Mechanical Properties of Materials

Materials Science · Practice Test · 30 Questions

1. What does the text define as the relationship between stress and strain?

A) Mechanical property
B) Stress-strain curve
C) Elastic modulus
D) Plastic deformation

2. What are the two main types of deformation discussed?

A) Elastic and plastic
B) Tensile and compressive
C) Shear and torsional
D) Bending and buckling

3. What is Young's modulus a measure of?

A) Resistance to shear
B) Stiffness in tension or compression
C) Resistance to elastic deformation
D) Ability to absorb energy

4. What does Poisson's ratio describe?

A) The ratio of stress to strain
B) The ratio of lateral strain to axial strain
C) The ratio of elastic limit to yield strength
D) The ratio of ultimate tensile strength to yield strength

5. What is the elastic limit?

A) The point where plastic deformation begins
B) The maximum stress a material can withstand
C) The point beyond which a material will fracture
D) The point where the material returns to its original shape after load removal

6. What is yield strength?

A) The stress at which a material begins to deform plastically
B) The maximum stress a material can withstand before fracturing
C) The stress at which a material returns to its original shape
D) The stress required to cause a certain amount of elastic deformation

7. What is ultimate tensile strength?

A) The maximum stress a material can withstand during tensile testing
B) The stress at which a material begins to deform plastically
C) The stress at which a material fractures
D) The stress required to cause a specific amount of elongation

8. What is the characteristic of brittle materials mentioned?

A) They undergo significant plastic deformation before fracture
B) They fracture with little or no plastic deformation
C) They have a high yield strength
D) They have a low elastic modulus

9. What is the characteristic of ductile materials mentioned?

A) They fracture with little or no plastic deformation
B) They undergo significant plastic deformation before fracture
C) They have a low ultimate tensile strength
D) They have a high elastic limit

10. What is the stress-strain curve used to determine?

A) The material's density and hardness
B) The material's mechanical properties
C) The material's melting point
D) The material's electrical conductivity

11. What does the slope of the elastic portion of the stress-strain curve represent?

A) Poisson's ratio
B) Young's modulus
C) Shear modulus
D) Bulk modulus

12. What is the phenomenon where a material's properties change over time under constant stress called?

A) Creep
B) Fatigue
C) Tension
D) Compression

13. What is fatigue in materials science?

A) The process of hardening a material
B) The weakening of a material caused by repeatedly applied loads
C) The ability of a material to deform without fracturing
D) The tendency of a material to return to its original shape

14. What is the main difference between elastic and plastic deformation?

A) Elastic deformation is permanent, while plastic deformation is not
B) Elastic deformation is temporary, while plastic deformation is permanent
C) Elastic deformation occurs at high temperatures, while plastic deformation occurs at low temperatures
D) Elastic deformation involves changes in atomic structure, while plastic deformation does not

15. What is the purpose of stress-strain diagrams?

A) To measure the material's hardness
B) To illustrate the mechanical behavior of a material under load
C) To determine the material's density
D) To calculate the material's thermal conductivity

16. In the context of stress-strain curves, what does the area under the curve represent?

A) The yield strength of the material
B) The energy absorbed per unit volume up to fracture
C) The elastic modulus of the material
D) The ultimate tensile strength of the material

17. What type of deformation is characterized by a permanent change in shape?

A) Elastic deformation
B) Plastic deformation
C) Creep
D) Fatigue

18. What is the relationship between stress and strain in the elastic region?

A) Non-linear and permanent
B) Linear and temporary
C) Linear and permanent
D) Non-linear and temporary

19. What is the term for the maximum stress a material can withstand before it starts to break?

A) Yield strength
B) Elastic limit
C) Ultimate tensile strength
D) Compressive strength

20. What is the effect of temperature on the mechanical properties of materials?

A) It generally increases strength and stiffness
B) It generally decreases strength and stiffness
C) It has no significant effect
D) It only affects brittle materials

21. What is the purpose of hardness testing?

A) To measure the tensile strength of a material
B) To measure a material's resistance to scratching or indentation
C) To determine the material's ductility
D) To measure the material's electrical conductivity

22. What is the difference between strain hardening and work hardening?

A) They are the same process
B) Strain hardening refers to metals, while work hardening is a broader term
C) Work hardening refers to metals, while strain hardening is a broader term
D) There is no significant difference

23. What is the role of dislocations in plastic deformation?

A) They prevent deformation
B) They facilitate slip and movement of atomic planes
C) They increase the elastic limit
D) They cause immediate fracture

24. What is the phenomenon of creep?

A) Sudden fracture under impact load
B) Permanent deformation under sustained stress at elevated temperatures
C) Rapid deformation during elastic loading
D) Sudden loss of strength at low temperatures

25. What is the effect of grain size on the mechanical properties of metals?

A) Smaller grains generally lead to higher strength and hardness
B) Larger grains generally lead to higher strength and hardness
C) Grain size has no effect on mechanical properties
D) Smaller grains lead to increased ductility and reduced strength

26. What is the purpose of annealing a metal?

A) To increase its hardness and strength
B) To reduce its hardness and increase its ductility
C) To make it more brittle
D) To increase its electrical conductivity

27. What is the relationship between the shear modulus (G) and Young's modulus (E) for an isotropic material?

A) G = E / (1 + ?)
B) G = E * (1 + ?)
C) G = E / (2 * (1 + ?))
D) G = E * (2 * (1 + ?))

28. What does the term 'anisotropy' refer to in material properties?

A) Properties being the same in all directions
B) Properties varying depending on the direction of measurement
C) Properties changing with temperature
D) Properties being consistent over time

29. What is the main application of understanding stress-strain behavior?

A) Predicting material failure and designing safe structures
B) Determining material cost
C) Estimating material weight
D) Calculating material's heat capacity

30. What is the main difference between a hard material and a tough material?

A) Hardness refers to resistance to scratching, while toughness refers to resistance to fracture
B) Hardness refers to resistance to fracture, while toughness refers to resistance to scratching
C) Hard materials are always brittle, while tough materials are always ductile
D) Tough materials have high elastic limits, while hard materials do not