

This Exam measure the following llos, a.8, a.13, b.2, b.18, c.5, and d.3

**Answer the following with net sketch**

**Question no. One (10 Mark)**

**Choose the correct answer**

- 1- The casting process basically involves all the following except (a) pouring molten metal into a mold patterned after the part to be manufactured, (b) allowing it to solidify, (c) machining and (d) removing the part from the mold.
- 2- During solidification of an alloy when a mixture of solid and liquid metals are present, the solid-liquid mixture is referred to as which one of the following? (a) eutectic composition, (b) ingot segregation, (c) liquidus, (d) mushy zone, or (e) solidus.
- 3- A riser that is completely enclosed within the sand mold and connected to the main cavity by a channel to feed the molten metal is called which of the following (may be more than one)? (a) blind riser, (b) open riser, (c) side riser, and (d) top riser
- 4- In a sand casting mold, the V/A ratio of the riser should be which one of the following relative to the V/A ratio of the casting itself? (a) equal, (b) greater, or (c) smaller.
- 5- Which one of the following casting processes is most widely used (one answer)? (a) centrifugal casting, (b) die casting, (c) investment casting, (d) sand casting, or (e) shell casting.
- 6- For which of the following reasons is a *green mold* so- named? (a) green is the color of the mold, (b) moisture is contained in the mold, (c) mold is cured, or (d) mold is dry.
- 7- Shell molding is which one of the following? (a) casting operation in which the molten metal has been poured out after a thin shell has been solidified in the mold, (b) casting operation used to make artificial sea shells, (c) casting process in which the mold is a thin shell of sand binded by a thermosetting resin, or (d) sand casting operation in which the pattern is a shell rather than a solid form.
- 8- Groove welds are most closely associated with which one of the following joint types: (a) butt, (b) corner, (c) edge, (d) lap, (e) tee.
- 9- The amount of heat required to melt a given volume of metal depends strongly on which of the following properties (more than one)? (a) coefficient of thermal expansion, (b) heat of fusion, (c) melting temperature, (d) modulus of elasticity, or (e) thermal conductivity.
- 10- Which of the following processes is/are classified as fusion welding (more than one)? (a) electrogas welding, (b) electron beam welding, (c) explosive welding, (d) percussion welding.

**Question no. Two (15 Mark)**

- a-** Casting processes are most often selected over other manufacturing methods for some reasons, mention, and what are its limitation?
- b-** The solidification process which involves the transformation of the molten metal back into the solid state differs depending on whether the metal is a pure element or an alloy. Discuss with drawing the cooling curve and characteristic grain structure
- c-** Three metal pieces being cast have the same volume, but different shapes: One is a sphere, one a cube, and, the other a cylinder with its height equal to its diameter. Which piece will solidify the fastest, and which one the slowest? Assume that  $n = 2$ .

**Question no. Three (15 Mark)**

- a-** Discuss the solidification time and its empirical relationship, and what are the steps of sand casting?
- b-** With net sketch explain the stages of shrinkage of casting, and why should turbulent flow of molten metal into the mold be avoided?

**C-** A steel casting has a cylindrical geometry with 4.0 in diameter and weighs 20 lb. This casting takes 6.0 min to completely solidify. Another cylindrical-shaped casting with the same diameter-to-length ratio weighs 12 lb. This casting is made of the same steel and the same conditions of mold and pouring were used. Determine: (a) the mold constant in Chvorinov's Rule; and (b) the dimensions, and (c) the total solidification time of the lighter casting. Note: The density of steel = 490 lb/ft<sup>3</sup>.

**Question no. Four (10 Mark)**

**a-** What are the defects of casting? support your answer with net drawing

**b-** What are the advantages and disadvantages of welding compared to other types of assembly operations? What is the *heat affected zone* (HAZ) in a fusion weld?

**c-** What are the five basic types of joints? And what are the types of welds?

**Question no. Five (10 Mark)**

It is wanted to manufacture the part shown in Fig. 1 by two different type of casting, one of them is sans casting.



Fig. 1

**Good Luck**  
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