

The Recycling Factory

Suppose that you are the new owner of the Owl Recycling Factory and you are looking for business.

An official from the city of Westminster, Mr. Smith, tells you that they have a dump truck full of recycled materials that must be separated, and they will pay you \$5,000 if you can do it. Unfortunately, the job is made more difficult by the fact that someone has ground all of the materials into a fine powder, making it impossible to separate them by hand.

Fortunately, Mr. Smith knows what the materials in the truck are, as well as their densities:

Material	Density (g/cm ³)
Aluminum soda cans	2.7
Steel cans	5.7
Milk jugs	0.95
Soda bottles	1.4

In your factory, you have the following materials at your disposal:

- A long conveyor belt
- A large tank that can be filled with water
- Another large tank labeled "Concentrated sugar water, density = 1.5 g/cm³"
- Several powerful magnets hanging above the conveyor belt
- Several nets for skimming the tanks and scooping material from the bottoms.

Your job: Find a way to separate the four recycled materials. You may need to do this in several steps.

You will have to write a letter to the city official that describes your plan. You may draw diagrams if they are neat.

Scoring:

- All parts of a letter are included
- Your plan will work
- Your plan is understandable
- You describe what will be separated by each step
- Your work is neatly done
- You use correct grammar and spelling
- Your letter is less than two pages, one side only

Good luck!

The Recycling Factory – Teacher Materials

Credits:

Before going any farther, I want to credit Al DeGennaro at Winters Mill High School in Westminster, Maryland for creating this worksheet. The concept, layout, and phrasing for this worksheet are entirely his – any errors you find should be considered artifacts created by the editorial process rather than errors with the original worksheet.

Teacher Information:

This activity was designed to get students thinking about a number of different concepts. Clearly, density and magnetism are the main scientific concepts covered by this activity. However, to do well in this activity, students will also need to think about the engineering involved in putting together an effective process. As if that weren't enough, students will need to put their ideas forth in a clear and concise manner, much as they will later have to do in their professional lives.

Clearly, there are many different orders that the recycling process in this activity can be successfully designed. One possible solution includes the following:

- Place the mixture on a conveyor belt that runs under large magnets. The steel cans will be separated from the rest of the mixture.
- Place the remainder of the mixture in the tank of water. The aluminum and soda bottles will sink, while the milk jugs float and can be skimmed off the top.
- Place the aluminum and soda mixture into the tank of sugar water. The sugar water will cause the soda bottle fragments to float, while the aluminum dust will settle to the bottom.

Grading for this activity will be most effective if you go directly from the rubric provided to the students at the end of the worksheet. Assign a point value to each of the scoring criteria and compare them to each student paper. Not only will this encourage consistency in grading, but also let students know exactly why they didn't receive full credit on each part.