

Cement

Q.1 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.2 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.3 The setting and hardening of cement after addition of water is due to

- (a) the presence of gypsum.
(b) binding action of water.
(c) hydration of some of the constituent compounds of cement.
(d) evaporation of water.

Q.4 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.5 The constituent compounds of cement in decreasing order of rate of hydration are

- (a) C_2S , C_3S and C_3A
(b) C_3S , C_3A and C_2S
(c) C_3A , C_3S and C_2S
(d) C_3A , C_2S and C_3S

Q.6 When water is added to the cement

- (a) chemical reaction starts.
(b) heat is absorbed.
(c) heat is generated.
(d) impurities are washed out.

Q.7 Snowcem is

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

Q.8 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.9 In medium-strength concrete, the water-cement ratio should not be less than

- (a) 0.25 (b) 0.35
(c) 0.4 (d) 0.45

Q.10 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.11 In the air permeability test of cement, the specific surface (in mm^2/g) is of the order of

- (a) 1000 (b) 2000 - 2500
(c) 2500 - 5000 (d) 225000 - 350000

Q.12 The mass of water required for testing cement cubes of average composition in compression is:

- (a) 15 kg (b) 25 kg
(c) 35 kg (d) 40 kg

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 In fineness test of rapid hardening portland cement, the residue on IS sieve No. 9 should not be more than

- (a) 1.0% (b) 5%
(c) 10% (d) 15%

Q.15 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.16 The number of cement bags in a pile of size $4\text{ m} \times 3\text{ m} \times 0.9\text{ m}$ height in a cement store could be

- (a) 100 (b) 150
(c) 175 (d) 200

Q.17 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.18 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.19 The DoE mix design method

- (a) determines aggregate-cement ratio
(b) uses free water content determined by the size and type of aggregate and the level of workability.
(c) uses free water-cement ratio based on target mean compressive strength.
(d) all of the above.

Q.20 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.21 The initial setting time for ordinary Portland cement as per IS specifications should not be less than

- (a) 10 minutes
(b) 30 minutes
(c) 60 minutes
(d) 600 minutes

Q.22 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.23 Gypsum consists of

- (a) H_2S and CO_2
(b) CaSO_4 and H_2O
(c) Lime and H_2O
(d) CO_2 and calcium

Q.24 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_2O_3)

Codes:

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

Q.25 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_2O_3)	3. 5%
D. Ferrous oxide (Fe_2O_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.26 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.27 Match List-I with List-II and select the correct answer by using the codes given below the list:

List-I

- A. Soundness of cement
- B. Initial setting time of cement
- C. Fineness of cement
- D. Consistency of cement

List-II

1. Le Chatelier's apparatus
2. Vicat's apparatus
3. Sieve analysis

Codes:

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

Q.28 Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I

- A. Vicat's needle
- B. Michaeli's compound
- C. Le-Chatelier's apparatus
- D. Turbidimeter

List-II

1. Setting time
2. Specific surface lever apparatus
3. Tensile Strength apparatus
4. Soundness

Codes:

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

Q.29 Assertion (A) : Pozzolana is added to cement to increase early strength.

Reason (R) : It reduces the heat of hydration.

- (a) both A and R are true and R is the correct explanation of A
- (b) both A and R are true but R is not a correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

Q.30 Consider the following statements:

The effect of air entrainment in concrete is to

1. Increase resistance to freezing and thawing
2. Improve workability
3. decrease strength

Which of these statements are correct?

- (a) 2 and 3
- (b) 1 and 3
- (c) 1 alone
- (d) 1, 2 and 3

Q.31 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.32 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.33 Which type of cement is used for mass concrete work?

- (a) High alumina cement
- (b) Quick setting cement
- (c) Rapid hardening cement
- (d) Low heat cement

Q.34 Low heat cement contains lower percentage of which of the following?

- (a) C_3A
- (b) C_3S
- (c) C_2S
- (d) None of these

Q.35 Specific surface of portland cement should not be less than

- (a) 2500 cm^2/gm
- (b) 2000 cm^2/gm
- (c) 2250 cm^2/gm
- (d) 2250 m^2/kg

Q.36 Loss on ignition in portland cement shall not be more than

- (a) 4%
- (b) 5%
- (c) 3%
- (d) 6%

Q.37 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.38 Which of the following cement has maximum percentage of C_3S ?

- (a) Ordinary Portland cement
- (b) Low heat cement
- (c) Sulphate resisting cement
- (d) Rapid Hardening cement

Q.39 Workability of concrete can be increased by

- (a) increase in maximum size of aggregate
- (b) decrease in temperature
- (c) use of round aggregate which has smooth surface texture
- (d) all of the above

Q.40 Increase in specific surface of cement results in

- (a) more early strength
- (b) ultimate strength unaffected
- (c) Increase in shrinkage and cracking of cement concrete
- (d) all of the above

Q.41 Portland cement is manufactured by burning in a kiln the following materials:

- (a) limestone and alumina.
- (b) limestone and clay.
- (c) limestone and sand.
- (d) sand and clay.

Q.42 Soundness test of cement is done to determine its

- (a) durability in sea water.
- (b) free-lime content.
- (c) iron oxide content.
- (d) alumina content.

Q.43 Plaster of paris is obtained by calcining

- (a) gypsum
- (b) bauxite
- (c) lime stone
- (d) kanker

Q.44 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.45 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

- A. Cement mortar for normal brick work
- B. Cement mortar for plastering works
- C. Cement mortar for grouting the cavernous rocks
- D. Cement mortar for gunfiring

List-II

1. 1:4
2. 1:3
3. 1:6
4. 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.46 Pick out the incorrect statement.

- (a) Cement is adhesive as well as cohesive material.
- (b) Portland cement is of hydraulic type.
- (c) For civil engineering works, generally calcareous cements are used.
- (d) Portland cement is an example of natural cement.

Q.47 Match List-I with List-II and select the correct answer using the codes given below the lists.

List-I (Oxide of cement)

- A. CaO
- B. SiO₂
- C. Al₂O₃

List-II (Function)

1. Deficiency, causes slow setting.
2. Deficiency, reduces setting time.
3. Excess, causes cracks.
4. Excess, lowers the strength.

Codes:

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

Q.48 Pick out the incorrect statement.

- (a) For hydraulic structures, a cement with small percentage of C₃S and more C₂S is recommended.
- (b) Setting and hardening of cement stop as soon as the concrete becomes dry.

- (c) The product C - S - H gel is known as tobermorite gel.
- (d) The stiffening of cement without strength development is caused because of C₄AF.

Q.49 The bound water (percentage by weight) required for complete hydration of cement is about

- | | |
|--------|--------|
| (a) 15 | (b) 23 |
| (c) 38 | (d) 40 |

Q.50 Before testing setting time of cement, one should test cement for

- | | |
|---------------|-----------------|
| (a) soundness | (b) strength |
| (c) fineness | (d) consistency |

Q.51 Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I (Laboratory Tests)

- A. Vicat's apparatus
- B. Le-Chatelier's apparatus
- C. Slump test
- D. Fineness modulus

List-II (Property)

1. Soundness of cement.
2. Initial setting time of cement.
3. Workability of cement concrete.
4. Relative size of aggregates.

Codes:

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

Q.52 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.53 Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I (Type of cement)

- A. Rapid hardening
- B. Quick setting
- C. High Alumina
- D. Low heat

List-II (Uses)

1. Refractory concrete in industries
2. Dams
3. Concrete under water
4. Concrete for cold weather
5. Repair of bridges

Codes:

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

Q.54 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.55 Statement-1 : Presence of excess sulphur results in unsoundness of cement.

Statement-2 : Unsoundness of cement due to sulphur can not be measured.

Of the above statements

- (a) Statement 1 is true, but 2 is false.
- (b) Statement 2 is true, but 1 is false.
- (c) Both statements are true.
- (d) Both statements are false.

Answers Cement

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

Explanations Cement

1. (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 .
2. (c)
Gypsum is added to control flash setting.
4. (d)
The compound C_3A 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.
5. (c)
The compound C_3A characteristically reacts fast with water and may lead to an immediate stiffening of paste. C_3A phase is responsible for the highest heat of evolution, both during the initial period as well as in the long run. In between C_3A and C_2S , C_3S results in rapid hardening and higher heat of hydration than C_2S .
6. (c)
When the cement comes in contact with water, hydration of cement proceeds slowly for two to five hours. In this process heat is generated.
8. (c)
Low-heat Portland cement is less reactive than OPC and is obtained by increasing the proportion of C_2S and reducing the proportion of C_3S and C_3A . The initial setting time is about one hour, i.e., greater than that of OPC.
10. (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.
15. (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.
17. (d)
Sulphate resisting cement contains low C_3A and C_4AF 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.
18. (d)
If expansion is more than 10 mm, cement is said to be unsound.
In autoclave expansion should not be more than 0.8%.
20. (b)
Le Chatelier's apparatus is used to determine the soundness of cement.
21. (b)
The initial setting time for ordinary Portland cement should not be less than 30 minutes nor the final setting time should be greater than 10 hours.
30. (d)
Air entrainment will reduce damage during freeze-thaw cycles thereby increasing the concrete's durability. However, entrained air is a trade-off with strength, as each one percent of air may result in five percent decrease in the compressive strength. The compounds used for air-entrainment are a number of natural wood resins, various sulphonated compounds, and some animal and vegetable fats and oils such as tallow, olive oil and their fatty acids such as stearic and oleic acids.
33. (d)
Low-heat Portland Cement: This cement is less reactive than OPC and is obtained by increasing the proportion of C_2S and reducing that of C_3S and C_3A ; this is achieved by restricting the amount of calcium and increasing that of silicates in the raw material for manufacture. This reduction in the contents of more rapidly hydrating compounds C_3S and C_3A results in a slow development of strength but the ultimate strength is the same.
The initial setting time is about one hour, i.e., greater than that of OPC, and final setting time is about 10 hours. This cement is recommended for the use in mass concrete construction such as retaining walls, bridge piers and abutments, dams, etc., where temperature rise by heat of hydration can become excessive.
36. (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.
38. (d)
Rapid-hardening Portland Cement: This cement also called high early strength cement is similar to OPC but with higher C_3S content (>55 percent) and finer grinding. A higher fineness of cement particles provides greater surface area (not less than $325000\text{ mm}^2/\text{g}$) for action with water. It gains strength more quickly than OPC, though the final strength is only slightly higher. The one-day strength of this cement is equal to the three-days strength of 33-grade OPC with the same water-cement ratio.
43. (a)
Plaster of Paris is a type of building material based on calcium sulphate hemihydrates, symbolically expressed as $(\text{CaSO}_4)_2 \cdot \text{H}_2\text{O}$. It is produced by heating gypsum to about 150°C .
 $2(\text{CaSO}_4 \cdot 2\text{H}_2\text{O}) \rightarrow (\text{CaSO}_4)_2 \cdot \text{H}_2\text{O} + 3\text{H}_2\text{O}(\uparrow)$
49. (b)
About an average 23 percent of water by weight of cement is required for complete hydration of portland cement. This water combines chemically with the cement compounds and is known as bound water. Some quantity of water about 15% by weight of cement is required to fill the cement gel pores and is known as gel water.
54. (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.