DATE . .	CO_2 SAND PRACTICE	SHEET NO.

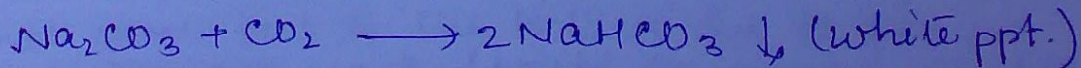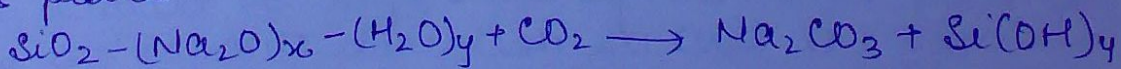AIM → To determine the effect of gassing time and sodium silicate content on hardness of the mould.

APPARATUS REQUIRED :-

(1) Electronic balance.
(2) Sand, Sodium Silicate
(3) CO_2 gas cylinder.
(4) Step pattern
(5) Mould Box.

THEORY :-

The CO_2 moulding is based on the hardening of sodium silicate causing bonding of sand grains by gel formation. Sodium silicate is an aqueous mixture of soda (Na_2O) and silica (SiO_2). The ratio of silica to soda is known as modulus, which varies from $1.5 - 3.0$.

When CO_2 gas is passed through the sodium silicate mixed sand then the following reaction takes place.

$$SiO_2 - (Na_2O)_x - (H_2O)_y + CO_2 \longrightarrow Na_2CO_3 + Si(OH)_y$$

$$Na_2CO_3 + CO_2 \longrightarrow 2NaHCO_3 \downarrow \text{ (white ppt.)}$$

Silica gel forms as a result of the chemical reaction. Silica gel is a kind of rigid gel which is characterised by the three dimensional rigid network of solid crystal with liquid entrapped in it. It is produced by polymerizing

mono-silicic acid molecules [$Si(OH)_4$] into a rigid 3D silica network, the interstices of which contain water molecules that are by-products of the polymerization process.

PROCEDURE:→

(i) Prepare a mixture of sand with 5% sodium silicate and seperately a mixture with 10% sodium silicate. Further procedure is to be done with both the mixtures.

(ii) We weighed out 155 gms of the mixture and prepared a standard sample (2 inch dia & 2 inch height) after ramming the sand 3 times.

(iii) The value of the CO_2 gas cylinder was opened by turning it anticlockwise.

(iv) Outlet pressure of CO_2 was adjusted to 1kg/cm^2 and the flow rate of CO_2 gas to 5 litres per minute.

(v) Pass CO_2 gas at the flow rate of 5 lpm in steps of 10 seconds.

(vi) The standard sand specimen with in the specimen tube should be supported by the metal post the from the opposite direction so that the specimen does not come out of the holder due to gas pressure. The gas mask should be gently inserted on to the specimen holder due to gas pressure. facilitate ease of its removal from the holder after gassing. ossis

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(VII) After passing the gas for 10 seconds the value was turned off.

(IX) After the gas was passed, the hardness of the surface of specimen was inspected with the help of scratch hardness tester.

(X) Repeat the above procedure for subsequent gassing intervals of 10 seconds untill the hardness is found to decrease than the previous value.

(XI) A graph is plotted for gassing time versus hardness of the specimen for both sand mixtures

PROCEDURE (to determine the effect of depth of penetration of gassing in sodium silicate CO_2 sand practice)

(1) 3 kg of sand was taken and 4% by weight (120 gm) of sodium silicate was added.

(2) A step pattern was placed in the mould box in proper orientation.

(3) Sand was filled in the mould box and rammed lightly to spread out sand properly.

(4) Made vents and gassed the mould from top side for 60 seconds.

(5) Mould box was turned and pattern removed

(6) Hardness was measured at every step in the mould.

(7) Scratch hardness Vs depth of penetration was plotted

Observations:

Sl no.	Depth of penetration (cm)	Hardness
1.	1.4	29
2	3.4	19
3	5.4	12
4	7.4	5
5	9.4	0

Hardness vs Depth of penetration
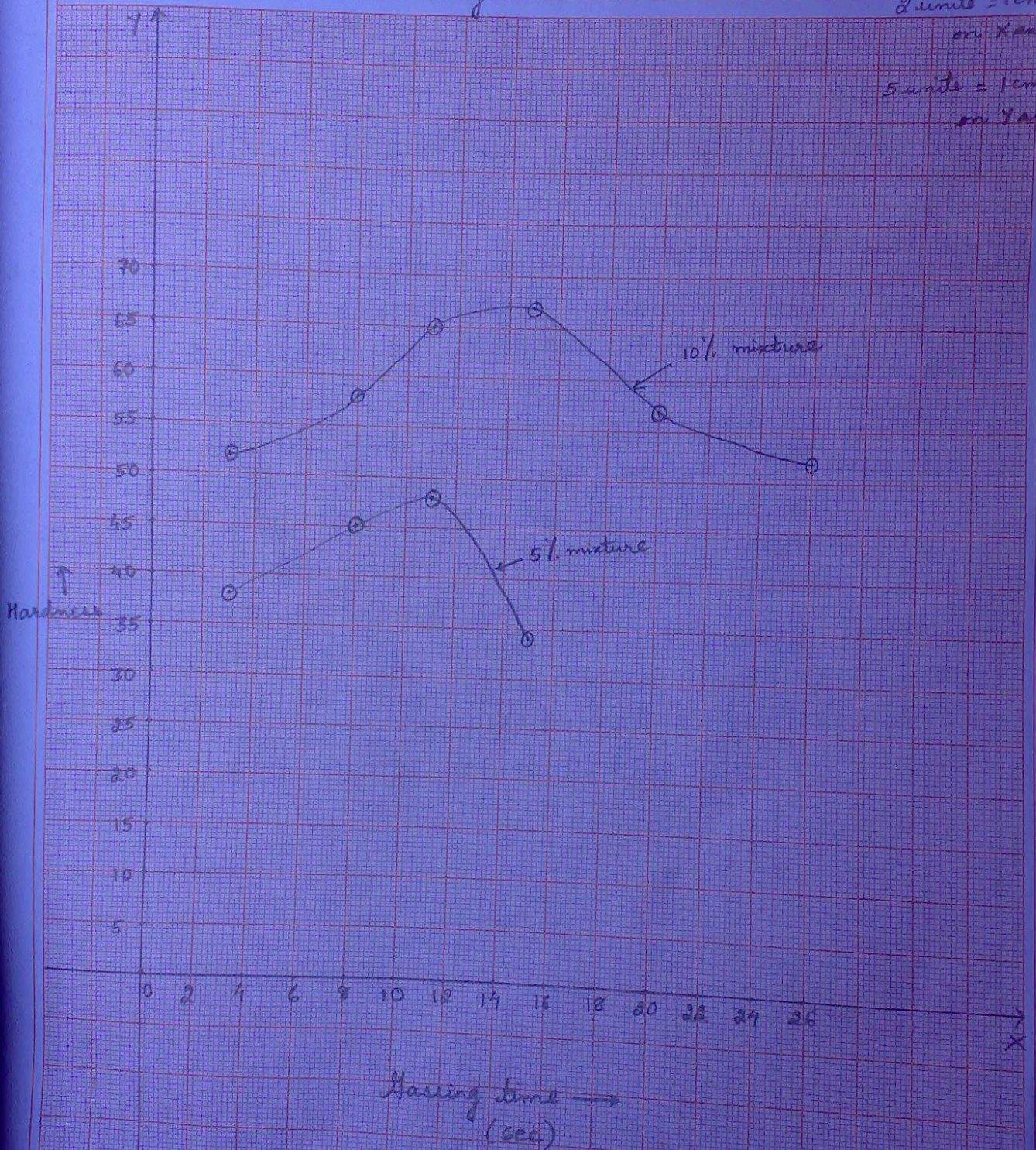
Scale:
1 unit = 1 cm on X-axis
5 units = 2 cm on Y-axis

Depth of penetration (cm) →
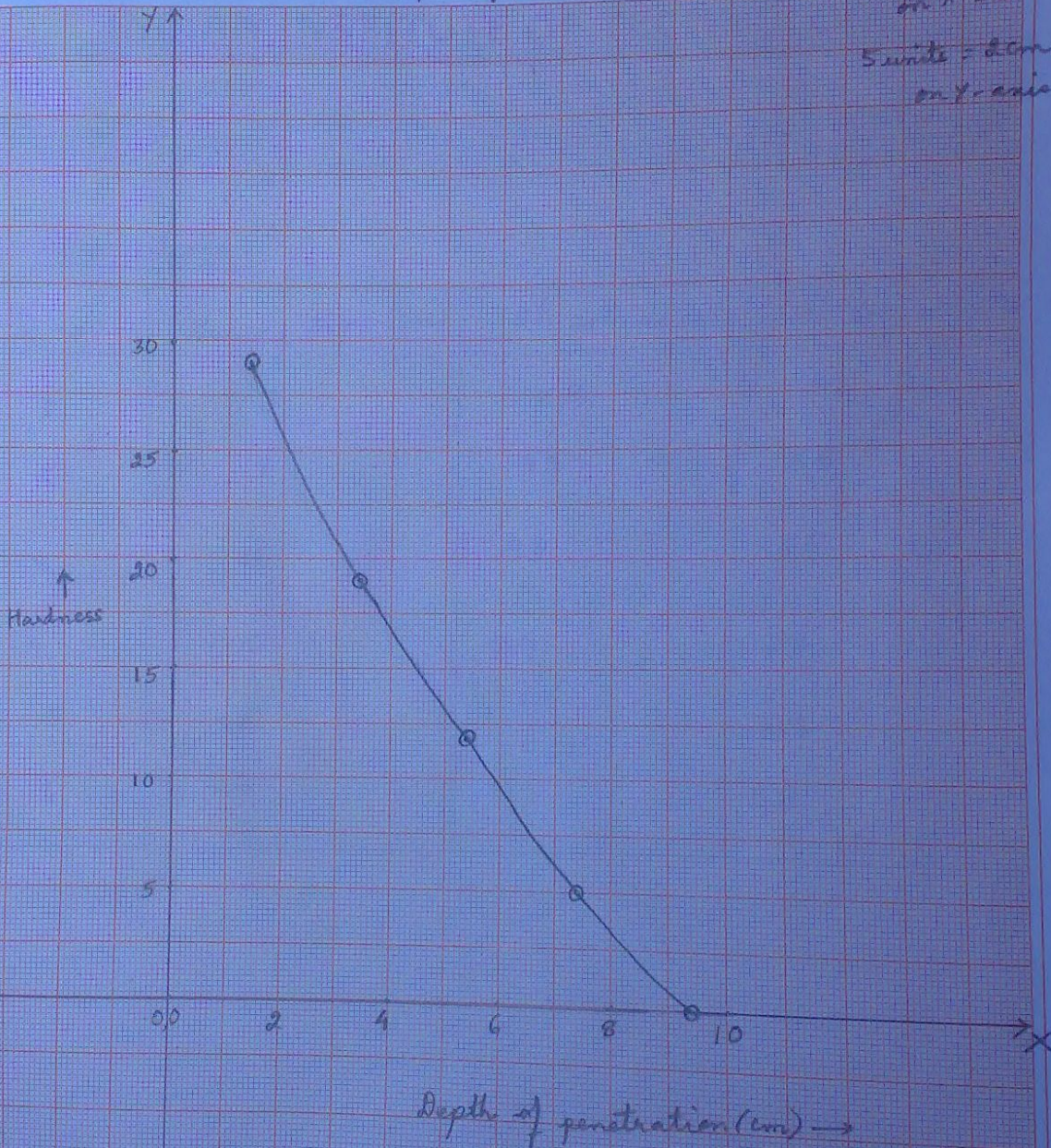
Observations :

Sl no.	Gassing time (sec)	5% sod. silicate	10% sod. silicate
1.	3	38	52
2.	8	45	58
3.	11	48	65
4.	15	34	67
5.	20		57
6.	26		52

Hardness VS Gassing Time

Scale
2 units = 1cm on X axis
5 units = 1cm on Y axis

10% mixture

5% mixture

Hardness

Gassing time → (sec)

Discussions:

1. CO_2 moulding practice makes the mould harder due to the formation of silica gel at the grain boundaries. ~~How if~~. This forms a very thin layer at the grain boundaries hence it is suitable for smaller size grains because if the grain size is large, thick coating of binder will also do as on even ramming it wont be able to fill the large spacings between large size grain particles fully and some permeability will be retained. But for smaller size grains thick binders can not be used as they would fill up the spaces fully giving zero permeability.