## Heat moves in three ways:

**1. _____, which works best in solids, is when heat moves molecule by molecule because they are in contact with each other. Some solids conduct heat very efficiently: they are called conductors. Others do not move heat efficiently, they are known as insulators. Conductors are**

**_____, insulators are**

**_____Insulation is made to PREVENT heat movement, and so insulation is made from insulators!**

**2. The second method is called**

**_____! This occurs when whole groups of molecules move in a circular motion. Convection only works in liquids and gasses because it needs to be able to flow.**

**3. The third method is called**

**_____! Radiation is heat that travels in Infra-red waves, very similar to light. Like light, it can be reflected, absorbed and emitted.**
**The color that absorbs IR waves best is:**
**The color that emits (gives off) heat the best is:**
**Radiation is the only type of heat that can travel through _____, and so is the only type we get from the sun!**

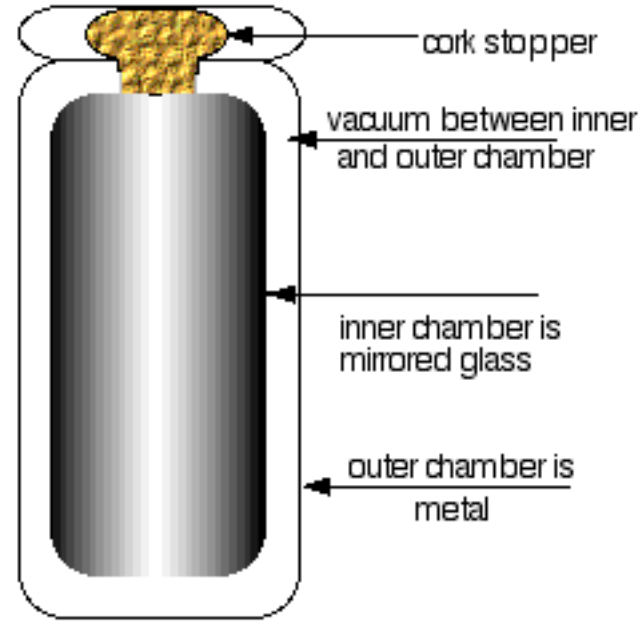
**Insulation prevents at least one method of heat flow. The best insulation stops all three!**

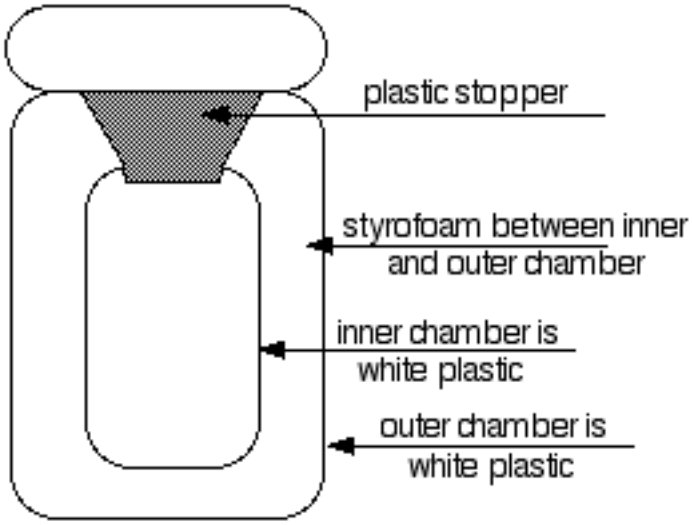
**To stop conduction, we use non-metals or non-solids - the best one is air! (cheap and effective)**

**To stop convection, we use solids. The best solids are mostly air, e.g. styrofoam, fiberglass or even better - a vacuum!**

**To stop radiation, we use mirrors and white colors.**

**Thermos / attics / et cetera**




Above are schematics of a thermos insulating container: on top, a deluxe original model, and on the bottom, a child's lunchbox model. The top model usually gains or loses about 1 degree every three hours if used properly.

1. Why is there a vacuum between the containers?

2. Why is the inner chamber mirrored?

3. Why is the outer container made of metal, if metal conducts heat so well?

4. Why is the kid's containers made differently?

5. Estimate how many degree per hour the bottom one loses, defending your answer.

**State changes take NRG!**

**We must _____ energy to move from a**

**solid to a liquid to a gas. We _____ energy to move from a gas to a liquid to a solid. You can move straight from a solid to a gas!**

**State changes have _____ temperature change.**

**The formulas: $Q = mH_f$ and $Q = mH_V$**

**$H_f$ and $H_V$ are numbers like "c" that you can look up on a chart or solve for. (You have that chart on the back of your sheet!)**

**State changes have names!**

**Solid to liquid is called _____**

**Liquid to gas is called _____**

**vaporization due to added heat is _____**

**if due to environmental heat = _____**

**Solid to gas is called _____**

**Gas to solid is also called _____ (deposition)**
**Gas to liquid is called _____**

**Liquid to solid is called _____**

**How much heat is needed to change 149 g of ice at $-46^oC$ to water at $27^oC$?**

**There are actually three steps to this problem:**

**1. Heat up the ice to it's melting point**
**2. Melt it.**
**3. Heat up the melted ice (now water) to $27^o$**

**1. $Q = mc\Delta T =$**

**2. $Q = mH_f =$**

**3. $Q = mc\Delta T =$**

**Add up totals =**

## For Homework:

**Ice cube demo - go home and place an ice cube in your hand and squeeze it for about 5 seconds. Note temperature and amount of water melting in your hand.**

**Wait a few seconds for your hand to warm back up and then place the cube back on your palm, this time covering it with salt before squeezing. (NOTE: DO NOT squeeze for more than 5 seconds!) Again, check for temperature and amount of water melting in your hand.**

**Be ready to report back to the class your findings.**

**Do the last section of your sheet, Pb C**