Chemistry 329 Name: _____ Group Name:_____ Section: _____

Other group members: _____

**Project Literature Part 1: *Deconstructing an article on cloud-point extraction and Fe detection in beer***
*Due Jan 25 in discussion. You will work in groups, but please submit your individual answers.*

Before your first day in this class, you were asked to read through Filik and Giray's article[1] on cloud-point extraction (CPE) and iron detection in beer samples, which is a central piece of literature for your Chemistry 329 project. Reading directly from a peer-reviewed journal can initially seem like daunting task! Hopefully, this activity will help you to extract the key aspects of this article that relate to your project; namely, the authors' ***motivation*** and ***main findings***, as well as the chemistry and rationale behind the ***methods*** of the paper. It will also guide you towards knowing what to look for in future articles you read – a very valuable skill for any scientist or engineer!

You'll notice from the syllabus that the laboratory project spans a significant portion of the schedule. In this project, you will work with your group members to adapt the methods described in Filik's paper to determine the iron content and speciation in beer samples. You'll also develop methods using chromatographic techniques to discover other chemical species important to the taste profile of beer. This project is intentionally designed as an open-ended, research experience. Your group will find the tasks challenging, and it's true not everything will work perfectly the first or even second time through. While this class investigates methods and techniques important to the process of chemical measurement, more important is ability to critically evaluate a measurement or calculation, and support or defend it as the correct one (or not). Science education research (shown in Figure 1) supports that working in groups, where ideas are shared through discussion and debate, is an effective way to gain mastery of the content.

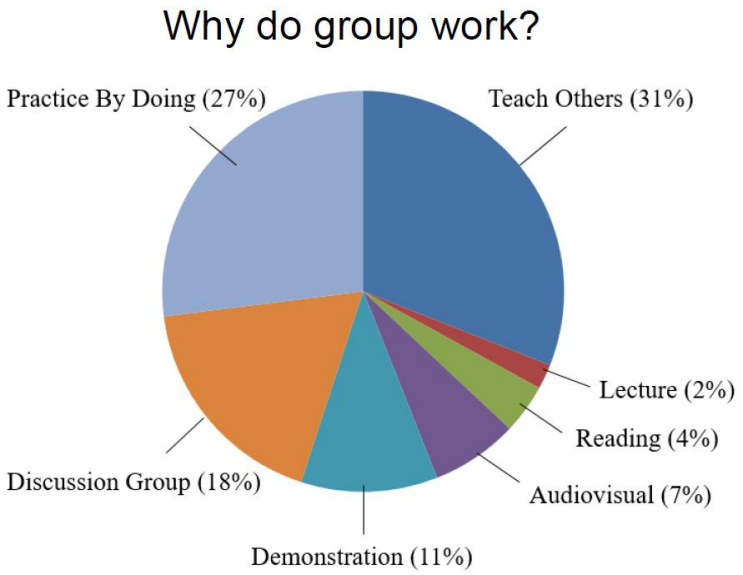



*Figure 1: Pie chart showing average retention rate after a 24 hour period from different teaching methods. (Reproduced from Elizabeth F. Barkley, Student Engagement Techniques: A Handbook for College Faculty, 2010 John Wiley and Sons, Inc.)*

[1] Filik, H., and Giray, D.; *Food Chemistry.* **2012**, *130*, 209-213.

After you finish the Weighing lab during the first period, work with your classmates and TA to form groups for the semester. Meet with your group members and decide on a group name. Have fun with this task! We are especially fond of group names with incorporated chemistry terms. After deciding on a group name, discuss the Filik article with your team mates using the questions below. Keep discussions respectful. If you don't understand a point of view, be curious and ask questions about it. If you disagree, use facts as you understand them to support your opposing viewpoint. Well-functioning groups tend to have members step into roles, such as, a lead or strategist, recorder, a skeptic, and a creative thinker. Good groups naturally have members share or exchange these roles in lively conversations, but this doesn't necessarily have to be true for your group to succeed. As you navigate these questions below, reflect on which role(s) you seem to feel most comfortable in making contributions to the team. As the tasks get more difficult, it will be important to identify each other's strengths and leverage them to make good progress on your projects.

A hard copy of the answers to the questions below is due to your TA by the beginning of discussion. Hand in your own answers to the questions. **For questions with an asterisk (*), make sure to reference a figure or section from the Filik paper in supporting your answers.**

**A. Motivation**

1. *What (according to the authors) is the paper's main contribution to the field of food chemistry? [1pt]

2. What do the authors mean by *"speciation"* of iron in beer (what species are we distinguishing between?) [1pt]

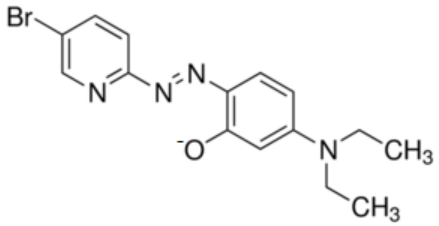
3. *Why is it important to determine (a) the total iron content and (b) the speciation of iron in beer? [2pts]

4. *Identify one problem the authors find in existing methods of measuring iron concentration in beer samples. [1pt]

**B. Methods and Results**

5. What technique is used to *measure* the concentration of Fe(II) in the beer sample? [1pt]

6. Consider the structure of the phenolate (basic form) of 5-Br-PADAP. [3pts]




   (a) Circle the part of this molecule that interacts with Fe(II).
   (b) Identify one reason why maintaining a buffered pH may be important in this experiment.

   (c) When two of these molecules bind to Fe(II), what type of compound is formed, and which of its properties makes it suitable for the technique you identified in Q5?

7. To prepare the buffer solution, the authors mixed acetic acid and sodium acetate solutions and then "adjusted the pH of the resulting solution" (section 2.2). How do you think they adjusted the pH? [1pt]

8. What is the significance of preparing standard Fe(II) solutions within a range of concentrations? [1pt]

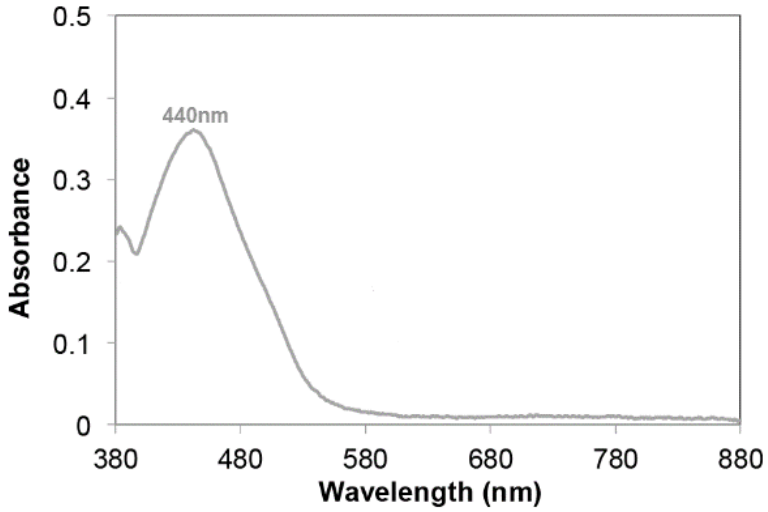
9. Define the terms *surfactant* and *micelle*. Which species acts as a surfactant in this set of experiments? [4pts]

(a) *Why is it challenging to use the reagent 5-Br-PADAP with a beer sample?

(b) *How do the authors get around this difficulty?

10. *What are the two phases that are separated during centrifugation? Which one contains the iron ions? [1pt]

11. A solution prepared in the same way as section 2.4 of the paper, but without any iron, has the following absorption spectrum: [3pts]




(a) Which species is responsible for the absorption at 440 nm?

(b) Sketch the absorption spectrum if the same solution is prepared with Fe(II) present.

(c) *Why do the authors measure the absorbance at 742 nm?

12. *What is the role of ascorbic acid? Do the authors use it for all iron samples they analyze? Why? [2pts]

13. (a) *Describe the role of EDTA as a "*masking agent*."

[2pts]

(b) Based on information from the article, circle the complex that is *most stable* among each pair:

i. Fe(II)-EDTA vs. Fe(II)-5-Br-PADAP

ii. Fe(III)-EDTA vs. Fe(III)-5-Br-PADAP

14. *What information led the authors to choose pH = 5.0 for their experiment?

[1pt]

15. *What information led the authors to choose $1.0 \times 10^{-5}$ mol/L of 5-Br-PADAP for their experiment? [1pt]

**----------THE END (OF THE BEGINNING)! ----------**