



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

- 10) On the CO<sub>2</sub> phase diagram, identify what region N is.
- 11) On the CO<sub>2</sub> phase diagram, identify what point Q is.
- 12) On the CO<sub>2</sub> 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<sub>3</sub>OH is dissolved in 35.4 mL of water solution at 58.2 °C. The molar mass of CH<sub>3</sub>OH is 32 g mol<sup>-1</sup>.
- 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<sub>2</sub>S molecule exhibit hydrogen bonding with another H<sub>2</sub>S 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<sub>3</sub>COOH molecule exhibit hydrogen bonding with another H<sub>3</sub>COOH molecule?
- 19) Arrange the following compounds in order of their boiling points: HCl , HF , HI , HBr.
- 20) The boiling point for CS<sub>2</sub> is 46.3 °C and its ΔH<sub>v</sub> is 30.90 kJ mol<sup>-1</sup>. What is its vapor pressure at 143.7 °C?
- 21) Explain why the effect of hydrogen bonding for water is double that for both ammonia and HF. (Extra credit)

NAME \_\_\_\_\_

1–2) Circle the right answer: dipole?

- A)  $\text{CO}_3^{2-}$  : YES NO
- B)  $\text{NO}_2^-$  : YES NO
- C) HCN : YES NO
- D)  $\text{H}_2\text{CO}$  : YES NO

3)  $P =$  \_\_\_\_\_ atm

4–5) London forces:

least \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ most

least \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ most

least \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ most

least \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ most

6) Freezing point:  $\Delta T =$  \_\_\_\_\_ °C (or K)

7–8) van't Hoff factor:

A) CaS : \_\_\_\_\_ E) RbOH : \_\_\_\_\_

B)  $\text{MgBr}_2$ : \_\_\_\_\_ F)  $\text{H}_2\text{NNH}_2$ : \_\_\_\_\_C) HBr : \_\_\_\_\_ G)  $\text{CH}_3\text{OH}$  : \_\_\_\_\_D)  $\text{HClO}_2$ : \_\_\_\_\_ H)  $\text{H}_2\text{CO}$  : \_\_\_\_\_9)  $\Delta T =$  \_\_\_\_\_ °C (or K)

NAME \_\_\_\_\_

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

10) What is region N? : \_\_\_\_\_

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<sub>2</sub>S : YES NO

B) HF : YES NO

C) HCOOH : YES NO

D) H<sub>3</sub>COOH : YES NO

19) lowest \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ &lt; \_\_\_\_\_ 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)  $\text{CO}_3^{2-}$  : **NO**  
 B)  $\text{NO}_2^-$  : **YES**  
 C)  $\text{HCN}$  : **YES**  
 D)  $\text{H}_2\text{CO}$  : **NO**

3)  $P = 0.4344$  atm

4–5) London forces:

- least  $\text{Li} < \text{Na} < \text{K} < \text{Rb} < \text{Cs}$  most  
 least  $\text{CH}_4 < \text{C}_2\text{H}_6 < \text{C}_3\text{H}_8 < \text{C}_4\text{H}_{10} < \text{C}_5\text{H}_{12}$  most  
 least  $\text{NF}_3 < \text{NCl}_3 < \text{NBr}_3 < \text{NI}_3 < \text{NAt}_3$  most  
 least  $\text{F}_2 < \text{Cl}_2 < \text{Br}_2 < \text{I}_2 < \text{At}_2$  most

6)  $\Delta T = 7.26$  °C (or K)

7–8) van't Hoff factor:

- |                    |          |                             |          |
|--------------------|----------|-----------------------------|----------|
| A) CaS             | <b>2</b> | E) RbOH                     | <b>2</b> |
| B) $\text{MgBr}_2$ | <b>3</b> | F) $\text{H}_2\text{NNH}_2$ | <b>1</b> |
| C) HBr             | <b>2</b> | G) $\text{CH}_3\text{OH}$   | <b>1</b> |
| D) $\text{HClO}_2$ | <b>1</b> | H) $\text{H}_2\text{CO}$    | <b>1</b> |

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 :  **$\text{CO}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{s}) \rightleftharpoons \text{CO}_2(\text{l})$** 14) Osmotic pressure is **6.80** atm15) iron is a **metal** the strongest force is **metallic bonding**.16) teflon is a **covalent solid** the strongest force is **covalent throughout**.

17–18) hydrogen bonding?

- A)  $\text{H}_2\text{S}$  **NO**  
 B) HF **YES**  
 C)  $\text{HCOOH}$  **YES**  
 D)  $\text{H}_3\text{COOH}$  **YES**

19) lowest  $\text{HCl} < \text{HBr} < \text{HI} < \text{HF}$  highest20) Pressure at 143.7 °C is **15.15** atm.