

# Reusable Hand-Warmers



This Science Project was done by:

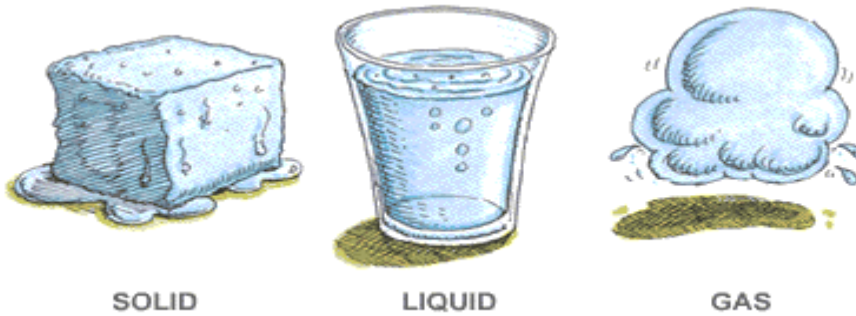
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(With a little help from Elizabeth's mum & dad)

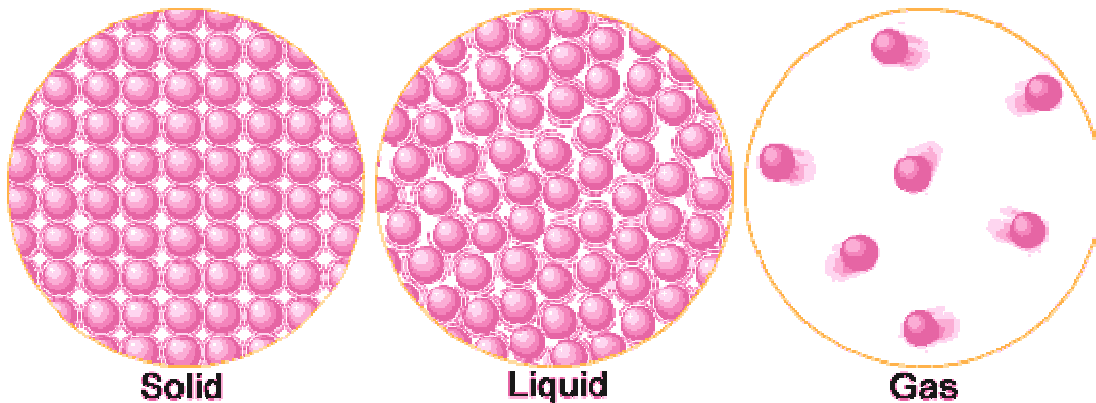
Warning – These need boiling in water to re-charge. Get an adult to help with that!

# Solids, Liquids & Gasses

- There are three main types of stuff:.



- The molecules that make up a solid are fixed together.
- In a liquid they can move around each other.
- In a gas they are flying around separately from each other.

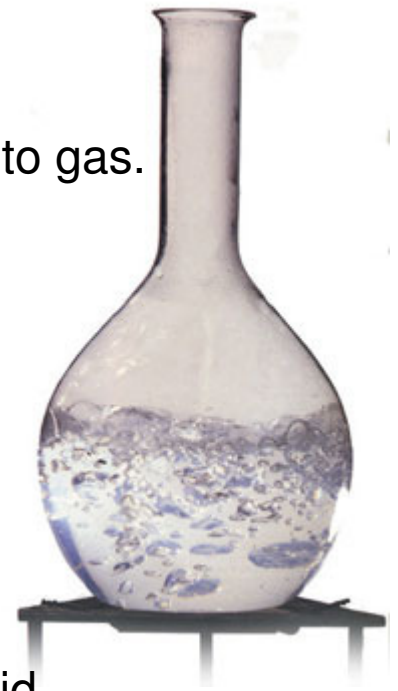


- It takes energy (heat) to turn a solid into a liquid
- It also takes energy (heat) to turn a liquid into a gas

Can you think of anything that uses energy to turn a liquid into a gas?



- When you boil water it stays at 100°C.
- The extra heat is used to turn the liquid into gas.

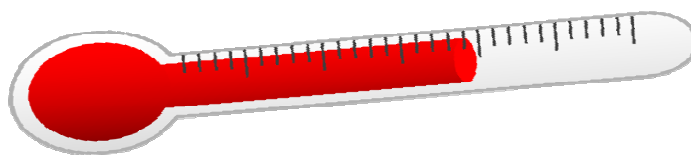


- When you hold an ice cube, the heat from your hand is used to turn solid ice into liquid water.

- Crystals are a type of solid that take lots of energy to melt.



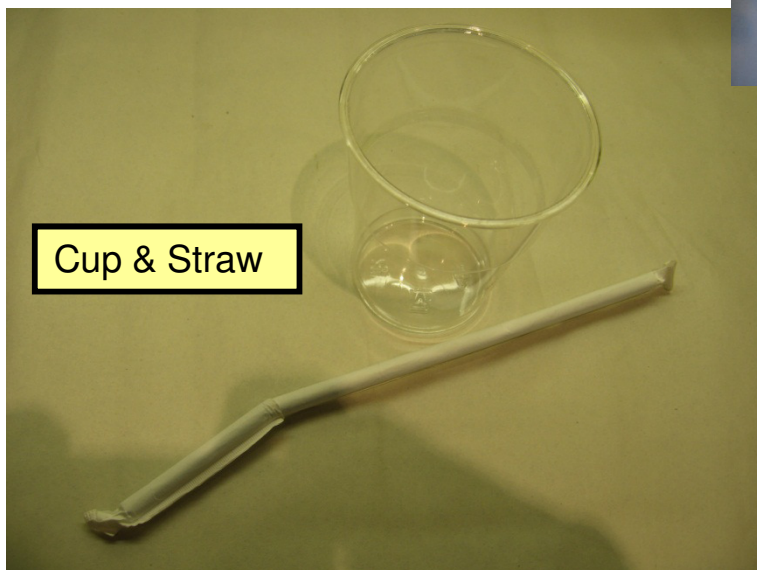
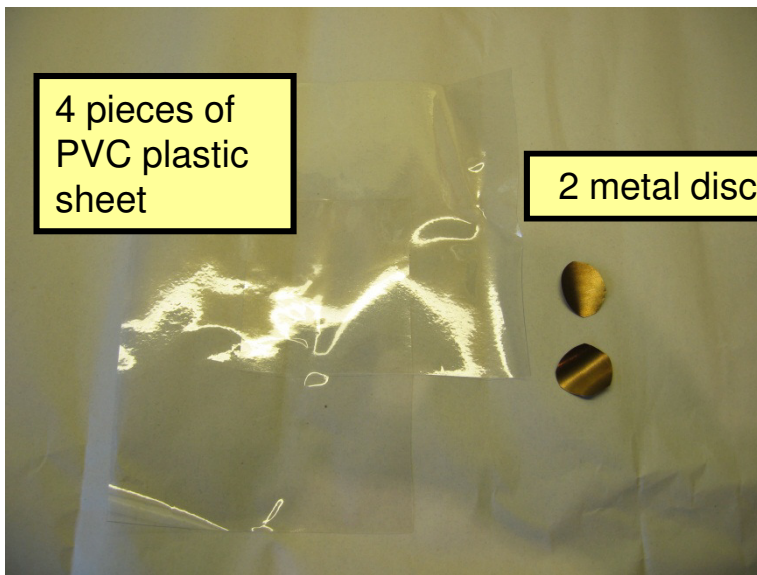
- If you melt a crystal and then let it become solid again, you get that energy back as heat – it gets hotter.



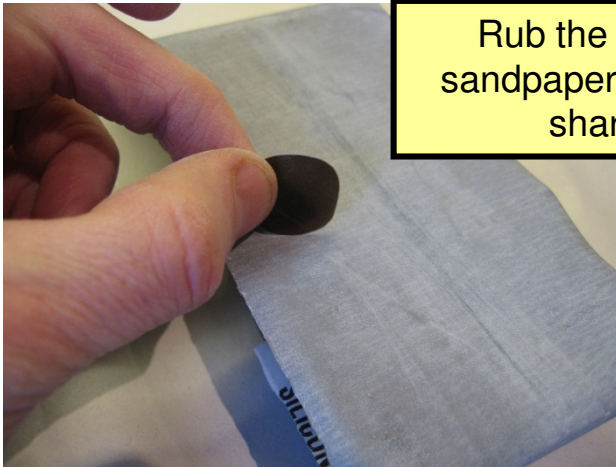
- Some materials can be melted and then cooled below the temperature that they should turn back to a solid. When they do crystallise we can feel them get hotter.
- We are going to use *sodium acetate*. This is a chemical that is very good at staying liquid until we want it to change into a solid.

# The things we need:

- Let's get the things we need.
  - You should have a tray with your name on.
  - See if you can find these things:



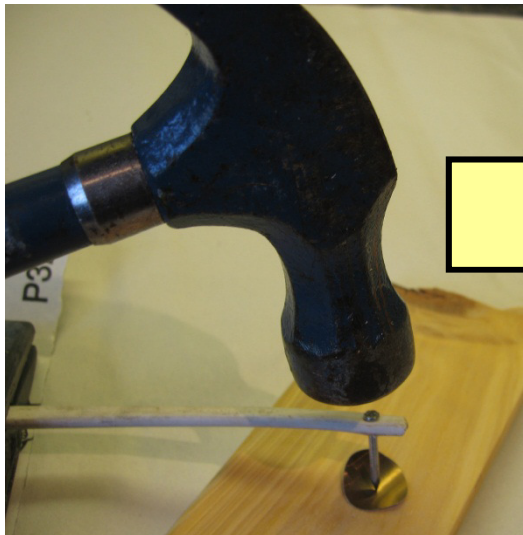
# Make the Starters:



Rub the discs on fine sandpaper to remove any sharp edges



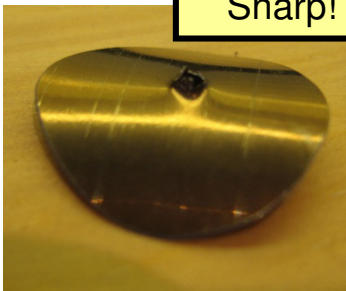
Put the disc on a bit of scrap wood and hold a nail in the middle



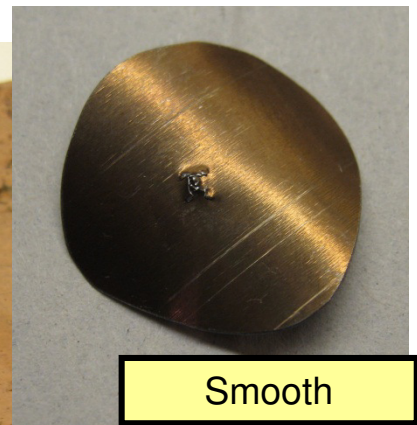
Knock the nail through



Sharp!

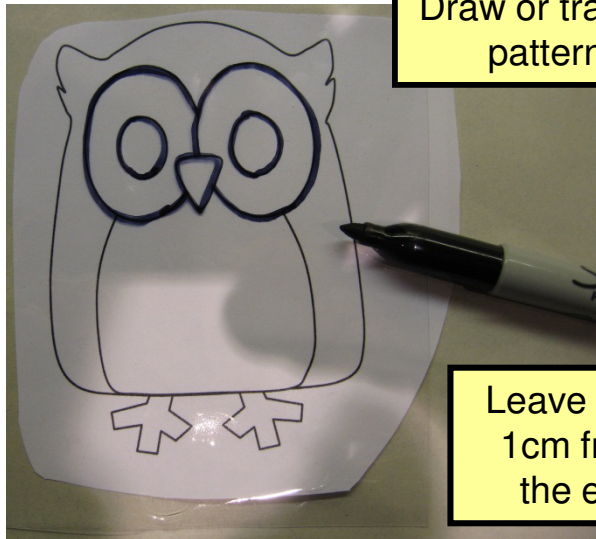


Flatten the sharp points



Smooth

# Decorate the PVC:

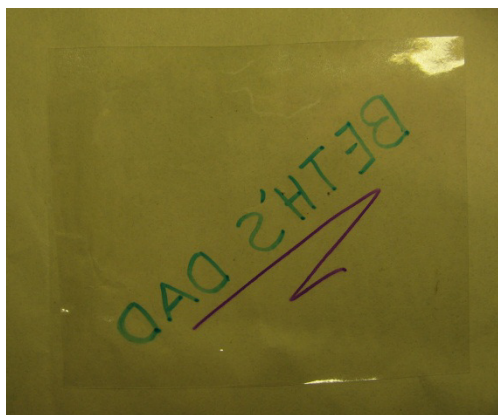


Draw or trace a pattern

Leave at least 1 cm from all the edges



Colour it in

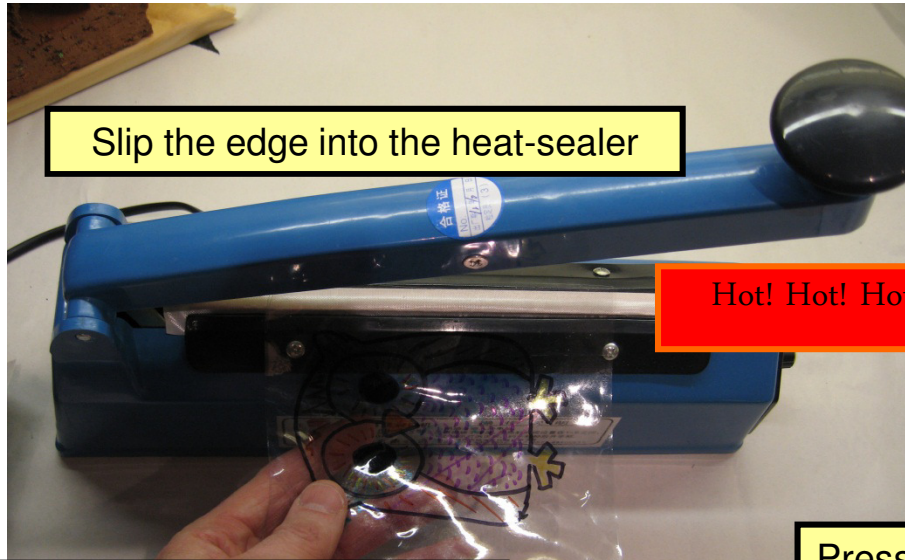


Any writing needs to be mirror-writing

We are decorating on the inside because otherwise the writing will come off when the hand-warmer is boiled.

That means everything will come out backwards.

# Make the Pouch



Slip the edge into the heat-sealer

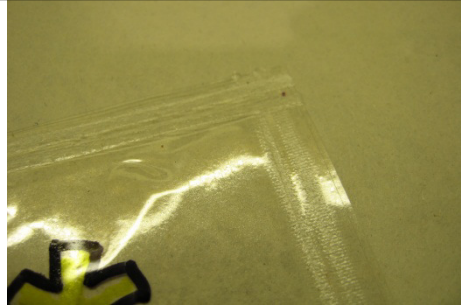
Hot! Hot! Hot! Hot!

Put the decorated sides together

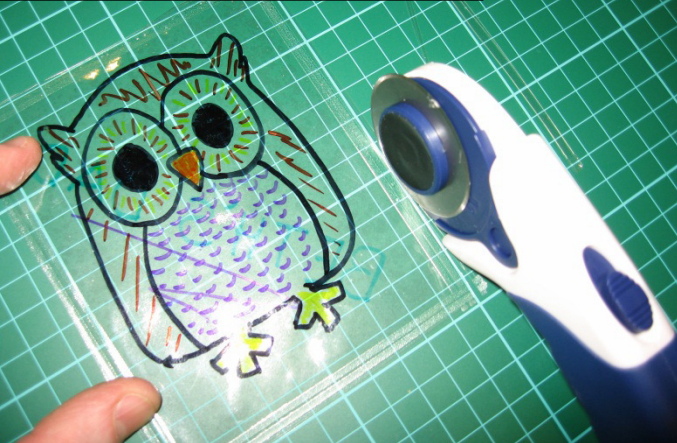


Press until the light goes out

Double-seal all the edges



Trim CAREFULLY

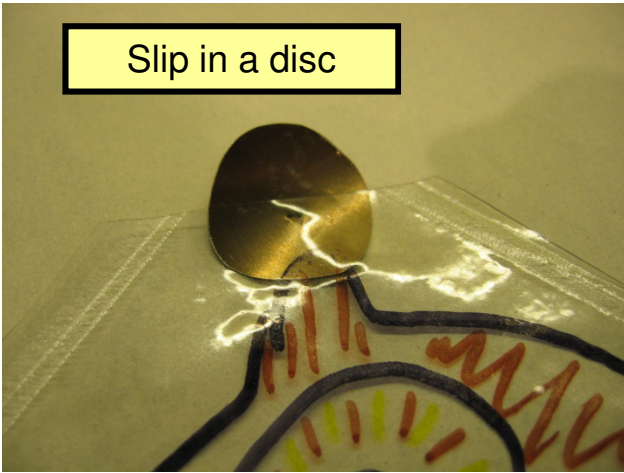


Snip off one corner



# Get Ready to Fill!

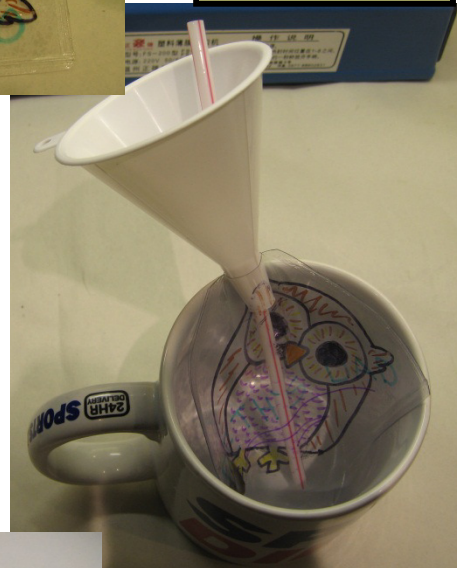
Slip in a disc



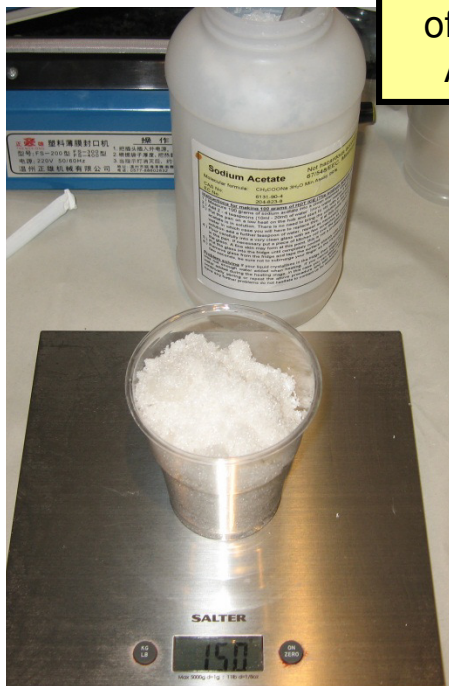
Poke in the straw



Add a funnel  
& stand in a  
large cup



Weigh 150g  
of Sodium  
Acetate



Put it in a pan with 2  
tablespoons (2 x 15 ml) water

Heat & Stir until all melted.  
Try not to let it boil.





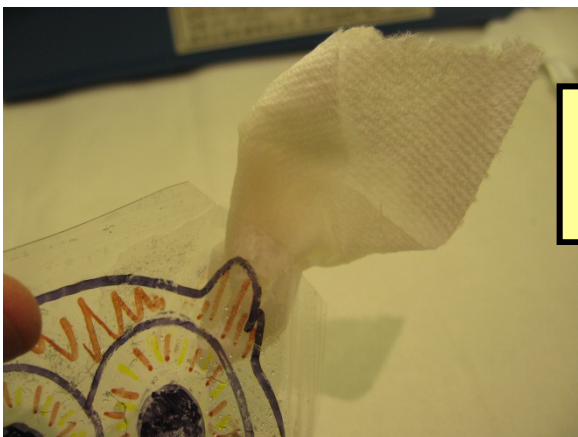
# Fill Them Up!



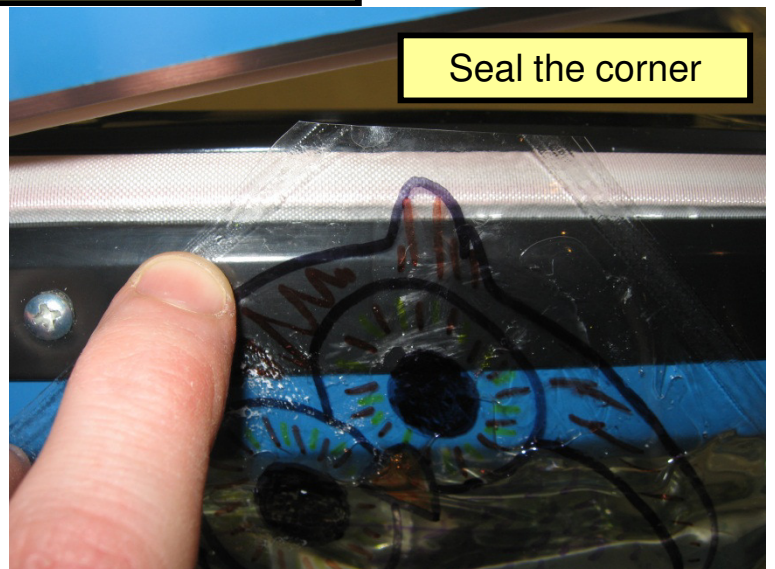
Carefully pour half of the liquid into each pouch



The straw will help you unstick the sides.



Wipe the hole with wet paper and then with dry



Seal the corner



You now have a re-usable hand warmer

# Using them...



To re-charge your hand warmer, put a paper towel in the bottom of a pan of boiling water and drop it in.

Let it boil until it is clear inside (5-10 mins usually)

Take it out with tongs and let it cool



Snap the starter or rub the hole between your finger and thumb to make it crystallise and get hot!

Slip it into its bag for warm, comfortable hands!



**DANGER!** – Make sure you get an adult to help with the boiling water bit!