

1. (10 pts.) a. Compounds that have low melting points have strong or weak intermolecular forces? Explain your answer. 1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

b. Which compound would have the higher boiling point, the compound with strong intermolecular forces or the one with weak intermolecular forces? Explain your answer. 4. \_\_\_\_\_

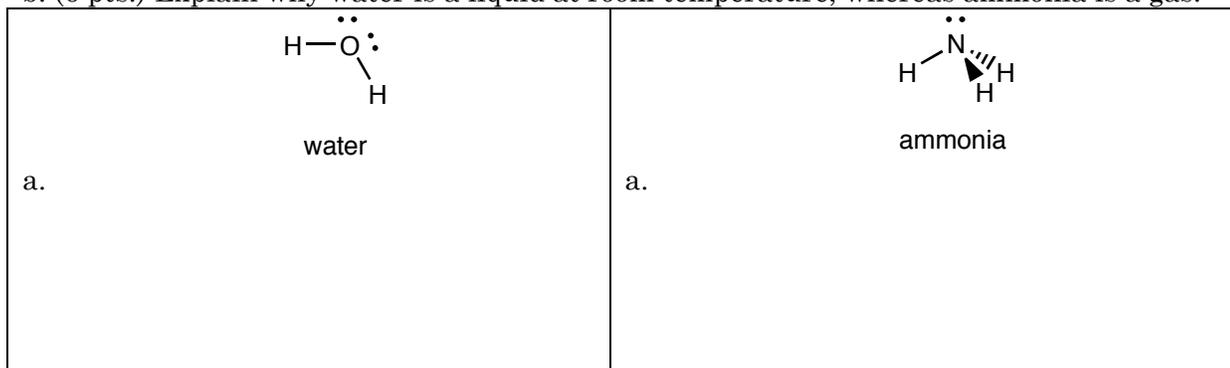
5. \_\_\_\_\_

6. \_\_\_\_\_

2. At room temperature, water is a liquid and ammonia is a gas. The structures for the two molecules are drawn below. 7. \_\_\_\_\_

a. (6 pts.) List the intermolecular forces that each of the molecules can use to interact with other identical molecules. 8. \_\_\_\_\_

b. (6 pts.) Explain why water is a liquid at room temperature, whereas ammonia is a gas. 9. \_\_\_\_\_



10. \_\_\_\_\_

11. \_\_\_\_\_

12. \_\_\_\_\_

13. \_\_\_\_\_

14. \_\_\_\_\_

b. 15. \_\_\_\_\_

16. \_\_\_\_\_

3. (8 pts.) Which of the following statements is true?

\_\_\_\_\_ a. A mole of items is equal to the number of  $^{12}\text{C}$  atoms whose total mass is exactly 12 grams.

\_\_\_\_\_ b. A mole of items is 12 items.

\_\_\_\_\_ c. There are the same number of atoms in 14.01 g of N as there are in 55.85 g of Fe.

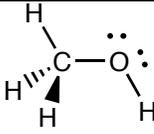
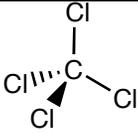
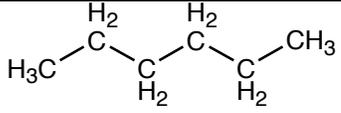
\_\_\_\_\_ d. The mass of a mole of carbon atoms is the same as the mass of a mole of oxygen atoms.

4. For small molecules (masses of 60 grams per mole or less), rank the following intermolecular forces in order of increasing strength (weakest to strongest).

dipole-dipole interactions      hydrogen bonds      London dispersion forces

5. Three molecules are drawn below. They are all liquids.

- a. (9 pts.) List the intermolecular forces that each of the molecules can use to interact with other identical molecules.

 <p style="text-align: center;">methanol</p>	 <p style="text-align: center;">carbon tetrachloride</p>	 <p style="text-align: center;">hexane</p>
a.	a.	a.

- b. (5 pts.) Which two liquids would be most likely to be miscible (dissolve in each other)?

6. Lead ions react with chloride to form lead(II) chloride according to the equation written below.



- a. (2 pts.) In the equation written above, what does the “(aq)” mean?
- b. (2 pts.) In the equation written above, what does the “(s)” mean?
- c. (4 pts.) If 36 formula units (“molecules”) of NaCl are floating around in solution, how many molecules of PbCl<sub>2</sub> can be formed.
- d. (4 pts.) How many moles of NaCl are needed to react with 1.37 moles of Pb<sup>2+</sup>? Show work to receive credit.

7. (10 pts.) a. Two shots of gin (90 mL of 80 proof gin) that is 40% alcohol by volume contains how many mL of alcohol?

b. How many mL of wine, which is 12% alcohol by volume, would contain the same amount of alcohol?

8. (2 pts each) Identify the acids in the following table. Circle the acidic H on each acid.

$\begin{array}{c} \text{H}-\text{Br}:\text{:} \\ \text{:} \\ \text{:} \end{array}$	$\begin{array}{c} \text{H}-\text{S}-\text{H} \\ \text{:} \\ \text{:} \end{array}$	$\begin{array}{c} \text{:Cl}-\text{H} \\ \text{:} \\ \text{:} \end{array}$
$\begin{array}{c} \text{:O}:\text{:} \\   \\ \text{H}-\text{O}-\text{Br}-\text{O}:\text{:} \\   \\ \text{:O}:\text{:} \end{array}$	$\begin{array}{c} \text{:O}:\text{:} \quad \text{H} \quad \text{:O}-\text{H} \\    \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	$\begin{array}{c} \text{H} \quad \text{:O}:\text{:} \\   \quad    \\ \text{:Cl}-\text{C}-\text{C}-\text{O}-\text{H} \\   \\ \text{:Cl}:\text{:} \end{array}$
$\begin{array}{c} \text{H}-\text{P}-\text{H} \\   \\ \text{H} \end{array}$	$\begin{array}{c} \text{H}-\text{O}:\text{:} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	$\begin{array}{c} \text{:O}-\text{H} \\   \\ \text{O}=\text{N}-\text{O}:\text{:} \\ \text{:} \end{array}$

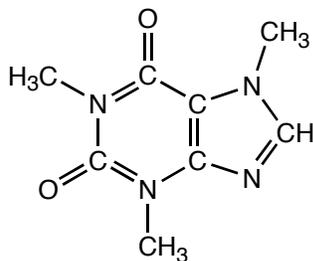
9. a. (8 pts.) For the laboratory activity where you determined the amount of salt (NaCl) in a piece of bread by isolating and weighing the AgCl that precipitated from the reaction of  $\text{Ag}^+$  ions with  $\text{Cl}^-$  ions, an aqueous  $\text{AgNO}_3$  solution was needed. How many moles of  $\text{AgNO}_3$  are needed to make 500 mL of the 0.100 M  $\text{AgNO}_3$  solution used in lab?

b. (6 pts.) How many grams of  $\text{AgNO}_3$  would be needed to make the solution in part a?

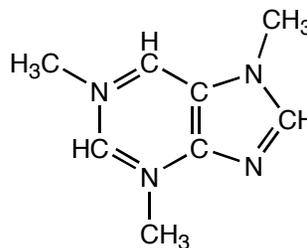
10. Thin layer chromatography (TLC) plates are typically coated with alumina ( $\text{Al}_2\text{O}_3$ ) or silica gel ( $\text{SiO}_2$ ).

a. (4 pts.) Are these coatings polar or non-polar?

b. (4 pts.) If the two materials drawn below were placed on an alumina-coated TLC plate, which one would travel farther up the plate A or B as the solvent travels up the plate?

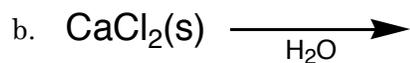
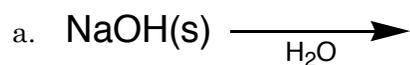


**A**



**B**

11. (3 pts. ea.) What happens when the following ionic compounds dissolve?



12. (3 pts.) Excluding acids, when covalently bonded molecules like  $\text{CH}_3\text{OH}$  dissolve, do they break apart into ions?

13. (4 pts.) Bases are ionic compounds that release what ion(s) when they dissolve?

14. a. (8 pts.) Write the balanced chemical equation for the reaction of stomach acid (HCl) with the antacid  $\text{CaCO}_3$ .

b. (4 pts.) Why do antacids like  $\text{CaCO}_3$  make some people burp?

15. When carbon dioxide ( $\text{CO}_2$ ) reacts with water ( $\text{H}_2\text{O}$ )  $\text{H}_2\text{CO}_3$  forms. How does the changing concentration of  $\text{CO}_2$  in our atmosphere effect the pH of the world's oceans.

16. (10 pts.) Determine the number of moles of HCl needed to neutralize 3.0 moles of  $\text{Mg}(\text{OH})_2$ .