



America's Cement Manufacturers™

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Lesson 2: What are the Parts of Concrete?

Age: Grades 7-12

Subjects: Science

Skills: Classification, identification, Comparing similarities and differences, small group work, observation

Duration: 45 minutes

Setting: Indoors

Key Vocabulary: Cement, concrete, aggregate, sieve

Objectives

Students will learn 1) What materials are used to make concrete, 2) How much energy is used to separate small or large particles

Method

Students will mix components of concrete together, separate them, and identify them.

Background

Concrete is basically a mixture of two components: Aggregates and paste. The paste, comprised of Portland cement and water, binds the aggregate (sand and gravel or crushed stone) into a rocklike mass as the paste hardens because of the chemical reaction of the cement and water. Aggregates are generally divided into two groups: fine and coarse. Fine aggregate consists of natural or manufactured sand with particle sizes ranging up to 3/8-inch; coarse aggregates are those with particles retained on the No. 16 sieve and ranging up to 6 inches. The most commonly used maximum aggregate is 3/4 inch or 1 inch.

Typical concrete mixes are proportioned by absolute weight. Some typical mixes would include:

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Cement	Water	Air	Fine agg	Coarse agg	
Mix I	15%	18%	8%	28%	31%
Mix II	7%	14%	4%	24%	51%
Mix III	15%	21%	3%	30%	31%
Mix IV	7%	16%	1/2%	25-1/2%	51%

Materials

You will need a class set (2 to 4 students per set of equipment) of separating sieves (available from Hubbard Scientific, Northbrook, IL) and a small bag of concrete mix from your local building materials dealer, a small bag of mortar mix, and a small bag of cement for other activities. You will also need an overhead projector, ruler, 250 ml beaker, and scale.

Procedure

To approximate the size of the openings of the sieves, place them on an overhead projector with a transparent ruler. Not only will you separate out the ingredients that go into making concrete, but you will learn the important lesson of the time and energy needed to separate the largest sized stones from the smallest particles that contain the cement.

Give each group of students a 250 ml beaker filled with dry concrete mix. Pour the mixture into the sieve with the largest sized openings with the succeeding smaller sizes below and the collection container at the bottom.

Using short brisk motions of the sieves, time how long it takes for each sized particle to be separated. This activity will lead you to a working definition of concrete.

The percent of each sized particle can be found by weighing each and comparing that to the total weight of the sample in the 250 ml beaker. Invite the students to identify each group of particles from the sieve. The finest particles contain the cement that



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makes up the bonding material holding the larger particles together when all of the four sized materials are mixed together with water.

The next group of particles in the succeeding sieves are the various sized stones that make up the aggregates of the concrete mixture. Mix each of the four different sized particles with a small amount of water to see which of the particles actually set.

If sieves are not available, have students pour out some of the concrete mixture on a sheet of paper and describe the range of the sizes of the particles that go into making concrete.

If you are using the sieves, the source of each of the particle can be identified. The small rocks that make up the largest particles and the next larger particles are called aggregate and can be mined from a gravel pit. The third set makes up the smallest sand grains and cement particles and the fourth contains much of the cement that is ground to a very fine powder from clinker.