

Exam augustus 2014 solutions Max

- 1) B
- 2) B
- 3) B
- 4) A
- 5) A
- 6) A
- 7)
- 8) D
- 9) A
- 10) B

11a) – If the material changes from metal to composite, the manufacturing process changes a lot. Composites require other manufacturing techniques than metals.

- If the material changes from metal to composite, the design might have to be reconsidered since composites usually are non-homogeneous materials, which are better in carrying stresses in one direction, but worse in carrying stresses in multiple directions.

11b) To avoid the extensive process of redesigning, re-iterating, certifying.

12a) Metals.

12b) Sand casting usually uses one mold, after which a new mold has to be created. The mold is destroyed at removal of the final product. However, if proper draft angles are implemented, molds may be re-used since in that case the final product can be removed without doing damage to the mold. Common number for product series is 1 (no draft angles) or small, like 10 (for draft angles).

12c) The liquid metal solidifies in the cavity of the mold, during which the metal shrinks. Additional liquid metal should be supplied to the cavity by risers in order to compensate for the effects of shrinkage. It could affect the casting process and product negatively when no sufficient additional liquid metal is fed to the cavity: then the final product will be incomplete, because there will be “empty” cavities in the mold. Also the shape of the cavity in the mold has to be a little bit bigger than the final product’s shape due to solid shrinkage. This is the type of shrinkage that occurs after the material completely has been solidified, and after the product has been removed from the mold.

13a) – At RTM two molds are used. At vacuum infusion only one mold is used. Hence a product made with RTM has two smooth surfaces, vacuum infusion only one.

- At vacuum infusion the resin is “pulled through” the product by applying vacuum at the outlet of the vacuum bag. At RTM the resin is pushed through with pumps.

13b) – Advantage: Lower cost

- Advantage: Lower forces need to be applied
- Disadvantage: Only one smooth surface
- Disadvantage: Can take more time. At RTM one can put a lot of force on the resin, so it goes through the product faster. At vacuum infusion one is dependent on the vacuum only.

14a) False: it depends on the product that is being assembled. There could be a metal product that needs higher accuracy than a composite structure.

14b) Accessible: This is important so that laborers can easily work on the product they are assembling using the jib.

Stiff: It is important that the jig does not deform under the loads of the products that are been assembled on it. If the jig deforms significantly, it might be impossible to still assemble the parts on it.

Cheap: Jigs should not be very expensive, since they have to be made specifically for every assembly.

14c) - Advantage: Product needs to be less accessible since only accessibility from one side is needed.

- Advantage: Jibs can be less complex.
- Disadvantage: You can't visually inspect from both sides if the product has been assembled correctly, you will have to assume it's correct.
- Disadvantage: You can't easily access the e.g. rivet from the other side. Hence when you riveted it wrong, you can't push it out from the other side.

15a) Break-even point is the point in time at which the cost equal the revenues. Hence net outcome is zero.

15b) Recurring cost will come back multiple times (e.g. labor cost of employees). Non-recurring cost are only appearing once (e.g. purchase of a large production hall)

16a) Difference: Short/long fibers can't be filament wined, while continuous fibers can. Consequence: For short/long fibers other production processes as filament winding need to be used.

16b) Difference: For thermoplastic based composited usually more force or heat is required since the viscosity of thermoplastics is a lot higher than viscosity for thermosets. Consequence: for thermoplastics e.g. injection molding with a screw is needed, shearing the thermoplastic during this manufacturing process.

16c) Casting makes the metal liquid and pours it in its final shape right away, while forging keeps the metal solid and deforms it by multiple hits or compressions. Consequence: Forging is more labor intensive.

16d) Composite structures can't be penetrated or cut as easily as metals because delamination may occur. Consequence: Other techniques for joining and making divisions are required.

16e) Reproducibility says something about how well a something can be re-done, while predictability says something about how well the outcome of a process is predictable. Consequence: Both process-characteristics need to be assessed before finally deciding on a production process.