

## Solids, Liquids & IMF's Practice

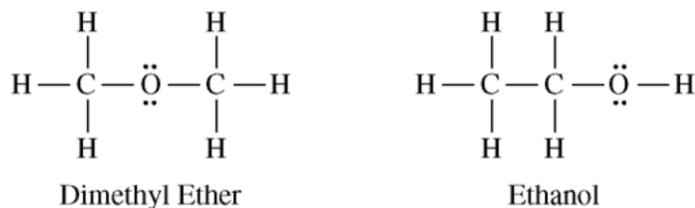
1. Use appropriate chemical principles to account for each of the following observations. In each part, your response must include specific information about both substances.

(a) At 25° C and 1 atm, F<sub>2</sub> is a gas whereas I<sub>2</sub> is a solid.

(b) The melting point of NaF is 993° C, whereas the melting point of CsCl is 645° C.

2. Answer the following questions by using principles of molecular structure and intermolecular forces.

(a) Structures of the dimethyl ether molecule and the ethanol molecule are shown below. The normal boiling point of dimethyl ether is 250 K, whereas the normal boiling point of ethanol is 351 K. Account for the difference in boiling points. You must discuss both of the substances in your answer.



(b)  $\text{SO}_2$  melts at 201 K, whereas  $\text{SiO}_2$  melts at 1,883 K. Account for the difference in melting points. You must discuss both of the substances in your answer.

(c) The normal boiling point of  $\text{Cl}_2(l)$  (238 K) is higher than the normal boiling point of  $\text{HCl}(l)$  (188 K). Account for the difference in normal boiling points based on the types of intermolecular forces in the substances. You must discuss both of the substances in your answer.

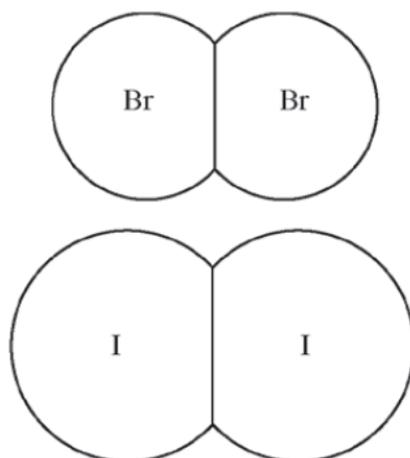
### Multiple Choice

3. The London (dispersion) forces are weakest for which of the following gases under the same conditions of temperature and pressure?
- (a)  $\text{H}_2$
  - (b)  $\text{O}_2$
  - (c)  $\text{F}_2$
  - (d)  $\text{N}_2$
4. Which of the following best accounts for why  $\text{C}_4\text{H}_{10}$  has a higher normal boiling point than  $\text{CH}_4$ ?
- (a)  $\text{C}_4\text{H}_{10}$  exhibits more hydrogen bonding than  $\text{CH}_4$
  - (b)  $\text{C}_4\text{H}_{10}$  has greater dispersion forces than  $\text{CH}_4$
  - (c)  $\text{C}_4\text{H}_{10}$  is a more polar molecule than  $\text{CH}_4$
  - (d)  $\text{C}_4\text{H}_{10}$  has a higher molar mass than  $\text{CH}_4$

Substance	Equilibrium Vapor Pressure at 20°C (torr)
$C_6H_6(l)$	75
$C_2H_5OH(l)$	44
$CH_3OH(l)$	92
$C_2H_6O_2(l)$	0.06

5. Based on the data in the table above, which of the following liquid substances has the weakest intermolecular forces?

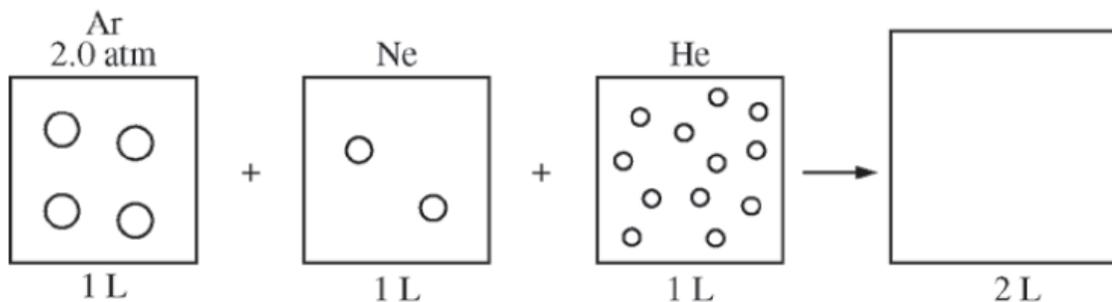
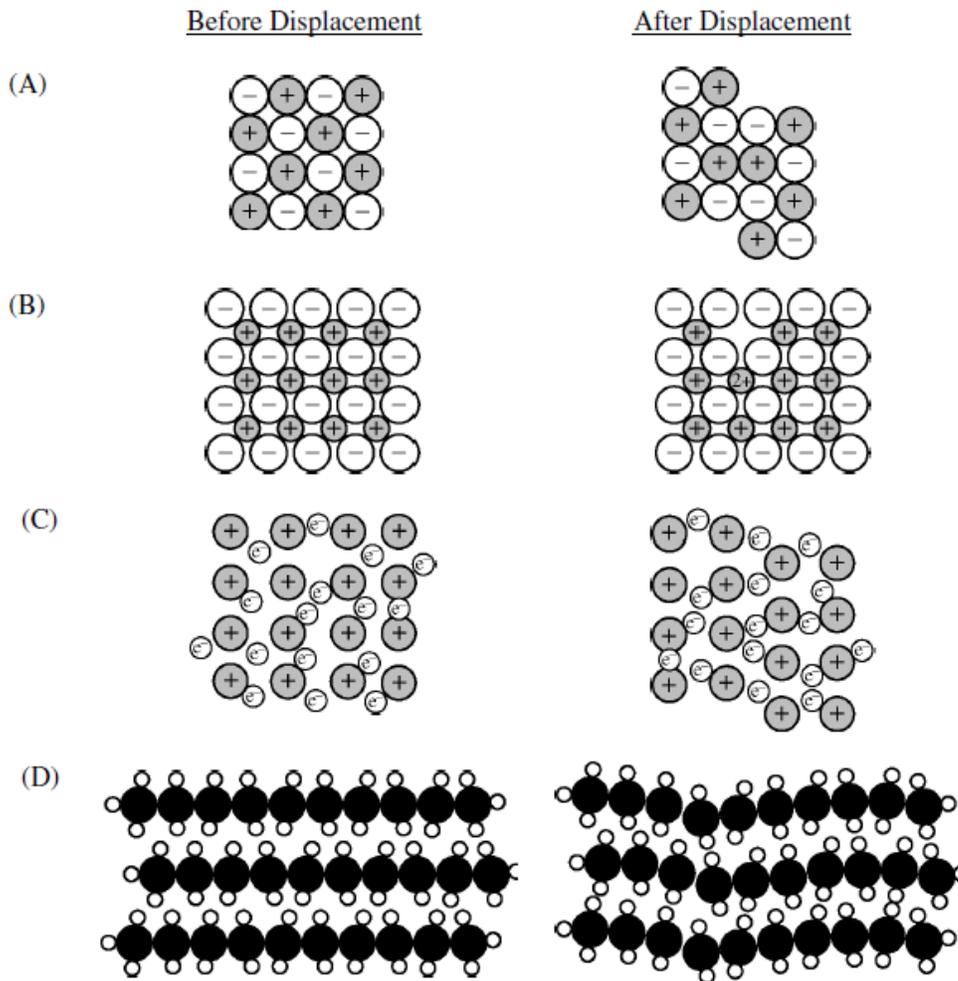
- (a)  $C_6H_6(l)$
- (b)  $C_2H_5OH(l)$
- (c)  $CH_3OH(l)$
- (d)  $C_2H_6O_2(l)$



6. The diagram above shows molecule of  $Br_2$  and  $I_2$  drawn to the same scale. Which of the following is the best explanation for the difference in the boiling points of liquid  $Br_2$  and  $I_2$ , which are  $59^\circ C$  and  $184^\circ C$ , respectively?

- (a) Solid iodine is a network covalent solid, whereas solid bromine is a molecular solid.
- (b) The covalent bonds in  $I_2$  molecules are weaker than those in  $Br_2$  molecules.
- (c)  $I_2$  molecules have electron clouds that are more polarizable than those of  $Br_2$  molecules, thus London dispersion forces are stronger in liquid  $I_2$ .
- (d) Bromine has a greater electronegativity than iodine, thus there are stronger dipole-dipole forces in liquid bromine than in liquid iodine.

7. Which of the following diagrams best illustrate how a displacement in an ionic crystal results in cleavage and brittleness?



8. The figure above represents three sealed 1.0 L vessels, each containing a different inert gas at 298 K. The pressure of Ar in the first vessel is 2.0 atm. The ratio of the numbers of Ar, Ne, and He atoms in the vessels is 2 : 1 : 6, respectively. After all the gases are combined in a previously evacuated 2.0 L vessel, what is the total pressure of the gases at 298 K?

- (a) 3.0 atm
- (b) 4.5 atm
- (c) 9.0 atm
- (d) 18 atm