

Cormier Practice Questions--Materials and Tolerance

1. Do the following statements describe the degradation (D) or the protection (P) of a material?

a) A wooden patio is treated with an antifungal coating.

Prot

b) The plastic pot that was left out all winter has cracks all over its surface

Degr

2. What can be done to protect a metal nail from corrosion?

- oil / grease
- paint
- galvanization \Rightarrow coat with Zn \Rightarrow Zn rust first before Iron.

3. What is the main degradation problem ceramics?

- environmental factors
- frost = thermal shock

4. • Heat + Humidity \Rightarrow mold + water (dissolves some of the materials in the ceramics)

13. The owners of the apple orchard are looking into purchasing a new set of bushel baskets. After some research, they have found that the bushel baskets are available in wood, plastic, or aluminum. Each of these materials has certain advantages and disadvantages.

Which of these materials do you think will be the best for the production of bushels?

Explain the advantages and disadvantages of the chosen material based on:

a) The scientific aspects of the material, considering both the mechanical constraints and the material's properties.

b) The environmental aspect, considering the environmental impact of producing the bushel.

- plant material =
- compostable
 - flexible
 - renewable

largest stick than is bigger smallest hole

- plastic
- flexible
 - durable

5. Can a stick that has a diameter of $60.5 \text{ mm} \pm 1.0$ fit in a hole that has a diameter of $61 \text{ mm} \pm 0.1 \text{ mm}$?

$60.5 \text{ mm} \pm 1.0$ $\left\{ \begin{array}{l} 59.5 \text{ mm lower limit} \\ 61.5 \text{ mm upper limit} \end{array} \right.$

$60 \text{ mm} \pm 0.1 \text{ mm}$ $\left\{ \begin{array}{l} 59.9 \text{ mm} \\ 60.1 \text{ mm} \end{array} \right.$ no! Upper limit of 61.5 mm is too high.

6. A company ordered a part that had a square side of $84 \text{ mm} \pm 3 \text{ mm}$. It received a part that has a side of 80 mm . Should the company accept the part?

$$84 \text{ mm} \pm 3 \text{ mm} \begin{cases} 81 \text{ mm lower limit} \\ 87 \text{ mm} \end{cases}$$

$$80 \text{ mm} < 81 \text{ mm} = \text{OK!}$$

Yes.

7. What should be the smallest acceptable tolerance on a 65 mm peg so that it may possibly fit in a $60 \text{ mm} \pm 2 \text{ mm}$ hole?

$\pm 7 \text{ mm}$

$$\text{hole} = 60 \text{ mm} \pm 2 \text{ mm} \begin{cases} 58 \text{ mm lower} \\ 62 \text{ mm upper} \end{cases}$$

$$\text{peg} = 65 \text{ mm peg} - 58 \text{ mm} = 7 \text{ mm}$$

$$65 \text{ mm} \pm 7 \text{ mm}$$

will allow peg to fit into lower limit hole

8.

Question 19

An engineering company is designing a prototype car that runs on hydrogen. Its exhaust is water. The only thing left to determine is the material that will be used to build the body of the car.



Specifications for the car

- > Low thermal conductivity *NOT metal*
- > High resilience
- > Will not easily rust *NOT metal*
- > Lightweight

The table below describes the properties of the materials.

Properties of Materials	
Material	Properties
Ceramics	<ul style="list-style-type: none"> • High density • Heat resistant • High degree of hardness but poor processing can make it fragile • Resistant to corrosion
Alum'num Alloys	<ul style="list-style-type: none"> • Malleable • Low density • Resistant to corrosion • Water resistant
Steel	<ul style="list-style-type: none"> • Malleable • Hardness • Resilient • Prone to Oxidation <i>X, rusts</i>
Fibreglass	<ul style="list-style-type: none"> • Low density • Resistant to compression • Prone to shearing • Resistant to corrosion

You have been hired by the company to analyze which material is best for the building of the car's body.

Determine which material is best suited for the body of the car from the specifications listed above.
 Justify your answer by referring to the specifications **and** properties of the material.
 Provide at least two justifications.

*fibreglass = prone to shear bad
 OR
 *aluminium alloy
 malleable good

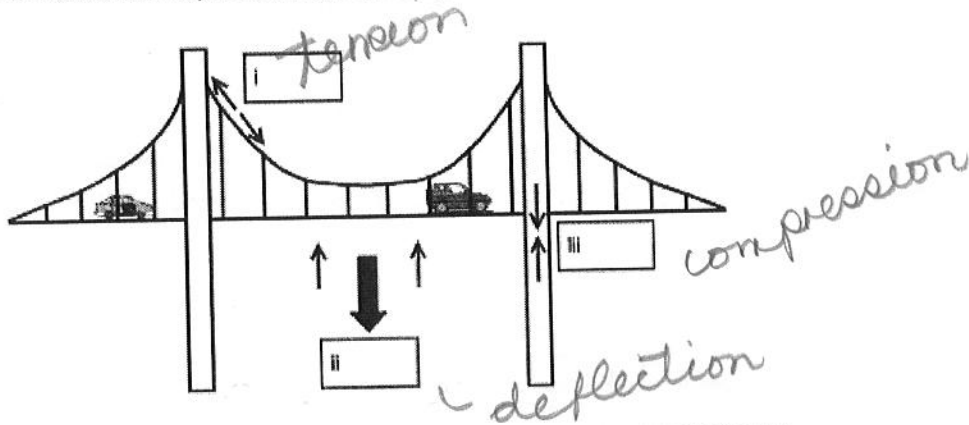
so Al alloy

9.

Question 13

Engineers must take into account the constraints acting on a bridge.

Refer to the constraint diagram of a suspension bridge below.



Which of the following correctly identifies the type of mechanical constraint subjected by the bridge at each numbered location?

- A) i - Tension
 ii - Deflection
 iii - Compression
- B) i - Compression
 ii - Deflection
 iii - Tension
- C) i - Deflection
 ii - Compression
 iii - Tension
- D) i - Compression
 ii - Tension
 iii - Deflection