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CLASS TEST 2019-2020

MECHANICAL ENGINEERING

Date of Test : 26/07/2019

ANSWER KEY ➤ Casting & Welding

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

DETAILED EXPLANATIONS

5. (d)

The hot chamber process is used for most of the low melting temperature alloys, such as zinc, lead and tin.

6. (c)

Strength of the part after compaction is called green strength.

7. (b)

Converging passages or sprues are provided to avoid aspiration effect. Air entrapped due to aspiration causes blow holes in castings.

9. (a)

Gating ratio is ratio of cross-sectional area of sprue : runner : gates

10. (d)

Converging passages are used as spures to gain in velocity of molten metal as it reduces airaspiration.

12. (d)

Hot chamber die casting is suitable to cast materials which has low melting point. This method is used to cast the alloys of lead, tin and zinc.

This method can also be used for casting Aluminium alloys because the material has a tendency to pick up some iron due to extended contact with the casting equipment.

14. (d)

Surface area of cube = $6l^2$

Surface area of sphere = $4\pi r^2$

According to Chorinov's relation

$$\text{Solidification time} \propto \left(\frac{\text{volume}}{\text{surface area}}\right)^2$$

as volume of cube and sphere are equal

$$\frac{t_c}{t_s} = \left(\frac{A_s}{A_c}\right)^2 = \left(\frac{4\pi r^2}{6l^2}\right)^2$$

$$\frac{t_c}{t_s} = \left(\frac{4\pi}{6}\right)^2\left(\frac{r}{l}\right)^4$$

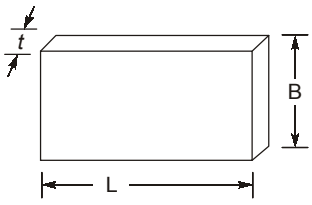
16. (c)

$$V = L\,B\,t$$

$$A = 2\,[LB + Lt + Bt]$$

$$\frac{V}{A} = \frac{LBt}{2[LB + Lt + bt]}$$

$$\frac{V}{A} = \frac{1}{2\left[\frac{1}{t} + \frac{1}{B} + \frac{1}{L}\right]}$$



Rectangular Slab

for slab, $L >> t$ and $B >> t$,

$$\therefore \quad \frac{V}{A} = \frac{t}{2}$$

Solidification time,

$$T \propto \left(\frac{V}{A}\right)^2$$

$$\therefore \quad \frac{T_1}{T_2} = \left(\frac{t_1}{t_2}\right)^2$$

or
$$t_2 = t_1\sqrt{\frac{T_2}{T_1}} = 3\sqrt{\frac{4}{2}} = 4.2426 \text{ cm}$$

20. (c)

$$t = k\left(\frac{V}{A}\right)^2$$

$$\frac{t_1}{t_2} = \left(\frac{V_1}{A_2} \times \frac{A_2}{V_2}\right)^2 = \left\{\left(\frac{d_1}{6}\right)\left(\frac{6}{d_2}\right)\right\}^2$$

$$\frac{t_1}{t_2} = \left(\frac{d_1}{d_2}\right)^2$$

$$\frac{10}{t_2} = \left(\frac{2}{4}\right)^2 = t_2 = 10 \times 4 = 40 \text{ sec}$$

21. (a)

$$\text{Bottom gate, } t_A = \frac{2A}{A_g\sqrt{2g}}\left[\sqrt{h_m} - \sqrt{h_m - H}\right] = 20 \text{ min.}$$

where,
$A \rightarrow$ area of mould
A_g = area of gate

According to question, $H = h_m$

$$\Rightarrow \quad t_A = \frac{2A}{A_g\sqrt{2g}}\sqrt{h_m} = 20$$

For top gate, $H = h_{m'}$

$$\Rightarrow \quad t_B = \frac{A\sqrt{h_m}}{A_g\sqrt{2g}} = \frac{t_A}{2} = 10 \text{ min}$$

22. (a)

$$d = 200\,\text{mm}$$

$$\therefore \quad r = 100\,\text{mm} = 0.1\,\text{m}$$

$$\text{Solidification time} = k\left(\frac{V}{A}\right)^2$$

$$1078 = k\left(\frac{\frac{4}{3}\times\pi\times(0.1)^3}{4\times\pi\times(0.1)^2}\right)$$

$$k = 1078\times\frac{9}{(0.1)^2} = 0.97\times10^6\ \text{s/m}^2$$

23. (d)

Aluminium, wax and mercury can be used for making patterns.

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