

Advanced Mechanical Engineering Principles

Mechanical Engineering · Answer Key · 12 Questions

1. In the context of the Rankine cycle, what is the primary purpose of the 'reheat' stage?

- A) To increase the quality of steam at the turbine exhaust**
- B) To decrease the thermal efficiency of the cycle
- C) To reduce the pump work requirement
- D) To decrease the enthalpy of the steam entering the condenser

2. Which non-dimensional number represents the ratio of inertial forces to viscous forces in fluid flow?

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

3. What is the specific crystal structure of alpha-iron (ferrite) at room temperature?

- A) Face-Centered Cubic (FCC)
- B) Hexagonal Close-Packed (HCP)
- C) Body-Centered Cubic (BCC)**
- D) Body-Centered Tetragonal (BCT)

4. According to the Buckingham Pi theorem, how many dimensionless groups are required to describe a physical system with 'n' variables and 'm' fundamental dimensions?

- A) $n + m$
- B) $n * m$
- C) n / m
- D) $n - m$**

5. In a four-bar linkage mechanism, Grashof's Law states that the sum of the shortest and longest links must be less than or equal to the sum of the other two links for what specific condition to exist?

- A) At least one link can perform a full rotation**
- B) All links remain fixed in position
- C) The mechanism will inevitably jam
- D) The mechanism acts as a rigid truss

6. Which thermodynamic property remains constant during an isenthalpic process, such as the Joule-Thomson expansion?

- A) Entropy
- B) Internal Energy
- C) Enthalpy**
- D) Temperature

7. What is the characteristic behavior of a 'Newtonian' fluid?

- A) Viscosity changes with the rate of shear
- B) Viscosity is independent of the rate of shear**
- C) The fluid exhibits a yield stress
- D) The fluid is non-compressible under all pressures

8. In fatigue analysis, what does the 'Endurance Limit' (or fatigue limit) represent for certain ferrous alloys?

- A) The stress level below which failure never occurs regardless of cycles**
- B) The maximum load before plastic deformation occurs
- C) The point of ultimate tensile strength
- D) The stress level at which the material becomes ductile

9. What is the primary function of a 'Volute' in a centrifugal pump?

- A) To increase the fluid velocity at the intake
- B) To convert kinetic energy into pressure energy**
- C) To filter solid particles from the fluid
- D) To prevent cavitation in the impeller

10. Which material hardening mechanism involves the introduction of solute atoms into the crystal lattice to impede dislocation motion?

- A) Strain hardening
- B) Precipitation hardening
- C) Solid solution strengthening**
- D) Annealing

11. In heat transfer, what is the 'Biot Number' used to characterize?

- A) The ratio of internal thermal resistance to external convection resistance**
- B) The ratio of convective heat transfer to conductive heat transfer
- C) The transition from laminar to turbulent flow
- D) The rate of radiative heat emission

12. What is the Miller Index notation for a plane that is parallel to the x-axis and y-axis, and intersects the z-axis at unity?

A) (100)

B) (010)

C) (001)

D) (111)