

TYPES OF CEMENT USED IN CONSTRUCTION

12.1. Vocabulary

Ex. 1. Match the words to their definitions.

1. calcium	a. having a strong aversion to water
2. pozzolana	b. a soft white mineral often used in making plaster of Paris and fertilizer
3. acid	c. substances that prevent water from penetrating a surface
4. bauxite	d. a salt or ester of sulfuric acid
5. sulphate	e. a chemical element that is essential for the growth and development of bones and teeth
6. gypsum	f. man-made constructions built in or near bodies of water, such as docks, piers, and bridges
7. water-repelling chemicals	g. a reddish-brown rock consisting mainly of aluminum minerals, widely used in the manufacture of aluminum
8. marine structures	h. a type of volcanic ash used in construction as a cement substitute
9. annual	i. happening once a year
10. sewage works	j. facilities designed to treat wastewater before it is released into the environment
11. hydrophobic	k. a substance with a pH less than 7, which can dissolve metals and burn skin

Ex. 2. Complete the sentences with the following words:

hydrophobic, bauxite, water-repelling, sewage, gypsum, acid, calcium, marine, pozzolana, annual, sulphate

Due to excessive exposure to _____(1), the metal structure began to corrode which made it less durable.

____(2) festivals are a great opportunity to experience different cultures and traditions.

The company had to import ____ (3) from another country as it was not available in their area.

____(4) supplements can help maintain strong bones and teeth.

____(5) is a essential material used in the production of cement and plaster.

The ____ (6) coating on the car's windshield prevents water from sticking to it during rain which makes for better visibility.

Engineers must consider the harsh ocean environment when designing ____ (7) structures such as oil rigs or docks.

____(8) is a material that can be added to concrete to increase its strength and durability.

____(9) works are crucial for treating and disposing of wastewater in a safe and efficient manner.

____(10) contamination of soil can have harmful effects on the growth of plants and vegetation.

Clothing companies use ____ (11) chemicals to make their products resistant to liquids like sweat and rain.

12.2. Reading

Ex. 1. Read the text.

13 Types of Cement and their Uses

1. Ordinary Portland Cement (OPC)

Ordinary Portland cement is the most widely used type of cement, which is suitable for all general concrete construction. It is the most commonly produced and used type of cement around the world, with annual global production of around 3.8 billion cubic meters per year. This cement is suitable for all kinds of concrete construction.

2. Portland Pozzolana Cement (PPC)

Portland pozzolana cement is prepared by grinding pozzolanic clinker with Portland cement. It is also produced by adding pozzolana with the addition of gypsum or calcium sulfate or by intimately and uniformly blending Portland cement and fine pozzolana.

This cement has a high resistance to various chemical attacks on concrete compared with ordinary portland cement, and thus, it is widely used. It is used in marine structures, sewage works, and for laying concrete underwater, such as bridges, piers, dams, and mass concrete works, etc.

3. Rapid Hardening Cement

Rapid hardening cement attains high strength in the early days; it is used in concrete where formworks are removed at an early stage and are similar to ordinary portland cement (OPC). This cement has increased lime content and contains higher C_3S content and finer grinding, which gives higher strength development than OPC at an early stage.

The strength of rapid hardening cement at the three days is similar to 7 days strength of OPC with the same water-cement ratio. Thus, the advantage of this cement is that formwork can be removed earlier, which increases the rate of construction and decreases the cost of construction by saving formwork cost.

Rapid hardening cement is used in prefabricated concrete construction, road works, etc.

4. Quick setting cement

The difference between the quick setting cement and rapid hardening cement is that quick-setting cement sets earlier. At the same time, the rate of gain of strength is similar to Ordinary Portland Cement, while quick hardening cement gains strength quickly. Formworks in both cases can be removed earlier.

Quick setting cement is used where works is to be completed in very short period and for concreting in static or running water.

5. Low Heat Cement

Low heat cement is produced by maintaining the percentage of tricalcium aluminate below 6% by increasing the proportion of C_2S . A small

quantity of tricalcium aluminate makes the concrete to produce low heat of hydration. Low heat cement suitable for mass concrete construction like gravity dams, as the low heat of hydration, prevents the cracking of concrete due to heat.

This cement has increased power against sulphates and is less reactive and initial setting time is greater than OPC.

6. Sulfates Resisting Cement

Sulfate resisting cement is used to reduce the risk of sulfate attack on concrete and thus is used in the construction of foundations where the soil has high sulfate content. This cement has reduced the contents of C3A and C4AF.

Sulfate resisting cement is used in construction exposed to severe sulfate action by water and soil in places like canals linings, culverts, retaining walls, siphons, etc.

7. Blast Furnace Slag Cement

Blast furnace slag cement is obtained by grinding the clinkers with about 60% slag and resembles more or less in properties of Portland cement. It can be used for works where economic considerations are predominant.

8. High Alumina Cement

High alumina cement is obtained by melting a mixture of bauxite and lime and grinding with the clinker. It is a rapid hardening cement with initial and final setting time of about 3.5 and 5 hours, respectively.

The compressive strength of this cement is very high and more workable than ordinary portland cement and is used in works where concrete is subjected to high temperatures, frost, and acidic action.

9. White Cement

It is prepared from raw materials free from Iron oxide and is a type of ordinary portland cement, which is white. It is costlier and is used for architectural purposes such as precast curtain wall and facing panels, terrazzo surface, etc. and for interior and exterior decorative work like

external renderings of buildings, facing slabs, floorings, ornamental concrete products, paths of gardens, swimming pools, etc.

10. Colored cement

It is produced by mixing 5- 10% mineral pigments with ordinary cement. They are widely used for decorative works on floors.

11. Air Entraining Cement

Air entraining cement is produced by adding indigenous air-entraining agents such as resins, glues, sodium salts of sulfates, etc. during the grinding of clinker.

This type of cement is especially suited to improve the workability with a smaller water-cement ratio and to improve frost resistance of concrete.

12. Expansive Cement

Expansive cement expands slightly with time and does not shrink during and after the time of hardening. This cement is mainly used for grouting anchor bolts and prestressed concrete ducts.

13. Hydrographic cement

Hydrographic cement is prepared by mixing water-repelling chemicals and has high workability and strength. It has the property of repelling water and is unaffected during monsoon or rains.

Hydrophobic cement is mainly used for the construction of water structures such as dams, water tanks, spillways, water retaining structures, etc.

Ex. 2. Choose the correct answer.

1. Which type of cement is the most widely used for general concrete construction?

- a) Portland Pozzolana Cement
- b) Rapid Hardening Cement
- c) Ordinary Portland Cement
- d) Quick Setting Cement

2. What is the annual global production of Ordinary Portland Cement?

- a) 3.8 million cubic meters per year
- b) 6 million cubic meters per year
- c) 2 million cubic meters per year
- d) 5 million cubic meters per year

3. Which type of cement is used in marine structures, sewage works, and for laying concrete underwater?

- a) Quick Setting Cement
- b) Low Heat Cement
- c) Portland Pozzolana Cement
- d) Sulfates Resisting Cement

4. What is the advantage of using Rapid Hardening Cement?

- a) It has a high resistance to various chemical attacks on concrete.
- b) It can be used in prefabricated concrete construction.
- c) Formwork can be removed earlier, which increases the rate of construction and decreases the cost of construction by saving formwork cost.
- d) It is used where works are to be completed in a very short period.

5. What is the difference between Quick Setting Cement and Rapid Hardening Cement?

- a) Quick Setting Cement sets earlier, while Rapid Hardening Cement gains strength quickly.
- b) Quick Setting Cement gains strength quickly, while Rapid Hardening Cement sets earlier.
- c) Both set earlier, but Quick Setting Cement gains strength quickly.
- d) Both gain strength quickly, but Rapid Hardening Cement sets earlier.

6. Which type of cement is suitable for mass concrete construction like gravity dams?

- a) Low Heat Cement
- b) Hydrographic Cement
- c) Sulfates Resisting Cement
- d) Expansive Cement

7. What is the compressive strength of High Alumina Cement compared to Ordinary Portland Cement?

- a) Higher
- b) Lower
- c) The same
- d) It depends on the water-cement ratio.

8. What is White Cement used for?

- a) Works where concrete is subjected to high temperatures, frost, and acidic action.
- b) Decorative works on floors.
- c) Construction exposed to severe sulfate action by water and soil.
- d) Works where the soil has high sulfate content.

9. What is Colored Cement produced by mixing with ordinary cement?

- a) Mineral pigments
- b) Sodium salts of sulfates
- c) Resins
- d) Glues

10. Which type of cement is especially suited to improve the workability with a smaller water-cement ratio and to improve frost resistance of concrete?

- a) Air Entraining Cement
- b) Hydrographic Cement
- c) Expansive Cement
- d) Low Heat Cement