

THE PREPARATION OF STERNO®

Materials:

Balance	Calcium acetate
Small beaker	95% ethyl alcohol (C ₂ H ₆ O)
3-inch evaporating dish	Pinch salt (sodium chloride)
50 or 100 mL Graduated cylinder	Tap water
matches	

Safety Precautions:

Wear safety goggles at all times. Avoid breathing alcohol vapors. Since ethyl alcohol is flammable, make sure to clean up spills immediately.

Introduction:

By mixing together a concentrated calcium acetate solution with alcohol, a **gel** is formed. When this gel is burned, it can be used as a heat source similar to the commercial product Sterno®. The gel is a more desirable heat source than pure alcohol because it is less likely to spill.

The exact structure of the gel is not known, but the calcium acetate solution probably traps the alcohol inside a flexible lattice. If the gel were to sit for several days, the alcohol and water would evaporate, leaving behind the solid calcium acetate. *The formation of the gel is a physical phenomenon and not a chemical reaction.*

Procedure:

1. Weigh out 1.5 grams of calcium acetate in a 125 mL beaker.
2. In a graduated cylinder, measure out 5 mL of water (tap water is fine) and add it to the calcium acetate. Stir to dissolve most of the solid (all of it will not dissolve).
3. Add a pinch of salt (sodium chloride) to the calcium acetate solution and stir. (Sodium chloride will make the flame more visible).
4. Your teacher will measure out 40 mL of ethyl alcohol for each group. Add the alcohol to the calcium acetate solution and stir. The gel will form as soon as the alcohol is added.
5. Using a spoon or spatula, transfer the gel to an evaporating dish.
6. **Rinse out all used glassware and return to the cart. Wash your hands. Clear your lab bench of all books, notebooks, and papers.**
7. Once your hands have been washed and your lab bench has been cleared, *carefully* light the gel with the matches provided.

8. Watch the flame carefully for about a minute. Write down any observations. (Your teacher may turn off the light to make the flame more noticeable).
9. To extinguish your flame, cover the evaporating dish with a large (1000 mL) beaker. The evaporating dish gets extremely hot, so use caution. Do not handle the dish until it has cooled completely.

Questions:

1. Write the balanced chemical equation for the combustion of ethyl alcohol (C_2H_6O).
2. Calculate the number of **grams** of ethyl alcohol used in this experiment. The density of ethyl alcohol is 0.784 g/mL.
3. Calculate the number of **moles** of ethyl alcohol used in this experiment.
4. The heat of combustion of ethyl alcohol (ΔH_{comb}) is -1368 kJ/mol. Assuming that all of the alcohol in your gel is burned, how much heat is released in this reaction?
5. When exposed to heat, calcium acetate decomposes to form calcium carbonate and acetone (C_3H_6O). Write the balanced equation for this reaction.
6. Based on the mass of calcium acetate used in this experiment, how many moles of acetone will be produced when the reaction is complete?
7. Since acetone is also flammable, it burns along with the ethyl alcohol in the gel. Write the balanced equation for the combustion of acetone (C_3H_6O).
8. Acetone has a heat of combustion (ΔH_{comb}) of -1821 kJ/mol. Assuming that all of the acetone in your gel is burned, how much heat is released in this reaction?
9. Based on your answers to 4 and 8, determine the **total** heat produced by burning your sample of Sterno. State your answer in joules, kilojoules, and kilocalories.

CONCLUSION

Lab Checklist:

- Title, purpose, name, date, period
- Data Table
- Questions 1-9, using proper units and showing ALL necessary work
- Brief conclusion (in complete sentences).