Unit 02: Material Mechanics and Analysis of Solid Objects

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Stephanie Redfern, Ranjeet (Ron) Agarwala, and Dr. Steve Gibbs. Mechanics I. The Saylor Foundation, http://www.saylor.org/courses/me102/

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1. Unit 02: Material Mechanics and Analysis of Solid Objects

4. Chapter: Unit 02: Material Mechanics and Analysis of Solid Objects

1. Unit 02: Material Mechanics and Analysis of Solid Objects Questions

4.1.1. Which of the following represents the area moment of inertia of a t...

Author: Stephanie Redfern

Which of the following represents the area moment of inertia of a thin, rectangular body about an axis through the center of the body and parallel to the long dimension of the rectangle? The long dimension of the rectangle is 10 cm and the short dimension is 5 cm.

Please choose only one answer:

- 1.0 x 10 [sup] -6 [/sup] m [sup] 4 [/sup]
- 1.0 x 10 [sup] 2 [/sup] m [sup] 4 [/sup]
- 1.0 x 10 [sup] -4 [/sup] m [sup] 4 [/sup]
- 1.0 x 10 [sup] -6 [/sup] m [sup] 2 [/sup]
- 2.0 x 10 [sup] -5 [/sup] m [sup] 4 [/sup]

4.1.2. Which of the following best describes the role of constitutive equa...

Author: Stephanie Redfern

Which of the following best describes the role of constitutive equations or relations in the calculation of mechanical behavior?

Please choose only one answer:

- Constitutive relations describe laminate mechanics.
- Constitutive equations allow calculation of material density as a function of external loads.
- Constitutive relations permit calculation of shear strains from normal stresses.
- Constitutive equations permit the calculation of dynamic behavior from molecular properties.
- Constitutive equations relate material stresses to material strains.

4.1.3. Which of the following statements best describes the difference bet...

Author: Stephanie Redfern

Which of the following statements best describes the difference between elastic and plastic deformation?

Please choose only one answer:

- Elastic deformation causes strain oscillations; plastic deformation does not.
- Elastic deformation occurs immediately upon application of a stress and reverses upon removal of the stress; plastic deformation is permanent.
- Elastic deformation occurs immediately upon application of a stress; plastic deformation occurs slowly.
- Plastic deformation occurs immediately upon application of a stress and reverses upon removal of the stress; elastic deformation is permanent.
- Elastic deformation results in dissipation of energy as heat; plastic deformation conserves energy.

4.1.4. Which of the following statements is true for a two-dimensional sta...

Author: Stephanie Redfern

Which of the following statements is true for a two-dimensional statically determinate truss?

I. There are at most two unknown forces at a pin joint.

II. The forces in the truss are independent of material properties.

III. Joint displacements need not be considered to calculate the internal forces.

Please choose only one answer:

- Both I and II
- II only
- I, II, and III
- Both II and III
- Both I and III

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4.1.5. Which of the properties below may be deduced from tensile tests?

Author: Stephanie Redfern

Which of the properties below may be deduced from tensile tests?

Please choose only one answer:

- Hardness
- Ultimate strength
- Viscosity
- Density
- Rebound index

4.1.6. Which of the following are the correct units for Young's modulus?

Author: Stephanie Redfern

Which of the following are the correct units for Young's modulus?

Please choose only one answer:

- Pa
- psi
- force per area
- A and B
- A, B, and C

4.1.7. Which of the following best describes the use of Mohr's circle?

Author: Stephanie Redfern

Which of the following best describes the use of Mohr's circle?

Please choose only one answer:

- It is a graphical representation of hardness indices for engineering materials.
- It is a graphical method for remembering how stresses and strains transform from one coordinate system to another by matrix or tensor operations.
- It is a graphical method for diagonalizing the stress tensor.
- Mohr's circle is a way of enforcing continuity of stresses and strains in numerical computations.
- Mohr's circle shows the time dependence of hardness as a result of fatigue.

4.1.8. Which of the following formulas correctly describes the area and ma...

Author: Stephanie Redfern

Which of the following formulas correctly describes the area and mass moments of inertia respectively? In the equations below, m represents mass, A represents area, and r represents the distance from the point about which the moment is calculated.

Please choose only one answer:

- $$I_A= \int_Ar^2 dA, \quad I_m= \int_m r^2 dm$$
- $$I_A= \int_Ar^1 dA, \quad I_m= \int_mr^ 1 dm$$
- $$I_A= \int_Ar^3 dA, \quad I_m= \int_mr^3 dm$$
- $$I_A= \int_Ar^2 dm dA, \quad I_m= \int_mr^2 dA dm$$
- $$I_A= \int_Ar^3 dm dA, \quad I_m= \int_m^3 dA dm$$

4.1.9. Consider a spherical pressure vessel of diameter 100 cm and wall th...

Author: Stephanie Redfern

Consider a spherical pressure vessel of diameter 100 cm and wall thickness 0.5 cm. If the internal pressure (gauge) is 7 atm, then which of the following represents the tensile stress in the spherical wall?

Please choose only one answer:

- 35.5 MPa
- 35.5 kPa
- 71 MPa
- 71 x 10 [sup]5[/sup] Pa
- 71 GPa

4.1.10. Which of the following best describes the difference between stiffn...

Author: Stephanie Redfern

Which of the following best describes the difference between stiffness and strength in engineering usage?

Please choose only one answer:

- Strength refers to resistance to bending, and stiffness refers to resistance to compression.
- Strength refers to resistance to elongation, and stiffness refers to resistance to bending.
- Strength refers to the load required for material failure, and stiffness refers to the load required to produce a set deformation.
- Stiffness refers to resistance to shear, and strength refers to the load required to produce a set compression.
- Stiffness refers to the elastic response of a material, and strength refers to the plastic deformation of a material.

4.1.11. The term stress concentration refers to which of the following?

Author: Stephanie Redfern

The term stress concentration refers to which of the following?

Please choose only one answer:

- Stress per unit area
- Stress per unit volume
- Local stress elevation caused by local geometrical features or defects
- Stress focusing from careful location of external loads
- Crack propagation due to applied stress

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4.1.12. A cylindrical body of length body of length 5 cm and diameter 1 cm ...

Author: Stephanie Redfern

A cylindrical body of length body of length 5 cm and diameter 1 cm is subject to a tension force of 1000 N. The cylinder extends by 3 mm in length. If the body behaves elastically, which of the following represents Youngs modulus for that material?

Please choose only one answer:

- 212 MPa
- 848 MPa
- 848 kPa
- 212 KPa
- 424 kPa

4.1.13. Which of the following statements best describes the difference bet...

Author: Stephanie Redfern

Which of the following statements best describes the difference between normal and shear stresses?

I. Normal stresses are more common than shear stresses.

II. Normal stresses may result in elongation or compression.

III. Shear stresses may cause a change in shape or sliding motions.

IV. Normal and shear stresses may have different units.

Please choose only one answer:

- Both I and IV
- Both II and IV
- III only
- Both II and III
- I only

4.1.14. Which relationship below correctly defines Young's modulus for one-...

Author: Stephanie Redfern

Which relationship below correctly defines Young's modulus for one-dimensional deformation?

Please choose only one answer:

- It is the ratio of stress to strain.
- It is the ratio of strain to stress.
- It is the ratio of dimensionless strain to stress.
- It is the ratio of force to area.
- It is the ratio of stress to elongation.