

**MECHANICAL ENGINEERING**  
**Casting & Welding**

**Q. No. 1 to Q. No. 10 carry 1 mark each**

**Q.1** Match **List-I** (Moulding/casting process) with **List-II** (Product) and select the correct codes as given below the lists:

**List-I**

- A. Slush casting
- B. Shell moulding
- C. Dry sand moulding
- D. Centrifugal casting

**List-II**

- 1. Small crankshafts
- 2. Machine tool bed
- 3. Cylinder block
- 4. Hollow castings like lamp shades
- 5. Rain water pipe
- 6. Cast iron shoe brake

**Codes:**

- |     | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
|-----|----------|----------|----------|----------|
| (a) | 2        | 6        | 1        | 3        |
| (b) | 4        | 1        | 3        | 5        |
| (c) | 4        | 5        | 3        | 1        |
| (d) | 3        | 1        | 6        | 2        |

**Q.2** Light impurities in the molten metal are prevented from reaching the mould cavity by providing a

- (a) stainer
- (b) bottom well
- (c) skim bob
- (d) All of these

**Q.3** Which one of the following gating system is best suited to obtain direction solidification?

- (a) Top gating
- (b) Parting gate
- (c) Bottom gate
- (d) Step gate

**Q.4** Hardness of green sand mould increases with

- (a) Increase in of moisture content beyond 6 percent
- (b) Increase in permeability
- (c) Decrease in permeability
- (d) Increase in both moisture content and permeability

**Q.5** Which of the following engineering materials is the most suitable candidate for hot chamber die casting?

- (a) low carbon steel
- (b) titanium
- (c) copper
- (d) tin

**Q.6** Green strength in powder metallurgy refers to the strength of

- (a) original material in the bulk form
- (b) the powder before compaction
- (c) the powder after compaction
- (d) the powder after sintering and cooling

**Q.7 Assertion (A):** Converging passage is used for feeding liquid metal into a mould.

**Reason (R):** Inhalation of air promotes blow holes in casting.

- (a) Both (A) and (R) are true and (R) is the correct reason for (A)
- (b) Both (A) and (R) are true but (R) is NOT the correct reason for (A)
- (c) Both (A) and (R) are false
- (d) (A) is false but (R) is true

**Q.8** Which of the following process would produce strongest components?

- (a) die casting
- (b) hot rolling
- (c) cold rolling
- (d) forging

**Q.9** Gating ratio of 1 : 2 : 4 is used to design the gating system for magnesium alloy casting. This gating ratio refers to the cross-section areas of the various gating elements as given below:

- 1. Down sprue
- 2. Runner
- 3. Ingates

The sequence of the above elements in the ratio 1 : 2 : 4 is

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

**Q.10** Converging passage is used for feeding the liquid molten metal into the mould to

- (a) increase the rate of feeding
- (b) quickly break off the protruding portion of the casting
- (c) decrease wastage of cast metal
- (d) avoid aspiration of air

**Q. No. 11 to Q. No. 30 carry 2 marks each**

**Q.11** Match the List-I with List-II and select the correct answer using the codes given below the lists:

**List-I**

- A. Sand casting
- B. Centrifugal casting
- C. Investment casting
- D. Die casting

**List-II**

- 1. Turbine blades
- 2. IC engine pistons
- 3. Large bells
- 4. Pulleys

**Codes:**

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

**Q.12** Hot chamber die casting process is not suited for

- (a) lead and its alloys
- (b) zinc and its alloys
- (c) tin and its alloys
- (d) aluminium and its alloys

**Q.13** Grey cast iron is best welded applying

- (a) TIG
- (b) MIG
- (c) Submerged work
- (d) Oxy-acetylene welding

**Q.14** Volume of a cube of side ' $l$ ' and volume of a sphere of radius ' $r$ ' are equal. Both the cube and the sphere are solid and of same material. They are being cast. The ratio of the solidification time of the cube to the same of sphere is

- (a)  $\left(\frac{4\pi}{6}\right)^3 \left(\frac{r}{l}\right)^6$
- (b)  $\left(\frac{4\pi}{6}\right) \left(\frac{r}{l}\right)^2$
- (c)  $\left(\frac{4\pi}{6}\right)^2 \left(\frac{r}{l}\right)^3$
- (d)  $\left(\frac{4\pi}{6}\right)^2 \left(\frac{r}{l}\right)^4$

**Q.15** Consider the following statements:

- 1. Phenomenon where ductile metals become stronger and harder when they are deformed plastically is called strain hardening or work hardening.

2. Increasing temperature lowers the rate of strain hardening. Hence materials are strain hardened at low temperatures, thus also called cold working.

3. During plastic deformation, dislocation density increases. And thus their interaction with each other results in increase in yield stress.

- (a) 1, 2, 3 are correct
- (b) 1, 3 are correct
- (c) 2, 3 are correct
- (d) 1 is correct

**Q.16** In a sand casting of a rectangular slab, the thickness of the solidified layer after 2 minutes is known to be 3 cm. Based on Chvorinov's rule, the solidified thickness after 4 minutes is

- (a) 3.15 cm
- (b) 3.64 cm
- (c) 4.24 cm
- (d) 4.95 cm

**Q.17** Which of the following casting processes are expendable mold operations?

- P : Centrifugal casting
- Q : Die casting
- R : Investment casting
- S : Low pressure casting
- T : Sand casting
- U : Shell moulding
- V : Slush casting
- W : Vacuum molding

- (a) P, R, U and V
- (b) R, T, U and W
- (c) P, T, U and W
- (d) R, U, V and W

**Q.18** Which of the following is used to improve the directional solidification for difficult casting geometries?

- (a) Chills
- (b) Chaplets
- (c) Step gate
- (d) Runner extension

**Q.19** Match **List-I** (Moulding process) with **List-II** (Binding agent) and select the correct answer using the codes given below the lists:

<b>List-I</b>	<b>List-II</b>
A. Green sand	1. Silicate
B. Core sand	2. Organic
C. Shell moulding	3. Clay
D. Carbondioxide moulding	4. Plaster of paris
	5. Plastic

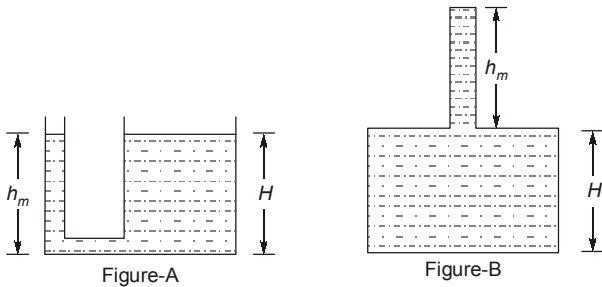
**Codes:**

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

**Q.20** A spherical drop of molten metal of radius 2 mm solidifies in 10 seconds. Then the solidification time of a similar spherical drop of molten of radius 4 mm is

- (a) 32 sec                      (b) 20 sec  
(c) 40 sec                      (d) 64 sec

**Q.21** If  $h_m = H$  in both of the below case. The time required to fill the mould in bottom gate arrangement (Figure - A) is 20 min. Then what will be the time required (in minutes) to fill the mould in top gate arrangement (Figure - B)? (Ignore frictional effects)



- (a) 10                              (b) 11  
(c) 12                              (d) 9

**Q.22** The solidification time of a spherical casting of 200 mm diameter is 1078 second then what will be its solidification factor

- (a)  $0.97 \times 10^6 \text{s/m}^2$       (b)  $0.52 \times 10^6 \text{s/m}^2$   
(c)  $1.1 \times 10^6 \text{s/m}^2$       (d) none of these

**Q.23** Which of the following materials can be used for making pattern?

1. Aluminium                      2. Wax  
3. Mercury                          4. Lead

Select the correct answer using the codes given below:

**Codes:**

- (a) 1, 3 and 4                      (b) 2, 3 and 4  
(c) 1, 2 and 4                      (d) 1, 2 and 3

**Q.24** Match **List-I** (Product) with **List-II** (Process of Manufacture) and select the correct answer using the codes given below the lists:

**List-I**

- A. Automobile piston in aluminium alloy  
B. Engine crankshaft in spheroidal graphite iron  
C. Carburettor housing in aluminium alloy  
D. Cast titanium blades

**List-II**

1. Pressure die-casting  
2. Gravity die-casting  
3. Sand casting  
4. Precision investment casting  
5. Shell moulding

**Codes:**

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

**Q.25 Assertion(A):** die casting yields a product of good accuracy and finish

**Reason(R):** low melting alloys are used in die casting

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

**Q.26** Consider the following statements in respect of investment casting :

- The pattern or patterns is/are joined to a stalk or sprue also of wax to form a tree of patterns
- The prepared moulds are placed in an oven and Heated gently to dry off the invest and melt out the bulk of wax
- The metal is usually poured by placing the moulds in a vaccum chamber

Which of the statements given above are correct

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

**Q.27** Freezing ratio or relative freezing time according to Caine's equation is

(a)  $\frac{A_C/V_R}{A_R/V_C}$                       (b)  $\frac{A_R/V_R}{A_C/V_C}$

(c)  $\frac{V_C/A_C}{V_R/A_R}$                       (d)  $\frac{V_R/A_R}{V_C/A_C}$

**Q.28** Investment casting is used for

- (a) shapes which are made by difficulty using complex patterns in sand casting.
- (b) mass production
- (c) shapes which are very complex and intricate and can't be cast by any other method.
- (d) there is nothing like investment casting

**Q.29** Blow holes are casting defects

- (a) which occur due to some sand shearing from the cope surface

- (b) which take the form of internal voids or surface depression due to excessive gaseous material not able to escape
- (c) which occur due to discontinuity in metal casting resulting from hindered contraction
- (d) caused by two streams of metals that are too cold to fuse properly

**Q.30** Cold shuts are casting defects

- (a) which occur due to some sand shearing from the cope surfaces
- (b) which take the form of internal voids or surface depression due to excessive gaseous material not able to escape
- (c) which occur due to discontinuity in metal casting resulting from hindered contraction
- (d) caused by two streams of metals that are too cold to fuse properly



# MECHANICAL ENGINEERING

## **ANSWER KEY** ➤ **Casting & Welding**

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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

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

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

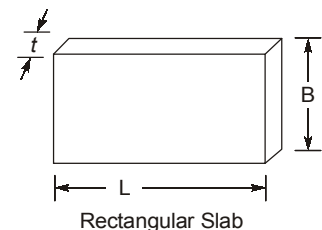
16. (c)

$$V = L B t$$

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

$$\frac{V}{A} = \frac{L B t}{2 [LB + Lt + bt]}$$

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



for slab,  $L \gg t$  and  $B \gg t$ ,

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

Solidification time,

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

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

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)

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

where,

$A \rightarrow$  area of mould

$A_g =$  area of gate

$H = h_m$

According to question,

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

For top gate,

$H = h_m$

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



22. (a)

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

∴

$$r = 100 \text{ mm} = 0.1 \text{ m}$$

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

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

$$k = 1078 \times \frac{9}{(0.1)^2} = 0.97 \times 10^6 \text{ s/m}^2$$

23. (d)

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

