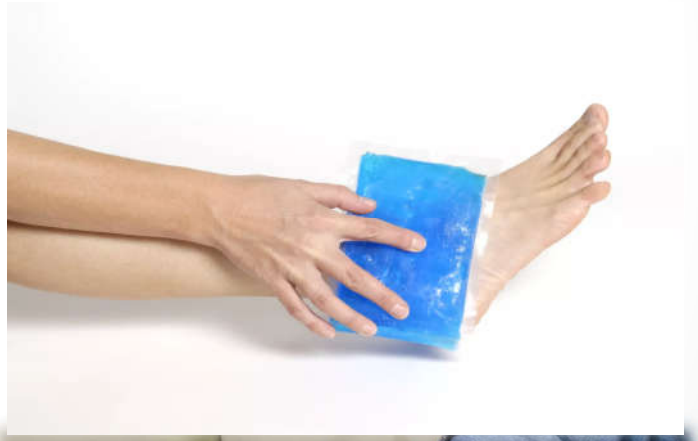
# Clinical Applications
# ( ICE & HOT PACKS)

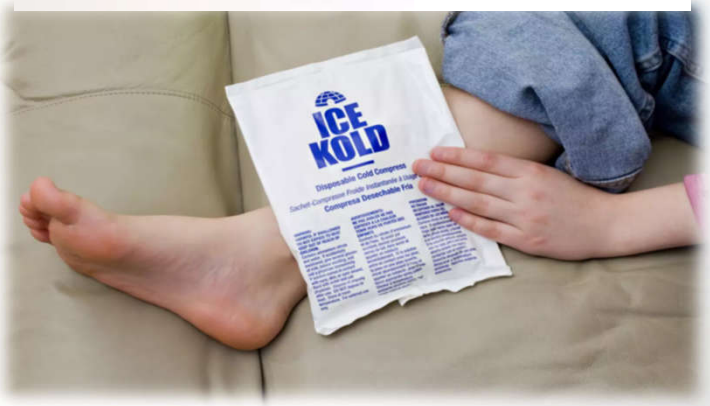
For Ionic compounds

Alaa J.Mahrath Chemistry &BiochemistryDept.

College of Medicine University of Babylon



**Ice and Hot Packs: Overview**



# Ice and Hot Packs: Overview

- **Ice Packs**: Designed for cold therapy, they reduce inflammation, numb pain, and slow blood flow. Types include gel-based (reusable) and instant (chemical reaction-activated).

- **Hot Packs**: Provide heat to relax muscles, improve circulation, and relieve pain. Common types include microwaveable gels, chemical-activated pads, and reusable phase-change materials (e.g., sodium acetate).

# Cold packs

- In a hospital, at a first-aid station, or at an athletic event, an instant ***cold pack*** may be used :
- to reduce swelling from an injury,
- remove heat from inflammation,
- or decrease capillary diameter to lessen the effect of **hemorrhage**.

- Inside the plastic container of a cold pack, there is a compartment containing solid ammonium nitrate **($NH_4NO_3$)** that is separated from a compartment containing water.
- The pack is activated when it is hit or squeezed hard enough to break the walls between the compartments and cause the ammonium nitrate to mix with the water.

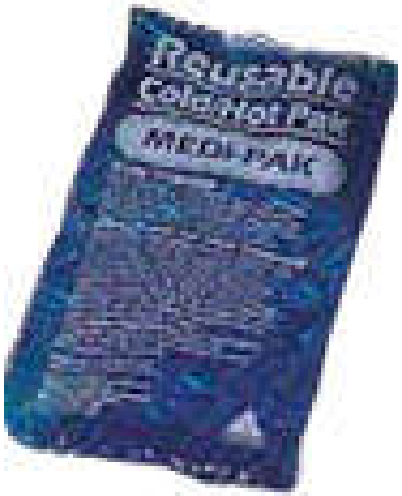
- In an endothermic process, 1 mole of $NH_4NO_3$ that dissolves in water absorbs **26 kJ.** The temperature drops to about **4 to 5 °C to give a cold pack** that is ready to use.
- note : 1 calorie (cal) =4.2 kilojoule (kJ)

# Endothermic process in a Cold Pack

$$NH_4NO_3(s) + 26\,kJ \xrightarrow{H_2O} NH_4NO_3(aq)$$


**Cold packs use an endothermic reaction**

# Is there another ways to make quick and easy ice packs ?

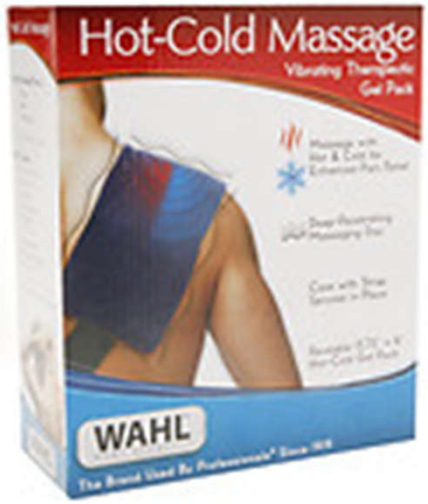


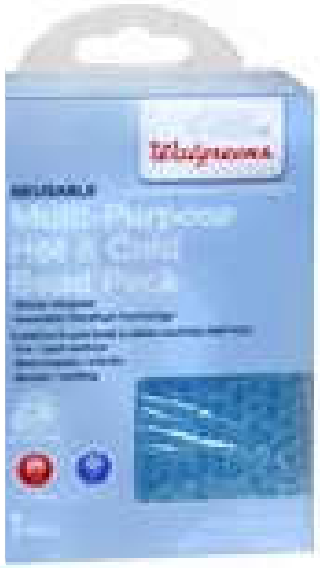

Video- How to Make a Gel Ice Pack.TS

# *Hot packs*

- *Hot packs* are used to relax muscles, lessen aches and cramps, and increase circulation by expanding capillary diameter.
- a hot pack contains a salt such as **$CaCl_2$.** When 1 mole of $CaCl_2$ dissolves in water, **82 kJ** is released as heat. The temperature rises to as much as **66 °C to give a hot pack** that is ready to use.

# Exothermic in a Hot Pack



DIY Microwaveable Heating Pad (Using Rice and a Tube Sock!) - YouTube.MKV

$$CaCl_2(s) \xrightarrow{H_2O} CaCl_2(aq) + 82\,kJ$$

**Are there another ways to make quick and easy ice packs ?**
**Try to find out.**

# Recent Applications

## 1. Medical Innovations

- **Cryotherapy and Fever Management**: Advanced ice packs used in post-surgical recovery, cancer treatment (to prevent hair loss during chemotherapy), and pediatric fever reduction.
- **Chronic Pain Relief**: Wearable heated patches for arthritis or muscle pain, integrating heat with transdermal medication delivery.
- **Organ Transport**: Specialized ice packs maintain低温 during organ transplantation, enhancing preservation times.
- **Telehealth Integration**: Increased home use for self-managed care, supported by telehealth guidance during the COVID-19 pandemic.

## 2. Logistics and Cold Chain

- **Vaccine Distribution**: Gel ice packs critical for COVID-19 mRNA vaccine transport, ensuring ultra-cold storage requirements.
- **Biopharmaceuticals**: Phase-change materials (PCMs) used in packaging to maintain stable temperatures for sensitive medications.

## 3. Environmental Sustainability

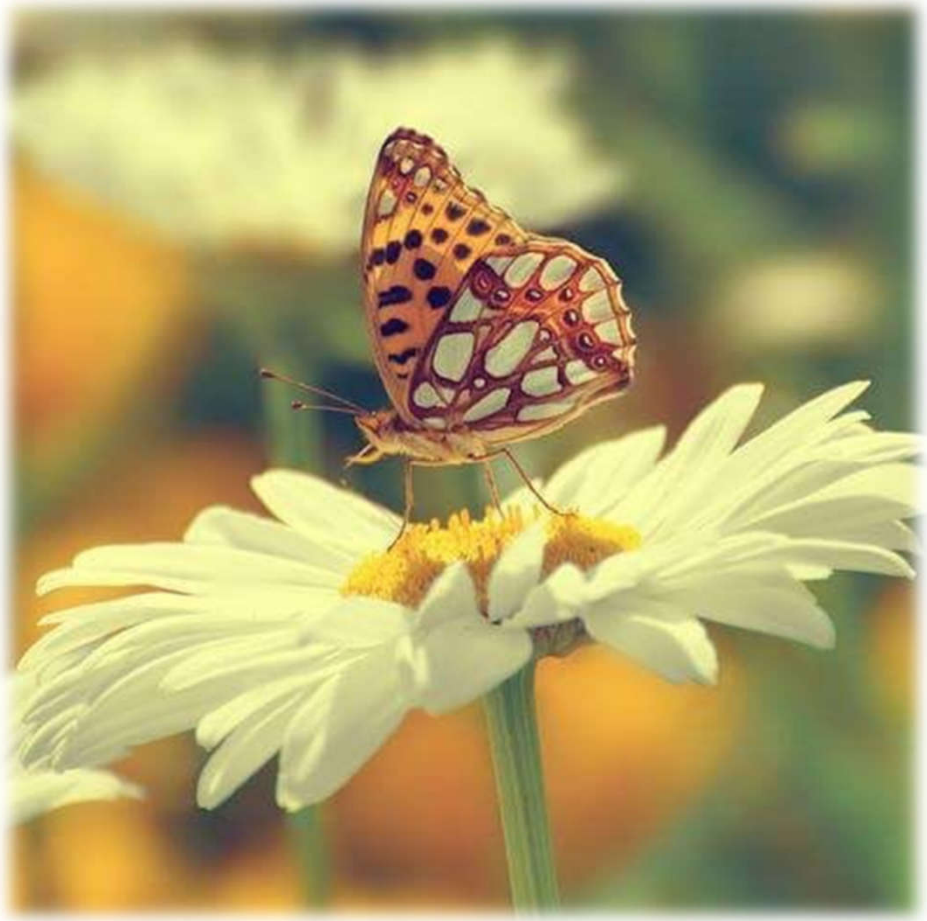
- **Biodegradable Materials**: Starch-based or plant-derived gels reduce plastic waste. Companies like ColdCure and EcoGel lead in eco-friendly disposable packs.
- **Reusable Systems**: PCM-based packs (e.g., paraffin or salt hydrates) for multiple cycles, minimizing single-use waste.

## 4. Consumer Goods and Wearables

- **Smart Textiles**: Clothing with PCMs for temperature regulation (e.g., cooling vests for athletes or construction workers).
- **Beauty Industry**: Ice packs for reducing under-eye puffiness; heated masks for skincare treatments.
- **Portable Warmers**: Battery-operated hot packs for outdoor activities, offering adjustable temperatures and extended heat duration.

## 5. Emergency and Disaster Response

- **Mobile Refrigeration**: Instant ice packs in disaster relief to preserve perishables and medicines without power.
- **Field Medicine**: Compact hot packs for hypothermia prevention in emergency kits.



# Thank You