

# Mechanical Engineering

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1. For forced convection, the heat transfer is primarily dependent on the:

- A) Fluid velocity.
- B) Thermal conductivity.
- C) Fluid density.
- D) Temperature difference.

Answer: A) Fluid velocity.

Explanation: In forced convection, fluid motion is caused by an external source like a pump or fan, and increasing this velocity significantly enhances the heat transfer rate.

2. The dew point temperature is the temperature at which:

- A) Water starts to boil.
- B) Air becomes saturated with moisture.
- C) Condensation begins when air is cooled at constant pressure.
- D) Relative humidity is 0%.

Answer: C) Condensation begins when air is cooled at constant pressure.

Explanation: It is the temperature to which air must be cooled to become saturated with water vapor.

3. The operation of producing a pattern of crossed lines on a cylindrical surface is called:

- A) Grooving
- B) Chamfering
- C) Knurling
- D) Reaming

Answer: C) Knurling

Explanation: Knurling is used to create a textured grip on handles and knobs.

4. A comparator is an instrument that:

- A) Measures the absolute dimension of a part.
- B) Compares the dimension of a part with a known standard.

- C) Measures the surface roughness.
- D) Checks the alignment of machine tools.

Answer: B) Compares the dimension of a part with a known standard.

Explanation: Comparators are used for high-precision inspection by amplifying the small difference between the workpiece and a master gauge.

5. A leaf spring in a vehicle's suspension is an example of a:

- A) Torsion spring
- B) Helical spring
- C) Beam subjected to bending
- D) Tension spring

Answer: C) Beam subjected to bending

Explanation: It is a form of beam, often a semi-elliptical one, that flexes under load to absorb road shocks.

6. The primary function of a piston ring is to:

- A) Lubricate the cylinder wall.
- B) Seal the combustion chamber and transfer heat.
- C) Keep the piston centered in the cylinder.
- D) Connect the piston to the connecting rod.

Answer: B) Seal the combustion chamber and transfer heat.

Explanation: Piston rings provide a seal to prevent blow-by of combustion gases and also help transfer heat from the hot piston to the cooler cylinder wall.

7. The critical path method (CPM) is a project management technique that uses:

- A) Probabilistic time estimates.
- B) Deterministic (single-point) time estimates.
- C) A focus on quality control.
- D) Inventory management principles.

Answer: B) Deterministic (single-point) time estimates.

Explanation: Unlike PERT, which uses three time estimates, CPM assumes that activity durations are known and fixed.

8. Pascal's law states that pressure applied to a confined fluid is transmitted:

- A) Only to the bottom of the container.
- B) Undiminished in all directions.
- C) In the direction of gravity only.
- D) Proportionally to the depth.

Answer: B) Undiminished in all directions.

Explanation: This principle is the fundamental basis for all hydraulic systems, such as hydraulic lifts, brakes, and presses.

9. In a parallel flow heat exchanger, the temperature difference between the hot and cold fluids:

- A) Is constant along the length.
- B) Decreases along the length.
- C) Increases along the length.
- D) Is maximum at the outlet.

Answer: B) Decreases along the length.

Explanation: Both fluids enter at one end and flow in the same direction, so the temperature difference is greatest at the inlet and smallest at the outlet.

10. Toughness of a material is a measure of its ability to:

- A) Resist scratching.
- B) Withstand shock or impact loading.
- C) Be drawn into a wire.
- D) Resist deformation.

Answer: B) Withstand shock or impact loading.

Explanation: Toughness represents the total energy a material can absorb up to the point of fracture and is often evaluated using an impact test like the Charpy or Izod test.

11. A cotter joint is used to connect two rods that are subjected to:

- A) Torsional loads.
- B) Axial tensile or compressive loads.
- C) Bending loads.

D) Shear loads only.

Answer: B) Axial tensile or compressive loads.

Explanation: It is a temporary fastening used to connect two coaxial rods.

12. The process of making a cup-shaped part from a sheet metal blank is called:

- A) Coining
- B) Embossing
- C) Deep drawing
- D) Piercing

Answer: C) Deep drawing

Explanation: This process is used to manufacture items like kitchen sinks, pots, and automotive body panels.

13. The Coriolis component of acceleration is always directed:

- A) Parallel to the rotating link.
- B) Perpendicular to the sliding velocity vector.
- C) Towards the center of rotation.
- D) Away from the center of rotation.

Answer: B) Perpendicular to the sliding velocity vector.

Explanation: Its direction is found by rotating the sliding velocity vector by 90 degrees in the direction of the link's angular velocity.

14. A dynamometer is a device used to measure:

- A) Engine speed
- B) Fuel consumption
- C) Force, torque, or power.
- D) Exhaust emissions

Answer: C) Force, torque, or power.

Explanation: Engine dynamometers are used to measure the torque and power output of an engine under various operating conditions.

15. The specific speed of a hydraulic turbine is an indicator of its:

- A) Rotational speed
- B) Power output
- C) Type and shape
- D) Efficiency

Answer: C) Type and shape

Explanation: Specific speed is a dimensionless parameter that helps in selecting the most suitable type of turbine (e.g., Pelton, Francis, Kaplan) for a given head and flow rate.

16. Surface tension is a phenomenon caused by:

- A) Viscous forces
- B) Cohesive forces between liquid molecules.
- C) Adhesive forces between liquid and solid molecules.
- D) Gravity

Answer: B) Cohesive forces between liquid molecules.

Explanation: The cohesive forces at the surface of a liquid create a net inward force, causing the surface to behave like a stretched membrane.

17. A perfect gas is a gas that:

- A) Obeys the ideal gas law under all conditions.
- B) Is incompressible.
- C) Has zero viscosity.
- D) Cannot be liquefied.

Answer: A) Obeys the ideal gas law under all conditions.

Explanation: A perfect gas is an idealized model where intermolecular forces are neglected. Real gases approximate this behavior at low pressures and high temperatures.

18. The purpose of annealing is to make a metal:

- A) Harder and stronger.
- B) Softer and more ductile.
- C) More brittle.
- D) More resistant to corrosion.

Answer: B) Softer and more ductile.

Explanation: Annealing involves heating and slow cooling to relieve internal stresses, refine the grain structure, and improve machinability.

19. A stud is a bolt that has:

- A) A head on one end and threads on the other.
- B) Threads on both ends and no head.
- C) A tapered shank.
- D) A square head.

Answer: B) Threads on both ends and no head.

Explanation: A stud is typically screwed into a tapped hole on one end, and a nut is used on the other end.

20. A Hooke's joint is another name for a:

- A) Universal joint
- B) Knuckle joint
- C) Cotter joint
- D) Riveted joint

Answer: A) Universal joint

Explanation: It is a common type of joint used to connect shafts with intersecting axes.

21. A cryogenic process is one that occurs at:

- A) Very high pressures.
- B) Very high temperatures.
- C) Very low temperatures.
- D) A vacuum.

Answer: C) Very low temperatures.

Explanation: Cryogenics is the science and engineering of temperatures below about -150°C (123 K).

22. The main alloying element in stainless steel is:

- A) Chromium
- B) Nickel
- C) Manganese

D) Molybdenum

Answer: A) Chromium

Explanation: A minimum of 10.5% chromium is required to form a passive, corrosion-resistant oxide layer on the surface of the steel.

23. The process of producing threads inside a hole is called:

A) Drilling

B) Reaming

C) Tapping

D) Boring

Answer: C) Tapping

Explanation: Tapping is done using a tool called a tap, which cuts the internal threads.

24. The stoichiometric air-fuel ratio for gasoline is approximately:

A) 10:1

B) 12:1

C) 14.7:1

D) 20:1

Answer: C) 14.7:1

Explanation: This is the ideal ratio by mass at which all the fuel is completely burned with all the oxygen in the air, with no excess of either.

25. The function of an intercooler in a multi-stage compressor is to:

A) Cool the air between stages.

B) Increase the pressure.

C) Remove moisture from the air.

D) Heat the air before compression.

Answer: A) Cool the air between stages.

Explanation: Cooling the air reduces its volume, which significantly reduces the work required for the subsequent compression stage, improving overall efficiency.

26. The point in a project where one or more activities start or finish is called a(n):

- A) Path
- B) Event or Node
- C) Duration
- D) Float

Answer: B) Event or Node

Explanation: In a project network diagram, nodes (circles) represent events, and arrows represent the activities that connect them.

27. A rolling contact bearing is also known as an:

- A) Antifriction bearing
- B) Journal bearing
- C) Sliding contact bearing
- D) Plain bearing

Answer: A) Antifriction bearing

Explanation: This name is used because the rolling friction in these bearings is much lower than the sliding friction in plain bearings.

28. The bulk modulus of a fluid is a measure of its:

- A) Viscosity
- B) Density
- C) Compressibility
- D) Surface tension

Answer: C) Compressibility

Explanation: It indicates the resistance of a fluid to uniform compression. A high bulk modulus means the fluid is difficult to compress.

29. A condenser in a refrigerator is the component where the refrigerant:

- A) Evaporates and absorbs heat.
- B) Is compressed to a high pressure.
- C) Rejects heat and condenses into a liquid.
- D) Expands and drops in temperature.

Answer: C) Rejects heat and condenses into a liquid.

Explanation: The high-pressure, hot refrigerant vapor from the compressor flows through the condenser, where it gives up its heat to the surroundings and turns back into a liquid.

30. The most common type of flame used in gas welding for steels is:

- A) Neutral flame
- B) Oxidizing flame
- C) Carburizing flame
- D) Reducing flame

Answer: A) Neutral flame

Explanation: A neutral flame has a one-to-one ratio of acetylene and oxygen and produces a clean weld without chemically altering the base metal.

31. The efficiency of a screw jack is maximized when the helix angle is:

- A) 90 degrees
- B) 0 degrees
- C)  $45^\circ - (\phi/2)$ , where  $\phi$  is the friction angle.
- D) Equal to the friction angle.

Answer: C)  $45^\circ - (\phi/2)$ , where  $\phi$  is the friction angle.

Explanation: This is the theoretical condition for maximum efficiency, derived from the equations for the effort required to lift a load.

32. The calorific value of a fuel is the amount of:

- A) Heat released during complete combustion of a unit mass of the fuel.
- B) Unburnt fuel left after combustion.
- C) Oxygen required for complete combustion.
- D) Flue gases produced during combustion.

Answer: A) Heat released during complete combustion of a unit mass of the fuel.

Explanation: It is a measure of the energy content of the fuel, typically expressed in kJ/kg or kJ/m<sup>3</sup>.

33. A flyball governor is used to control the:

- A) Torque of an engine.
- B) Speed of an engine.

C) Power of an engine.

D) Fuel-air ratio.

Answer: B) Speed of an engine.

Explanation: It is a classic centrifugal governor that senses engine speed and adjusts the throttle to maintain a near-constant speed under varying loads.

34. The process of improving the properties of rubber by heating it with sulfur is called:

A) Polymerization

B) Vulcanization

C) Saponification

D) Halogenation

Answer: B) Vulcanization

Explanation: Vulcanization creates cross-links between the polymer chains, making the rubber stronger, more elastic, and more durable.

35. In an impulse turbine, the steam pressure:

A) Decreases across the moving blades.

B) Increases across the moving blades.

C) Remains constant while passing over the moving blades.

D) Decreases across both nozzles and moving blades.

Answer: C) Remains constant while passing over the moving blades.

Explanation: In an impulse turbine, the entire pressure drop occurs in the fixed nozzles. The steam then strikes the blades, and its direction changes, causing an impulse force, but the pressure does not change.

36. The purpose of a draft tube in a reaction turbine is to:

A) Increase the exit velocity.

B) Recover the kinetic energy at the runner outlet.

C) Prevent cavitation.

D) Guide water to the runner.

Answer: B) Recover the kinetic energy at the runner outlet.

Explanation: By having a diverging cross-section, the draft tube slows down the water leaving the runner, converting its kinetic energy into a pressure head, thereby increasing the net head on the turbine.

37. An open system in thermodynamics is one in which:

- A) Only energy can cross the boundary.
- B) Only mass can cross the boundary.
- C) Both mass and energy can cross the boundary.
- D) Neither mass nor energy can cross the boundary.

Answer: C) Both mass and energy can cross the boundary.

Explanation: An open system is also called a control volume. Examples include a pump, a turbine, or a heat exchanger.

38. A profilometer is an instrument used to measure:

- A) Surface roughness.
- B) Flatness.
- C) Roundness.
- D) Concentricity.

Answer: A) Surface roughness.

Explanation: It measures the fine-scale variations on a surface by dragging a stylus across it and recording its vertical movement.

39. The cam follower motion that has the lowest jerk (rate of change of acceleration) is:

- A) Uniform velocity
- B) Simple Harmonic Motion (SHM)
- C) Uniform acceleration and retardation (parabolic)
- D) Cycloidal motion

Answer: D) Cycloidal motion

Explanation: Cycloidal motion has zero acceleration at the start and end of the rise and fall, resulting in very smooth operation and minimal vibrations, making it suitable for high-speed applications.

40. The primary purpose of a bearing is to:

- A) Join two shafts together.

- B) Transmit torque.
- C) Support a moving element and reduce friction.
- D) Store and release energy.

Answer: C) Support a moving element and reduce friction.

Explanation: Bearings are essential machine elements that constrain relative motion to only the desired motion and reduce friction between moving parts.

41. Which of the following is an example of a single-point cutting tool?

- A) Milling cutter
- B) Grinding wheel
- C) Lathe tool
- D) Drill bit

Answer: C) Lathe tool

Explanation: A lathe tool uses a single cutting edge to remove material during operations like turning and facing.

42. The process of joining metal parts by heating them to a suitable temperature and using a filler metal with a melting point above 450°C but below the melting point of the base metal is called:

- A) Welding
- B) Soldering
- C) Brazing
- D) Riveting

Answer: C) Brazing

Explanation: Brazing creates a strong, permanent joint without melting the base metals. The filler metal is drawn into the joint by capillary action.

43. The operation of producing a flat surface on a workpiece by using a multi-point rotating cutter is called:

- A) Turning
- B) Drilling
- C) Milling

D) Grinding

Answer: C) Milling

Explanation: Milling is a versatile machining process used to create flat surfaces, slots, pockets, and complex contours.

44. In arc welding, the electric arc is produced between the workpiece and the:

A) Welding torch

B) Electrode

C) Filler rod

D) Shielding gas nozzle

Answer: B) Electrode

Explanation: The intense heat of the electric arc melts the workpiece and the electrode (if it is a consumable type), forming a molten pool that solidifies to create the weld.

45. The process of enlarging an existing hole is called:

A) Drilling

B) Reaming

C) Boring

D) Tapping

Answer: C) Boring

Explanation: Boring is performed to increase the diameter of a previously drilled hole to a precise dimension and improve its surface finish.

46. A pattern in sand casting is a replica of the object to be cast, with some modifications. One of these modifications is the addition of:

A) Risers

B) Runners

C) Shrinkage allowance

D) Gates

Answer: C) Shrinkage allowance

Explanation: The pattern is made slightly larger than the final desired part to compensate for the

contraction or shrinkage of the metal as it cools and solidifies.

47. Go and No-Go gauges are examples of:

- A) Measuring instruments
- B) Limit gauges
- C) Templates
- D) Working gauges

Answer: B) Limit gauges

Explanation: They do not measure the actual size but check whether a part is within its specified upper and lower dimensional limits.

48. The process of cutting metal by forcing it through a die is known as:

- A) Forging
- B) Rolling
- C) Extrusion
- D) Drawing

Answer: C) Extrusion

Explanation: Extrusion is used to produce long, straight parts with a constant cross-section, such as aluminum window frames and pipes.

49. A sine bar is used to measure:

- A) Length
- B) Angles
- C) Flatness
- D) Roundness

Answer: B) Angles

Explanation: It is used in conjunction with slip gauges to set up and measure angles with very high precision.

50. The Unilateral System of tolerance is one in which the tolerance is allowed on:

- A) Both sides of the basic size.

B) One side of the basic size.

C) The upper limit only.

D) The lower limit only.

Answer: B) One side of the basic size.

Explanation: In this system, one of the limits coincides with the basic size, and the tolerance zone lies entirely on one side of it.

51. The process of improving the surface finish and dimensional accuracy of a workpiece by removing a very small amount of material using abrasive particles is called:

A) Knurling

B) Lapping

C) Facing

D) Parting

Answer: B) Lapping

Explanation: Lapping is a finishing operation that produces very smooth, flat, and accurate surfaces.

52. Computer Numerical Control (CNC) refers to the automation of machine tools by means of:

A) Mechanical cams and linkages.

B) A computer executing a pre-programmed sequence of commands.

C) Hydraulic tracer systems.

D) Manual handwheels and levers.

Answer: B) A computer executing a pre-programmed sequence of commands.

Explanation: CNC technology allows for high precision, repeatability, and the manufacturing of complex shapes with minimal human intervention.

53. The function of a differential in an automobile is to:

A) Allow the front wheels to turn at different speeds.

B) Transmit power from the engine to the gearbox.

C) Allow the driving wheels to rotate at different speeds when cornering.

D) Act as a suspension component.

Answer: C) Allow the driving wheels to rotate at different speeds when cornering.

Explanation: When a car turns, the outer wheel must travel a longer distance than the inner wheel.

The differential enables this difference in speed while still transmitting torque to both wheels.

54. The component that connects the gearbox to the differential is the:

- A) Clutch
- B) Axle
- C) Propeller shaft
- D) Piston rod

Answer: C) Propeller shaft

Explanation: The propeller shaft (or driveshaft) transmits the rotational power from the transmission to the rear differential in a rear-wheel-drive vehicle.

55. A disc brake works by squeezing brake pads against a:

- A) Rotating drum
- B) Rotating disc or rotor
- C) Stationary drum
- D) Wheel rim

Answer: B) Rotating disc or rotor

Explanation: The friction between the pads and the disc converts the kinetic energy of the vehicle into heat, thus slowing it down.

56. The purpose of the suspension system in a vehicle is to:

- A) Transmit engine power.
- B) Absorb shocks and vibrations from the road surface.
- C) Steer the vehicle.
- D) Cool the engine.

Answer: B) Absorb shocks and vibrations from the road surface.

Explanation: The suspension system maximizes the friction between the tires and the road surface, providing steering stability with good handling and ensuring passenger comfort.

57. The octane rating of gasoline is a measure of its:

- A) Ignition quality
- B) Viscosity
- C) Volatility
- D) Resistance to knocking or detonation

Answer: D) Resistance to knocking or detonation

Explanation: A higher octane rating indicates greater resistance to auto-ignition, which allows for higher compression ratios and improved engine efficiency.

58. The critical path in a project network (PERT/CPM) is the sequence of activities that:

- A) Has the maximum duration.
- B) Has the minimum duration.
- C) Has zero slack.
- D) Involves the most resources.

Answer: A) Has the maximum duration.

Explanation: The critical path determines the shortest possible time to complete the entire project. Any delay in an activity on the critical path directly delays the project completion. It also has zero slack.

59. The economic order quantity (EOQ) is the order quantity that:

- A) Maximizes the total inventory cost.
- B) Minimizes the ordering cost.
- C) Minimizes the carrying cost.
- D) Minimizes the total inventory holding and ordering costs.

Answer: D) Minimizes the total inventory holding and ordering costs.

Explanation: EOQ is a model used in inventory management to find the optimal order size that balances the cost of holding inventory against the cost of ordering it.

60. Work study is a management technique that involves:

- A) Financial auditing and accounting.
- B) Method study and work measurement.

C) Marketing and sales analysis.

D) Product design and development.

Answer: B) Method study and work measurement.

Explanation: Method study is used to improve methods of production, and work measurement is used to assess human effectiveness and set standard times for tasks.