

## AP Chemistry Multiple Choice Questions - Chapter 12

1 As pure molecular solids, which of the following exhibits dipole-dipole intermolecular forces:  $\text{PBr}_3$ ,  $\text{SO}_2$ ,  $\text{I}_2$ , and  $\text{CO}_2$ ?

- a  $\text{PBr}_3$  only  
b  $\text{PBr}_3$  and  $\text{SO}_2$   
c  $\text{SO}_2$  and  $\text{CO}_2$   
d  $\text{I}_2$  and  $\text{CO}_2$   
e  $\text{PBr}_3$ ,  $\text{SO}_2$ , and  $\text{I}_2$

	12.5a
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2 As pure molecular solids, which of the following exhibits dipole-dipole intermolecular forces:  $\text{HCl}$ ,  $\text{Cl}_2$ ,  $\text{SCl}_2$ , and  $\text{CCl}_4$ ?

- a  $\text{HCl}$  only  
b  $\text{HCl}$  and  $\text{Cl}_2$   
c  $\text{HCl}$  and  $\text{SCl}_2$   
d  $\text{Cl}_2$  and  $\text{CCl}_4$   
e  $\text{SCl}_2$  and  $\text{CCl}_4$

	12.5a
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1 Which of the following statements concerning induced dipole/induced dipole forces is/are CORRECT?  
1. In general, induced dipole/induced dipole interactions increase as the size of a molecule increases  
2. Induced dipole/induced dipole forces are the attractive forces in molecular solids with nonpolar mol.  
3. Induced dipole/induced dipole forces exist in both polar and nonpolar molecular solids

- a 1 only  
b 2 only  
c 3 only  
d 1 and 2 only  
e 1, 2, and 3

	12.5a
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2 What intermolecular force or bond is primarily responsible for the solubility of carbon dioxide ( $\text{CO}_2$ ) in water?

- a Dipole/Dipole force  
b Hydrogen Bonding  
c Dipole/Induced Dipole Force  
d Hydrogen Bonding-Dipole Force  
e Ion-Induced Dipole Force

	12.5a
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3 Which of the following statements concerning intermolecular forces is/are CORRECT?

1. Dipole-dipole attractions occur in all molecules that contain polar bonds, regardless of whether the molecule has a dipole  
2. Hydrogen bonding occurs in all molecules containing both oxygen and hydrogen atoms  
3. Induced dipole/induced dipole forces exist in all molecular solids

- a 1 only  
b 2 only  
c 3 only  
d 1 and 2 only  
e 1, 2, and 3

	12.5a
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3 Which intermolecular forces is/are present in liquid  $\text{SO}_2$ ?

1. Induced dipole/induced dipole
2. Dipole-dipole
3. Hydrogen bonding

- a** 1 only                      **b** 2 only  
**c** 3 only                      **d** 1 and 2  
**e** 1 and 3

	12.5a
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1 Which of the following molecules is expected to form hydrogen bonds in the pure liquid or solid phase: ethylene glycol ( $\text{HOCH}_2\text{CH}_2\text{OH}$ ), formaldehyde ( $\text{H}_2\text{CO}$ ), and dimethyl ether ( $\text{CH}_3\text{OCH}_3$ )?

- a Ethylene glycol only
- b Formaldehyde only
- c Dimethyl ether only
- d Ethylene glycol and formaldehyde
- e Ethylene glycol, formaldehyde, and dimethyl ether

	12.5b
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2 Which of the following should exhibit hydrogen bonding?

- a  $\text{CH}_3\text{OH}$
- b  $\text{CH}_4$
- c  $\text{PH}_3$
- d  $\text{LiH}$

	12.5b
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3 Hydrogen bonding occurs in molecules when

- a A hydrogen atom forms a covalent bond with another atom
- b A hydrogen atom forms covalent bonds with more than one atom
- c A hydrogen atom bonded to a small electronegative atom is attracted to an electron pair on an electronegative atom on an adjacent molecule
- d A hydrogen atom forms an ionic bond with another atom
- e None of the above

	12.5b
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## AP Chemistry Multiple Choice Questions - Chapter 12

1 Which of the following nonpolar molecules has the highest boiling point?

- a  $F_2$     b  $CH_4$   
c  $N_2$     d  $O_2$   
e  $CO_2$

12.5d

2 Which of the following molecules has the lowest boiling point?

- a  $CH_4$      b  $CHCl_3$   
c  $CH_2Cl_2$     d  $CH_3Cl$   
e  $CCl_4$

12.5d

358 Which of the following lists the substances  $F_2$ , HCl, and HF in order of increasing boiling point?

- a  $HF < HCl < F_2$                                     b  $HF < F_2 < HCl$   
c  $HCl < F_2 < HF$                                     d  $HCl < HF < F_2$   
e  $F_2 < HCl < HF$

12.5d

140 Which of these substances has the lowest boiling point?

- a NaCl     b HF  
c  $H_2O$      d  $H_2$

12.5d

141 Which of these substances has the highest melting point?

- a  $Cl_2$      b  $H_2O$   
c KCl    d  $CaCl_2$

12.5d

142 Which of these substances has the highest boiling point?

- a  $H_2O$      b  $H_2Se$   
c  $H_2S$      d  $H_2Te$

12.5d

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138 Which of these statements is true?

- a The vapor pressure of a liquid increases with decreasing temperature
- b The boiling point of a liquid is independent of atmospheric pressure
- c Vapor pressure varies directly with volume
- d The higher the boiling point of a liquid at 1 atm atmospheric pressure, the greater the internal cohesive forces of the liquid.

	12.6a
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176 Butane has a boiling point of  $-0.5^{\circ}\text{C}$ . It is used inside a butane torch and yet it does not boil inside at room temperature. Which statement is correct?

- a  $\Delta H_v$  of butane is larger than indicated by the boiling point and this prevents boiling
- b Intermolecular forces are large and significant between butane molecules and the surface of the inside walls of the torch
- c The internal pressure in the torch is higher than atmospheric pressure and this increases the boiling point
- d Intermolecular forces between butane molecules increase with temperatures above the boiling point and this prevents boiling

	12.6a
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2 A phase diagram of a pure compound has a triple point at  $18^{\circ}\text{C}$  and 72 mm Hg, a normal melting point at  $21^{\circ}\text{C}$ , and a normal boiling point at  $87^{\circ}\text{C}$ . Which of the following statements regarding this compound is/are correct?

1. The density of the solid is greater than that of the liquid
2. Sublimation occurs if starting with a solid at constant temperature of  $17^{\circ}\text{C}$  the pressure is decreased until a phase change occurs
3. Condensation occurs if the temperature is decreased from  $55^{\circ}\text{C}$  to  $13^{\circ}$  at constant pressure of 1.00 atm.

- a 1 only
- b 2 only
- c 3 only
- d 1 and 2 only
- e 1, 2, and 3

	12.6a
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## AP Chemistry Multiple Choice Questions - Chapter 12

**3** The phase diagram for CO<sub>2</sub> has a triple point at -56.6°C and 5.19 atm, and a critical point at 31.0°C and 73 atm. The solid and gas phases are in equilibrium at -78.7°C and 1.00 atm. Which of the following statements regarding CO<sub>2</sub> is/are correct?

	<b>12.6b</b>
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1. Sublimation occurs if the temperature of the solid phase is increased from -79.0°C to 0.0°C at a constant pressure of 2.5 atm.
2. CO<sub>2</sub> is a supercritical fluid at 55°C and 75 atm.
3. Only the gas phase exists at a temperature of -56.6°C and a pressure of 1.00 atm.

- a** 1 only    **b** 2 only  
**c** 3 only    **d** 1 and 2 only  
**e** 1, 2, and 3

**2** Which of the following statements is NOT true in relation to a system that has reached a critical temperature?

	<b>12.6b</b>
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- a** The system must be a closed system  
**b** The system can be described as a homogeneous fluid  
**c** Substances can have more than one critical temperature  
**d** A surface between the liquid and vapor phases no longer exists

**3** Which of the following is NOT true in relation to the triple point on a single component phase diagram?

	<b>12.6b</b>
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- a** The point at which solid, liquid, and gaseous phases for a substance co-exist  
**b** The triple point for a substance occurs at a specific temperature and pressure  
**c** The triple point exists at a single temperature and is independent of pressure  
**d** The system must be enclosed so that no vapor may escape

## AP Chemistry Multiple Choice Questions - Chapter 12

- 1 The viscosity of a liquid
- a Increases with increasing temperature
  - b Decreases with increasing temperature
  - c Increases with increasing quantity
  - d Decreases with decreasing quantity

	<b>12.6c</b>
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- 2 What property of water refers to water's ability to stick to itself?
- a Capillary Action
  - b Surface Tension
  - c Cohesion
  - d Adhesion

	<b>12.6c</b>
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- 3 What property of water refers to water's ability to stick to other things?
- a Capillary Action
  - b Surface Tension
  - c Cohesion
  - d Adhesion

	<b>12.6c</b>
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	12.6d
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