CHEM 1110 test 4 – Summer 2009 Par

Part I

Answer the following questions on the answer sheet.

- 1–2) A) Does a CO_3^{2-} ion have a dipole?
 - B) Does a NO_2^- ion have a dipole?
 - C) Does a HCN molecule have a dipole?
 - D) Does a H_2CO molecule have a dipole?
- 3) Calculate the vapor pressure of C_2H_5Br at 18.6 °C if 7.24 g of C_2H_5Cl is dissolved in 1620.5 g of C_2H_5Br . Give your answer to **4 significant figures**. The following data are relevant.

The vapor pressure of pure C_2H_5Br at 18.6 °C is 0.438 atm. The molar mass of C_2H_5Br is 108.9 g mol⁻¹. The molar mass of C_2H_5Cl is 64.45 g mol⁻¹.

- 4–5) Place the following in the proper sequence for increasing London forces:
 - A) NaKLiCsRbB) CH_4 C_3H_8 C_4H_{10} C_5H_{12} C_2H_6 C) NAt_3NCl_3NI_3NF_3NBr_3D) Cl_2 F_2 At_2 I_2 Br_2
- 6) 0.569 moles of a non–electrolyte is dissolved in 403 g of urethane. What is the freezing point lowering? The K_f for urethane is 5.14 K mol⁻¹ kg.
- 7–8) Give the van't Hoff factor for each of the following:

A)	CaS	E)	RbOH
B)	MgBr ₂	F)	H ₂ NNH ₂
C)	HBr	G)	CH ₃ OH
D)	HClO ₂	H)	H_2CO

9) 7.28 g of FeCl₃ is dissolved in 51.6 g of water. What is the freezing point lowering for this solution? The K_f for water is 1.86 °C kg mol⁻¹. The molar mass of FeCl₃ is 162.2 g mol⁻¹. Give your answer to **4 significant figures**.

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For questions 11 through 14, refer to the attached phase diagram

- 10) On the CO_2 phase diagram, identify what region N is.
- 11) On the CO_2 phase diagram, identify what point Q is.
- 12) On the CO_2 phase diagram, identify what line R is.
- 13) Write all the equilibria associated with point Q.
- 14) Calculate the osmotic pressure when 0.28 g of the non–electrolyte CH_3OH is dissolved in 35.4 mL of water solution at 58.2 °C. The molar mass of CH_3OH is 32 g mol⁻¹.
- 15) What classification of solid is iron and what is the strongest force responsible for it being a solid?
- 16) What classification of solid is teflon and what is the strongest force responsible for it being a solid?

17 - 18)

- A Does a H_2S molecule exhibit hydrogen bonding with another H_2S molecule?
- B Does a HF molecule exhibit hydrogen bonding with another HF molecule?
- C Does a HCOOH molecule exhibit hydrogen bonding with another HCOOH molecule?
- D Does a H₃COOH molecule exhibit hydrogen bonding with another H₃COOH molecule?
- 19) Arrange the following compounds in order of their boiling points: HCl , HF , HI , HBr.
- 20) The boiling point for CS₂ is 46.3 °C and its ΔH_v is 30.90 kJ mol⁻¹. What is its vapor pressure at 143.7 °C?
- 21) Explain why the effect of hydrogen bonding for water is double that for <u>both</u> ammonia and HF. (Extra credit)

NA	ME							
1–2	2) Circle	e the right ans	wer: dipo	le?				
	A)	CO ₃ ²⁻ :	YES		NO			
	B)	NO_2^- :	YES		NO			
	C)	HCN :	YES		NO			
	D)	H ₂ CO :	YES		NO			
3)	P =			_atm				
4–5) Lond	on forces:						
	least	<		_<		_<	<	most
	least	<		_<		_<	<	most
	least	<		_<		<	<	most
	least	<		_<		_<	<	most
6)	Freezing	g point: $\Delta T = $				°C (or K)		
7–8	s) van't	Hoff factor:						
	A)	CaS :			E)	RbOH :		
	B)	MgBr ₂ :			F)	H ₂ NNH ₂ :		
	C)	HBr :			G)	CH ₃ OH :		
	D)	HClO ₂ :		_	H)	H ₂ CO :		
9)	$\Delta T =$			°C (e	or K)			

NA	ME							_
For	questions	11 through 14	l, refer to	o the atta	ched pha	se diagra	m	
10)	What is re	egion N? :						_
11)	What is p	oint Q? :						_
12)	What is li	ne R? :						_
13)	Equilibria	for point Q is	:					
14)	Osmotic p	pressure is			atm			
15)	iron is a _			the strong	gest force	is		
16)	teflon is a			th	ne stronges	st force is		
17–	18)	Circle the righ	nt answer	: hydroge	n bonding	;?		
	A)	H_2S :	YES	N	0			
	B)	HF : YES		NO				
	C)	НСООН :	YES	N	0			
	D)	H ₃ COOH :	YES	N	0			
19)	lowest	<		<	<		_ highest	
20)	Pressure a	tt 143.7 °C is _			atm			
21)	Explain w	hy the effect o	f hydrog	en bondin	g for wate	er is doubl	le that for both	ammonia and HF

(Extra nydrogen bonding iy credit))

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1–2) dipole?

A)	CO_3^{2-} :	NO
B)	NO_{2}^{-} :	YES
C)	HCN :	YES
D)	H_2CO :	NO

- 3) P = **0.4344** atm
- 4–5) London forces:
 - $\begin{array}{lll} \text{least} & Li < Na < K < Rb < Cs & most \\ \text{least} & CH_4 < C_2H_6 < C_3H_8 < C_4H_{10} < C_5H_{12} & most \\ \text{least} & NF_3 < NCl_3 < NBr_3 < NI_3 < NAt_3 & most \\ \text{least} & F_2 < Cl_2 < Br_2 < I_2 < At_2 & most \end{array}$
- 6) $\Delta T = 7.26$ °C (or K)
- 7–8) van't Hoff factor:

A)	CaS	2	E) RbOH	2
B)	MgBr ₂	3	F) H_2NNH_2	1
C)	HBr	2	G) CH ₃ OH	1
D)	$HClO_2$	1	H) H ₂ CO	1

- 9) $\Delta T = 6.47 \,^{\circ}\text{C}$ (or K)
- 10) What is region N? : liquid
- 11) What is point Q? : triple point
- 12) What is line R? : liquid-solid phase boundary
- 13) Equilibria point Q is : $CO_2(g) \Rightarrow CO_2(s) \Rightarrow CO_2(l)$
- 14) Osmotic pressure is 6.80 atm
- 15) iron is a metal the strongest force is metallic bonding.
- 16) teflon is a covalent solid the strongest force is covalent thoughout.

17–18)	hydrogen be	hydrogen bonding?		
A)	H_2S	NO		
B)	HF	YES		
C)	HCOOH	YES		
D)	H ₃ COOH	YES		

- 19) lowest HCl < HBr < HI < HF highest
- 20) Pressure at 143.7 °C is **15.15** atm.