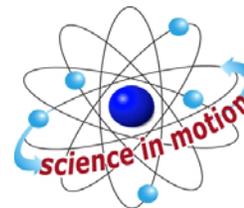


# INVESTIGATION OF UREA-CONTAINING COLD PACKS- GUIDED INQUIRY VERSION



Westminster College

## LAB 3

From *Vernier Investigating Chemistry through Inquiry*

### INTRODUCTION

An instant cold pack usually consists of a rugged plastic bag with water and a soluble compound inside. The water is sealed in a fragile inner bag to keep it separated from the solid. When the cold pack is needed, it is squeezed to break open the inner container and bring the water and solid together. As the water and solid interact, heat is absorbed and temperature decreases.

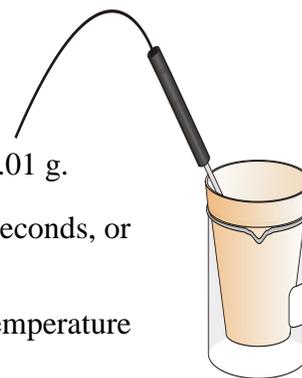
Ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , has been the solid most often used in instant cold packs. But, because it is much less hazardous, urea,  $(\text{NH}_2)_2\text{CO}$ , is replacing ammonium nitrate for this use. In this experiment, you will investigate the properties of urea and urea-containing cold packs.

In the Preliminary Activity, you will gain experience using a Temperature Probe as you determine the temperature change as a sample of urea dissolves in water.

After completing the Preliminary Activity, you will investigate your assigned researchable question. Use reference sources to find out more about cold packs, urea, and heat before planning and conducting your investigation.

### PROCEDURE

1. Obtain and wear goggles.
2. Connect the Temperature Probe to the data-collection interface. Set up the data-collection program to collect data for 300 seconds following your instructor's directions.
3. Place a Styrofoam cup into a 400 mL beaker as shown in Figure 1. Add 50.0 mL of water to the cup.
4. Prepare a ~10 g sample of urea. Write down the mass to the nearest 0.01 g.
5. Place the Temperature Probe into the water. Stir gently for about 45 seconds, or until the temperature reading is stable.
6. Begin data collection. After 10 seconds have elapsed and the initial temperature has been established, add the urea to the water in the cup. Stir gently.
7. When the temperature readings reach a minimum value and begin to rise, end data collection.
8. Use the Statistics function to determine the minimum and maximum temperature readings. Record these values.



9. Dispose of the urea solution as directed by your instructor.

### **QUESTIONS**

1. Subtract the minimum temperature from the maximum temperature to determine  $\Delta t$ , the temperature change.
  
2. Which kind of process is the dissolving of urea in water, endothermic or an exothermic? Explain.

**Note:** The plan that you submit for instructor approval should list laboratory safety concerns, including chemical safety concerns, and specify how you will address these safety concerns during your investigation.