مختبر مواد البناء / التجربة الاولى / الشعبة 1

Building Materials Laboratory

Experiment No.: 1

Normal Consistency
and Setting time of hydraulic cement

Name	Mark
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Student's number	Section number	Experiment day and date	Submission day and date
1931793	1	25/10/2020	1/11/2020

Experiment 1

Normal Consistency and Setting time of hydraulic cement

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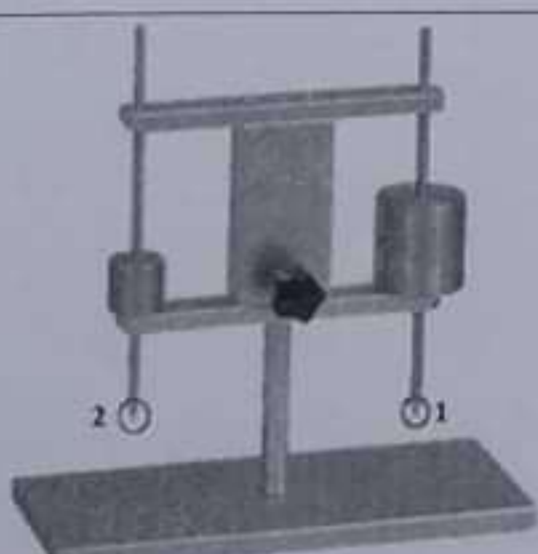
1.1. Objective

1- Measure the suitable quantity of water for cement "Normal consistancy" 2- Find out the initial and final setting time of cemement baste to know the validity to use the cement.

1.2. Apparatus and Equipment

	Apparatus Name is Vicat Apparatus Part 1 is pase plate Part 2 is conical mould Part 3 is Needle of (1 mm) Part 4 is Rod of (10 mm) Part 5 is Scale
	Apparatus Name is Gillmore apparatus Part 1 is Thin needle (The final setting needle) Part 2 is Thick needle (the initial setting needle)

1.3. Materials

Water

Cement

1.4. Data and Calculations

1.4.1. Normal Consistency

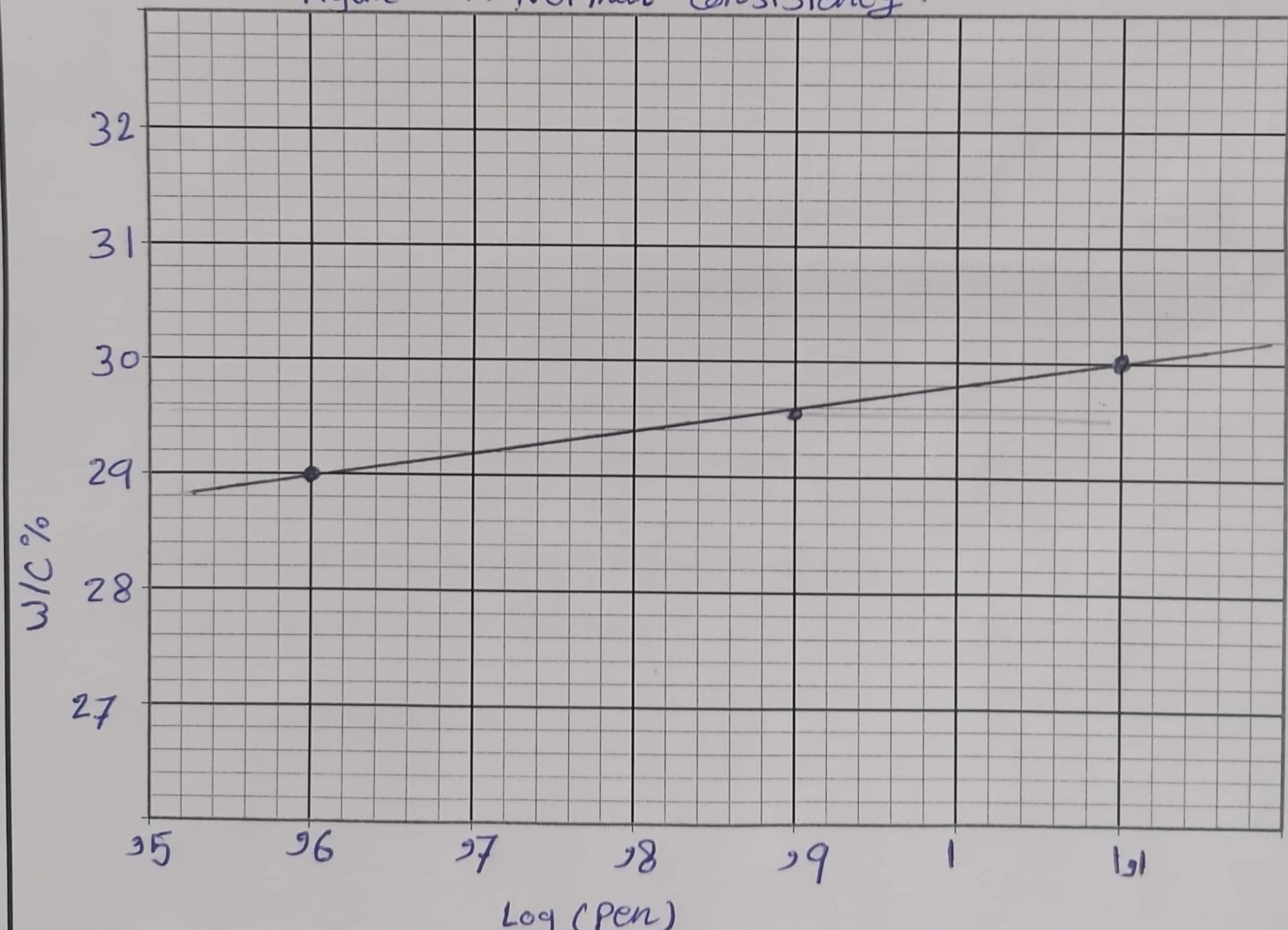
Table 1.1: variation of penetration with w/c ratio

Wt. of Cement = 650 g

Wt. of Water (g)	W/C %	Penetration (mm)	Log (Pent.)
195	30.0	14	1.1
191.75	29.5	9	.9
188.5	29.0	4	.6

- Draw a chart for w/c% versus Log [penetration]; Figure 1.1
  Use the following chart and set on it the chart number, chart title, the axis title and units.

Figure 1.1: Normal Consistency.



- From this chart, the normal consistency is...29.8%

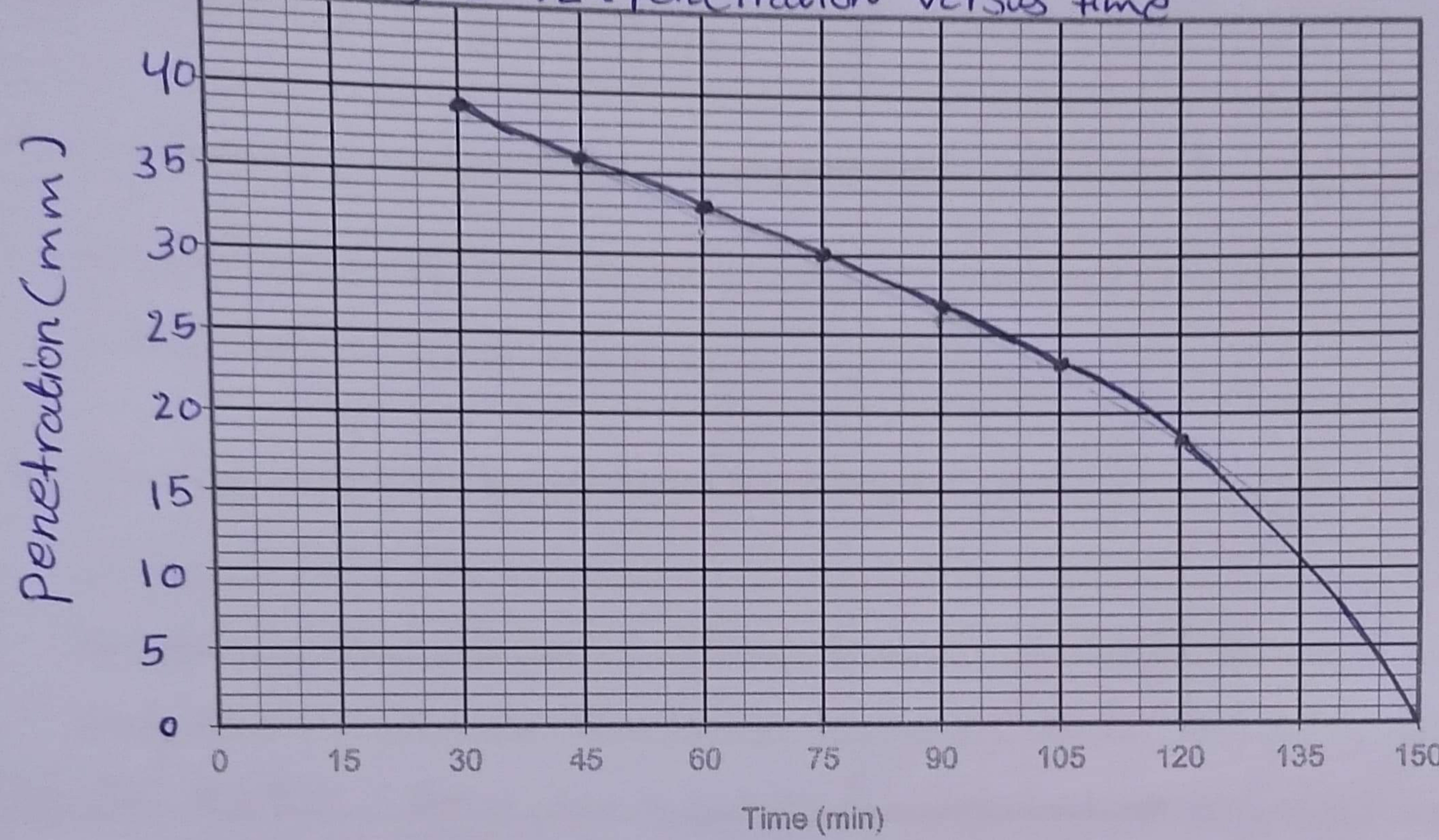
1.4.2. Initial and Final Setting Time

Table 1.2: variation of penetration with time

	Wt. of cement =		W/C% =			Wt. of water =	
Time (min)	30	45	60	75	90	105	120
Penetration (mm)	38	36	33	30	27	23	18

- Draw a chart for penetration versus time; Figure 1.2.
  Use the following chart and set on it the chart number, chart title, Y-axis title and unit.

Figure 1,2 : penetration versus time



- From this curve, initial setting time is...100 min.

  Final setting time is ...150..min.

- Calculate the Final setting time using the approximate equations

FST = 1,2 (100) + 90 min

FST = 210 min

1.5. Discussion

- The relation between penetration and w/c ratio using table 1.1, is Direct (direct / indirect).

- The relation between penetration and w/c ratio using figure1.1. (w/c% versus Log(penetration)) is Linear (Linear / Non-linear).

- The relation between penetration and time using table 1.2, is Indirect (direct / indirect).

- The relation between penetration and time using figure1.2. (penetration versus time) is Non Linear (Linear / Non-linear).

- Our cement can be used in the construction or not? Why?

Yes, it can be used because, the final setting time is less than 6,25 hrs and the initial setting time is more than 45 min as it acceptable in ASTM (American Society for testing Materials) and the normal consistency is acceptable in (ASTM).

- Compare the results of calculated final setting time using the approximate equations with the actual one (measured graphically)

When we find the (Fst) in the laboratory it gaves 150 minutes, but when we find it by approximate equations it gaves different number of (FST) 210 minutes.

	Experiment 2 Compressive Strength of Cement Mortar	
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2.1. Objectives

*To determine the compressive strength of cement mortar, and determine the quality of cement (to know if it accepted or not to use it), and calculate the strength of mortar in the compression test.

2.2. Apparatus and Equipment

-Trowel

-mixer

-Gloves

-containers

-cubic molds (9 molds)

6-Gradnated glass (cylinder)

7-Compression test machine

8-Oil

9-weighingscale

3. Materials

1-water

2-Cement

3-Sand (fine aggregate)

2.4. Data and Calculations

Note: The answers must be to the nearest two decimal places

Cement Type: Low heat Portland cement (IV)

Ratios:

Cement: Sand = 1: 2.75
Water: Cement = 0.485

Weights: Cement = 740g
Sand = 2035g
Water = 359g

Age (Day)	Compressive Force (KN)	Compressive Strength (MPa)	Average Strength (Mpa)	Accepted range (Mpa)	Accepted or Not	Accepted Avg. Strength
3	24.1	9.64	11.2	10.08 - 12.33	No	12
	30.1	12.04			yes	
	29.9	11.96			yes	
7	49.3	19.72	21.76	19.58 - 23.93	yes	21.76
	53.3	21.32			yes	
	60.6	24.24			yes	
28	55.7	22.28	20.64	18.5 - 22.7	yes	22.38
	42.9	17.16			No	
	56.2	22.48			yes	

- Sample of calculations:

$* \ \sigma = \frac{P}{A} \rightarrow A = 500 * 50 * 10^{-6} \rightarrow \boxed{A = 2.5 \times 10^{-3} m^2}$

$* \ \sigma_1 = \frac{P_1}{A_1} \rightarrow \sigma_1 = \frac{24.1 * 10^3}{25 * 10^{-3}} \rightarrow \boxed{\sigma_1 = 9.64 \text{ Mpa}}$

$\# \ \sigma_2 = \frac{P_2}{A_2} \rightarrow \sigma_2 = \frac{30.1 * 10^3}{2.5 * 10^{-3}} \rightarrow \boxed{\sigma_2 = 12.04 \text{ Mpa}}$

$\# \ \sigma_3 = \frac{P_3}{A_3} \rightarrow \sigma_3 = \frac{29.9 * 10^3}{2.5 * 10^{-3}} \rightarrow \boxed{\sigma_3 = 11.96 \text{ Mpa}}$

$* \ \sigma_{Avg} = \frac{\sigma_1 + \sigma_2 + \sigma_3}{3} \rightarrow \sigma_{avg} = \frac{9.64 + 12.04 + 11.96}{3} \rightarrow \boxed{\sigma_{avg} = 11.21 \text{ Mpa}}$

* Range $\sigma_{avg} \pm 0.1 \ \sigma_{avg}$

(10.08 - 12.33)

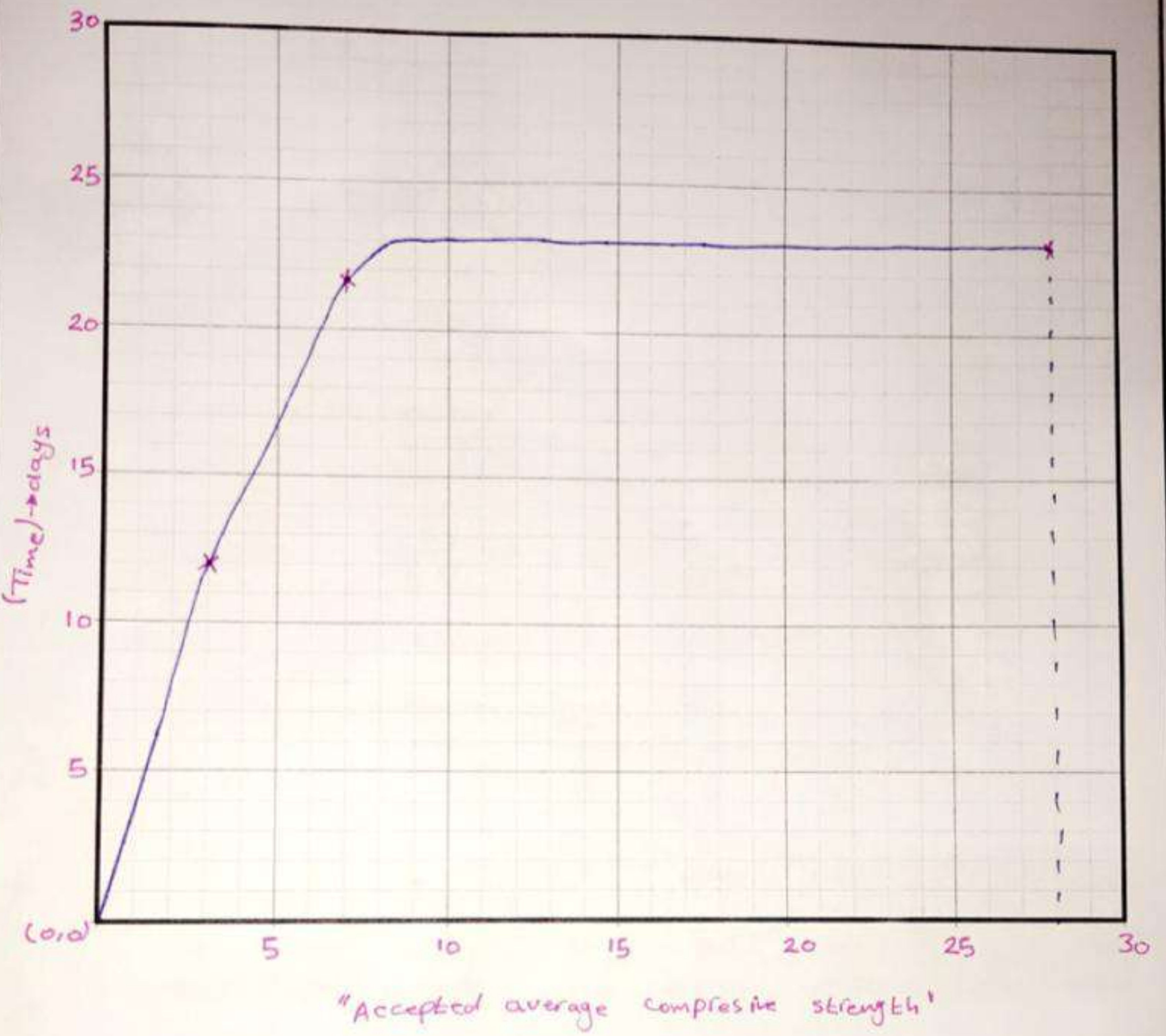
*Accepted Average strength $= \frac{12.04 + 11.96}{2} = 12$ Mpa

2.5. Plot

Draw the experimental accepted average Compressive Strength (MPa) of Mortar versus Time (Days).

(Start from origin)

Use the following chart and set on it the chart number, chart title, the axis title and units.



2.6. Discussion

1. What is the expected tensile strength of the tested cement at 28 days?

* Average tensile strength $= \sigma_{avg} \pm 0.15\ \sigma_{avg}$

$20.64 \pm 0.15\,(20.64)$

$= (17.55 - 23.73)\,MPa$

2. Comment on (compressive strength - time) curve

* Going back to the curve, I noticed that as the Average increase the compressive strength is also increase

* This means that when Age of cement increase, the strength will also increase

* The relation between time and compressive strength is direct and non-linear.

3. The tested cement is accepted or not? Why? Show your work on table 2.1.

Time	Compressive strength Acceptable	IV	Acceptable or Not
3	12	—	—
7	20.52	7.0	yes
28	22.38	17.0	yes

2.7. Specifications

* The tested cement is accepted *

Table 2.1: ASTM C 150-05 requirements for minimum strength of cement (MPa (Psi))

Age (Days)	ASTM C 150 – 05 (mortar cube), cement type (table 4.4)							
	I	IA	II*	IIA*	III	IIIA	IV	V
1	-	-	-	-	12.0	10.0	-	-
	-	-	-	-	(1740)	(1450)	-	-
3	12.0	10.0	10.0	8.0	24.0	19.0	-	8.0
	(1740)	(1450)	(1450)	(1160)	(3480)	(2760)	-	(1160)
7	19.0	16.0	17.0	14.0	-	-	7.0	15.0
	(2760)	(2320)	(2470)	(2030)	-	-	(1020)	(2180)
28	28.0[a]	22.0[a]	28.0[a]	22[a]	-	-	17.0	21.0
	(4060)	(3190)	(4080)	(3190)	-	-	(2470)	(3050)

* Strength values depend on specified heat of hydration or chemical limits of tricalcium silicate and tricalcium aluminate

[a] Optional

	Experiment 3 Compressive Strength of Cement Mortar	
ID:	**Name:**	**SEC.1**

3.1. List 4 equipment and tools used in this experiment: **(1 mark)**

______________________ ______________________

______________________ ______________________

3.2. The tested materials are: (0.5 mark)

______________________ ______________________

3.3. Specific gravity and absorption of coarse aggregates **(3 marks)**

A: Weight of oven-dry test sample in air (g)	**1497**
B: Weight of S.S.D. sample in air (g)	**1500**
C: Weight of saturated sample in water (g)	**964**

Calculations:

1. Apparent Specific Gravity =

2. Bulk Specific Gravity (SSD) =

3. Absorption (%) =

3.4. Specific gravity and absorption of fine aggregate **(3 marks)**

A: Weight of oven —dry specimen in air (g)	**481**
B: Weight of Pycnometer filled with water (g)	**1071**
S: Weight of the saturated surface-dry specimen (g)	**500**
C: Weight of Pycnometer with specimen and water (g)	**1367**

Calculations:

1. Apparent Specific Gravity =

2. Bulk Specific Gravity (SSD) =

3. Absorption (%) =

3.5. True or False **(2.5 mark)**

1. Absorption of the tested fine aggregate is accepted. (   )
2. Apparent specific gravity is less than bulk specific gravity. (   )
3. Special balance with basket used to determine the mass of water [where; volume of water = volume of coarse aggregate]. (   )
4. the fine aggregate must be tamped into the mold with 25 light drops of the tamper. (   )
5. The tested fine aggregate using the conical mold will be considered SSD if it slumps fully. (   )

* compressive strength of cement Mortar *

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85/100

3.1 1- oven

3- special Balance with Basket

2- pycometer

4- Conical mold

3.2 1- water

2- Fine/coarse aggregate.

3.3 specific gravity and absorption of coarse aggregates.

1- Apparend specific Gravidy $= \frac{A}{A-C} = \frac{1497}{1497-964} = \boxed{2.808}$

2- Bulk specific Gravity (SSD)

$\frac{B}{B-C} = \frac{1500}{1500-964} = \boxed{2.79}$

3- Absorption (%) $= \left(\frac{B-A}{A}\right) * 100 = \left(\frac{1500-1497}{1497}\right) * 100 = \boxed{0.2\%}$

3.4 specific gravity and absorption of fine aggregate.

1- apparend specific Gravity

$\frac{A}{B+A-C} = \frac{481}{1071+481-1367} = \frac{481}{185} = \boxed{2.6}$

2- Bulk specific Gravity (SSD) $= \frac{S}{B+S-C} = \frac{500}{1071+500-1367} = \frac{500}{204} = \boxed{2.45}$

3- Absorption (%) $= \left(\frac{S-A}{A}\right) * 100\% = \frac{500-481}{481} = \boxed{3.95\%}$

3.5 True or False

1. (True) 2. (True)

3. (True) 4. (False)

5. (True)

	Experiment 4 Resistance to degradation of small-size coarse aggregate by abrasion and impact in the Los Angeles machine	
ID:	**Name:**	**SEC.1**

4.1. List 4 objectives of this experiment: **(1.25 mark)**

______________________ ______________________

______________________ ______________________

4.2. The used apparatus and equipment are: **(1.5 mark)**

______________________ ______________________

______________________ ______________________

4.3. The tested material is: **(0.5 mark)**

____

4.4. Data: (0.5 marks)

W_1: Weight of aggregate before testing [original weight] (g)	
W_2: Weight of aggregate retained on sieve #12 after testing (g)	**4010**

4.5. Calculations: (1 marks)

Calculate the Abrasion%

4.6. Discussion (1.5 marks)

What is the quality of our sample? Why?

____

____

____

4.6. True or False **(3.75 mark)**

1. The number of revolutions is 500 rounds. (   )
2. The number of steel balls used in L.A. machine is 10. (   )
3. If the machine velocity is 20rpm instead of 30rpm then the L.A. % will be decreased. (   )
4. If the tested aggregate is weighted directly after sieving on sieve #12 without washing, then the L.A. value will be increased. (   )
5. The abrasion value found from Los Angeles test for two aggregates A and B are 12% and 22% respectively. These results indicates that aggregate A is harder than B. (   )

4.7. Help

$$\text{Abrasion\%} = \frac{\text{Weight of passing sieve No.12}}{\text{Weight of original sample}} * 100\%$$

OR:

$$\text{Abrasion\%} = \frac{\text{Weight og original sample - Weight of retained on sieve No.12}}{\text{Weight of original sample}} * 100\%$$

Table 4.1: Quality of tested aggregate depending on the abrasion % result

Abrasion %	Quality of Aggregate
< 15	Ultra-High Quality
15 – 25	High Quality
25 – 35	Medium Quality
35 – 45	Low Quality
> 45	Can't be used

☺ GOOD LUCK ☺

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90/100

4.1
1. wearing percent
2. check quality of aggregate
3. to find abrasion
4. hardness of course aggregate

4.2
1. steel balls
2. balance
3. sieves
4. los angalous machine

3 4.3 coars aggregate, fine aggregate.

4.4 $w_1 = 5000g$ $w_2 = 4010$

4.5 Abrasion% $= \frac{w_1 - w_2}{w_1} \times 100\% = \frac{5000 - 4010}{5000} \times 100\% = 19.8\%$

4.6

The quality of sample is High quality because the Abrasion% (18-25%) = 19.8% and High qulity (15 - 25)

4.6 True or False

1. ✓
2. X
3. ✓
4. X
5. ✓

	Experiment 5 Bulk Density (Unit Weight) and Voids in Aggregate Angularity Number of Coarse Aggregate	
ID:	**Name:**	**SEC.1**

5.1. List 4 objectives of this experiment: **(1 mark)**

________________ ________________

________________ ________________

5.2. The used apparatus and equipment are: **(0.75 mark)**

________________ ________________

____

5.3. The tested material is: **(0.25 mark)**

____

5.4. Data:

Weight of measure plus compacted aggregate (kg)	20.54
Weight of measure plus loose aggregate (kg)	19.54
Weight of measure filled with water (kg)	15.3
Weight of measure (kg)	6.00
Density of water (kg/m^3)	1000
Specific gravity of aggregate	2.73

5.5. Calculations: (6 marks)

1. Volume of aggregate =

2. Compacted Bulk density of aggregate =

3. Voids (%) of compacted sample=

4. Bulk density of loose aggregate =

5. Voids (%) of loose sample =

6. Calculate the angularity number if the bulk density (measured to calculate it) is 0.97 of the compacted bulk density.

5.6. Discussion (2 marks)

1. The relation between Bulk density and Voids ratio is ------------------------ (Linear, Non-Linear).
2. The relation between the roundness of the aggregate and the angularity number is ----------------------- (Linear, Non-Linear).
3. Loose voids ratio is ------------------- (Less, Greater) than compacted voids ratio.
4. The relation between Angularity # and Voids ratio is ------------------------ (Linear, Non-Linear).

5.7. Help

1. Volume of measue:

$$\text{Density of water} = \frac{\text{Mass of water}}{\text{Volume of water}}$$

$$\text{Volume of water} = \frac{\text{Mass of water}}{\text{Density of water}}$$

2. Compacted bulk density

$$\text{Compacted bulk density} = \frac{\text{Mass of compacted agregate}}{\text{Volume of of compacted aggregate}}$$

3. Loose bulk density

$$\text{Loose bulk density} = \frac{\text{Mass of loose agregate}}{\text{Volume of of loose aggregate}}$$

4. Compacted Voids%

$$\text{Compacted Voids\%} = (1 - \frac{\text{Compacted bulk density}}{Gs * \text{Density of water}})*100$$

5. Loose Voids%

$$\text{Loose Voids\%} = (1 - \frac{\text{loose bulk density}}{Gs * \text{Density of water}})*100$$

6. Angularity Number

Assume: bulk density required to calculate the Angularity number = Compacted bulk density

$$\text{Angularity \#} = 67 - (100 * \frac{\text{Compacted bulk density}}{Gs * \text{Density of water}})$$

☺ **GOOD LUCK** ☺

Exp.5 : Bulk Density (Rodded unit weight) of C.A

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100/100

5.1 1- Determine voids Ratio
2- Determine Bulk Density
3- compacted and loos bulk density
4- Determine Angularity Number

5.2 1- Tompting rod 2- Balance 3. Measure

5.3 Coarse Aggregate.

5.5 1- volume of aggregate = Density of water = $\frac{15.3 - 6}{1000} = 9.3 * 10^{-3}\ m^3$

2- Bulk density = $\frac{20.54 - 6}{9.3 * 10^{-3}} = 1563.440\ kg/m^3$

3- % of compacted sample = $\left(1 - \frac{1563.440}{2.73 * 1000}\right) * 100 = 42.73\%$

4- Bulk of density of loss aggregate = $\frac{19.54 - 6}{9.3 * 10^{-3}} = 1455.91\ kg/m^3$

5- voids % of loose = $\left(1 - \frac{1455.91}{2.73 * 1000}\right) * 100 = 46.6\%$

6- Angularity = $= 67 - \left(100 * \frac{0.97 * 1563.4}{2.73 * 1000}\right) = 11.45$

5.6
1- Non-Linear
2- Linear
3. Greater
4. Non-Linear

	Experiment 6 Sieve Analysis of Fine and Coarse Aggregates	
ID: 1931793	Name: Maya Ahmad Askar 87/100	SEC.1

6.1. the used apparatus and equipment are:

pan — sieve for fine and coarse aggregate

Blance — mechanical sieves shaker

6.2. Data and Calculations

6.2.1. Sieve analysis of coarse aggregates

Table 6.1: Sieve analysis of coarse aggregates

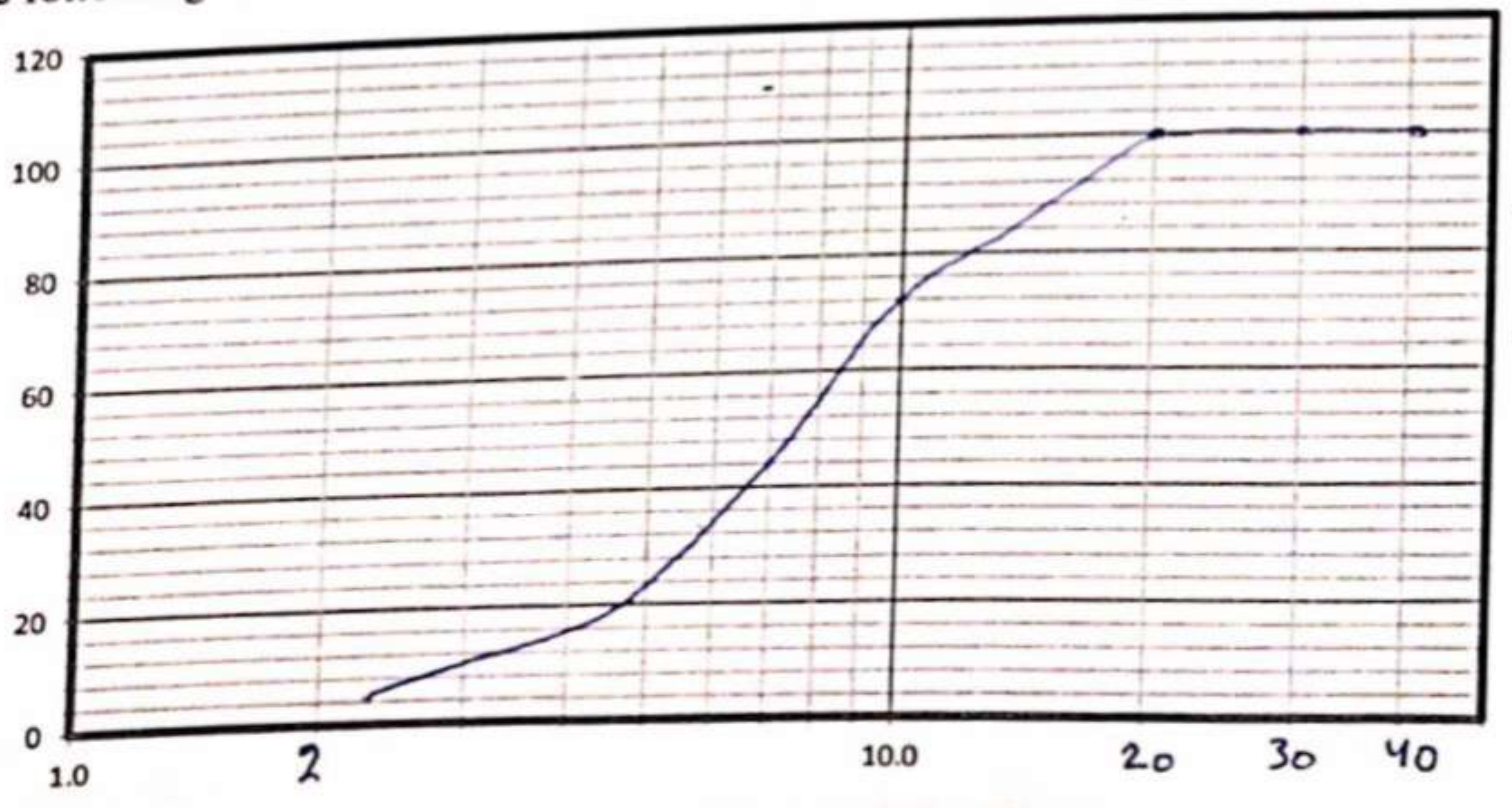
sieve size (mm)	sieve No.	sieve wt. (g)	Sieve +ret. (g)	Ret. Wt. (g)	Retained (%)	Cum. Ret. (%)	Cum. Pass (%)
37.5	1 1/2"	496	496	0	0	0	100
25	1"	465	465	0	0	0	100
19	3/4"	476	476	0	0	0	100
12.5	1/2"	460	502	42	4.2	4.2	95.8
9.5	3/8"	471	720	249	24.8	29	71
4.75	4	495	1010	515	51.4	80.4	19.6
2.36	8	385	573	188	18.9	99.3	0.7
0.075	200	244	247	3	0.3	99.6	0.4
pan		304	308	4	0.4	100	0
		Total weight retained		1001			

Determine:

1. F.M. = $\frac{0+0+29+80.4+99.38+100+100+100+99.09}{100} = 6.08$

2. M.S. = 19 mm (3/4 inch)
3. N.M.S. = 12.5 mm Not standard // 19 mm standard

Draw the [cumulative passing (%)] versus [sieve size (mm)]; ((Excluding sieve #200))
Use the following chart and set on it the axis title and units.



6.2.2. Sieve analysis of fine aggregates

Table 6.2: Sieve analysis of fine aggregates

sieve size (mm)	sieve No.	sieve wt. (g)	Sieve + ret. (g)	Ret. Wt. (g)	Retained (%)	Cum. Ret. (%)	Cum. Pass (%)
9.5	3/8"	469	469	0	0	0	100
4.75	4	436	436	0	0	0	100
2.36	8	385	395	10	3.37	3.37	96.63
1.18	16	419	441	22	7.43	10.8	89.2
0.6	30	345	401	56	18.91	29.71	70.29
0.3	50	365	469	104	35.13	64.84	35.16
0.15	100	294	362	68	22.97	87.81	12.19
0.075	200	246	268	22	7.43	95.24	4.76
pan		302	316	14	4.72	100	0
		Total weight retained		296			

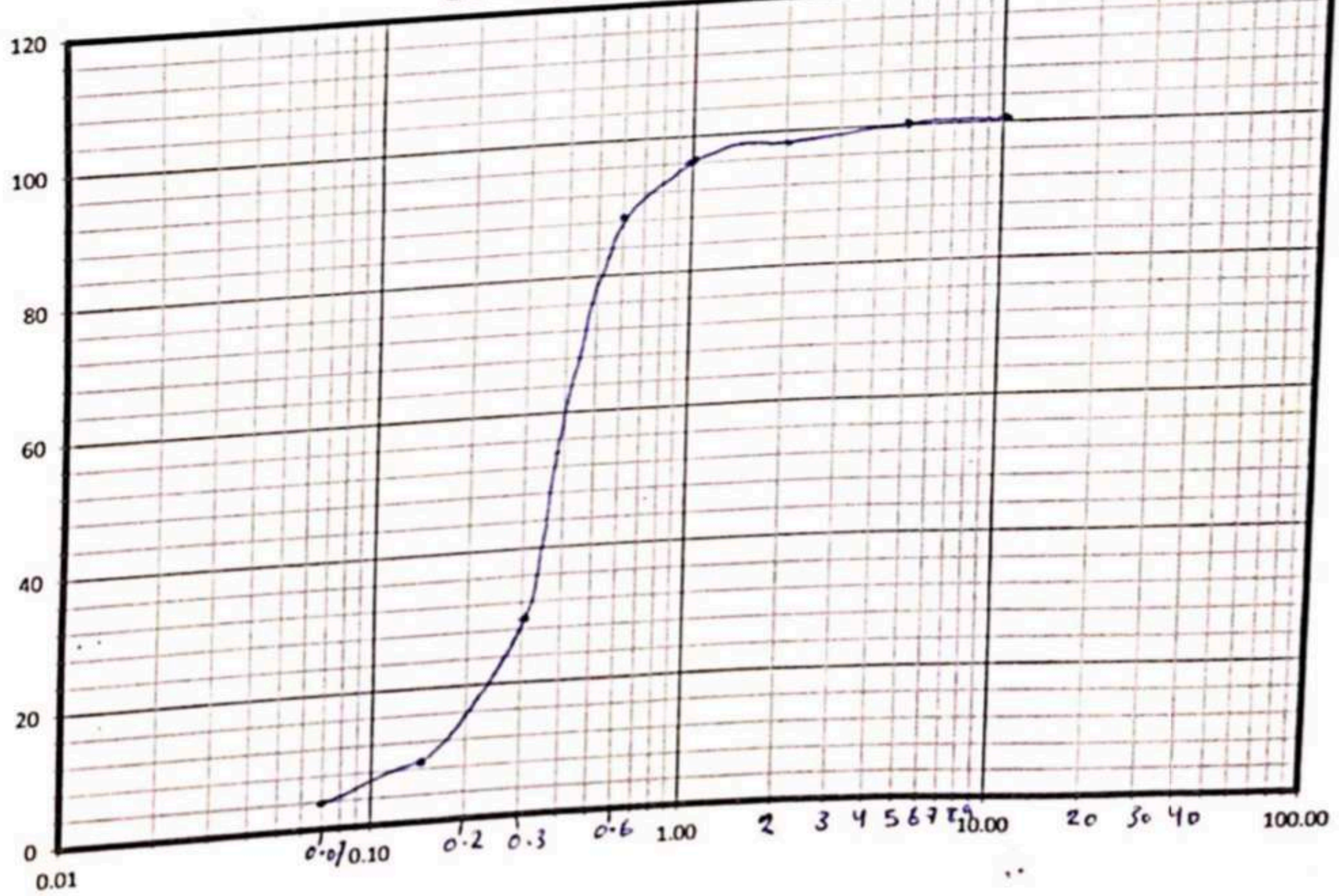
Determine:

1. F.M. = $\frac{0+0+10.8+29.71+3.37+64.84+95.24+87.81}{100} = 2.91$

2. M.S. = 4.75mm (4 inch)
3. N.M.S. = 1.18 mm (16 inch)

Draw the [cumulative passing (%)] versus [sieve size (mm)]; ((Including sieve #200))
Use the following chart and set on it the axis title and units.

Grading Curve (Fine Aggregates)



Prepared by Eng Buthaina Abu-Saleem

6.3. Discussion

6.3.1. Coarse Aggregate

1. The aggregate is ---Poor graded--------------- (well graded, gap graded, poor graded or single sized).
2. Classify the aggregate type according to ASTM Standards.

   coarse aggregate (F.M ≥ 5) According ASTM

3. Is the aggregate accepted or not according to ASTM, BS, and Jordanian Specifications?
   Important: Show me your work on the following tables.

Table 6.3.: Some of the grading requirements for coarse aggregate according to ASTM C 33-92a

Sieve size		Percentage by mass passing sieve				
		Nominal size of graded aggregate			Nominal size of single-sized aggregate	
mm	in.	37.5-4.75mm ($1\frac{1}{2}$ to $\frac{3}{16}$ in.)	19 – 4.75mm ($\frac{3}{4}$ to $\frac{3}{16}$ in.)	12.5-4.75mm ($\frac{1}{2}$ to $\frac{3}{16}$ in.)	63 mm ($2\frac{1}{2}$ in.)	37.5 mm ($1\frac{1}{2}$ in.)
75.0	3	-	-	- ✓	100	-
63.0	$2\frac{1}{2}$	-	-	- ✓	90 – 100	-
50.0	2	100	-	- ✓	35 – 70	100
38.1	$1\frac{1}{2}$	95 – 100	-	- ✓	0 – 15	90 – 100
25.0	1	-	100	- ✓	-	20 – 55
19.0	$\frac{3}{4}$	35 – 70	90 – 100	100 ✓	0 – 5	0 – 15
12.5	$\frac{1}{2}$	-	-	90 – 100 ✓	-	-
9.5	$\frac{3}{8}$	10 – 30	20 – 55	40 – 70 ✗	-	0 – 5
4.75	$\frac{3}{16}$	0 – 5	0 – 10	0 – 15	-	-
2.36	No. 8	-	0 – 5	0 – 5	-	-

The tested C.A. is ----Not Accepted-- **(Accepted or Not Accepted)** according to **ASTM**

Table 6.4.: Grading requirements for coarse aggregate according to BS 882: 1992

Sieve size		Percentage by mass passing BS sieve							
		Nominal size of graded aggregate			Nominal size of single-sized aggregate				
mm	in.	40–5mm ($1\frac{1}{2}$ - $\frac{3}{16}$ in)	20–5mm ($\frac{3}{4}$ - $\frac{3}{16}$ in)	14–5mm ($\frac{1}{2}$ - $\frac{3}{16}$ in)	40 mm ($1\frac{1}{2}$ in.)	20 mm ($\frac{3}{4}$ in.)	14 mm ($\frac{1}{2}$ in.)	10 mm ($\frac{3}{8}$ in)	5 mm ($\frac{3}{16}$ in)
50	2	100	-	- ✓	35 – 70	100	-	-	-
37.5	$1\frac{1}{2}$	95 - 100	-	- ✓	0 – 15	90 – 100	-	-	-
20	$\frac{3}{4}$	35 – 70	90 – 100	100 ✓	0 – 5	0 – 15	100	-	-
14	$\frac{1}{2}$	-	-	90 – 100 ✓	-	-	85 – 100	100	-
10	$\frac{3}{8}$	10 – 30	20 – 55	40 – 70 ✗	-	0 – 5	0 – 50	85 - 100	100
5	$\frac{3}{16}$	0 – 5	0 – 10	0 – 15	-	-	0 – 10	0 – 25	50–100
2.36	#7	-	0 – 5	0 – 5	-	-	-	0 – 5	0 – 30

The tested C.A. is Not accepted-------- **(Accepted or Not Accepted)** according to **BS.**

Table 6.5.: Grading requirements for coarse aggregate according to J.S. (Jordanian Standards)

Sieve size mm	Sieve size in.	Percentage by mass passing sieve – Nominal size of graded aggregate: 40 mm ($1\frac{1}{2}$ in.)	25 mm (1 in.)	20 mm ($\frac{3}{4}$ in.)	12 mm ($\frac{1}{2}$ in.)
51	2	100	-	-	-
38	$1\frac{1}{2}$	80 – 100	100	-	-
25.4	1	20 – 50	95 – 100	100	-
19	$\frac{3}{4}$	10 – 30	40 – 80	95 – 100	100
12.7	$\frac{1}{2}$	-	5 – 50	50 – 80	90 – 100
9.5	$\frac{3}{8}$	0 – 10	0 – 15	25 – 60	80 – 100
4.75	$\frac{3}{16}$	0 – 5	0 – 5	0 – 10	5 – 50
2.36	#8	0 – 2	0 – 5	0 – 10	0 – 25
0.075	#200	0 – 2	0 – 2	0 – 2	0 – 2

The tested C.A. is ---Not Accepted--- (Accepted or Not Accepted) according to JS.

6.3.2. Fine Aggregate

1. The aggregate is ---well graded--- (well graded, gap graded, poor graded or single sized).
2. Classify the aggregate type according to ASTM Standards.

~~Sand~~

Coarse ≥ 3

Medium 2.2 – 2.8 sand → F.m = 2.91

3. Clay% is ---Accepted--- (Accepted, Not Accepted). Why?

because the clay less than 5%.

↓

(4.75 < 5%)

4. Is the aggregate accepted or not according to ASTM, BS, and Jordanian Specifications?
Important: Show me your work on the following tables.

Table 6.6.: Grading requirements for fine aggregate according to J.S. (Jordanian Standards)

Sieve size		Percentage by mass passing sieve		
		Nominal size of graded aggregate		
mm	No.	9.5 mm ($\frac{3}{8}$ in.)	4.75 mm (No. 4)	1.18 mm (No. 8)
9.5mm	$\frac{3}{8}$ in.	95 – 100	100	- ✓
4.75 mm	4	80 – 100	90 – 100	- ✓
2.36 mm	8	50 – 80	75 – 100	100 ✗
1.18 mm	16	20 – 70	55 – 90	90 – 100
600 µm	30	10 – 35	35 – 59	60 – 90
300 µm	50	5 – 15	8 – 30	20 – 60
150 µm	100	0 – 5	0 – 10	0 – 20
75 µm	200	0 – 5	0 – 5	0 – 10

The tested F.A. is Not accepted (Accepted or Not Accepted) according to JS

Table 6.7.: BS and ASTM grading requirements for fine aggregate

Sieve size		Percentage by mass passing sieve				ASTM C 33-92a
		BS 882: 1992				
BS	ASTM No.	Overall limits	Additional limits* C	M	F	
10 mm	$\frac{3}{8}$ in.	100 ✓	-	-	-	100
5 mm	$\frac{3}{16}$ in.	89 – 100 ✓	-	-	-	95 – 100
2.36 mm	8	60 – 100 ✓	60 – 100 ✓	65 – 100	80 – 100	80 – 100
1.18 mm	16	30 – 100 ✓	30 – 90 ✓	45 – 100	70 – 100	50 – 85
600 µm	30	15 – 100 ✓	15 – 54 ✓	25 – 80	55 – 100	25 – 60
300 µm	50	5 – 70 ✓	5 – 40 ✓	5 – 48	5 – 70	10 – 30
150 µm	100	0 – 15‡ ✓	-	-	-	2 – 10

* C = coarse; M = medium; F = fine.
‡ For crushed rock sands the permissible limit is increased to 20 percent, except when used for heavy duty floors.

The tested F.A. is Accepted (Accepted or Not Accepted) according to ASTM

The tested F.A. is Accepted (Accepted or Not Accepted) according to BS.

IF F.A. is accepted according to BS; classify it as (Fine sand, Medium sand or Coarse sand). Coarse sand

	Experiment 7 Concrete workability	
ID: 1931793	Name: Maya Ahmad 91/100	SEC...1.......

Remember to make your report tidy and neat ☺

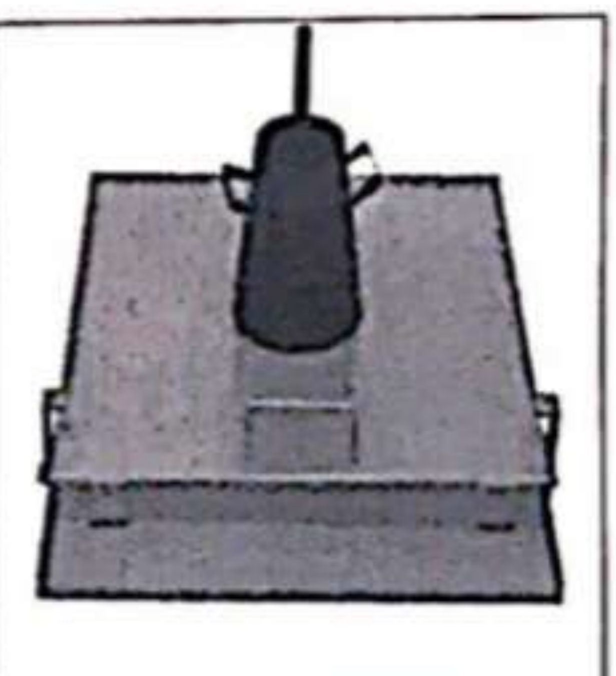
7.1. Objective

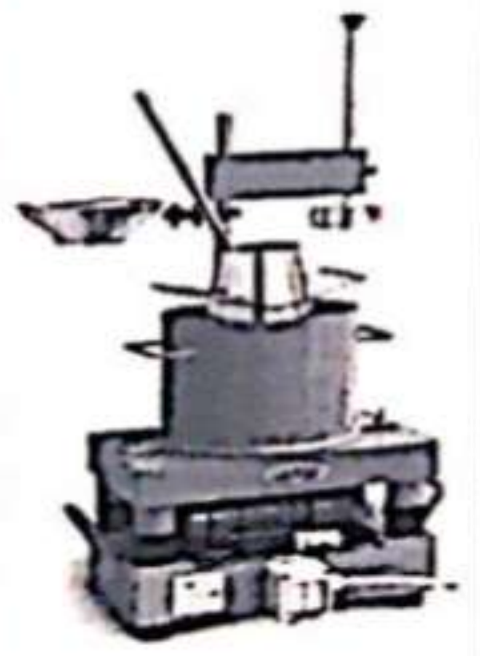
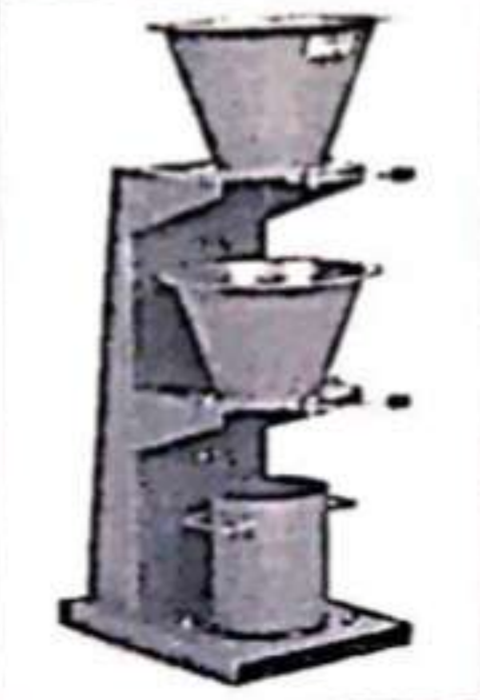
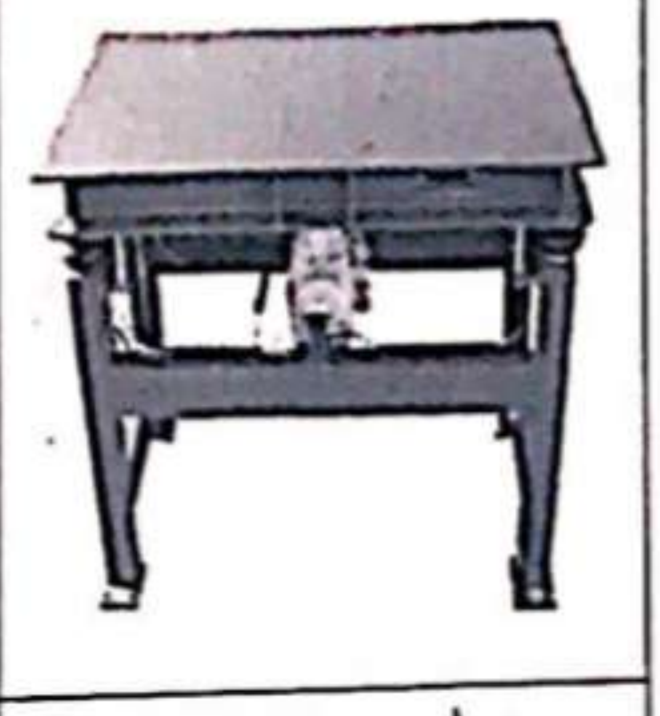
Find workibility for fresh concret by 5 test:-
1-Vebe test 2-slump test 3-Kelly ball test
4-compacting Factor 5-Flowtable test
→ To Find the condition of concret (suitable and homogeneous) or Not

7.2. Materials

Fine aggregate, water, course aggregate, cement, Admixture (super plasticizer)

7.3. Tests Apparatus and Equipment

Apparatus / Tools				
Name	slump cone	Tamping rod	concrete mixer	Flow table

Apparatus / Tools				
Name	vebe consistant	compacting Factor	Kelly ball test	vibrater table

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7.4. Data and Results

Workability Test

7.4.1. Weights

Batch= 35kg

Cement= 4.7 kg

Coarse Aggregate= 18.6 kg

Fine Aggregate= 9.4 kg

Water= 2.35 kg

7.4.2. Slump Test

Cone Height (cm)	Slump (cm)	Slump Type
30	4	True slumpe

7.4.3. Vebe Test

Time (sec) *(Vebe Seconds)*
7 seconds

7.4.4. Flow Table Test

Dimensions (cm)	Readings (mm)	Diameters (mm)		$D_{f\text{-avg}}$ (mm)	Flow Factor (%)
Table	196	D_{f1}	700-(200 +196)	325	$\left(\frac{325-200}{200}\right) * 100\%$
70 x 70	200		= 304		= 62.5%
D_i	185	D_{f2}	700-(169 + 185)		
20	169		= 346		

7.4.5 Compacting Factor Test

Wt. of Partially compacted concrete (kg)	Wt. of Fully compacted concrete (kg)	Compacting Factor
9.2	11.21	0.748

7.5. Sample of Calculations

Flow Table

$D_1 = 700 - (196 + 260) = 304\ mm$

$D_2 = 700 - (185 + 169) = 346\ mm$

$D_{avg} = \frac{D_1 + D_2}{2} = \frac{304 + 346}{2} = 325\ mm$

$\text{Flow Factor}\% = \frac{D_{avg} - 200}{200} * 100\% = \frac{325 - 200}{200} * 100\% = 62.5\%$

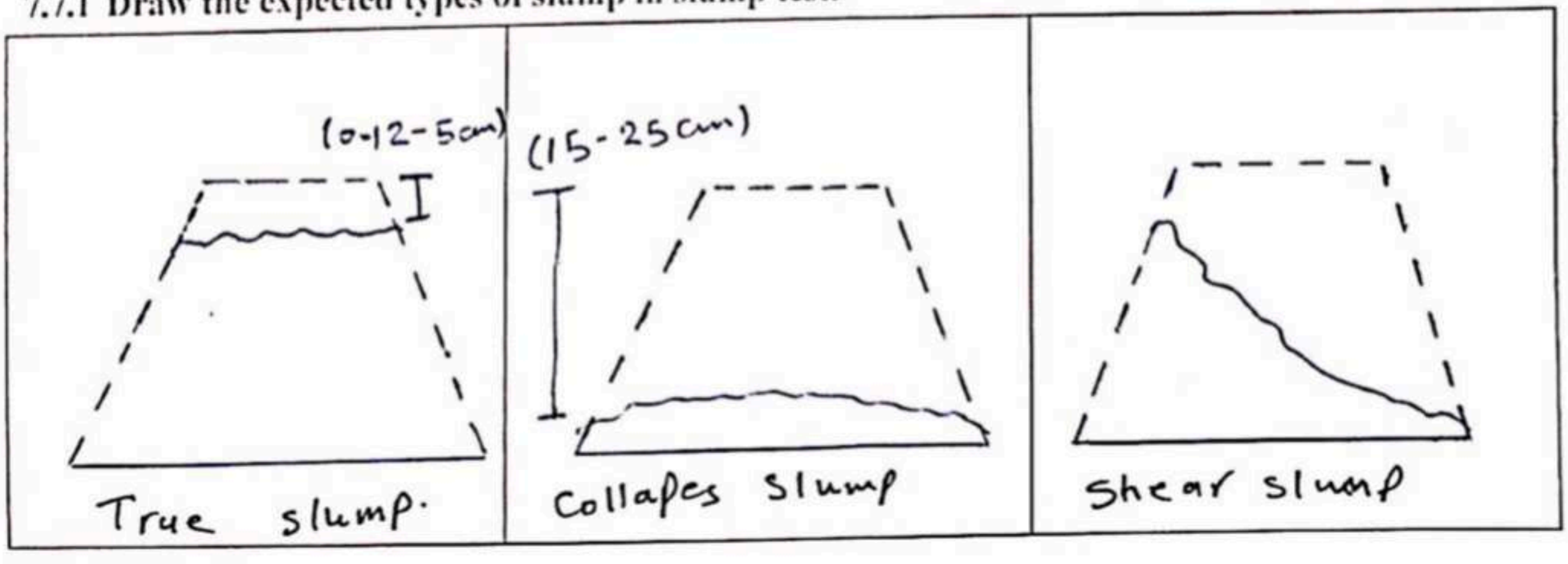
Compacting Factor

$\frac{\text{weight partially compacted concrete}}{\text{weight of compacted concrete}} = \frac{9.2 - 3.22}{11.21 - 3.22} = 0.748$

7.6. Plot no graphs are needed.

7.7. Discussion

7.7.1 Draw the expected types of slump in slump test.



7.7.2 Fill the following table

Test	Is it suitable for very low, low, medium, high or very high workability?	What is the workability degree of the tested concrete? Why?	Other notes
Slump	medium	Law, because have slump 40mm Thus between the range (25-50)mm	Increase in slump the workability is in increase.
Compacting factor	Low medium	very law According the compacting Factor 0.78 and we have CF = 0.74 Thus less than 0.78	when compacting factor increase then the workibility increase
Vebe test	Low very Low	Medium and high because we have V.B Time = 7 seconds and this between (3-7)-(7-10)	The V.B increase when the workibility decrease.
Flow table	High very hight	Low because the value of flow less than 400 mm Davg = 325mm	- used for collapse slump -use to find seegregetion -when workibility increase the Davg increase

..S. Specifications

Degree of concrete workability according to the slump value

Degree of Workability	Slump (mm)
very low	0 – 25
Low	25 – 50
Medium	50 – 100
High	100 - 175
Very High	> 175

Degree of concrete workability according to the compacting factor value

Degree of Workability	Compacting Factor
very low	0.78
Low	0.85
Medium	0.92
High	0.95
Very High	-

Degree of concrete workability according to the vebe time

Degree of Workability	V.B. Time
very low	20 - 40
Low	10 - 20
Medium	7 - 10
High	3 - 7
Very High	1 - 3

Flow Table Test:
A value of 400 mm indicates a medium workability, and 500 mm a high workability.

	Experiment 8+9 Part.1: Concrete Strength by Non-Destructive Methods Part.2: Concrete Strength by Destructive Methods	
ID: 1931793	**Name:** Haya Ahmad Askar 99/100	**SEC.1**

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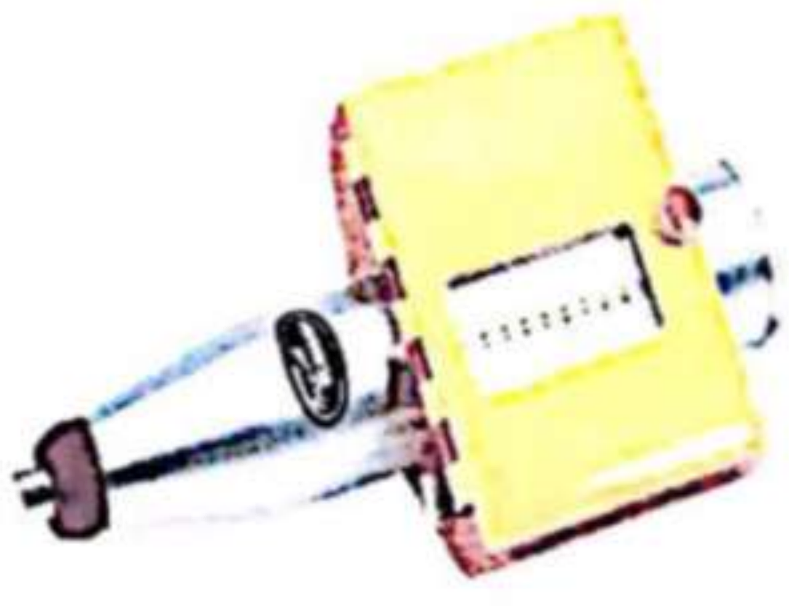
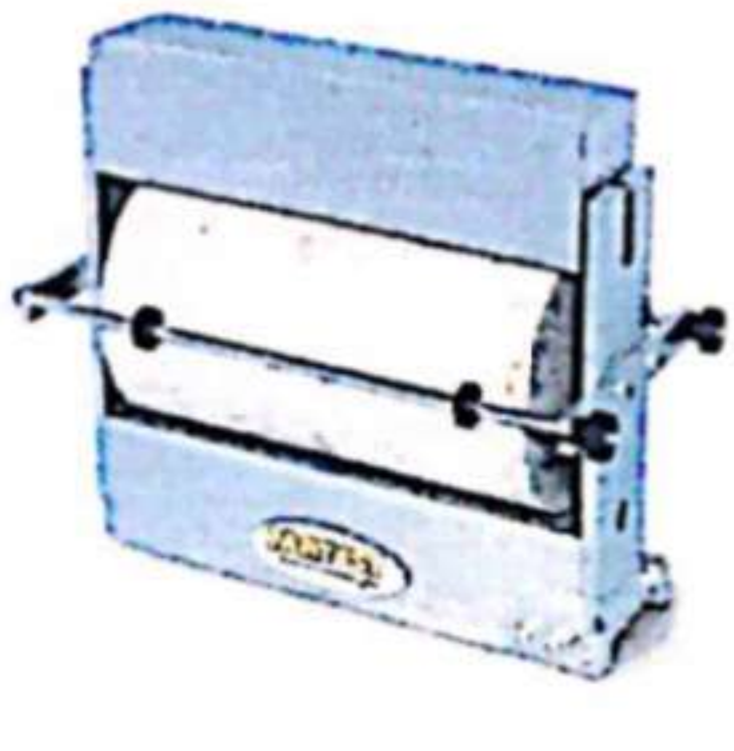
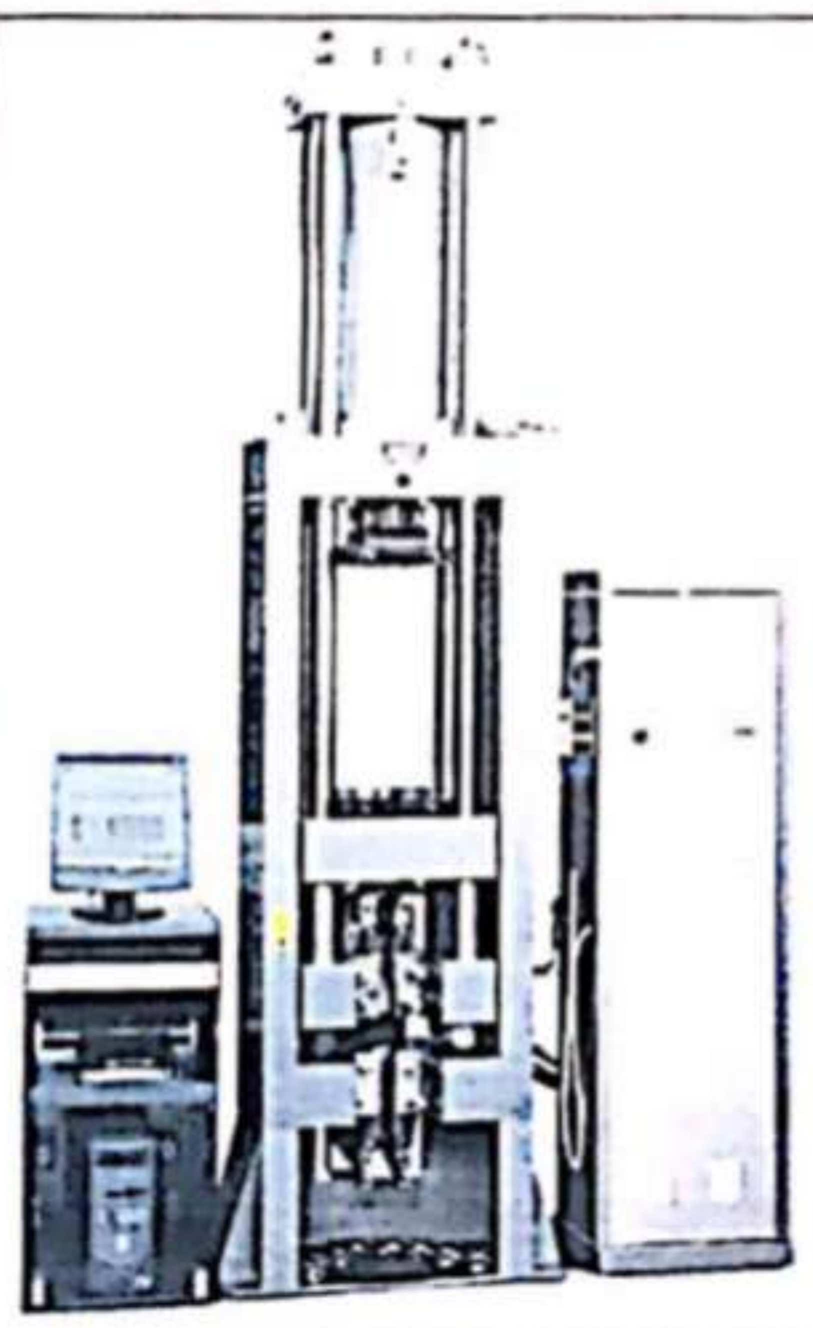
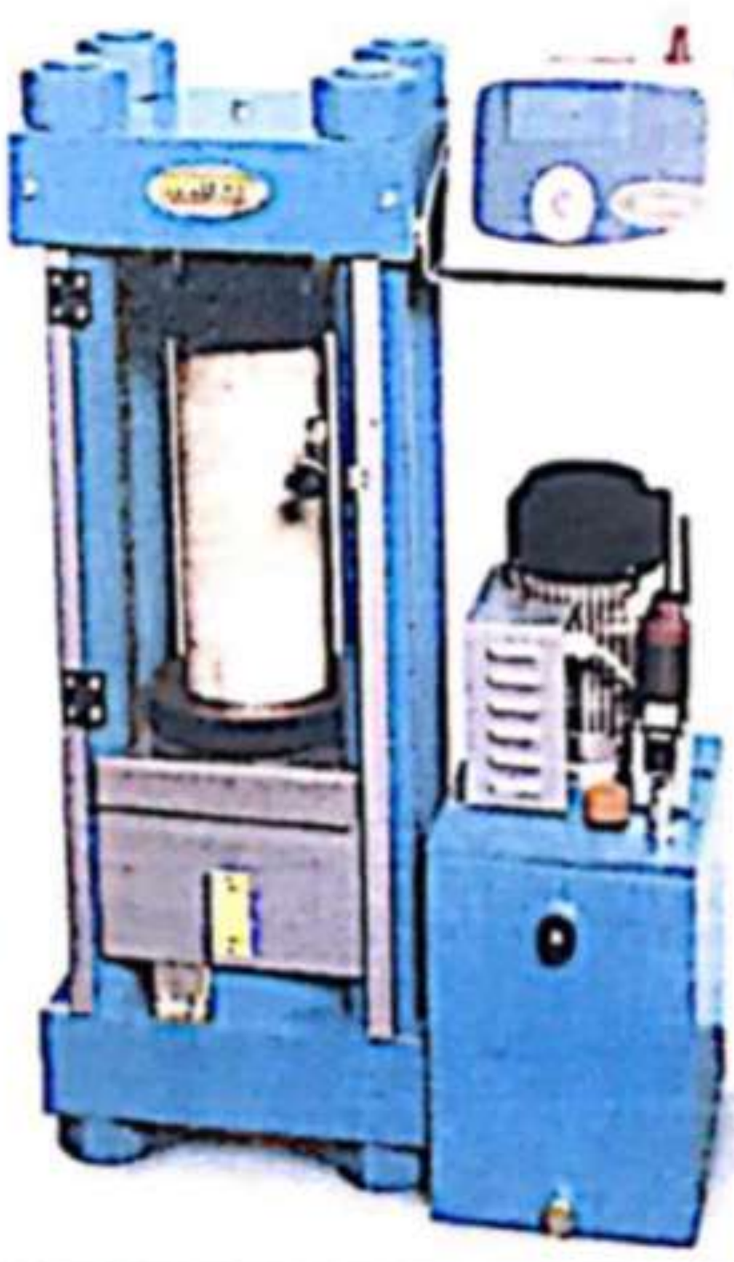
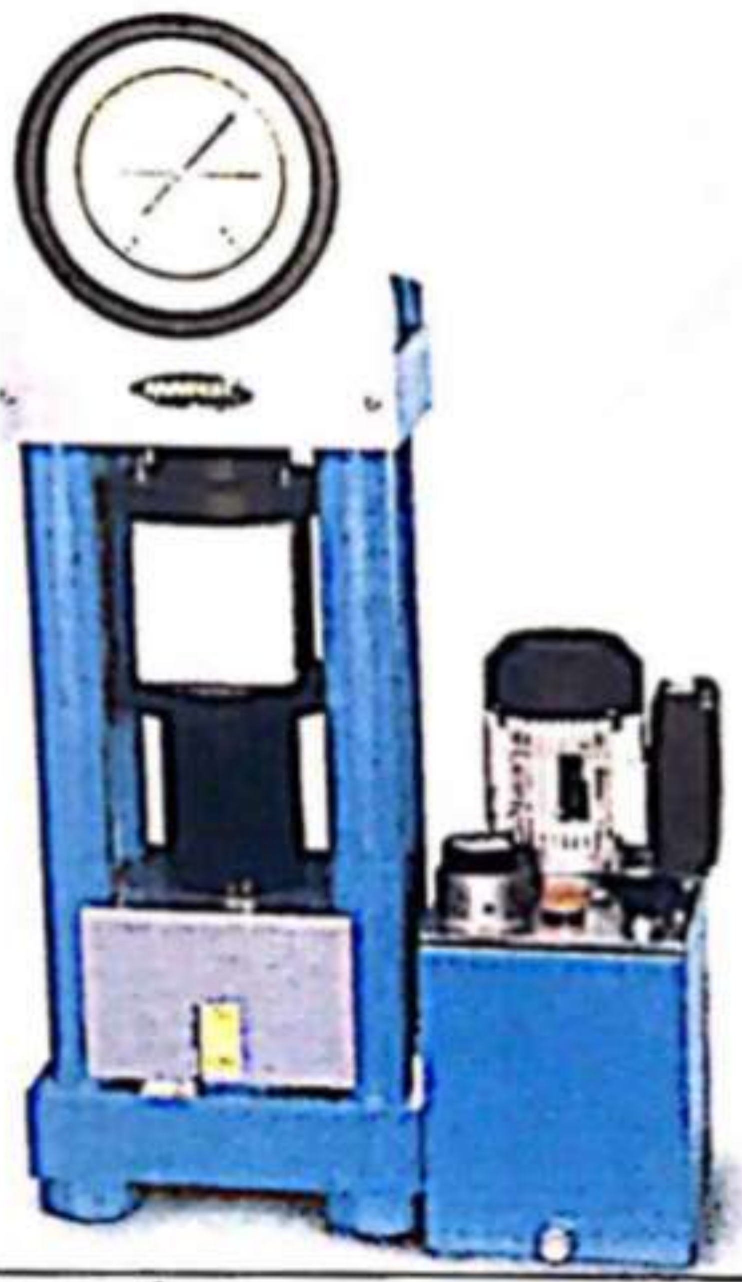
8.1. Apparatus and Equipment:

Apparatus			
Name	~~Schmidt Ha.~~ Rebound Hummer	Pulse velocity Apparatus	Supplementary Bearing Bar or Plate (splitting apparatus)

Apparatus			
Name	computerized universal testing machine (UTM)	motorized compressive machine	hand operating compession testing machine.

8.2. Data and Calculations

8.2.1. Non –Destructive Tests

Show your calculations in the following tables

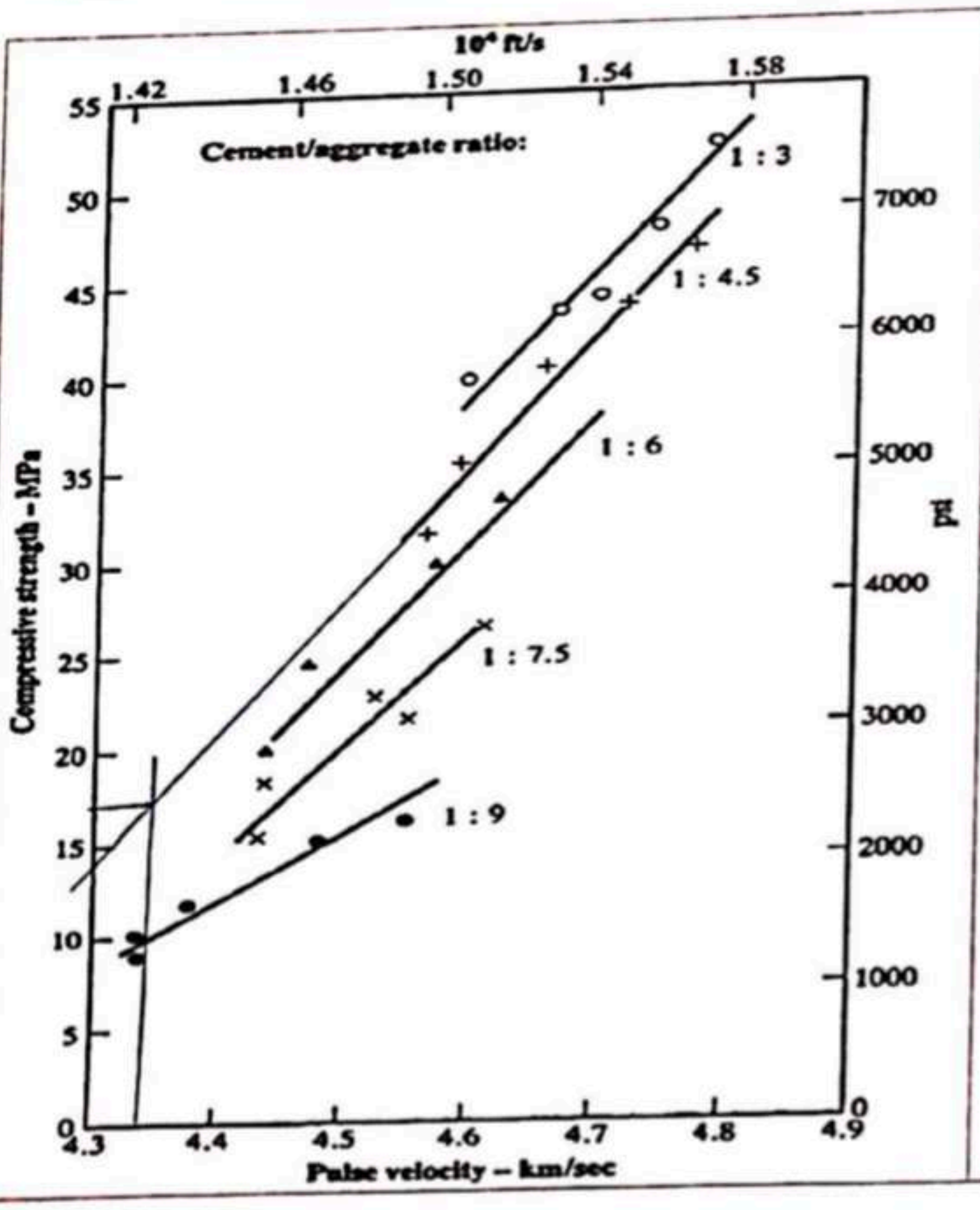
8.2.1.1. Pulse Velocity

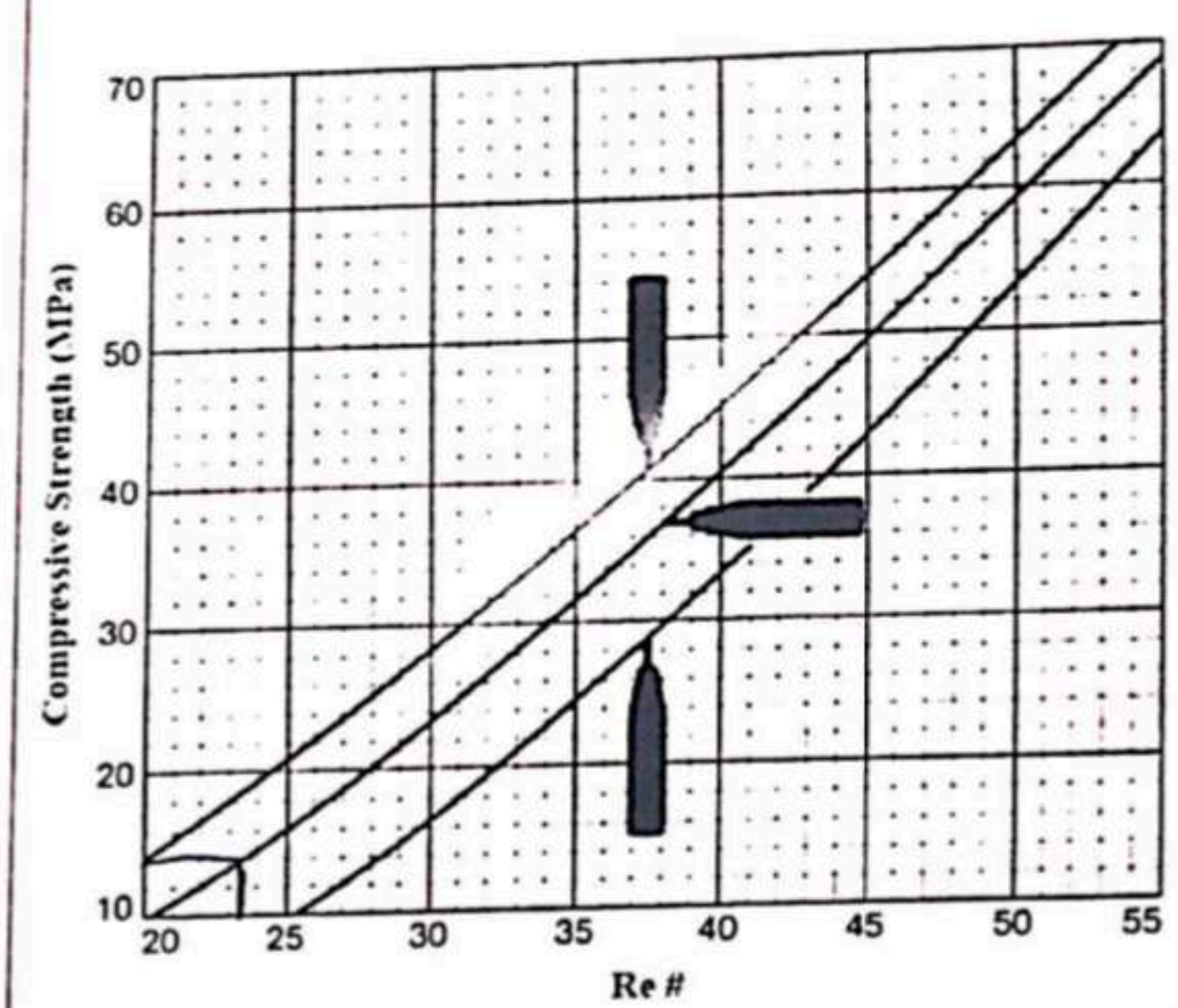
Cement= 10kg, F.A. = 20 Kg, C.A. = 25 kg

T (μsec)	22.8	23.4	22.6	23.3	23.2	23.1	23.3	23
T_{avg} (μsec)	$\frac{22.8+23.4+22.6+23.3+23.2+23.1+23.3+23}{8} = 23.087$							
V_{avg} (Km/sec)	$\frac{6.1}{23.087} = 4.33$ Km/sec							
σ_{avg} (Mpa)	17 Mpa							

8.2.1.2. Rebound Number

Re #	21	22	27	27	24	21	22	25	26	22
$Re_{(avg)}$	$\frac{21+22+27+27+24+21+22+25+26+22}{10} = 23.7$									
$Re_{(range)}$	$23.7 \mp 6 = (17.7 - 29.7)$									
$Re_{(new\ avg)}$	$\frac{21+22+27+27+24+22+22+25+26+21}{10} = 23.7$									
σ_{avg} (Mpa)=	14 Mpa									





* cement / aggregate = 1 / 4.5

8.2.2. Destructive Tests

Test	Max. Load (KN)	Strength (MPa) Show your calculations
Compressive Strength [Cubes] (100*100*100)mm	221	$\sigma = \frac{P}{A} = \frac{221 * 10^3}{100 * 100} = 22.1$ Mpa
Compressive Strength [Cylinders] (100*200)mm	188	$\sigma = \frac{P}{A} = \frac{188 * 10^3}{\pi * (50)^2} = 23.9$ Mpa
Indirect Tensile Strength [Splitting Test] (100*200)mm	101	$\sigma = \frac{2P}{\pi D L} = \frac{2 * 101 * 10^3}{\pi * 100 * 200} = 3.2$ Mpa
Indirect Tensile Strength [Flexural Test] (2-Point) (100*100*300)mm	12	$\sigma = \frac{PL}{bh^2} = \frac{12(300) * 10^3}{100(100)^2} = 3.6$ Mpa

8.3. Discussion

8.3.1. Non-Destructive Tests

1) Error% of Rebound Number Test

$\frac{22.1-14}{22.1}$ *100% = 36.65%

2) Error% of Pulse Velocity Test

$\frac{22.1-17}{22.1}$ *100% = 23.07%

3) Which one is more accurate Rebound or Pulse velocity test? Why?

pulse velocity because the waves will pass through the centre cement cobe

4) Fatty substance must be used to grease the surfaces of the transmitter and receiver; why?

To remove dust and impurites and dirt

8.3.2. Destructive Tests

1) Fill the following table

	Experimental Results	Standards	Accepted or Not
Compressive Strength of Cube / *Compressive Strength of Cylinder*	$\frac{22.1}{23.9}$ = 0.92	Not standard (1.25)	Not Accepted
Direct Tension (MPa)	0.9 spilitting strength = 0.9 (3.2) = 2.88		
Compressive Strength of Cube / *Direct Tension*	$\frac{22.1}{2.88}$ = 7.67	standard (7-11)	Accepted
Flexural Strength (2P) / *Splitting Strength*	$\frac{3.6}{3.2}$ = 1.125	Not standard (1.25-1.25)	Not Accepted

2) If we redo the test by 1-Point loading method, give an estimate of modulus of rupture based on the 2-Point loading result? Why?

The result from (1point) is higher than result from (2point) because the midest area in (1Point) method explores to shear so leads increase the strength, but the midest area in (2point) exp[illegible] to pure the middle without shear=0

3) The failure forms of a cube subjected to compressive strength are:

1 Explosive  2 Non-expolsive 

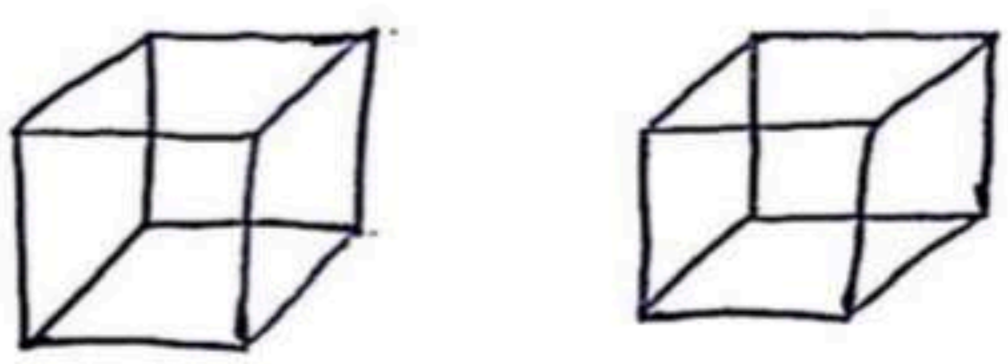
And our case is Non-expolsive

4) The failure forms of a cylinder subjected to compressive strength are:

spliting Shear shear and spliting

5) Draw the failure of a cylinder subjected to splitting Load

6) Draw the failure of a flexural beam



	Experiment 10 Tensile Strength of Steel	
ID:1931793	Name: Maya Ahmad Asker 67/100	SEC.1

10.1. Apparatus: Balance / Full computerized universal testing machine (UTM)

10.2. Materials: carbon steel / grade 60 and 40

10.3. Data and Calculations

10.3.1. Data

Li mm=	350	LF mm= 350 + 66 = 416 mm	
Di mm=	15.5	Ai mm² = → $\frac{\pi}{4}(15.5)^2 = 188.6\ mm^2$	
DF mm=	12.2	AF mm² = $\frac{\pi}{4}(12.2)^2 = 116.89$	

	Load (KN)	Elongation (mm)	Eng. Stress (MPa)	Eng. Strain	Sample of Calculations:
1	0	0	0	0	
2	2	2	10.6	5.71 * 10⁻³	
3	8	2.9	42.41	8.28 * 10⁻³	
4	19	3	100.74	8.57 * 10⁻³	
5	35	3.1	185.57	8.85 * 10⁻³	
6	47	3.2	249.2	9.14 * 10⁻³	
7	68	3.4	360.5	9.71 * 10⁻³	
8	69	5	365.8	14.28 * 10⁻³	
9	69	7	365.8	20 * 10⁻³	
10	70	10	371.2	28.5 * 10⁻³	
11	72	12	381.7	34.2 * 10⁻³	
12	77	15	408.3	42.8 * 10⁻³	
13	80	17	424.2	48.6 * 10⁻³	
14	82	18	434.8	51.4 * 10⁻³	
15	87	20	461.3	57.1 * 10⁻³	
16	92	23	487.8	65.7 * 10⁻³	
17	97	27	514.3	77.1 * 10⁻³	
18	102	30	540.8	85.7 * 10⁻³	
19	107	36	567.3	102.8 * 10⁻³	
20	109	42	577.9	120 * 10⁻³	
21	111	47	588.5	134.3 * 10⁻³	
22	112	49	593.8	140 * 10⁻³	
23	112	52	593.8	148 * 10⁻³	
24	113	54	599.2	154.2 * 10⁻³	
25	113	56	599.2	160 * 10⁻³	
26	113	60	599.2	171.4 * 10⁻³	
27	112	62	593.8	177.1 * 10⁻³	
28	110	64	583.2	182.8 * 10⁻³	
29	108	65	572.6	185.7 * 10⁻³	
30	102	66	540.8	188.6 * 10⁻³	

10.3.2. Calculations

1. Draw the stress strain Diagram (if you want, use Excel Program) and show on it these regions: Elastic, Plastic, Yield, Hardening, and Necking

2. Determine the following in (MPa):

Proportional Limit	Yield Point	Hardening Point	Ultimate Strength	Fracture Point
360.5	365.8	381.7	599.2	540.8

3. Calculate:

Modulus of Elasticity = $\frac{\Delta\sigma}{\Delta\varepsilon} = \frac{(100.74-42.41)*10^6}{(8.57-8.28)*10^{-3}} = 201.137$ GPa

Ductility (Elongation) = $\frac{\Delta L}{L_i} * 100\% = \frac{416-350}{350} * 100\% = 18.85\%$

Ductility (Reduction in area) = $\left|\frac{A_f - A_i}{A_i}\right| * 100\% = \left|\frac{116.89-188.6}{188.6}\right| * 100\% = 38.02\%$

True Stress at fracture Point = $\sigma = \frac{P}{A_f} = \frac{102*10^3}{116.89*10^{-6}} = 872.61$ MPa

True Strain at Fracture Point = $\varepsilon = \frac{\Delta L}{L_f} = \frac{66}{416} = 0.158$

Modulus of Resilience = Area under the curve in elastic region

$(14.28-5.71)*10^{-3} * 365.8*10^6 = 3.13$ MJ/m^3

Modulus of Toughness = Total area under the curve

Number of square * Area of square

$40 * (0.02*100) = 80$ MJ/m^3

10.4. Discussion

1. What is the type (grade) of steel? Why?

yeild > 275 MPa → 365.8 > 275 MPa

ulimate > 380 MPa → 599.2 > 380 MPa .

*Grade (40 mm)

2. Compare your values of modulus of elasticity and toughness with the typical values for tested specimens.

* Modulus of elesticity = 201.137 GPa → (190 - 210) GPa .

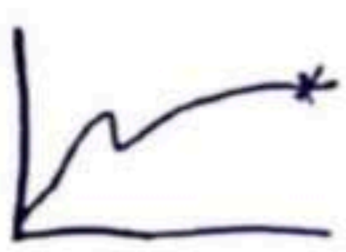
* Toughness = 80 mJ/m³ to calculate the area under the carve .

3. Draw the shape of failure. What is called?

M → cup → by angle = 45°

U → cave

4. Draw the shape of necking. Where does the bar begin to forms neck?



Begin ultimate strength and end at Fracture point

→ Necking

5. Compare the actual (true) stress with engineering (normal) stress.

$\sigma_{avg} < \sigma_{true}$

6. Compare the actual (true) strain with engineering (normal) strain.

$\varepsilon_{avg} > \varepsilon_{true}$