

# Exercise 10.7

## Physical States

Name: \_\_\_\_\_

Date: \_\_\_\_\_ Per: \_\_\_\_\_

### There are four types of crystalline solids:

**Ionic solids:** Made up of positive and negative ions and held together by electrostatic attractions. They're characterized by very high melting points and brittleness and are poor conductors in the solid state. An example of an ionic solid is table salt, NaCl.

**Molecular solids:** Made up of atoms or molecules held together by London dispersion forces, dipole-dipole forces, or hydrogen bonds. Characterized by low melting points and flexibility and are poor conductors. An example of a molecular solid is sucrose.

**Covalent-network (also called atomic) solids:** Made up of atoms connected by covalent bonds; the intermolecular forces are covalent bonds as well. Characterized as being very hard with very high melting points and being poor conductors. Examples of this type of solid are diamond and graphite, and the fullerenes.

**Metallic solids:** Made up of metal atoms that are held together by metallic bonds. Characterized by high melting points, can range from soft and malleable to very hard, and are good conductors of electricity.

1. What type of solid will each of the following substances form?

- |                           |                                 |                            |
|---------------------------|---------------------------------|----------------------------|
| a. $\text{CO}_2$ : _____  | e. Ru : _____                   | i. NaOH : _____            |
| b. $\text{SiO}_2$ : _____ | f. $\text{I}_2$ : _____         | j. U : _____               |
| c. Si : _____             | g. KBr : _____                  | k. $\text{CaCO}_3$ : _____ |
| d. $\text{CH}_4$ : _____  | h. $\text{H}_2\text{O}$ : _____ | l. $\text{PH}_3$ : _____   |

2. Consider the following data concerning four different substances. Label the four substances as either ionic, network, metallic, or molecular solids.

Formula	Conducts Electricity as a Solid	Other Properties	Solid Type
$\text{B}_2\text{H}_6$	No	Gas at 25°C	
$\text{SiO}_2$	No	High mp	
CsI	No	Aqueous solution conducts electricity	
W	Yes	High mp	

3. Consider two different organic compounds, each with the formula  $\text{C}_2\text{H}_6\text{O}$ . One of these compounds is a liquid at room conditions and the other is a gas. Identify which molecule is the liquid and which is the gas. Justify your answer.

Organic Compound	Liquid or Gas?	Explanation
$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\ddot{\text{O}}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $		
$  \begin{array}{c}  \text{H} \quad \quad \text{H} \\    \quad \quad   \\  \text{H}-\text{C}-\ddot{\text{O}}-\text{C}-\text{H} \\    \quad \quad   \\  \text{H} \quad \quad \text{H}  \end{array}  $		

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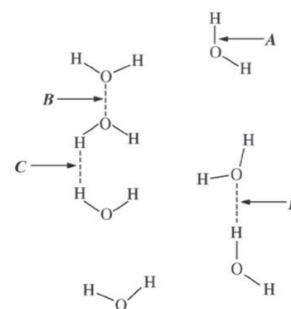
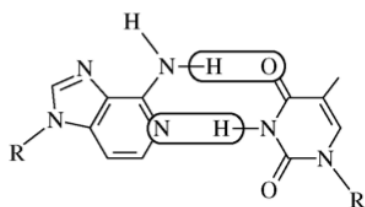
Name: \_\_\_\_\_

Date: \_\_\_\_\_ Per: \_\_\_\_\_

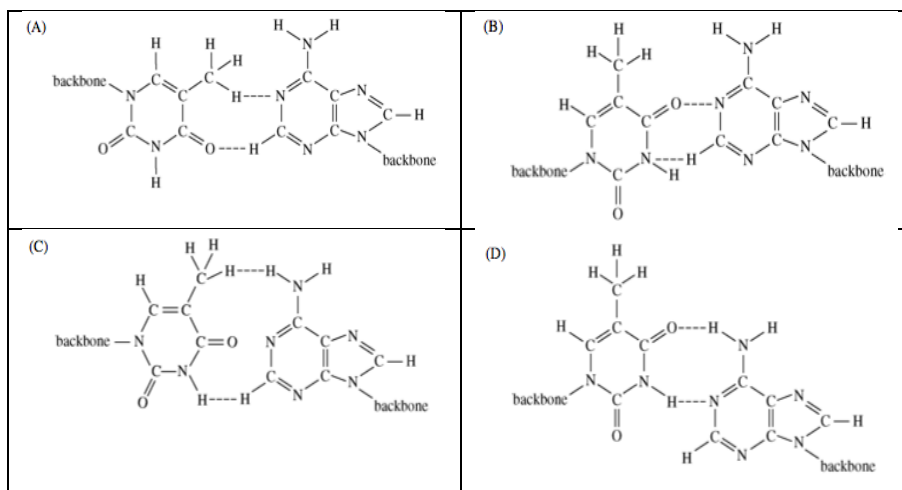
4. Explain why methanol ( $\text{CH}_3\text{OH}$ ) has a higher normal boiling point and a higher normal melting point than methylfluoride ( $\text{CH}_3\text{F}$ ), given the following data:

Formula	Molecular weight (amu)	b.p. ( $^{\circ}\text{C}$ )	m.p. ( $^{\circ}\text{C}$ )
$\text{CH}_3\text{OH}$	32.04	65	-94
$\text{CH}_3\text{F}$	34.03	-78	-142

5. In the diagram at right, which of the labeled arrows identifies hydrogen bonding in water? \_\_\_\_\_



6. What type of interaction occurs between the atoms within the circled areas of the two molecules represented above? \_\_\_\_\_
7. Thymine and adenine form a base pair in the DNA molecule. These two bases can form a connection between two strands of DNA via two hydrogen bonds. Which of the following diagrams shows the correct representation of the hydrogen bonding (denoted by dashed lines) between thymine and adenine base pairs? (In each diagram, thymine is shown at the left and adenine is shown at the right. The bases are attached to the backbone portion of the DNA strands.) \_\_\_\_\_



8. The figure below shows that in solid hydrogen fluoride there are two distances between H atoms and F atoms. Provide an explanation for this observation.

