:56 am

11題其實很D能,BOHO有寫出來但不覺得有那麼比,**靠**北==