Making and Testing Concrete

A property of all mixtures is that there can be different amounts of each of the substances that make up the mixture.

Concrete is made up of 4 substances: cement, sand, stones, and water.

In this investigation you will test mixtures with different amounts of each ingredient to figure out which recipe makes the best concrete.

Safety Precautions

- Clean up yourself and the lab bench immediately if any concrete mixture is spilled. Dried cement is nearly impossible to clean off.
- Wash your hands and clean up the work area when you have completed the activity.

What You Need

cement
sand
stones
water
paper cups
marker
stirring rod
spoon
metre stick

What to Do

Day 1: Make the concrete

1. Label 5 paper cups with your name and the numbers 1 to 5.

2. Add the dry ingredients to each paper cup using the amounts in the table below. For cup 5, decide what ingredients you want to try, and record the number of level spoons you place in the cup.

Cup Number	Dry Ingredients (# of level spoons)			Amount of Water Left in Cylinder After Water Is Added	Amount of Water Added
	Cement	Sand	Water (mL)	Water (mL)	Water (mL)
1	1	2	3		
2	2	2	2		
3	3	2	2		
4	4	2	2		
5 your own recipe					

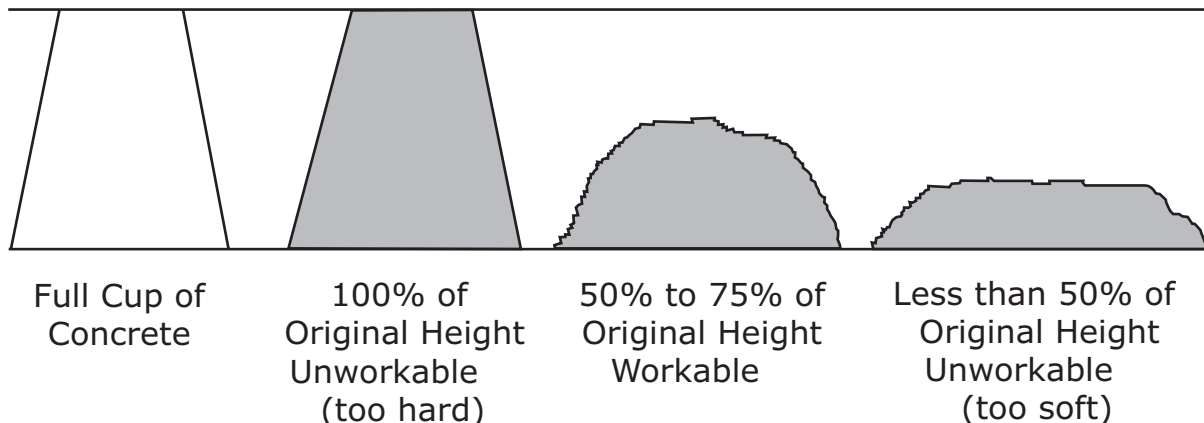**3.** Use a stirring rod to mix the dry ingredients thoroughly.

4. Place exactly 50 mL of water into a graduated cylinder.
   - Slowly add small amounts of water to cup 1 until the mixture is wet, not flooded.
   - Stir the mixture continuously to ensure you do not add too much water.
   - To test if you have the right amount of water, do a slump test.

How to Do a Slump Test

a) Fill an inverted, bottomless cone with the concrete mixture. A foam or paper cup with the bottom removed makes a good bottomless cone.

b) Make sure to pack the concrete several times while filling the cone.

c) Carefully remove the cone by lifting it straight upward.

d) Place the cone beside the pile of concrete. The best pile should be about $\frac{1}{2}$ to $\frac{3}{4}$ the height of the cone for a concrete mixture with good workability.

e) On one cup, measure the height of the cup and mark the half-way height. Compare each sample for "slump" according to the diagram and record your rating in the data table below.

| Full Cup of Concrete | 100% of Original Height Unworkable (too hard) | 50% to 75% of Original Height Workable | Less than 50% of Original Height Unworkable (too soft) |

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5. Record the amount of water that is left in the cylinder. Subtract that amount from 50 mL to find out how much water you added to the mixture.

6. Repeat step 4 for each of the five cups. Start with exactly 50 mL of water each time. Record the amount of water added to each cup.

7. Set each cup to dry until next class.

8. **a)** Predict which cup you think will have the best concrete. _____

- It should stay together and not crumble.
- It should hold its shape and resist breaking when dropped.
- It should be able to hold a large mass.

b) Why do you think the cup you chose will be the best?

_____

Day 2: Test the properties of the concrete mixtures

9. Remove each sample from the paper cup.

- In the data table, write down if the concrete crumbles while you do this.
- Write down anything else you notice about each sample.

10. Step on each sample.

- Do they hold up or do they break or crumble?
- Record this in the data table.

11. Take each sample to a patch of floor or patch of ground that your teacher says is the "drop zone."

- Drop it from a height of exactly one metre. Make sure you drop each sample from the exact same height.
- Record which samples broke with one drop.

12. If samples did not break the first time, drop them a second time.

- Drop them up to five times or until they break.
- Record how many drops it takes before the sample breaks.
- If the sample does not break, record "Does not break after 5 drops."

Name: _____   Date: _____

Test	Cup 1	Cup 2	Cup 3	Cup 4	Cup 5
a) Did the sample crumble when the paper cup was removed?					
b) What was the amount of "slump" in the sample?					
c) Did the sample break when stepped on?					
d) Did the sample break when dropped once from 1 m?					
e) How many drops from 1 m did it take to break the sample?					
f) Rate the sample from 1 to 5 (1 = best, 5 = worst)					

What Did You Discover?

13. Which sample was the best? Why do you think so?

_____

_____

14. What were the proportions of the dry ingredients and water for the best sample?

_____

Name: _____ Date: _____

15. Look back at your prediction from day 1. Was it correct?

_____

16. Why do you think your prediction was correct or incorrect?

_____

_____

_____

17. Write about your experience with this activity. What could you do better next time?

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