

# Advanced Mechanical Engineering Concepts

Mechanical Engineering · Practice Test · 25 Questions

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**1. What is the specific value of the adiabatic index ( $\gamma$ ) for a monatomic ideal gas?**

- A) 1.33
- B) 1.40
- C) 1.67
- D) 1.29

**2. In the context of beam deflection, what does the term 'flexural rigidity' specifically represent?**

- A)  $EI$
- B)  $E/I$
- C)  $I/E$
- D)  $GL$

**3. Which dimensionless number represents the ratio of inertial forces to viscous forces in fluid dynamics?**

- A) Nusselt number
- B) Reynolds number
- C) Prandtl number
- D) Grashof number

**4. According to the Mohr-Coulomb failure criterion, what does the yield surface represent in the principal stress space?**

- A) A sphere
- B) An ellipsoid
- C) A hexagonal prism
- D) A cylinder

**5. What is the primary function of a 'desuperheater' in a steam power cycle?**

- A) To increase pressure
- B) To reduce steam temperature
- C) To remove moisture
- D) To increase kinetic energy

**6. Which material property is defined as the energy absorbed per unit volume up to the point of fracture?**

- A) Resilience
- B) Ductility
- C) Toughness
- D) Malleability

**7. In a four-bar linkage mechanism, what condition must be met for at least one link to perform a full revolution (Grashof's Law)?**

- A)  $s + l \leq p + q$
- B)  $s + l > p + q$
- C)  $s + p = l + q$
- D)  $s + q > l + p$

**8. What is the name of the phenomenon where a metal gains strength through plastic deformation at temperatures below its recrystallization temperature?**

- A) Annealing
- B) Work hardening
- C) Tempering
- D) Quenching

**9. The 'Stanton number' is a dimensionless quantity that relates heat transfer coefficient to what?**

- A) Thermal conductivity
- B) Mass flux and heat capacity
- C) Dynamic viscosity
- D) Surface tension

**10. In thermodynamics, what is the 'Clausius inequality' used to determine?**

- A) Energy conservation
- B) Entropy production
- C) Enthalpy change
- D) Work potential

**11. What is the relationship between the shear modulus (G), Young's modulus (E), and Poisson's ratio ( $\nu$ ) for an isotropic material?**

- A)  $G = E / (2(1+\nu))$
- B)  $G = E / (1+\nu)$
- C)  $G = E * (1+\nu)$
- D)  $G = E / (2(1-\nu))$

**12. Which type of heat exchanger is most efficient for high-temperature and high-pressure applications?**

- A) Shell and tube
- B) Plate and frame
- C) Double pipe
- D) Regenerative rotary

**13. What is the critical speed of a rotating shaft dependent upon?**

- A) Its natural frequency
- B) Its angular momentum
- C) Its surface finish
- D) The fluid density

**14. In gear terminology, what is the 'addendum' defined as?**

- A) Depth below the pitch circle
- B) Distance from pitch circle to top of tooth
- C) Width of the gear tooth
- D) Circular thickness of the gear

**15. The 'Peltier effect' is most directly associated with which technology?**

- A) Gas turbines
- B) Thermoelectric cooling
- C) Internal combustion
- D) Solar thermal

**16. Which law states that the mass flow rate of a fluid through a pipe is constant if the density is constant?**

- A) Bernoulli's principle
- B) Continuity equation
- C) Navier-Stokes equation
- D) Darcy-Weisbach law

**17. What is the Miller index notation (1 1 1) in crystallography referring to?**

- A) A specific atom
- B) A crystal plane
- C) A dislocation line
- D) A grain boundary

**18. Which cycle is the ideal theoretical cycle for a gas turbine engine?**

- A) Otto cycle
- B) Diesel cycle
- C) Brayton cycle
- D) Rankine cycle

**19. What is the unit of 'Dynamic Viscosity' in the SI system?**

- A) Pascal-second
- B) Newton-meter
- C) Poise
- D) Stokes

**20. In fracture mechanics, what is the stress intensity factor (K) typically proportional to?**

- A) Square root of crack length
- B) Crack length squared
- C) Inverse of crack length
- D) Crack volume

**21. What does a 'Pitot tube' measure in a fluid flow?**

- A) Static pressure
- B) Stagnation pressure
- C) Dynamic viscosity
- D) Flow rate

**22. What is the 'Biot number' used to characterize?**

- A) Fluid convection
- B) Internal vs external thermal resistance
- C) Radiation heat loss
- D) Latent heat transfer

**23. Which of these manufacturing processes involves the use of a high-energy electron beam?**

- A) MIG welding
- B) EBW
- C) TIG welding
- D) Plasma arc cutting

**24. What is the purpose of 'doping' in material science?**

- A) Increasing surface area
- B) Altering electrical properties
- C) Reducing melting point
- D) Increasing density

**25. In a bolted joint, what is the 'pre-load' intended to do?**

- A) Increase joint stiffness
- B) Decrease friction
- C) Lubricate the threads
- D) Prevent fastener vibration