Recitation Worksheet 5: Properties of Solutions (11.1 – 11.3)

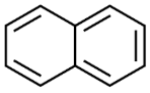
Name: | MyID:

Instructions:

1. Please enter your first and last name as it appears on the eLC classlist (do not use a nickname).
2. Your UGA myID is a combination of letters and numbers (example: Dr. Abdelrahman MyID is ema88805). **Do not use your 81x number.**
   a. If you do not have access to a printer, type your answers in the worksheet PDF and then upload it to **Gradescope** by Friday, February 24th at 11:59 pm. Write your work on separate sheets of paper, convert to a PDF and upload to the "Recitation Worksheet 4 Dropbox" on eLC.
   b. If you are using an app to annotate the worksheet, make sure the pages are in the correct order and have the same layout as the original or Gradescope will not be able to read it.
   c. If you have access to a printer, print out the worksheet, write your answer in the answer boxes, and show your work on it when appropriate. Then convert it to a PDF and upload to **Gradescope** by Friday, February 24th at 11:59 pm. You do not need to upload anything to eLC. The pages must be in the correct order and have the same layout as the original, or Gradescope will not be able to read it.
   d. There is a **Gradescope App** available for both iOS and Android devices that allows you to scan and submit your printed work or you can submit your fillable PDF directly. Detailed instructions on how to access and use the app can be found on your CHEM 1212 class eLC page under content ⟶ Welcome module ⟶ Gradescope ⟶ Gradescope new mobile app.
3. Answers must be written in the corresponding answer box, or no credit will be awarded.
4. The instructions for uploading worksheets to Gradescope can be found in the Content area of eLC in the Welcome Module.

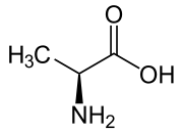
1. Substances that dissolve in water (H_2O) generally do not dissolve in benzene (C_6H_6). However, some substances are moderately soluble in both. Which of the substances below do you think would be **moderately** soluble in **both** water and benzene?

A. Naphthalene

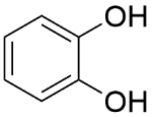


B. *para*-dichlorobenzene

C. Alanine (an amino acid)



D. *ortho*-hydroxyphenol



2. You want to prepare a perfectly roasted turkey for a family gathering and you must soak the turkey for at least 8 hours in a 3.87% by mass brine solution (a solution consisting of salt (NaCl) dissolved in water). How many liters of water are needed to dissolve 725 g of NaCl to prepare the 3.87% by mass brine solution? Keep your answer to three sig figs.

[ ] L

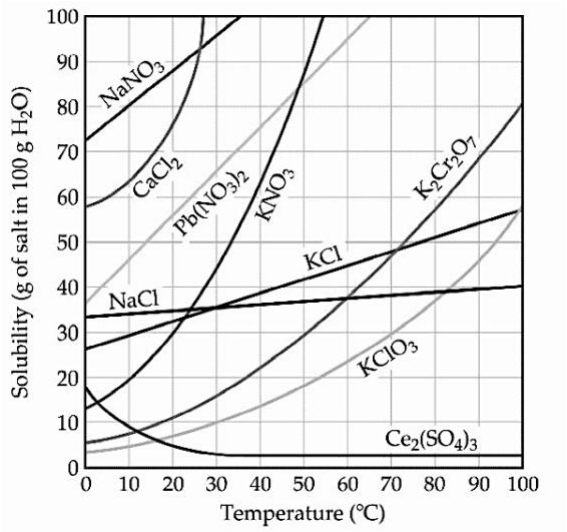
3. In CHEM 1212 lab, you are working on a freezing point depression experiment, and you decide to perform a rather dangerous trial. Instead of water as a solvent and $CaCl_2$ as a solute, you decide to use carbon disulfide (neurotoxic agent) as a solvent and iodine as a solute. In the first step you want to prepare a 0.286 *m* solution of iodine in carbon disulfide. How many grams of iodine (I_2) must be dissolved in 625 mL of carbon disulfide solvent (CS_2, density = 1.261 g/mL) to produce the 0.286 *m* solution? Keep your answer to three sig figs.

[ ] g

4. Henry's law constant for gas X is 3.30×10^{-2} M/atm. What total volume of solution is needed to completely dissolve 1.65 L of gas at a pressure of 725 torr and a temperature of 25 °C? Keep your answer to three sig figs.

[ ] L

5. Refer to the plot below solubility versus temperature to answer the following question.



A solution that is 2.75 *m* of potassium chlorate (molar mass = 122.55 g/mol) at 95 °C is considered

[ ]

A. Hydrated
B. Unsaturated
C. Saturated
D. Supersaturated
E. Dehydrated

6. Phosphoric acid is commonly used as a cleaning detergent for removal of rust and stains. If a commercial detergent contains 26.0% by mass H_3PO_4 and has a density of 1.148 g/cm^3 at 30 °C. What is the
   A. Molality of H_3PO_4 in the detergent solution? Keep your answer to three sig figs.

   ☐ *m*

   B. Molarity of H_3PO_4 in the solution? Keep your answer to three sig figs.

   ☐ M

   C. Mole fraction of H_3PO_4 in the detergent solution? Keep your answer to three sig figs.

   ☐

7. Which cation is expected to have the largest hydration energy?

   ☐

   A. Li^+
   B. Ca^{2+}
   C. Ba^{2+}
   D. Cs^+
   E. Al^{3+}

8. A water sample is found to have 9.4 ppb of chloroform, $CHCl_3$. How many grams of $CHCl_3$ would be found in a glass of this water? (One glass of water = 250 mL). <u>Keep your answer to two sig figs and use scientific notation.</u>

   ☐ x 10 ☐ g

9. You are performing an experiment which requires you to prepare a 0.250 m KOH solution, but you only have a 100.0 mL of a stock (concentrated) solution containing 109.2 g/L KOH (density = 1.012 g/cm^3). What is the mass of water needs to be added to the 100 mL stock solution to obtain 0.250 *m* KOH solution? **<u>(This is a bonus question. If you chose not to answer this question your grade will not be affected).</u>**

   ☐ g

10. Lithium iodide (LiI) is used as a solid-state electrolyte for **high-temperature batteries**. When LiI is dissolved in water, the solution becomes hotter. Which of the following statement(s) is true?

    ☐

    A. The dissolution of LiI is exothermic
    B. $|\Delta H_{solute}| < |\Delta H_{hydration}|$
    C. ΔH_{soln} is negative and ΔS_{soln} is positive
    D. The solute-solvent interaction is greater than the solute-solute and the solvent-solvent interaction
    E. All the above statements are true

11. The concentration nitrogen gas in the ocean at 25 °C is 445 μM and Henry's law constant for nitrogen is 0.61×10^{-3} mol/L·atm.

    A. What is the mass of nitrogen in a liter of ocean's water? Keep your answer to three sig figs.

    ☐ g

    B. Calculate the partial pressure of N_2 in the atmosphere. Keep your answer to two sig figs.

    ☐ atm

12. A person is considered legally intoxicated with a blood alcohol level of 80. mg/dL. If blood plasma has a density of 1.025 g/mL, what is this concentration expressed in **ppm**? Keep your answer to two sig figs.

    ☐ ppm

13. Calculate the mole fraction of the solute in each of the following solutions:
    A. 0.112 M $C_6H_{12}O_6$ (density = 1.006 g/mL). Keep your answer to three sig figs.

B. 3.20% C_2H_5OH by volume (density of pure C_2H_5OH= 0.789 g/mL). Keep your answer to three sig figs.