

AIM

**To Study the  
Setting of Cement**

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# CERTIFICATE

This is to certify that this project work is submitted by ROHIT GUPTA to the Chemistry department, Aditya Birla Public School, Kovaya was carried out by him under the guidance & supervision during academic year 2009-2010.

Principal

School (Head of chemistry dept.)  
Kovaya

Mr. B D Kotwani Aditya Birla public

# ACKNOWLEDGEMENT

I wish to express my deep gratitude and sincere thanks to Principal, Raji Jayaprasad, Aditya Birla public school, Kovaya for her encouragement and for all the facilities that she provided for this project work. I sincerely appreciate this magnanimity by taking me into her fold for which I shall remain indebted to her.

I extend my hearty thanks to Mr. B D Kotwani, chemistry teacher, who guided me to the successful completion of this project. I take this opportunity to express my deep sense of gratitude for his invaluable guidance, constant encouragement, constructive comments, sympathetic attitude and immense motivation, which has sustained my efforts at all stages of this project work.

I can't forget to offer my sincere thanks to my classmates who helped me to carry out this project work successfully & for their valuable advice & support, which I received from them time to time.

ROHIT GUPTA.

## DECLARATION

I do hereby declare that this project work has been originally carried under the guidance and supervision of Mr. B D Kotwani, head of chemistry department, Aditya Birla Public School, kovaya.

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# Experiment - 1

**AIM :** To study the setting of mixtures of cement with lime, sand, of different qualities, rice husk, fly ash, etc.....

## Requirements :

Beakers, glass rod, weights, small wooden boxes or empty match boxes. Lime, pit sand, river sand, cement, fly ash, rice husk...

# Introduction

Cement is essentially a finely ground mixture of calcium silicates ( $3\text{CaO} \cdot \text{SiO}_2$ ) and aluminates ( $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ ) which sets to a hard mass treated with water. This property makes cement capable of joining rigid masses like bricks, stones, tiles etc. into coherent structures. The cements have property of setting and hardening under water due to certain physicochemical process and are, therefore, called hydraulic cements. During setting of cement, the physical changes taking place are gel formation and crystallization and chemical changes are hydration and hydrolysis.

The process of solidification of cement paste involves: (i) *setting*, and (ii) *hardening*.

Setting is stiffening of the original plastic mass into initial gel formation. After setting, hardening starts due to gradual start of crystallization in the interior of the mass. The strength developed by cement at any time depends upon the amount of gel formed and the extent of crystallization. A mixture of cement, sand, small pieces of stone (gravel) and

water is known as **concrete** and sets to an extremely hard structure.

When cement is used for construction purposes, it is always mixed with sand and little water to make a pasty material called **mortar**. Here cement or lime forms the binding material and function of sand is to prevent shrinking and cracking and to increase the bulk, thereby reducing the cost of the mortar. When cement is used as the binding material it is called **cement mortar** and when lime is used as the binder it is called **lime-mortar**. Sand in addition to its other functions also increases the adhesive qualities of the binding material.

**Effect of quality of sand on setting of cement mortar.** Sand obtained from different sources has different qualities. For example, *sea sand* obtained from sea contains some unwanted salts and retards the setting of cement and is unsuitable for making mortar. On the other hand, *pit sand* obtained from pits in the soil and *river sand* obtained from river bed are considered excellent for preparing mortar and concrete.

**Effect of time on setting of cement mortar.** Time has an important role on the strength developed by cement mortar. When a cement sand paste in the ratio 1:3 in water is allowed to dry, the strength of the solid mass keeps on

increasing with increase in the time given for setting. It acquires nearly full strength in 28 days.

## Procedure :-

1. Prepare the sets of mixtures of various compositions as given in the observation table.
2. Take each of the mixtures in different beakers and prepare their pastes by adding minimum quantity of water.
3. Take 10 empty match-box inner cases and mark them from 1 to 10.
4. Transfer the prepared pastes immediately into the match-boxes and compact them by pressing with hand.
5. Spray water from time to time over the pastes so that they are always moist.
6. Take out the slabs after three days and test for its strength. For that hold a weight of 10g on the hand at a fixed height (say 50 cm above the ground) and drop the weight on the slab. See if the slab breaks or not. If it does not break then take 20g weight and drop it from the same height. This way keep on increasing the weight and note down the minimum weight required to break the slab.



# Observations

**Setting time allowed = 3 days.**

SL.NO	COMPOSITION OF MORTAR (Ratio by volume of various components)						MINIMUM WEIGHT REQUIRED TO BREAK THE SLAB
	CEMENT	RIVER SAND	PIT SAND	LIME	FLY-ASH	RICE-HUSK	
1	1	3	****	****	****	****	.....g
2	1	6	****	****	****	****	.....g
3	1	****	3	****	****	****	.....g
4	1	****	6	****	****	****	.....g
5	1	6	****	****	1	****	.....g
6	2	9	****	****	1	****	.....g
7	1	3	****	1	****	****	.....g
8	1	3	****	2	****	****	.....g
9	1	1	****	****	****	1	.....g
10	1	3	****	****	****	2	.....g

## Experiment - 2

AIM : To study the setting of mixtures of cement with sand, lime and fly-ash with respect to time and strength.

### Requirements

Beakers, glass rod, weights, small wooden boxes or empty match boxes. Lime, pit sand, river sand, cement, fly-ash, rice husk.

## Procedure :-

1. Prepare mixtures of the various compositions as given in the following observation table.
2. Take each of the mixtures in different beakers and prepare their pastes by adding minimum quantity of water.
3. Take 9 empty match-box inner cases and mark them from 1 to 9.
4. Fill three cases with paste of each composition.
5. Spray water from time to time over the pastes so that they remain moist all the time.
6. After three days take out one slab of each composition and test for their strength by the method described in previous experiment.
7. Similarly, take out a set of three slabs after 7 days and then after 30 days and test for their strengths.

## Observations :-

S.NO	Composition of mixture	Minimum weight required to break the slab after		
		3 Days	7 Days	30 Days
1	Cement : River sand			
	1:03	.....gm	.....gm	.....gm
2	Cement: River sand: Fly-ash			
	2:09:01	.....gm	.....gm	.....gm
3	Cement: River sand: Lime			
	1:03:01	.....gm	.....gm	.....gm

## Conclusions :-

**The strength of the slab increases with increase in the setting time allowed...!**

## DEDICATION:-

I DEDICATE THIS PROJECT WORK TO THE  
LOTUS FEET OF

MY FATHER

MR. VINOD GUPTA

&

MY MOTHER

MRS. SUNITA GUPTA

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