

# Dry Ice

## Ice which Does Not Melt

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Did you know that dry ice is basically frozen carbon dioxide in a solid form? It is colourless, odourless (無味的) and non-flammable (不易燃燒的). A block of dry ice has a surface temperature of about  $-109^{\circ}$  Celsius, making it a very effective cooling agent. The substance is broadly used to preserve (保存) food and package (包裝) items that need to remain cold or frozen.

To see it yourself, buy an ice cream cake at Häagen-Dazs and note how they pack the cake over a bed of dry ice in a box for you to take home. Don't worry even if your trip home takes over an hour. Thanks to the dry ice, the cake arrives 'safe and sound'.

When dry ice is exposed to air at temperatures above  $-56.4^{\circ}\text{C}$ , it begins to sublime (昇華). This means that the carbon dioxide in the dry ice changes directly from a solid form to a gas form, without becoming liquid in the process. The process is virtually visible (可看見的) to the naked eye.

Sublimation is an amazing physical change. Besides the carbon dioxide in dry ice, it is also evident in such substances as the iodine (碘) in iodine tincture (碘酒), the naphthalene (石腦油精) in air fresheners and the camphor (樟腦) in mothballs (防蛀蟲丸).



## Sublimation of Camphor

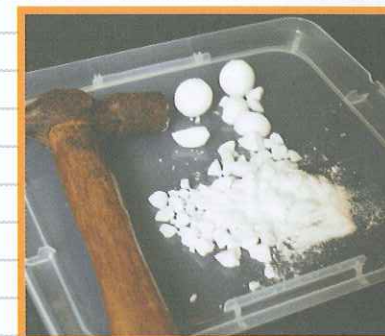
To do the experiment, you will need

1. some mothballs which contain camphor
2. a hammer
3. two beakers (one bigger than the other)
4. a big heat resistant plastic box
5. some ice water
6. some hot water

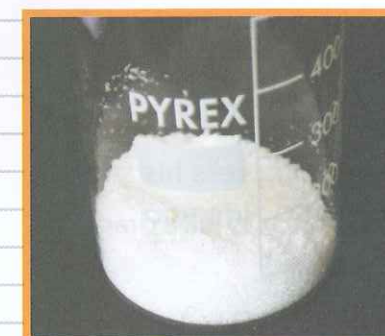
### Safety Precaution

Make sure you do this experiment in a well-ventilated (空氣流通) room.

## Procedures



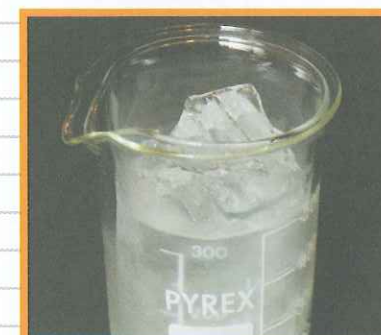
1. Break or crush the mothballs into very small pieces using the hammer.



2. Place them in the bigger beaker.



3. Fill the smaller beaker with ice water until it is about three quarters full.



4. Put the small beaker in the big one. Make sure that its base does not touch the mothball pieces.



5. Fill the big bowl with hot water (around  $90^{\circ}\text{C}$ ) until it is about one third full.



6. Place the beakers in the bowl and see what happens.

While the heat from the hot water causes the camphor in the mothball pieces to sublime, the coldness of the ice water causes the gaseous camphor to condense back to solid form.

