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BUILDING MATERIALS

CIVIL ENGINEERING

Date of Test : 12/03/2024

ANSWER KEY ➤

1.	(b)	7.	(a)	13.	(c)	19.	(b)	25.	(d)
2.	(c)	8.	(b)	14.	(c)	20.	(d)	26.	(c)
3.	(a)	9.	(a)	15.	(d)	21.	(a)	27.	(d)
4.	(d)	10.	(c)	16.	(b)	22.	(b)	28.	(c)
5.	(a)	11.	(c)	17.	(d)	23.	(c)	29.	(c)
6.	(b)	12.	(d)	18.	(c)	24.	(d)	30.	(a)

DETAILED EXPLANATIONS

3. (a)

The raw materials used for manufacturing of high alumina cement are limestone and bauxite.

4. (d)

Rebound hammer test is a non-destructive test used to determine the strength of hardened concrete by noting the rebound deflection when the concrete is hit with plunger, strength of hardened concrete is assessed.

10. (c)

The rate of hydration and the rate of heat liberation increases with the fineness of cement but the total amount of heat liberated is unaffected by the fineness of cement.

11. (c)

1 m^3 freshly mixed concrete corresponds to 1.54 m^3 dry volume of concrete.

Summation of proportions = 1 + 2 + 4 = 7

$$\therefore \quad \text{Volume of cement} = \frac{1.54}{7} = 0.22 \text{ m}^3$$

$$\text{Volume of sand} = \frac{2}{7} \times 1.54 = 0.44 \text{ m}^3$$

12. (d)

IS 456 : 2000 stipulates a minimum of 7 day moist curing while **IS : 7861 (Part I) 1975** stipulates a minimum of 10 days curing under hot weather condition. On an average, the one-year strength of continuously moist cured concrete is 40% higher than that of 28 days moist cured concrete, while non moist curing can lower the strength to about 40%. Moist curing for the first 7 to 14 days may result in a compressive strength of 70% - 85% of that of 28 days moist curing.

13. (c)

$$\text{Slenderness ratio, } S_R = \frac{L}{t} \text{ or } \frac{h}{t \times k_n} \text{ whichever is less}$$

h = 3 m, k_n = 1.2, t = 0.20 m, L = 3.5 m

$$S_R = \frac{3.5}{0.2} = 17.5$$

$$S_R = \frac{3}{0.20 \times 1.2} = 12.5$$

So, $S_R = 12.5$

14. (c)

Most hardwoods contain a type of cell called "VESSEL CELL" or "VESSEL ELEMENT" that appear as small pipes running throughout the tree in longitudinal direction. These vessels in the cross-section of hard-wood appear as holes.

16. (b)

1 m^3 of wet cement mortar = 1.25 m^3 of dry mortar

Sum of proportions = 1 + 6 = 7

$$\therefore \quad \text{Volume of cement} = \frac{1.25}{7} = 0.17857 \text{ m}^3$$

$$\therefore \quad 0.17857 \text{ m}^3 \text{ of cement} = \frac{50}{0.0347} \times 0.17857 = 257.3 \text{ kg cement}$$

$$\text{Volume of sand} = \frac{6 \times 1.25}{7} = 1.07 \text{ m}^3$$

17. (d)

Chrysotile is incombustible upto 110°C.

19. (b)

Assuming 1 m*l* of cement on hydration produces 2.06 m*l* of gel.

$$\text{Volume of gel} = C \times 0.319 \times 2.06 = 0.657\, C$$

$$\text{Space available} = C \times 0.319 + W_o$$

$$\text{Gel space ratio} = \frac{0.657C}{0.319C + W_o}$$

20. (d)

$$\left.\frac{\sigma_{\text{cylinder}}}{\sigma_{\text{cube}}} = 0.8\right\}_{\text{For the given dimension of each}}$$

21. (a)

For 1 m^3 of concrete, $$1 = \frac{W_C}{\rho_C} + \frac{W_{CA}}{\rho_{CA}} + \frac{W_W}{\rho_W} + \frac{W_{FA}}{\rho_{FA}}$$

$$\Rightarrow \quad 1 = \frac{480}{3.2 \times 10^3} + \frac{1100}{2.65 \times 10^3} + \frac{W_W}{10^3} + \frac{520}{2.6 \times 10^3}$$

$$\Rightarrow \quad 10^3 = 150 + 415.094 + W_W + 200$$

$$\Rightarrow \quad W_W = 234.906 \text{ kg} \simeq 234.9 \text{ kg}$$

22. (b)

- **Rapid hardening cement:** It is suitable for repairs of roads and bridges and when load is required to be applied in a short period of time.
- **Quick setting portland cement:** It is used when concrete is to be laid under water or in running water.
- **High alumina cement:** It is resistant to the action of fire, sea water, acidic water and sulphates and is used as refractory concrete in industries and is widely used for precasting.
- **Low heat portland cement:** It is most suitable for large mass concrete works such as dams, large raft foundations, etc.

23. (c)

$$\text{Nominal size of modular brick} = 20 \times 10 \times 10 \text{ cm}$$

$$\text{Actual size of modular brick} = 19 \times 9 \times 9 \text{ cm}$$

$$\text{Mortar required for 1 m}^3\text{ brick work} = 1 - \frac{1}{0.2 \times 0.1 \times 0.1} \times 0.19 \times 0.09 \times 0.09$$

$$= 0.2305 \text{ m}^3$$

$$\text{Volume of mortar lost between joints} = 22\%$$

$$\text{Volume of set mortar} = 0.2305 + 0.22 \times 0.2305$$

$$= 0.28121 \text{ m}^3$$

$$\text{Actual volume of bricks} = 1 - 0.28121 \text{ m}^3 3$$

$$= 0.71879 \text{ m}^3$$

$$\text{Number of modular bricks} = \frac{0.71879}{0.19 \times 0.09 \times 0.09} = 467.05 \approx 468$$

24. (d)

Neutral bricks are used for neutral lining. They offer resistance to the corrosive action of slags and acid fumes. As compared to the basic bricks, the neutral bricks are more inert to the slags following are the type of neutral bricks:

(i) Chromite bricks

(ii) High alumina bricks

25. (d)

Hydraulic lime: It is also known as the water lime as it sets under water. It contains clay and some amount of ferrous oxide.

Following facts should be noted:

(i) The increase in percentage of clay makes the slaking difficult and increases the hydraulic property.

(ii) With about 30% of clay, the hydraulic lime resembles natural cement.

(iii) The hydraulic lime can set under water and in thick walls where there is no free circulation of air.

(iv) The colour of hydraulic lime is not perfectly white. It therefore appears less sanitary then the fat lime.

26. (c)

We know that cross-section area of briquette at its least section is 6.45 cm^2.

$$\text{So ultimate tensile strength} = \frac{\text{Failure load}}{6.45} = \frac{161.25}{6.45} = 25 \text{ kg/cm}^2$$

27. (d)

Non-refractory timbers can be rapidly seasoned without any trouble.

Highly refractory timbers are likely to get damaged severely during seasoning.

29. (c)

Initial setting time of high alumina cement is more than 3.5 hours and final setting time is about 5 hours.

High alumina cement is produced by grinding clinkers formed by calcining bauxite and lime.

Advantages:

(i) Initial setting time = $3\frac{1}{2}$ hours.

Hence, it allows more time for mixing and placing operations.

(ii) It can stand high temperature.

(iii) It resists the action of acids in a better way.

30. (a)

The durability of concrete can be defined and interpreted to mean its resistance to deteriorating influences which may reside inside the concrete itself, or to the aggressive environments.

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