Introduction

Heat capacities can be measured using a calorimeter, which is an insulated device that minimizes heat transfer between the system being studied and the surroundings. A simple design is shown in the textbook Fig 9.12 (OpenStax) or Fig 6.8 (Chang). An ideal calorimeter would not absorb any heat from its contents, so that the temperature change of the contents could be used to calculate the heat transfer between contents. You will design your own calorimeter and use the discrepancy between heat capacities measured with your calorimeter and literature values to see how far from ideal your calorimeter is.

Procedure: In the interest of time efficiency put about 400 mL of hot tap water in a 600 mL beaker, place it on the hot plate shared between the two groups at your bench and turn your hot plate up to about 350 C (if you are using a Fischer Isotemp hot plate). This will be your bath for heating your solid samples. You want the bath to be at a continuous gentle boil. Make sure you do not burn yourself on the hot plate or melt any wires or plastic cups.

A. Build a calorimeter

- Construct a calorimeter from 8 oz styrofoam coffee cups, cardboard, lab tape and a Vernier temperature probe that is designed to:

  a. minimize heat transfer between the inside and outside;

  b. have a way to monitor the temperature inside the calorimeter;

  c. have a way to quickly transfer a metal sample into the calorimeter (see the samples on your bench);

  d. to prevent it from tipping over during the experiment and from melting if it touches your hot plate the calorimeter should be placed inside a beaker into which it fits snuggly.

In addition to the coffee cups, cardboard, lab tape and temperature probes, you will have available scissors, the contents of your drawer and a nail.

- Draw the design of your calorimeter and load the image into the cell below.(Ideally will have a quick sketch program available or a camera and scratch paper).

In [4]:
```
from IPython.display import HTML
display(HTML('<img src="tstimg.jpg"/>'))
```

B. Measure the heat capacity of brass

1. Using the bench top balance measure the mass of the sample. The brass sample is a calibration weight. As long as the weight is clean you can simultaneously see how good the calibration of the balance is.
2. Record the mass in the table below. *Each time you enter data in the table make sure to click the 'save updates' button.*

In [5]:
```
from input_table import *
rows =['Brass','Lead']
cols = ['Mass(g)','Ti(water)(C)','Ti(solid)(C)','Tf(C)','deltaT(water)(C)','deltaT(solid)(C)',
'C(solid)(J/C)','c(solid)(J/g/C)']
tbl=input_table(columnlabels=cols, rowlabels=rows)
display(HTML(tbl.htmlstr()))
```

Save Updates	Mass(g)	Ti(water)(C)	Ti(solid)(C)	Tf(C)	deltaT(water)(C)	deltaT(solid)(C)	C(solid)(J/C)	c(solid)(J/g/C)
Brass								
Lead								