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## Intermolecular Force Questions

2. (5 points) Which of the following intermolecular forces can ideal gases experience? Select all that apply.
- Dipole-dipole interactions.
  - London forces.
  - Hydrogen bonds.
  - None of these.
3. (5 points) Which of the following will an ideal gas never do? Select the one best answer.
- Mix with other ideal gases.
  - Expand when heated.
  - Condense to form a liquid.
  - Exert pressure on its container.
4. (2 points) Which compound of the two given below can form the strongest hydrogen bonds?  
 $\text{H}_3\text{C}-\text{O}-\text{H}$                       or                       $\text{H}-\text{F}$
5. (2 points) Which compound of the two given below has the strongest dipole-dipole interactions?  
 $\text{H}_3\text{C}-\text{Cl}$                       or                       $\text{H}_3\text{C}-\text{Br}$
6. (2 points) Which compound of the two given below has the strongest London interactions?  
 $\text{Cl}_2$                       or                       $\text{Br}_2$
8. (4 points) Explain conceptually why the latent heat of fusion (melting) for a substance is always less than the same substance's latent heat of vaporization.

11. (15 points) Three compounds with similar structures and similar molar masses are shown below, along with their molar masses and boiling temperatures.

Name	Structure	molar mass, g	boiling temperature, °C
2-methylpropane	$  \begin{array}{c}  \text{H} \\    \\  \text{H} \quad \text{H}-\text{C}-\text{H} \\    \quad   \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H}  \end{array}  $	58	-11.7
propanone	$  \begin{array}{c}  \text{H} \quad :\text{O}: \quad \text{H} \\    \quad    \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad \quad   \\  \text{H} \quad \quad \text{H}  \end{array}  $	58	56.0
2-propanol	$  \begin{array}{c}  \text{H} \\    \\  \text{H} \quad :\text{O}: \quad \text{H} \\    \quad   \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H}  \end{array}  $	60	82.5

Explain why the boiling temperature of propanone is higher than the boiling temperature of 2-methylpropane, and why the boiling temperature of 2-propanol is higher than the boiling temperature of propanone.

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## Gas Stoichiometry Questions

7. Santanna, inspired by the movie *Backdraft*, tries to figure out how much gasoline she would have to burn to completely consume all the oxygen from the air in a small room. The room she has in mind has a volume of 60.0 cubic meters, which is 60,000 liters.
- a. (5 points) The mole fraction of oxygen gas,  $O_2$ , in air is 0.21. When the air pressure in the room is 0.960 atmospheres, what is the partial pressure of oxygen in the air, in atmospheres?
- b. (5 points) The temperature of the air in the room is 20 °C. How many moles of oxygen are contained in the air in the room?
- c. (5 points) Gasoline is a mixture of many different compounds. For this question, we will model it as being composed only of octane, which has the formula  $C_8H_{18}$ . Balance the equation below for the combustion of octane and use the resulting coefficients to tell me how many moles of octane are needed to react with all of the oxygen in the room.



Moles of  $C_8H_{18}$  needed: \_\_\_\_\_

- d. (5 points) What mass of octane is this?



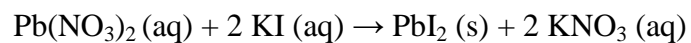
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### Plug-and-Chug Questions

1. (5 points) The tires of Airy's car are inflated to the recommended pressure of 32 psi when the air temperature is 22 °C. But Airy lives in Aroostook County, Maine, where on a clear January morning the air temperature is -24 °C. Tires aren't like balloons; they keep approximately constant volume as the air pressure inside them changes. Assuming that the tire's volume is constant, what is the tire pressure (in psi) on this clear County morning?
  
  
  
  
  
  
  
  
  
  
9. (5 points) Alixe makes a solution by dissolving 1.43 mol of pyridine in water to a total volume of 1.50 L. What is the concentration of pyridine in the solution, in moles per liter?
  
  
  
  
  
  
  
  
  
  
10. (5 points) The latent heat of fusion (melting) for CCl<sub>4</sub> is 174 J/g. The latent heat of vaporization of nitrogen N<sub>2</sub> is 199 J/g. Javier has a container of liquid nitrogen at its boiling point of 77 K. He holds a flask containing 15.0 grams of liquid CCl<sub>4</sub> in the nitrogen so that the CCl<sub>4</sub> is cooled down by the liquid nitrogen. Soon, the CCl<sub>4</sub> cools down to its freezing temperature and begins to freeze. What mass of liquid nitrogen must boil to absorb the heat given off by the freezing CCl<sub>4</sub>?
  
  
  
  
  
  
  
  
  
  
12. (5 points) Alton pours 0.450 liters of a 0.15 M sucrose solution into a bowl. How many moles of sucrose is this?

13. (5 points) For a chemistry lab, Grai wants to make a precipitate of lead (II) iodide by the reaction



using  $1.50 \times 10^{-4}$  moles  $\text{Pb}(\text{NO}_3)_2$ . What volume of 0.100 M KI solution will Grai need to just precipitate out all the lead from the solution? The molar mass of lead(II) nitrate is 331.208 g.

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### Concentration and Solution Stoichiometry Questions

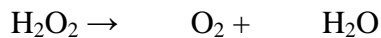
14. Phonics buys a 1-liter bottle of 3.0% hydrogen peroxide,  $\text{H}_2\text{O}_2$ , from Evil-Mart. The “3.0%” is the mass fraction of  $\text{H}_2\text{O}_2$  in the solution, with the remainder of the solution being the solvent water. The molar mass of  $\text{H}_2\text{O}_2$  is 34.014 g, and the molar mass of water is 18.015 g. The density of the 3% hydrogen peroxide solution is 1.00 kg/L.

a. (5 points) What is the mole fraction of  $\text{H}_2\text{O}_2$  in the solution?

b. (5 points) What is the *molality* of  $\text{H}_2\text{O}_2$  in the solution?

c. (5 points) How many moles of  $\text{H}_2\text{O}_2$  are contained in one liter of the solution?

d. (5 points) If all the  $\text{H}_2\text{O}_2$  in the solution decomposes to  $\text{O}_2$  and water, how many moles of  $\text{O}_2$  are produced? Balance the reaction equation to help you find out.



Moles of  $\text{O}_2$ : \_\_\_\_\_