Appendix 1
Example Experiments for Each Mode of Delivery for a Liberal Arts Chemistry Course

Simulated labs. As our department had access to a BeyondLabz license, we used this platform for some experiments, particularly to explore **precipitation reactions** and **acid-base titrations**. We did not evaluate different simulation software, but the features available for these two experiments were sufficient for our purposes. Importantly, guided discussions and modified worksheets were provided to students. We chose simulated labs for these experiments so that the students would get the chance to participate in a virtual laboratory. Both experiments had several moving parts that might be lost in a recording or a livestream. A simulated lab, at the very least, allowed the students to "perform" the experiment themselves. In the case of acid-base titrations, a recording was also provided to demonstrate proper titration techniques and use of a buret to supplement the simulated experience. During the discussion of **Beer's law**, we used the University of Colorado's PhET interactive simulations combining a livestream and simulated labs. Students were provided with a worksheet that can be answered by utilizing the interactive tool. The instructor also shared the screen to illustrate some basic principles. This combined mode was effective as it allowed students to simultaneously engage with the material, the instructor, and their peers.

***Livestream*.** We used Microsoft Teams throughout the course as students have access to the Microsoft suite through their university email. For instructor demonstration, we utilized a studio setup with a camera facing the instructor and the front of the room so that demonstration could simultaneously livestreamed and done for face-to-face students. All demonstrations were done in this manner. For student experiments, this format was used for the **density of liquids** lab and the **Briggs-Rauscher reaction**. The density of liquids lab was an introductory lab on the use of glassware. In this case, the instructor played the dual role of a student/instructor discussing the proper use of glassware while going through the motions of the experiment to measure the density of water and an unknown. Remote students are required to engage during the session as the students take turns in telling the "instructor student" what to do to accomplish the tasks. The Briggs-Rauscher reaction experiment was done in pairs of face-to-face and remote students. Students in the laboratory hosted remote students through Teams. Student engagement was apparent in our experience, as this was perhaps the loudest lab and we can actually hear the students communicate with each other.

Recordings. As mentioned in the article, this was done as last resort during a quarantine period. The experiment was the **extraction of fats from chips**. The experimental procedure was relatively simple: washing chips with hexane, decanting, and evaporating residual hexane. While the instructor and an assistant prepared the materials, the students had to record all data. Any measurements were brought to the view of the camera during the video and photos were also taken for clearer view. As such, the students were still responsible for data collection and analysis. In retrospect and as discussed in the article, recordings can be used for preclass demonstrations or to emphasize safety protocols and proper handling of equipment. As these are uploaded for consumption by students asynchronously, they can come back to the material as needed.

Home experiments. At the beginning of the semester, we verified that students had access to a kitchen or a similar space. We also gave them a list of possible materials that might need to be purchased (Pop Rocks, soda, tiny balloons) and gave the students the option to request these

materials and have them sent to their addresses. Two examples used this semester were the quantification of **carbon dioxide in Pop Rocks and soda** (as explained in the article) and **rock candy making**. These are ideal experiments to be done at home as they are relatively easy and also permit student exploration without huge risks of failure. In both experiments, students were encouraged to test variables but were not provided clues as to what can be changed. All students addressed different things. For instance, in the Pop Rocks experiment, students looked at different sodas as well as different temperatures. For the rock candy experiment, some students tested the rate of cooling and using a thermos to slow down the rate of temperature change.