

AP Chemistry – Gases / Intermolecular Forces – 24

Name _____ Per ____

1. A 1.000 mole sample of CO_2 is confined to a 3.000 L container at 0.0°C . Calculate the pressure of the gas using (a) the ideal-gas law, and (b) the van der Waals equation.
2. Mesitylene, a hydrocarbon that occurs in small amounts in crude oil, has an empirical formula of C_3H_4 . The experimentally determined molecular weight of this substance is 121 g. What is the molecular formula of mesitylene?
3. Which of the following statements best explains why a closed balloon filled with helium rises in air?
- (a) Helium is a monatomic gas, whereas nearly all the molecules that make up air, such as nitrogen and oxygen are diatomic.
 - (b) The average speed of helium atoms is higher than the average speed of air molecules, and the higher speed of collisions with the balloon walls propels the balloon upwards.
 - (c) Because the helium atoms are of lower mass than the average air molecule, the helium gas is less dense than air. The balloon thus weighs less than the air displaced by its volume.
 - (d) Because helium has a lower molar mass than the average air molecule, the helium atoms are in faster motion. This means that the temperature of the helium is higher than the air temperature. Hot gases tend to rise.
4. The metabolic oxidation of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$ in our bodies produces CO_2 , which is expelled from our lungs as a gas: $\text{C}_6\text{H}_{12}\text{O}_{6(\text{aq})} + 6\text{O}_{2(\text{g})} \rightarrow 6\text{CO}_{2(\text{g})} + 6\text{H}_2\text{O}_{(\text{l})}$
Calculate the volume of dry CO_2 produced at body temperature (37°C) and 0.970 atm when 24.5 g of glucose undergoes this reaction.

5. A mixture of gases contains 0.75 mol of N_2 , 0.30 mol of O_2 and 0.15 mol of NH_3 . If the total pressure of the mixture is 1.56 atm, what is the partial pressure of each component?
6. Benzoic acid melts at 122°C . The density of the liquid at 130°C is 1.08 g/mL where the density of the solid at 15°C is 1.27 g/mL. In which state is the average distance between molecules greater? Explain.
7. List the type(s) of intermolecular force that is/are common to:
- (a) Xe and CH_3OH
 - (b) CH_3OH and CH_3CN
 - (c) NH_3 and HF
8. Which member of the following pairs has the stronger intermolecular dispersion forces? Explain.
- (a) Br_2 or O_2
 - (b) $\text{CH}_3\text{CH}_2\text{SH}$ or $\text{CH}_3\text{CH}_2\text{CH}_2\text{SH}$
 - (c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ or $(\text{CH}_3)_2\text{CHCl}$
9. Identify the types of intermolecular forces present in each of the following substances, and select the substance in each pair that has the higher boiling point. Explain in each case.
- (a) C_6H_{14} or C_8H_{18}
 - (b) C_3H_8 or CH_3OCH_3
 - (c) HOOH or HSSH
 - (d) NH_2NH_2 or CH_3CH_3