Plaster molds

As Andrew Martin points out:
"Plaster comes from gypsum, a naturally occurring mineral. It is minded, ground, calcined (heated) and processed to perform in a vast array of applications, from pottery to the medical and construction fields."

Using a plaster slump or hump mold, you can quickly make a number of identical forms that to which you can then add parts (multiple pressed units combined, handles, spouts, lids, feet, sculptural additions) as a research tool for design ideas. The object of having multiples of the same form is for exploration of design decisions and comparison of the finished works.

Choice of a form to mold is very important. Your selected item must not have any undercuts, or the plaster will not release. Items that have a strong character of their own may be visually "filled" and not leave you many options for personal exploration.

Students will be paying for plaster at the book store in the same method clay is purchased. Keep track of the number of pounds of plaster you use, and have the clay monitor make a ticket for you to pay at the book store. Once you pay, give the receipt to one of the clay monitors.

Dry, powdered plaster comes in a number of forms, the finished results varying in hardness and absorbency. Plaster of Paris is too soft to be useful for our purposes. U.S. Gypsum No. 1 Pottery Plaster is often used for slip casting mold-making because of it's strength and appropriate porosity.

The powdered plaster is mixed w/water according to direction. It sets up quickly, so the mold you are making should be prepared beforehand. Plaster makes a detailed rendition of whatever it is poured into, onto, or around. Plaster molds are absorbent and can be used for slip casting shapes, press-molding, hump or slump molding.

Please work carefully in the designated plaster areas. Plaster contamination in clay or glaze materials causes serious problems with calcium spit-outs or other defects. Plaster poured down drains can cause severe drain blocks. Clean up after working. Have a stand-buck of water waiting to clean hands, tools, and buckets. Dry plaster can be put in the trash. Clay used for plaster work (puttying molds, etc.) should not be used for firing purposes later, nor recycled with class clay.

Andrew Martin, slip-cast porcelain

1. Determine the approximate volume of plaster needed. Volume = length x width x height for rectangles, for cylinders v = $\prod$ x radius^2 x height ($\prod$ (pi) = 3.14). Use inches as your measurement. Your volume will be in cubic inches. It is a good idea to mix 10%-20% more plaster to allow for spills, leaks, etc.

Plaster is mixed by weight, the ratio for No. 1 Pottery Plaster in parts by weight is 3 parts plaster to 2 parts water. The more plaster used per weight of water, the faster it sets, and the harder and less absorbent the product becomes.

One quart of water weighs 2 pounds. A quart of water plus 2 lbs. 12 oz. of plaster = about 80 cubic inches of mixed plaster. Andrew Martin rounds out the plaster to water ratio at 1 quart of water to 3 pounds of plaster. So,

$$\frac{\text{number of cubic inches of plaster needed}}{80} = \text{the number of quarts of water required.}$$

Add the appropriate amount of plaster (3 pounds of plaster per quart (2 pounds) of water.

2. Prepare the proper amount of plaster and water to be mixed
Cold water will give increased expansion (possibly making mold removal difficult) and slower setting time. Do not use water below 65○. Warm water will give less expansion and faster setting. About 70○ is ideal, although you can use water up to about 100○ without problems.

All mixing equipment should be clean. Bits of plaster on your equipment can cause premature setting around those lumps.

3. Prepare your molds or forms. Plaster releases well from leather-hard clay. For other materials, you must "size" the mold with mold soap (available from Ceramics suppliers) or several layers of a water-soluble release like Murphy's Oil Soap (actually water-soluble). Using an oil-based releases like Vaseline will release, but the oils can block the mold pores and decrease absorbency of the mold.

Before you begin mixing, arrange your containers for clean-up, molds or forms, and a container or cardboard box to dispose of excess plaster before it hardens in your bucket.

BEFORE mixing, please note: cottles (or coddles) to hold in plaster to case a mold may be made from wood, linoleum (heat before bending into a cylinder), tar paper, clay, plastic, etc. The cottle must be able to hold the WEIGHT of the plaster, or be reinforced. All seams should be puttied in with soft clay. Cottles may be held together w/large elastic mold bands, clamps, etc.

4. Gently sift plaster onto the water, allowing it to float on the surface, soak up water, and settle (if done too quickly it sinks and forms lumps).

5. Let the plaster soak 2 or 3 minutes after all is added to the water. Generally, it is a good idea to begin mixing not longer than 5 min. from when you began to sift.

6. Mix by hand for 3-5 minutes or with a drill paddle for 1-2½ minutes. Andrew Martin recommends mixing with a drill for serveral minutes and doing the last minute by hand. The plaster should begin to set, and you will be able to see a faint trail if you drag your finger across the surface of the plaster. Tap the bucket several times to bring trapped bubbles of air to the surface. Plaster is setting and ready to pour.

7. Pour plaster slowly to avoid air bubbles or splashing. Tap the container or jiggle the table gently to release bubbles. Pour excess plaster into a trash bag, onto newspaper, etc. and rinse the bucket in the rinse bucket. Pouring too early will allow the water in the plaster to degrade the mold soap and may cause release problems. Pouring too late may result in uneven plaster pours. Plaster heats as it sets, and reaches maximum expansion in about 20 minutes, then contracts slightly. It is a good idea, according to Richard Notkin, to wait at least an hour before taking molds apart.

8. Clean up the mold. Use a metal rib or Sur-form to round sharp edges that may flake plaster into your work.

9. Molds should be dry before using. *Do not exceed 120○ while drying*, or the mold will become soft and chalky, and it will crumble easily.

Make molds on a level, smooth surface (formica, marble, glass, linoleum). Use mold soap or Murphy's Oil Soap to size your item to be cast and the inside of the cottle. Porous items should be sized several times. Do not size too far in advance, as the effect may be lost over time. A non-oily soap liquid is often used, as greasy sizing (like Vaseline) may clog mold pores and interfere w/use later. Dish soap or Murphy's Oil Soap (actually water-based) work.

References:

Frith, Donald, ***Mold Making for Ceramics***
Martin, Andrew, ***The Definitive Guide to Mold Making & Slip Casting; Contemporary Techniques for Potters***, 1999.
Peterson, Susan, ***The Craft and Art of Clay,*** pp. 87-97
U.S. Gypsum web site:
http://www.usgypsum.com
No 1 Pottery Plaster info page: http://usgypsum.com/ig/product/ceramics/ig1366.htm

Table from Andrew Martin

WATER (quarts)	**PLASTER Wt. (70)**	**PLASTER Wt. (66)**	**VOLUME CREATED (cu. in.)**
0.5	1.40	1.5	40
1	2.85	3	80
2	5.70	6	160
3	8.55	9	240
4	11.40	12	320
5	14.25	15	400
6	17.10	18	480
7	19.95	21	560
8	22.80	24	640
9	25.65	27	720
10	28.50	30	800

PLASTER MIXING AND SETTING SCHEDULE							
Step description	Add plaster	Soak	Mix	Liquid	Thix-otropic	Plastic	Done
Time per step	1 minute	3	3	3	2	3	0
Total time elapsed	I minute	4	7	10	12	15	15

Liquid	plaster flows like heavy cream
Thixotropic	plaster stands on its own but returns to liquid when shaken
Plastic	plaster has the ability to be modeled like clay

Richard Notkin, cast,
Heart Teapot