Incorporation of the GEMs item: ***Solventless reactions: the aldol reaction*** submitted by James E. Hutchison into the Organic Chemistry curriculum.

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Summary: This is a nifty five-minute solventless and atom efficient crossed-aldol reaction. The experiment starts with the mixing of two solids which liquefy by melting point depression. The addition of catalytic NaOH effects the formation of the product, causing the clear liquid to change into a yellow solid. The experiment can be used to introduce a variety of concepts within the sophomore organic lab curriculum and could lead into a general introduction of organic chemistry and carbon-carbon bond formation.

Because the procedure is technically trivial, the reaction can be done as one of the first experiments of the course, before the student is familiar with more elaborate lab techniques. Because the reaction mechanism is one of the most elaborate that organic students face, the lab can be utilized late in the second semester when aldol chemistry is typically introduced in lecture. The aldol condensation represents a powerful general method for the construction of carbon-carbon bonds, one of the central themes of synthetic organic chemistry. In this base-catalyzed aldol condensation reaction, deprotonation alpha (adjacent) to a carbonyl group demonstrates enhanced acidity through a resonance-stabilized enolate anion, which then carries out nucleophilic attack at the carbonyl group of the electrophile. This is an opportunity to review resonance structures and the structural rational for pK_a's.

In addition to providing a memorable demonstration of the impact of impurities on melting points and a display of endo and exothermic processes, this experiment highlights the possibility of carrying out organic reactions in the absence of solvents. This can trigger a much needed discussion of the purpose of solvents in organic reactions. The aldol condensation, if effected without dehydration, has an atom economy of 100% and requires only a catalytic amount of acid or base. Even with dehydration, the atom economy remains quite high. Depending on the percent yield, the effective mass yield could be quite high.