



POSTAL BOOK PACKAGE 2024

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CIVIL ENGINEERING

Objective Practice Sets

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Cement

- Q.1** Regarding the composition of raw materials used for manufacturing ordinary Portland cement, match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

List-I	List-II
A. Calcium oxide (CaO)	1. 2%
B. Silica (SiO ₂)	2. 3%
C. Aluminium oxide (Al ₂ O ₃)	3. 5%
D. Ferrous oxide (Fe ₂ O ₃)	4. 65%
E. Magnesium oxide (MgO)	5. 25%

Codes:

	A	B	C	D	E
(a)	4	5	3	2	1
(b)	1	2	3	4	5
(c)	2	4	5	1	2
(d)	2	1	3	5	4

- Q.2** The constituent compounds of cement in decreasing order of rate of hydration are

- (a) C₂S, C₃S and C₃A
- (b) C₃S, C₃A and C₂S
- (c) C₃A, C₃S, and C₂S
- (d) C₃A, C₂S and C₃S

- Q.3** The tricalcium aluminate compound present in cement

- (a) provides weak resistance against sulphate attack.
- (b) is responsible for highest heat of evaluation.
- (c) is characteristically fast reacting with water.
- (d) all of the above.

- Q.4** Match **List-I** with **List-II** and select the correct answer by using the codes given below the list:

List-I	List-II
A. Argillaceous	1. Sand (silica SiO ₂)
B. Silicious	2. Lime (CaO)
C. Calcareous	3. Clay (alumina Al ₂ O ₃)

Codes:

	A	B	C
(a)	1	2	3
(b)	3	2	1
(c)	2	1	3
(d)	3	1	2

- Q.5** Gypsum consists of

- (a) H₂S and CO₂
- (b) CaSO₄ and H₂O
- (c) Lime and H₂O
- (d) CO₂ and calcium

- Q.6** A sample of cement is said to be sound when it does not contain free

- (a) lime
- (b) silica
- (c) iron oxide
- (d) alumina

- Q.7** Le Chatelier's device is used for determining the

- (a) setting time of cement.
- (b) soundness of cement.
- (c) tensile strength of cement.
- (d) compressive strength of cement.

- Q.8** Low heat cement contains lower percentage of which of the following?

- (a) C₃A
- (b) C₃S
- (c) C₂S
- (d) None of these

- Q.9** An excess of free lime in portland cement

- (a) results in an increase in strength.
- (b) increases the initial setting time.
- (c) causes unsoundness in the product.
- (d) improves the quality of the product.

- Q.10** Initial setting time is maximum for

- (a) portland-pozzolana cement
- (b) portland-slag cement
- (c) low-heat portland-pozzolana cement
- (d) high strength portland cement

Q.11 Snow cream is

- (a) chalk powder
- (b) powdered lime
- (c) mixture of chalk powder and lime
- (d) coloured-cement

Q.12 The cement used in construction of docks and harbours is

- (a) blast-furnace slag cement.
- (b) water proof cement.
- (c) hydrophobic cement.
- (d) sulphate-resisting portland cement.

Q.13 The field test for the quality of cement consists in putting a small quantity of cement in a bucket containing water. A good quality cement will

- (a) immediately dissolve in the water.
- (b) float on the water surface.
- (c) sink to the bottom of the bucket.
- (d) produce steam.

Q.14 Match **List-I** (Apparatus) with **List-II** (Purpose) and select the correct answer using the code given below the lists:

List-I

- A. Le-Chatelier's apparatus
- B. Vicat Needle
- C. Vee-Bee apparatus
- D. Briquettes test machine

List-II

- 1. Workability of concrete.
- 2. Soundness of cement.
- 3. Tensile strength.
- 4. Final setting time of cement.

Codes:

- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 3 | 2 | 4 |
| (b) | 2 | 4 | 1 | 3 |
| (c) | 1 | 4 | 2 | 3 |
| (d) | 2 | 3 | 1 | 4 |

Q.15 Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

List-I

- A. Water and cement
- B. Tricalcium silicate
- C. Di-calcium silicate
- D. Tri-calcium aluminate

List-II

- 1. Fast in reaction
- 2. Slow in reaction
- 3. Slowest in reaction
- 4. Hydrates

Codes:

- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 2 | 3 | 1 |
| (b) | 1 | 3 | 2 | 4 |
| (c) | 4 | 1 | 2 | 3 |
| (d) | 3 | 2 | 1 | 4 |

Q.16 High alumina cement is produced by fusing together a mixture of

- (a) limestone and bauxite.
- (b) limestone, bauxite and gypsum.
- (c) limestone, gypsum and clay.
- (d) limestone, gypsum, bauxite, clay and chalk.

Q.17 Which of the following is correct if they are arranged in decreasing order of heat of hydration?

- (a) $C_3A > C_4AF > C_3S > C_2S$
- (b) $C_3A > C_4AF > C_2S > C_3S$
- (c) $C_3A > C_3S > C_2S > C_4AF$
- (d) $C_3A > C_3S > C_4AF > C_2S$

Q.18 Pick out the incorrect statement.

- (a) For hydraulic structures, a cement with small percentage of C_3S and more C_2S is recommended.
- (b) Setting and hardening of cement stop as soon as the concrete becomes dry.
- (c) The product C - S - H get is known as tobermorite gel.
- (d) The stiffening of cement without strength development is caused because of C_4AF .

Q.19 Which one of the following statement regarding the cement fineness is NOT correct?

- (a) Fine cement is more liable to suffer from shrinkage cracking than a coarse cement.
- (b) Fine cement will show faster rate of hardening than coarse cement.
- (c) Fine cement shows faster rate of heat evolution and total quantity of heat evolved is much larger than coarse cement.
- (d) Fine cement shows the same setting time as coarse cement.

- Q.20** If 'P' is percentage of water required for standard consistency of cement, water to be added for determination of unsoundness due to lime is
(a) $0.65 P$ (b) $0.85 P$
(c) $0.78 P$ (d) $0.5 P$
- Q.21** Match **List-I** (Cement mortar for different work) with **List-II** (Proportion of cement and sand in mortar) and select the correct answer using the codes given below the lists:
- List-I**
- Cement mortar for normal brick work
 - Cement mortar for plastering works
 - Cement mortar for grouting the cavernous rocks
 - Cement mortar for guniting
- List-II**
- 1 : 4
 - 1 : 3
 - 1 : 6
 - 1 : 1.5
- Codes:**
- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 4 | 2 | 1 |
| (b) | 1 | 2 | 3 | 4 |
| (c) | 3 | 1 | 4 | 2 |
| (d) | 1 | 4 | 2 | 3 |
- Q.22** In the manufacture of cement definite proportions of argillaceous and calcareous materials are burnt at a temperature of
(a) 425°C (b) 875°C
(c) 1450°C (d) 1650°C
- Q.23** The percentage of gypsum added to the clinker during manufacturing process is
(a) 0.2 (b) 0.25 to 0.35
(c) 2.5 to 3.5 (d) 5 to 10
- Q.24** In the air permeability test of cement, the specific surface (in mm^2/g) is of the order of
(a) 1000-2000 (b) 2000-2500
(c) 2500-5000 (d) 225000-350000
- Q.25** For ordinary portland cement the maximum expansion by Le Chatelier's method should not exceed
(a) 2 mm (b) 5 mm
(c) 7.5 mm (d) 10 mm
- Q.26** As per IS specifications, the maximum final setting time for ordinary Portland cement should be
(a) 30 minutes (b) 1 hour
(c) 6 hour (d) 10 hours
- Q.27** The temperature range in a cement kiln is
(a) 500° to 1000°C (b) 1000° to 1200°C
(c) 1300° to 1500°C (d) 1600° to 2000°C
- Q.28** Specific surface of portland cement should not be less than
(a) $2500 \text{ cm}^2/\text{gm}$ (b) $2000 \text{ cm}^2/\text{gm}$
(c) $2250 \text{ cm}^2/\text{gm}$ (d) $2250 \text{ m}^2/\text{kg}$
- Q.29** Loss on ignition in portland cement shall not be more than
(a) 4% (b) 5%
(c) 3% (d) 6%
- Q.30** "Ciment Fondu" is the trade name of
(a) Expanding cement
(b) Hydrophobic cement
(c) High alumina cement
(d) Coloured cement
- Q.31** Consider the following statements:
1. Fine grinding of cement results in early development of strength.
2. Rate of hydration of cement is increased when it is ground finer.
Which of the above statements are CORRECT?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of these
- Q.32** Consider the following statements:
When cement is tested for setting time; on gauging it shows quick setting. This phenomenon known as "Flash set" of cement is due to the presence of high
1. tricalcium aluminate (C_3A) in cement
2. alkalies in cement
3. tricalcium silicate (C_3S) in cement
Which of these statements are correct?
(a) 1, 2 and 3 (b) 2 and 3
(c) 1 and 2 (d) 1 and 3
- Q.33** Consider the following statements:
High early strength of cement is obtained as a result of
1. fine grinding
2. decreasing the lime content

Q.56 Soundness test of cement is carried out to determine its

- (a) Alumina content (b) Magnesia content
(c) Free lime content (d) Iron oxide content

Q.57 Which of the following statement(s) is/are correct regarding the compressive strength test of cement?

- (a) A mixture of cement of Ennore sand in proportion of 1 : 3 by weight is mixed for one

minute and then water $\left(\frac{P}{4} + 3\right)\%$ is added

until the mixture is of uniform colour where P = percentage of water required to produce a paste of standard consistency.

- (b) Temperature of water and test room should be $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
(c) Three specimen cubes are prepared of size 70.6 mm having face area of about 5000 mm².
(d) Load is applied starting from zero at a rate of 35N/sq mm/minute.

Q.58 If 'W' is the percentage of water required for normal consistency of cement, than which of the following statement(s) is/are correct?

- (a) Water to be added for determination of initial setting time is 0.85 W.

- (b) Water to be added for determination of soundness is 0.78 W.

- (c) Water to be added for determination of compressive strength is $\left(\frac{W}{5} + 2.5\right)\%$.

- (d) Water to be added for determination of tensile strength is $\left(\frac{W}{4} + 3\right)\%$.

Q.59 Which of the following statement(s) is/are incorrect?

- (a) Hydrophobic cement grains possesses low wetting ability.

- (b) Rapid-hardening cement is useful in concreting under static or running water.

- (c) Quick-setting cement helps concrete to attain high strength in the final stage.

- (d) White cement is just a variety of ordinary cement free of colouring oxides.

■■■■

Answers		Cement							
1. (a)	2. (c)	3. (d)	4. (d)	5. (b)	6. (a)	7. (b)	8. (a)	9. (c)	10. (c)
11. (d)	12. (d)	13. (b)	14. (b)	15. (a)	16. (a)	17. (d)	18. (d)	19. (c)	20. (c)
21. (b)	22. (c)	23. (c)	24. (d)	25. (d)	26. (d)	27. (c)	28. (c)	29. (a)	30. (c)
31. (c)	32. (d)	33. (b)	34. (c)	35. (c)	36. (c)	37. (b)	38. (b)	39. (a)	40. 33
41. 7.0 to 7.10	42. 3.10 to 3.20	43. 20	44. 5	45. (b)	46. (c)	47. (a)	48. (c)		
49. (a)	50. (c)	51. (a, b, d)	52. (a, c)	53. (c, d)	54. (b, c, d)				
55. (a, b, c, d)	56. (b, c)	57. (a, b, c, d)	58. (a, b)	59. (b, c)					

Explanations Cement

1. (a)

Constituents of Portland cement (Raw Material)

Oxide	Composition	Average
Lime (CaO)	60-65	63
Silica (SiO ₂)	17-25	20
Alumina (Al ₂ O ₃)	3-8	6
Iron oxide (Fe ₂ O ₃)	0.56	3
Magnesia (MgO)	0.5-4	2
Soda or Potash (Na ₂ O + K ₂ O)	0.5-1	1
Sulphur trioxide (SO ₃)	1-2	1.5

2. (c)

The compound C₃A characteristically reacts fast with water and may lead to an immediate stiffening of paste. C₃A phase is responsible for the highest heat of evolution, both during the initial period as well as in the long run. In between C₃A and C₂S, C₃S results in rapid hardening and higher heat of hydration than C₂S.

3. (d)

The compound C₃A characteristically reacts fast with water and may lead to an immediate stiffening of paste, and this process is termed flash set. It provides weak resistance against sulphate attack and its contribution to the development of strength of cement is less significant than that of silicates.

4. (d)

Argillaceous	Calcareous
<ul style="list-style-type: none"> • Shale and Clay • Blast furnace slag • Slate 	<ul style="list-style-type: none"> • Cement Rock • Lime stone • Chalk • Marine shells • Marl

6. (a)

The unsoundness of cement is caused by the undesirable expansion of some of its constituents, sometimes after setting the unsoundness is due to the presence of free lime and magnesia in the cement.

7. (b)

LeChatelier's apparatus is used to determine the soundness of cement.

8. (a)

Low heat cement is a Portland cement with relatively, lower contents of the more hydrating compounds C₃S and C₃A and more contents of C₂S.

9. (c)

Unsoundness in cement is due to excess of lime, excess of magnesia or excessive proportion of sulphates. Le Chatelier test detects unsoundness due to free lime only. Autoclave test is used to detect unsoundness due to magnesia and lime.

10. (c)

Low-heat Portland cement is less reactive than OPC and is obtained by increasing the proportion of C₂S and reducing the proportion of C₃S and C₃A. The initial setting time is about one hour, i.e., greater than that of OPC.

11. (d)

Snow cream is type of coloured cement.

12. (d)

Sulphate resisting cement contains low C₃A and C₄AF contents and is very effective against sulphate attack. The use of sulphate resisting cement is recommended for concrete to be used in the marine environment, foundations in chemically aggressive soils etc.

13. (b)

If a small quantity of cement is thrown in a bucket of water. It should float for some time before they sink.

14. (b)

Le-Chatelier apparatus: Soundness of cement

Vicat needle: Final setting time of cement

Vee bee apparatus: Workability of concrete

Briquettes test machine: Tensile strength

15. (a)

Water and cement : Hydrates

Tri-calcium silicate: Slow in reaction

Di-calcium silicate: Slowest in reaction

Tri-calcium aluminate: Fast in reaction

16. (a)

High alumina cement (IS : 6452)

The raw material used for its manufacture consists of 40% bauxite, 40% lime, and 15% Iron oxide,

with a little % of ferric oxide and silica, magnesia etc. ground finely at a very high temperature.

17. (d)

Rate of heat evolution of the principle compound of equal amount of each is considered will be in following descending order.

C_3A (865 J/g) > C_3S (500 J/g) > (C_4AF) (420 J/g) > C_2S (260 J/g)

18. (d)

The stiffening of cement with strength development is caused because of C_3A .

19. (c)

Fine cement shows faster rate of heat evolution and total quantity of heat evolved is same as than coarse cement.

20. (c)

In Le-chatelier method of soundness, the mould is placed on glass sheet and is placed with neat cement paste by gauging 100 g cement with 0.78 times the water required to give paste of standard consistency.

22. (c)

Cement is obtained by burning together, in a definite proportion, a mixture of naturally occurring argillaceous (containing alumina) and calcareous (containing calcium carbonate or lime) materials to a partial fusion at high temperature of about 1450°C.

23. (c)

Gypsum is added to control flash setting.

24. (d)

Minimum specific surface of cements as per air permeability test is
2250 cm²/g to 3500 cm²/g
i.e., 225000 mm²/fg to 350000 mm²/g

25. (d)

If expansion is more than 10 mm, cement is said to be unsound.
In autoclave expansion should not be more than 0.8%.

26. (d)

	Methods of testing	Grade		
		33	43	53
Setting time Initial (min.) Final (max.)	Vicat apparatus	30 min 10 hr	30 min 10 hr	30 min 10 hr

27. (c)

The temperature range of cement kiln is

- For wet process — 1500-1600°C
- For dry process — 1400-1500°C

28. (c)

Type of cement	Specific surface not less than (cm ² /g)
Ordinary port land cement	2250
High alumina cement	2250
Portland pozzolana cement	3000
Low heat cement	3200
Rapid hardening cement	3250

29. (a)

The loss on ignition test is carried on portland cement to determine the loss of weight when the sample is heated to 900°C-1000°C. The loss in weight occurs as the moisture and carbon dioxide which are present is combination with free lime or magnesia evaporate.

The loss on ignition is determined by heating one gram of cement sample in a platinum crucible at a temperature of 900°C-1000°C for minimum of 15 minutes. Normally, the loss will be around two percent. Maximum allowable loss is four percent.

30. (c)

"*Ciment Fondu*" is trade name of high alumina cement.

32. (d)

The compound tricalcium aluminate (C_3A) is fast reacting and may lead to immediate stiffening of paste, and this process is termed flash set. The role of gypsum is to prevent such a fast reaction. Similarly C_3S may also cause flash setting if present in excessive amounts.

Alkalies cause alkali-aggregate reaction which increases volume of concrete and causes spalling.

33. (b)

Gypsum is a retarder and prevents flash set. The rapid rate of development of strength is attributed to higher fineness and higher C_3S and lower C_2S content. Thus decreasing lime content will not result in rapid hardening or high early strength cement. The OPC has 63% CaO while rapid hardening cement has 64.5% CaO. A slight increase of CaO causes considerable increase in