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) Na K Li Cs Rb

B) CH_4 C_3H_8 C_4H_{10} C_5H_{12} C_2H_6

C) NAt_3 NCl_3 NI_3 NF_3 NBr_3

D) 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_2NNH_2
C)	HBr	G)	CH_3OH
D)	$HClO_2$	H)	H_2CO

9) 7.28 g of $FeCl_3$ 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 $FeCl_3$ is 162.2 g mol^{-1}.
Give your answer to **4 significant figures**.

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

10) On the CO_2 phase diagram, identify what region N is.

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

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 H_3COOH molecule exhibit hydrogen bonding with another H_3COOH molecule?

19) Arrange the following compounds in order of their boiling points: HCl , HF , HI , HBr.

20) The boiling point for CS_2 is 46.3 °C and its DELTA$\mathbf{H}_v$ 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)

NAME_____

1–2) Circle the right answer: dipole?

A) CO_3^{2-} : YES NO

B) NO_2^- : YES NO

C) HCN : YES NO

D) H_2CO : YES NO

3) P = _____atm

4–5) London forces:

least _____ < _____ < _____ < _____ < _____ most

least _____ < _____ < _____ < _____ < _____ most

least _____ < _____ < _____ < _____ < _____ most

least _____ < _____ < _____ < _____ < _____ most

6) Freezing point: DELTA*T* = _____ °C (or K)

7–8) van't Hoff factor:

A) CaS : _____ E) RbOH : _____

B) $MgBr_2$: _____ F) H_2NNH_2: _____

C) HBr : _____ G) CH_3OH : _____

D) $HClO_2$: _____ H) H_2CO : _____

9) DELTA*T* = _____ °C (or K)

For questions11 through 14, refer to the attached phase diagram

10) What is region N? : _____

NAME_____

For questions11 through 14, refer to the attached phase diagram

11) What is point Q? : _____

12) What is line R? : _____

13) Equilibria for point Q is : _____

14) Osmotic pressure is _____ atm

15) iron is a _____ the strongest force is _____

16) teflon is a _____ the strongest force is _____

17–18) Circle the right answer: hydrogen bonding?

A) H_2S : YES NO

B) HF : YES NO

C) HCOOH : YES NO

D) H_3COOH : YES NO

19) lowest _____ < _____ < _____ < _____ highest

20) Pressure at 143.7 °C is _____ atm.

21) Explain why the effect of hydrogen bonding for water is double that for both ammonia and HF. (Extra credit)

_____

_____

ANSWER SHEET

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:

least Li < Na < K < Rb < Cs most
least $CH_4 < C_2H_6 < C_3H_8 < C_4H_{10} < C_5H_{12}$ most
least $NF_3 < NCl_3 < NBr_3 < NI_3 < NAt_3$ most
least $F_2 < Cl_2 < Br_2 < I_2 < At_2$ most

6) DELTA*T* = **7.26** °C (or K)

7–8) van't Hoff factor:

A) CaS **2**
B) $MgBr_2$ **3**
C) HBr **2**
D) $HClO_2$ **1**
E) RbOH **2**
F) H_2NNH_2 **1**
G) CH_3OH **1**
H) H_2CO **1**

9) DELTA*T* = **6.47** °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 : **$CO_2(g) \rightleftharpoons CO_2(s) \rightleftharpoons CO_2(l)$**

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 bonding?

A) H_2S **NO**
B) HF **YES**
C) HCOOH **YES**
D) H_3COOH **YES**

19) lowest HCl < HBr < HI < HF highest

20) Pressure at 143.7 °C is **15.15** atm.