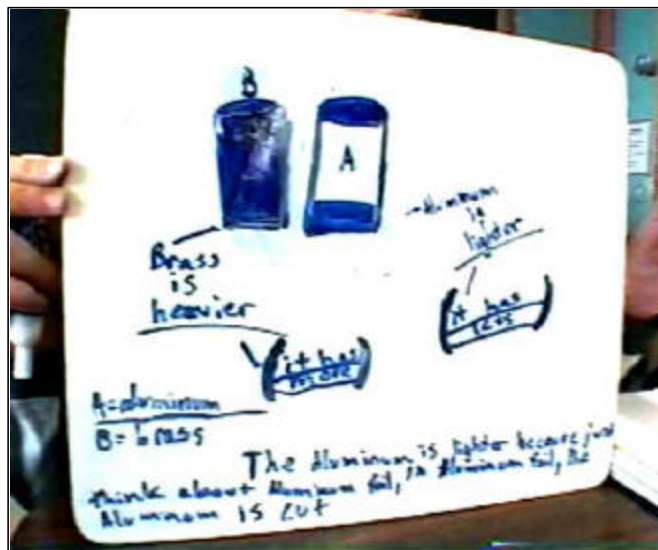
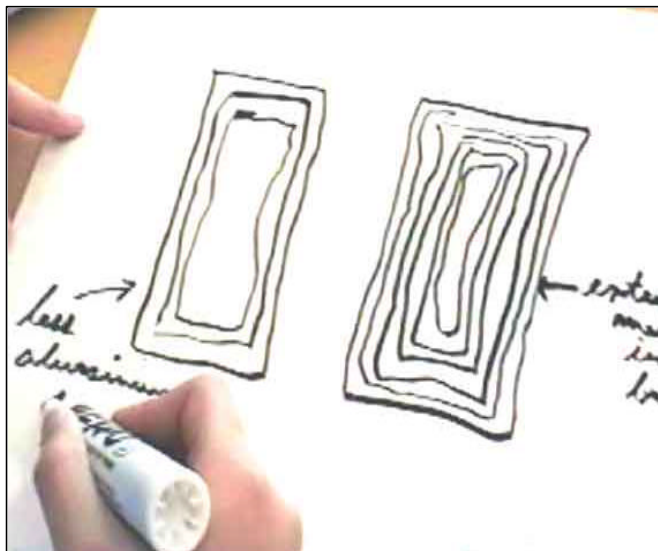


## Student Models Comparing Two Cylinders

### Hollow Models

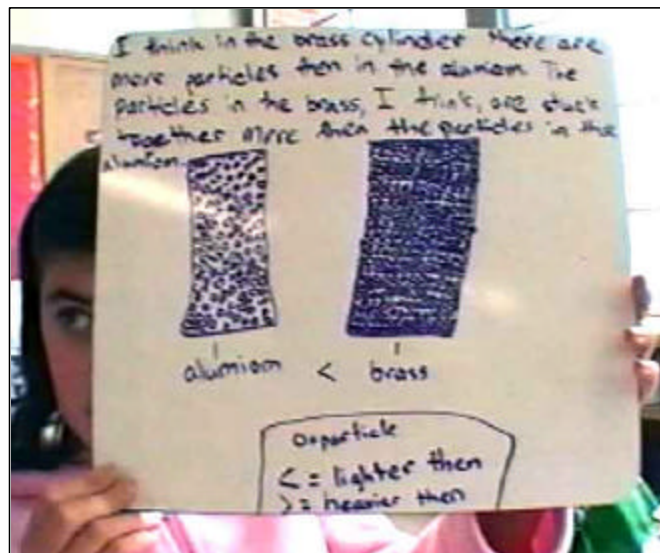
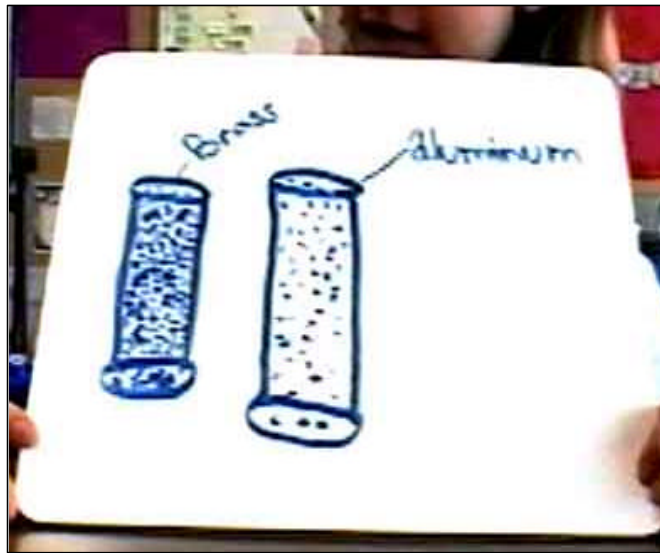
One explanation that students often come up with for differences in mass between cylinders of the same volume is that all or part of a cylinder is hollow. This is a possible explanation. It deals with mixed density. The added density of the metal plus the air inside it results in a cylinder that is lighter than one composed entirely of metal. Notice that the student example on the bottom also reveals an awareness that there are different kinds of materials and that some are lighter than others. In this case the student draws upon his or her experience with aluminum foil and reasons from that experience.



## Student Models Comparing Two Cylinders

### Dot Models

It is fairly common for students to draw particle models to show the differences between the two cylinders. This is especially so when students have a good understanding of the particulate nature of matter. Common variations on these models include more or less spacing between the dots, larger or smaller dots, and darker or lighter dots.



## Student Models Comparing Two Cylinders

### Half Models

Occasionally, students will show a model where the bottom half of the aluminum is filled in but not the top half, while the other cylinder is entirely filled in. When their ideas are probed, it sometimes turns out that they don't really think that only half of the cylinder is filled, but are using this as a convention to show that the aluminum cylinder has less mass. In other cases, students use the half model in a similar way to the hollow model, as on the first page of this handout.

