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GUESS PAPERS

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Questions



Detailed
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Answers



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English

Q.36

Choose the correct completion: “We look forward to ____ you at the orientation.”

- A. meet
- B. met
- C. meeting
- D. have meet

Q.37

Choose the correct completion: “By the time we reached the station, the train ____.”

- A. has left
- B. leaves
- C. had left
- D. will leave

Q.38

In “The trainer told a light-hearted story to break the ice”, what does “break the ice” mean?

- A. Make the room colder
- B. Reduce initial awkwardness
- C. End an official agreement
- D. Interrupt the session permanently

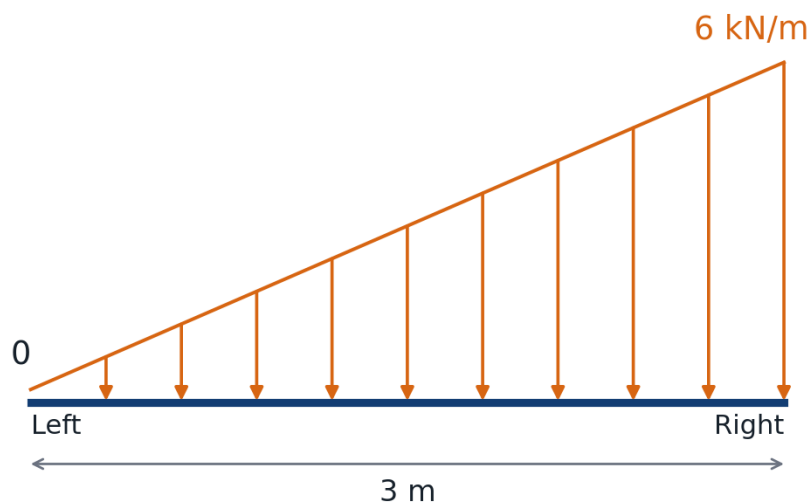
Q.39

Choose the correct completion: “Before the bus service began, I used to ____ to work.”

- A. have walking
- B. walking
- C. walked
- D. walk

Q.56

A downward distributed load increases linearly from zero at the left end of a 3 m beam segment to 6 kN/m at the right end. Where does its equivalent resultant act, measured from the left end?



Schematic for the stated question

- A. 1 m
- B. 1.5 m
- C. 3 m
- D. 2 m

Q.57

A rotor has mass 8 kg and mass moment of inertia 2 kg m^2 about its rotation axis. What is its radius of gyration about that axis?

- A. 0.5 m
- B. 0.25 m
- C. 1 m
- D. 2 m

Mechanical Engineering

SECTION B • DOMAIN KNOWLEDGE • 90 MINUTES

Q.51

For the matrix given below, what is the entry in the second row and first column of its inverse?

$$A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$$

- A. -1
- B. -2
- C. 3
- D. -3

Correct option D

First verify that the matrix is invertible by computing its determinant.

$$\det A = 2(2) - 1(3) = 1$$

For a two-by-two matrix, interchange the diagonal entries and reverse the signs of the other two entries, then divide by the determinant.

$$A^{-1} = \frac{1}{1} \begin{bmatrix} 2 & -1 \\ -3 & 2 \end{bmatrix}$$

The requested entry is the lower-left element.

$$(A^{-1})_{21} = -3$$

Q.4

In an election between two candidates, all votes are valid. The winner receives 60 percent of the votes and wins by 80 votes. How many votes are cast?

- A. 400
- B. 320
- C. 200
- D. 480

Q.5

Initially, the numbers of girls and boys in a club are in the ratio three to two. Ten girls join, and no one leaves. The new ratio of girls to boys is five to three. What was the initial total membership?

- A. 100
- B. 120
- C. 180
- D. 150

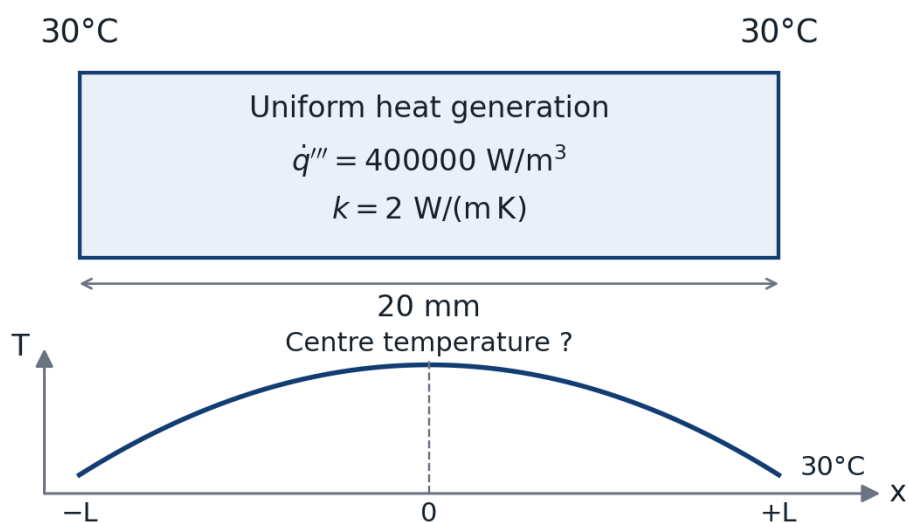
Q.6

Two articles are each sold for 120 rupees. One sale earns a 20 percent profit and the other incurs a 20 percent loss, each percentage being based on its own cost. What is the overall result?

- A. No profit or loss
- B. 4 percent loss
- C. 4 percent profit
- D. 8 percent loss

Q.85

A plane slab has total thickness 20 mm, thermal conductivity 2 W/(m·K), and uniform volumetric heat generation of 400,000 W/m³. Both faces are held at 30°C. For steady one-dimensional conduction, what is the centre temperature?



Schematic for the stated question

- A. 70°C
- B. 50°C
- C. 40°C
- D. 35°C

Correct option C

Symmetry makes the centre the maximum-temperature location. Use half-thickness in the standard result.

$$L = 0.010 \text{ m}, \quad T_{\max} - T_s = \frac{\dot{q}''' L^2}{2k}$$

$$T_{\max} = 30 + \frac{400000(0.01)^2}{2(2)} = 40^\circ\text{C}$$

Using total thickness instead of half-thickness would overstate the temperature rise by a factor of four.

Q.94

Why is quenched martensitic steel commonly tempered before service?

- A. To reduce brittleness and residual stresses while obtaining a useful strength–toughness balance
- B. To remove all carbon from the steel
- C. To convert every steel into grey cast iron
- D. To guarantee a higher hardness than the as-quenched state

Correct option A

Quenching can produce hard martensite with high residual stress and limited toughness.

Tempering reheats the steel below the lower critical temperature to permit controlled structural changes.

Toughness usually improves with some sacrifice of hardness; the treatment is selected for the service requirement.

Q.95

Which casting process commonly uses a disposable wax pattern surrounded by a refractory ceramic mould?

- A. Investment casting
- B. Centrifugal casting only
- C. Permanent metallic-mould casting only
- D. Sand casting with a reusable split wooden pattern

Correct option A

The wax pattern reproduces the required shape, including fine detail.

A refractory shell is built around it and the wax is removed before pouring.

This lost-wax route is investment casting; the pattern is not reused for each casting.

Q.24

All six faces of a solid cube are painted. It is then cut into 27 equal small cubes by making two equally spaced cuts in each of three mutually perpendicular directions. How many small cubes have paint on exactly three faces?

- A. Four
- B. Six
- C. Eight
- D. Twelve

Q.25

Four people stand at the north, east, south and west points of a circle, all facing directly away from its centre. A person at the west point turns left through a right angle. Which direction does that person now face?

- A. North
- B. West
- C. East
- D. South

Q.26

Among 20 trainees, 14 know Hindi and 11 know English. What is the minimum possible number who know both languages?

- A. Three
- B. Five
- C. Four
- D. Nine

Q.65

Three external spur gears A, B and C mesh in a simple train: A meshes with B, and B with C. All axes are fixed. If A turns clockwise, in which direction does C turn?

- A. It cannot rotate
- B. Counterclockwise
- C. Clockwise
- D. Its direction depends on the tooth count of B

Correct option C

Q.66

A stable linear single-degree-of-freedom system is displaced and released from rest. Among nonoscillatory viscously damped responses with the same mass and stiffness, which damping condition gives the fastest return toward equilibrium?

- A. Critical damping
- B. Any overdamping, increasing without limit
- C. Zero damping
- D. Negative damping

Correct option A

Q.67

For a close-coiled helical spring, wire diameter is doubled while mean coil diameter, active coil count and material remain unchanged. Ignoring curvature corrections, by what factor does axial stiffness increase?

- A. 2
- B. 4
- C. 8
- D. 16

Correct option D

Q.79

At a point in a fluid at rest, how does the normal compressive stress depend on the orientation of an imaginary plane through that point?

- A. It is zero on vertical planes
- B. It is larger on horizontal planes
- C. It equals the viscosity multiplied by depth
- D. It is the same for every orientation

Correct option D

Q.80

A thin soap bubble has radius 2 mm and surface tension 0.03 N/m. Neglect film thickness. What is the pressure excess inside the bubble over its surroundings?

- A. 120 Pa
- B. 30 Pa
- C. 15 Pa
- D. 60 Pa

Correct option D

Q.81

A curved gate forms part of the bottom boundary of an open water tank, with water above the gate. The imaginary vertical prism between the curved surface and the free surface contains 0.5 m^3 of water. Taking water density as 1000 kg/m^3 and gravity as 10 m/s^2 , what is the vertical component of the water's gauge-pressure force on the gate?

- A. 5 kN downward
- B. 5 kN upward
- C. 10 kN upward
- D. 0.5 kN downward

Correct option A

Q.95

In submerged-arc welding, what covers the arc and molten weld region during operation?

- A. A layer of granular flux
- B. Only a bare tungsten electrode
- C. A pool of room-temperature water
- D. A rotating grinding wheel

Q.96

Which machining operation enlarges and improves the accuracy of an existing hole using a single-point tool?

- A. Knurling
- B. Boring
- C. Parting
- D. External thread rolling

Q.97

At five equally spaced positions, a surface profile has signed deviations from its mean line of positive 2, negative 2, positive 1, negative 1 and zero micrometres. What is the arithmetic mean roughness estimated from these samples?

- A. 1.2 micrometres
- B. 0.6 micrometre
- C. Zero
- D. 2 micrometres

Q.75

A closed system travels between the same two equilibrium states by two different processes. Which statement must be true?

- A. The heat transfer is the same for both processes
- B. Its internal-energy change is the same for both processes
- C. The work is the same for both processes
- D. Both processes must be reversible

Correct option B

Internal energy is a state property, so its change depends only on the endpoints.

Heat and work are transfers associated with a process and can differ between paths.

$$Q_A - W_A = Q_B - W_B = U_2 - U_1$$

Equal endpoint states fix the energy change, not heat and work separately.

Q.76

A closed adiabatic system undergoes an internally irreversible process. With no mass crossing the boundary, its total entropy:

- A. Increases
- B. Must remain constant
- C. Becomes zero
- D. Decreases

Correct option A

No entropy is transferred with heat because the boundary is adiabatic, and no mass carries entropy across it.

$$\Delta S = S_{\text{gen}}$$

Internal irreversibility gives positive entropy generation, so total system entropy increases.

Adiabatic does not mean isentropic unless the process is also internally reversible.

Q.98

Why is a gravity-fed casting sprue commonly tapered so that its cross-sectional area decreases downward?

- A. To prevent any metal reaching the runner
- B. To make metal slow down solely because of gravity
- C. To follow the accelerating liquid stream and reduce air aspiration
- D. To ensure a vacuum is always produced

Correct option C

Molten metal accelerates as it descends under gravity.

For a fixed flow rate, the flowing cross-sectional area therefore tends to decrease downward.

A suitable taper keeps the sprue full more effectively and reduces the tendency to draw air into the stream.

Q.99

A forecast for the current month is 100 units, and actual demand is 120 units. With simple exponential smoothing and smoothing constant 0.25, what is the next forecast?

- A. 95 units
- B. 115 units
- C. 105 units
- D. 120 units

Correct option C

The next forecast corrects the current forecast by a fraction of its error.

$$F_{t+1} = F_t + \alpha(A_t - F_t)$$
$$F_{t+1} = 100 + 0.25(120 - 100) = 105$$

Only one-quarter of the latest error is incorporated, not one-quarter of actual demand alone.

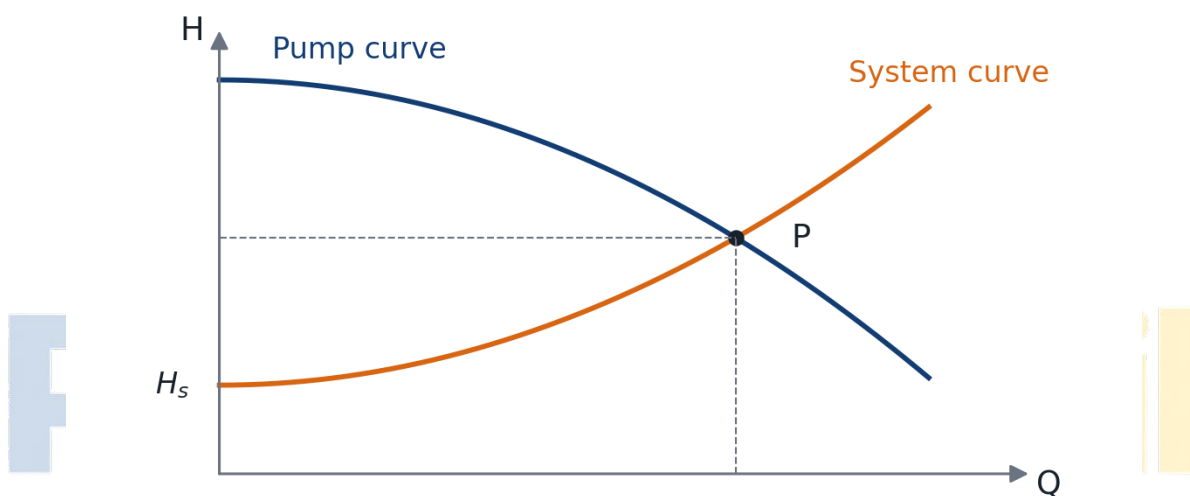
Q.88

Two separated surfaces exchange heat across an ideal vacuum. With no supporting solid path and no matter crossing the gap, which mechanism can transfer energy between them?

- A. Molecular conduction through the vacuum
- B. Thermal radiation
- C. Forced convection
- D. Natural convection

Q.89

A centrifugal pump supplies a pipeline at fixed pump speed. On a head-versus-discharge plot, where is the normal steady operating point determined?

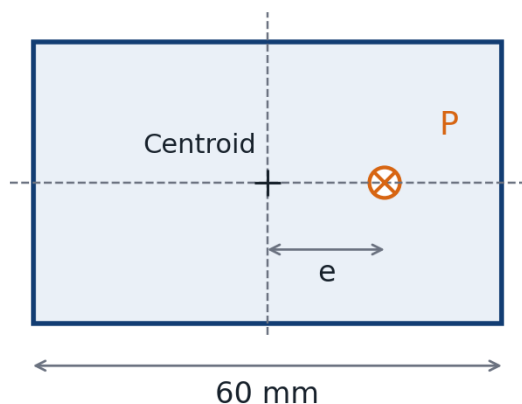


Schematic for the stated question

- A. At the pump's shutoff head regardless of the pipeline
- B. At the intersection of pump and system head curves
- C. At zero system resistance for every pipeline
- D. At the maximum discharge marked on either axis

Q.59

A short rectangular column has a 60 mm dimension along the direction of load eccentricity. A compressive load acts with eccentricity measured from the centroid along that dimension. Under linear elastic stress distribution, what is the largest eccentricity that keeps the entire section in compression or at zero stress?



Compressive load into the section

Schematic for the stated question

- A. 5 mm
- B. 30 mm
- C. 15 mm
- D. 10 mm

Correct option D

At the limiting eccentricity, bending just reduces compression to zero at one extreme fibre.

$$\frac{P}{A} = \frac{Pe}{Z}$$

$$e_{\max} = \frac{Z}{A} = \frac{b}{6} = \frac{60}{6} = 10 \text{ mm}$$

This is the middle-third or kern condition for loading along the given rectangular dimension.

Q.92

In a conventional vapour-compression system, a thermostatic expansion valve principally regulates refrigerant flow to maintain a selected:

- A. Subcooling at the compressor discharge
- B. Compressor motor frequency
- C. Condenser-water velocity
- D. Superheat at the evaporator outlet

Correct option D

The sensing bulb responds to evaporator-outlet temperature while evaporator pressure provides the saturation reference.

The valve adjusts refrigerant feed to maintain the desired outlet superheat.

This promotes effective evaporator use while limiting liquid carryover into the compressor; it is not a direct motor-speed controller.

Q.93

Within the usual grain-size range where the Hall–Petch relation applies, reducing grain size in a polycrystalline metal generally has what effect?

- A. It changes the metal into a polymer
- B. It always reduces yield strength to zero
- C. It removes all grain boundaries
- D. It increases yield strength

Correct option D

Grain boundaries impede dislocation motion across neighbouring grains.

Finer grains introduce more such barriers per unit distance.

$$\sigma_y = \sigma_0 + k_y d^{-1/2}$$

The usual relation therefore predicts increasing yield strength as grain size decreases; extreme nanocrystalline regimes are outside the stated range.