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BUILDING MATERIALS

CIVIL ENGINEERING

Date of Test : 08/09/2024

ANSWER KEY ➤

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

DETAILED EXPLANATIONS

1. (b)

As per **Cl. 3.1** of **IS 2180-1988**, the compressive strength of heavy duty clay bricks should not be less than:

Class 40 : Compressive strength not less than 40 N/mm^2 (400 kgf/cm^2)

Class 45 : Compressive strength not less than 45 N/mm^2 (450 kgf/cm^2)

2. (b)

Wagner Turbidimeter is used to determine the fineness of cement by measuring the specific surface area by using a photoelectric cell to measure the light passing through the suspension of cement.

3. (a)

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

4. (a)

5. (d)

Brard's test is performed to check the frost resistance of stone.

6. (d)

7. (a)

8. (b)

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

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

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

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

9. (c)

10. (a)

Velocity of pulse (km/sec)	Quality of concrete
> 4.5	Excellent
3.5 – 4.5	Good
3 – 3.5	Moderate
< 3	Doubtful

11. (c)

12. (c)

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

Summation of proportions = 1 + 2 + 4 = 7

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

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

13. (c)

Slenderness ratio, $S_R = \frac{L}{t}$ or $\frac{h}{t \times k_n}$ 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.

15. (d)

16. (c)

17. (a)

For ordinary concrete, maturity should be not be less than 19800°C-hrs.

If the period of wait after the concrete is placed before removing or stripping the forms is t days, then the maturity at the given strength of 21 MPa at average curing temperature of 7°C is

$$M = (T - T_0) \times \Delta t$$

where M = Maturity in °C-hours (or °C-days)

T = Average concrete temperature, °C, during each time interval, Δt

T_0 = Datum temperature (typically taken to be –11°C)

Δt = Time intervals (hours or days)

$\therefore \quad M = \{7 - (-11)\} \times t$

$\therefore$ To achieve minimum desired concrete maturity of 19800°C-hrs

$$M = \{7 - (-11)\}\, t = 19800$$

$\Rightarrow \quad t = 1100$ hrs

$\Rightarrow \quad t = 45.833$ days $\simeq 46$ days

18. (d)

19. (a)

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

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

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

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

20. (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.

21. (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.

22. (b)

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

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

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

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

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

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

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

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

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

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

23. (c)

To prepare 2.5 m^3 workable RCC mix,

Volume of dry concrete = $1.53 \times 2.5 = 3.825 \text{ m}^3$

$$V_{\text{cement}} = \frac{1}{7} \times 3.825 = 0.546 \text{ m}^3$$

$$\text{Number of bags} = \frac{0.546}{0.347} = 15.74 \simeq 16$$

24. (d)

25. (d)

26. (b)

$$\text{water} = \left(\frac{P}{5} + 2.5\right)\% \text{ where } P = \text{Std. consistency}$$

$$= \left(\frac{30}{5} + 2.5\right)\% = 8.5\%$$

27. (a)

28. (c)

Electrical seasoning method uses the application of AC currents through a bad conductor causes heating leads to rapid drying of the timber. Due to uniform rise in temperature and consequently uniform evaporation of moisture, results in uniform quality of timber.

29. (c)

$$CaO + H_2O \rightarrow Ca(OH)_2$$

$56\ g \qquad 18g$

$1g \qquad \frac{18}{56}g$

$10kg \qquad \frac{18}{56} \times 10kg = 3.2kg$

30. (c)

- Angularity number varies in the range between 0 to 11.
- LA abrasion test is used to find hardness of the aggregates.

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