Q. No. 1 – 25 Carry One Mark Each

1. A streamline and an equipotential line in a flow field

(A) Are parallel to each other (B) Are perpendicular to each other

(C) Intersect at an acute angle (D) Are identical

Answer: - (B)

Explanation:- $\left(\frac{dy}{dx}\right)_{\phi} \times \left(\frac{dy}{dx}\right)_{\psi} = -1$

Slope of equipotential Line $\times$ slope of stream function= -1

They are orthogonal to each line other.

2. If a mass of moist air in an airtight vessel is heated to a higher temperature, then

(A) Specific humidity of the air increases

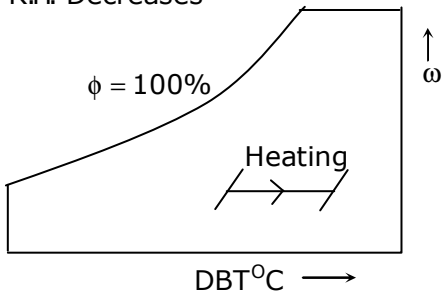
(B) Specific humidity of the air decreases

(C) Relative humidity of the air increases

(D) Relative humidity of the air decreases

Answer: - (D)

Explanation:- R.H. Decreases

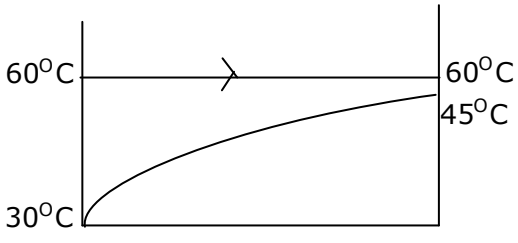


3. In a condenser of a power plant, the steam condenses at a temperature of 60^0C. The cooling water enters at 30^0C and leaves at 45^0C. The logarithmic mean temperature difference (LMTD) of the condenser is

(A) 16.2^0C (B) 21.6^0C (C) 30^0C (D) 37.5^0C

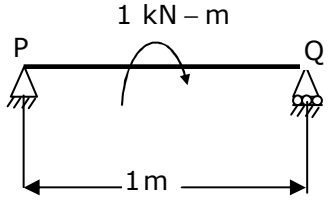
Answer: - (B)

Explanation: - Flow configuration in condenser as shown below.



$$\Delta T_1 = 30^{O}C, \Delta T_2 = 15^{O}C, LMTD = \frac{\Delta T_1 - \Delta T_2}{\ln\left(\frac{\Delta T_1}{\Delta T_2}\right)} = \frac{30-15}{\ln\left(\frac{30}{15}\right)} = 21.6^{O}C$$

4. A simply supported beam PQ is loaded by a moment of 1kN-m at the mid-span of the beam as shown in the figure. The reaction forces R_P and R_Q at supports P and Q respectively are



(A) 1kN downward, 1kN upward (B) 0.5kN upward, 0.5kN downward
(C) 0.5kN downward, 0.5kNupward (D) 1kN upward, 1kN upward

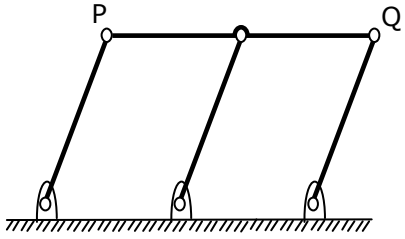
Answer: - (A)

Explanation: - Take moments about 'Q'

$$R_Q \times 1 - 1 = 0 \Rightarrow R_Q = 1\text{kN} \uparrow$$

But $R_P + R_Q = 0 \Rightarrow R_P = -R_Q = -1\text{kN}$ or $R_P = 1\text{kN} \downarrow$

5. A double – parallelogram mechanism is shown in the figure. Note that PQ is a single link. The mobility of the mechanism is



(A) -1 (B) 0 (C) 1 (D) 2

Answer: - (C)

6. The maximum possible draft in cold rolling of sheet increases with the
(A) Increase in coefficient of friction (B) Decrease in coefficient of friction
(C) Decrease in roll radius (D) Increase in roll velocity

Answer: - (A)

7. The operation in which oil is permeated into the pores of a powder metallurgy product is known as
(A) Mixing (B) Sintering (C) Impregnation (D) Infiltration

Answer: - (C)

8. A hole is dimension $\phi 9^{+0.015}_{+0}$ mm. The corresponding shaft is of dimension $\phi 9^{+0.010}_{+0.001}$ mm. The resulting assembly has
(A) Loose running fit (B) Close running fit
(C) Transition fit (D) Interference fit

Answer: - (C)

9. Heat and work are

(A) Intensive properties (B) Extensive properties

(C) Point functions (D) Path functions

Answer: - (D)

Explanation: - Heat and work are path functions.

Since δQ and δW are dependent on path followed between two given end states of a thermodynamic process undergone by system.

10. A column has a rectangular cross-section of 10mm x 20mm and a length of 1m. The slenderness ratio of the column is close to

(A) 200 (B) 346 (C) 477 (D) 1000

Answer: - (B)

Explanation:-

$$\text{Slenderness ratio} = \frac{\text{length of column}}{\text{least radius of gyration}} = \frac{L}{K}$$

$$\text{But } K = \sqrt{\frac{I_{min}}{A}}$$

Where I_{min} is minimum area moment of inertia i.e. I_{xx} or I_{yy}, whicever is less.

$$\text{For the given section } I_{min} = \frac{20 \times 10^3}{12} = 1667 mm^3$$

$$\therefore K = \sqrt{\frac{1667}{20 \times 10}} = 2.89 \text{ and ratio} = \frac{1000}{2.89} = 346$$

11. A series expansion for the function $\sin\theta$ is

(A) $1 - \frac{\theta^2}{2!} + \frac{\theta^4}{4!} - ....$ (B) $\theta - \frac{\theta^3}{3!} + \frac{\theta^5}{5!} - ....$

(C) $1 + \theta + \frac{\theta^2}{2!} + \frac{\theta^3}{3!} + ...$ (D) $\theta + \frac{\theta^3}{3!} + \frac{\theta^5}{5!} + ...$

Answer:- (B)

Explanation:- $\text{Sinx} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - ....$

12. Green sand mould indicates that

(A) Polymeric mould has been cured (B) Mould has been totally dried

(C) Mould is green in colour (D) Mould contains moisture

Answer: - (D)

13. What is $\lim_{\theta \to 0} \frac{\sin\theta}{\theta}$ equal to?

(A) θ (B) $\sin\theta$ (C) 0 (D) 1

Answer: - (D)

Explanation: - Applying L' Hospitals rule, we have $\lim_{\theta \to 0} \frac{\text{Cos}\theta}{1} = \text{Cos}0 = 1$

14. Eigen values of a real symmetric matrix are always

(A) Positive (B) Negative (C) Real (D) Complex

Answer: - (C)

Explanation: - Eigen values of a real symmetric matrix are always real

15. A pipe of 25mm outer diameter carries steam. The heat transfer coefficient between the cylinder and surroundings is $5W/m^2K$. It is proposed to reduce the heat loss from the pipe by adding insulation having a thermal conductivity of 0.05W/mK. Which one of the following statements is TRUE?

(A) The outer radius of the pipe is equal to the critical radius

(B) The outer radius of the pipe is less than the critical radius

(C) Adding the insulation will reduce the heat loss

(D) Adding the insulation will increase the heat loss

Answer: - (C)

Explanation: -Critical Radius of Insulation $= \left(\frac{k}{h}\right) = \left(\frac{O.05}{5}\right) m = 10mm$

$(r_{outer}) > r_{critical} \Rightarrow$ Adding insulation shall decrease H.T. Rate.

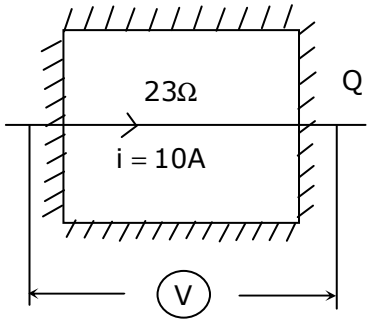
16. The contents of a well-insulated tank are heated by a resistor of 23Ω in which 10A current is flowing. Consider the tank along with its contents as a thermodynamic system. The work done by the system and the heat transfer to the system are positive. The rates of heat (Q), work (W) and change in internal energy (ΔU) during the process in kW are

(A) $Q = 0, W = -2.3, \Delta U = +2.3$ (B) $Q = +2.3, W = 0, \Delta U = +2.3$

(C) $Q = -2.3, W = 0, \Delta U = -2.3$ (D) $Q = 0, W = +2.3, \Delta U = -2.3$

Answer: - (A)

Explanation: -



$W_{electric} = i^2R = \left(10^2 \times 20\right)$ watts $= -2.3$ kw (on system)

Ilaw : – $\phi - w = \Delta U$

$O - \left(-W_{elect}\right) = \Delta u$