International Advanced Research Centre for Powder Metallurgy and New Materials ARCI

Notations :

1.Options shown in green color and with ✔ icon are correct.

2.Options shown in red color and with ✖ icon are incorrect.

Scientist B SRF JRF Mechanical Engineering

PART A

Question Number : 1 Question Id : 8616631201 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Circumferential and longitudinal strains in cylindrical boiler under internal steam pressure, are e_1 and e_2 respectively. Change in volume of the boiler cylinder per unit volume will be

Options :

1. ✖ $e_1 + 2e_2$

2. ✔ $2e_1 + e_2$

3. ✖ $e_1^2 e_2$

4. ✖ $e_1 e_2^2$

Question Number : 2 Question Id : 8616631202 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which stresses are involved in the table fan's shaft, when it's on condition?

Options :

1. ✔ Torsion and Bending

2. ✖ Tensile and Bending

3. ✖ Only Torsion

4. ✖ Only Bending

Question Number : 3 Question Id : 8616631203 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A two plates are fixed together by means of a rivet. Both rivet and plates are made of a plain carbon steel 10C4 with a yield strength of 250 MPa. The load of 5 kN is applied on both ends of the plates. The factor of safety is 2.5. Determine the shear stress according to the principal shear stress theory?

Options :

1. ✖ 100 MPa

2. ✖ 125 MPa

3. ✔ 50 MPa

4. ✖ None of the options are correct

Question Number : 4 Question Id : 8616631204 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What is the relationship between shear stress and yield tensile stress in von-Mises distortion energy theory

Options :

1. ✖ $\tau_s = 0.5\ \sigma_y$

2. ✖ $\tau_s = 0.75\ \sigma_{yt}$

3. ✖ $\tau_s = 0.9\ \sigma_{yt}$

4. ✔ $\tau_s = 0.577\ \sigma_{yt}$

Question Number : 5 Question Id : 8616631205 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

For a single welded V-joint, what should be the thickness of the plate that necessitates edge beveling before welding?

Options :

1. ✖ Less than 5 mm

2. ✔ In between 5mm to 25 mm

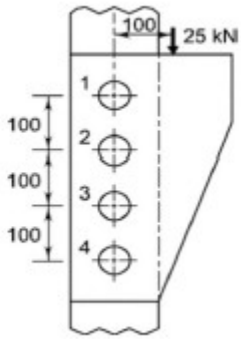
3. ✖ In between 30 to 50 mm

4. ✖ More than 50 mm

Question Number : 6 Question Id : 8616631206 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A bracket, attached to a vertical column by means of four identical rivets, is subjected to an eccentric force of 25 kN as shown in Figure. Determine the resultant force acting on the rivet 1, if the permissible shear stress is 60 N/mm^2.



Options :

1. ✖ 6250 N

2. ✖ 7500 N

3. ✖ 13750 N

4. ✔ 9762.81 N

Question Number : 7 Question Id : 8616631207 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A propeller shaft is required to transmit 45 kW power at 500 rpm. It is a hollow shaft, having an inside diameter 0.6 times of outside diameter. It is made of plain carbon steel and the permissible shear stress is 84 N/mm^2. Calculate the inside and outside diameters of the shaft.

Options :

1. ✔ $d_i = 23.47$ mm, $d_o = 39.12$ mm

2. ✖ $d_i = 11.73$ mm, $d_o = 19.56$ mm

3. ✖ $d_i = 46.94$ mm, $d_o = 78.24$ mm

4. ✖ $d_i = 25.47$ mm, $d_o = 50.12$ mm

Question Number : 8 Question Id : 8616631208 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A multi-disk clutch consists of five steel plates and four bronze plates. The inner and outer diameters of the friction disks are 75 and 150 mm respectively. The coefficient of friction is 0.1 and the intensity of pressure on friction lining is limited to 0.3 N/mm^2. Assuming uniform wear theory, calculate the required force to engage the clutch

Options :

1. ✖ 1325.36 N

2. ✖ 7952.16 N

3. ✔ 2650.72 N

4. ✖ 3976.08 N

Question Number : 9 Question Id : 8616631209 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The _____ load carrying capacity of a bearing is defined as the radial load in radial bearings (or thrust load in thrust bearings) that can be carried for a minimum life of one million revolutions

Options :

1. ✖ Static

2. ✔ Dynamic

3. ✖ Radial

4. ✖ Thrust

Question Number : 10 Question Id : 8616631210 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

To connect non-parallel and non-intersecting shafts, spiral gears are used. The spiral gears are having maximum efficiency if the spiral angle is equal to

Options :

1. ✔ $\frac{\theta+\phi}{2}$

2. ✖ $\frac{\theta-\phi}{2}$

3. ✖ $\theta+\phi$

4. ✖ $\theta-\phi$

Question Number : 11 Question Id : 8616631211 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If a point is moving along a straight line and the straight line is rotating, then the normal component of acceleration (a_n) is given by

Options :

1. ✖ $a_n = 2v\omega - r\alpha$

2. ✖ $a_n = \frac{dv}{dt} + r\omega^2$

3. ✖ $a_n = 2v\omega + r\alpha$

4. ✔ $a_n = \frac{dv}{dt} - r\omega^2$

Question Number : 12 Question Id : 8616631212 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

It is the point about which one body rotates relative to another body for the configuration being considered. The bodies do not have any linear velocity relative to each other at this point. If a mechanism is having 'n' links, then the number of instantaneous centers would be

Options :

1. ✖ $\frac{n(n+1)}{2}$

2. ✔ $\frac{n(n-1)}{2}$

3. ✖ $n(n+1)$

4. ✖ $n(n-1)$

Question Number : 13 Question Id : 8616631213 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The smallest circle drawn from the cam center to the pitch curve is called

Options :

1. ✖ Base circle

2. ✖ Pitch circle

3. ✔ Prime circle

4. ✖ Cam profile

Question Number : 14 Question Id : 8616631214 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Sensitiveness of a governor is defined as

Options :

1. ✔ The ratio of the range of speed to the mean speed

2. ✖ The ratio of the range of speed to the radius of rotation

3. ✖ The ratio of the mean speed to the range of speed

4. ✖ The ratio of the radius of rotation to the range of speed

Question Number : 15 Question Id : 8616631215 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the inertia forces and couples exerted by the rotating masses are in equilibrium among themselves, the masses are said to be in

Options :

1. ✖ Static balance

2. ✖ Controlling force curve

3. ✔ Dynamic balance

4. ✖ Unbalanced centrifugal force

Question Number : 16 Question Id : 8616631216 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

For the free longitudinal vibration, the natural frequency is

Options :

1. ✖ $\frac{1}{2\pi}\sqrt{\frac{\delta}{g}}$

2. ✔ $\frac{1}{2\pi}\sqrt{\frac{g}{\delta}}$

3. ✖ $2\pi\sqrt{\frac{g}{\delta}}$

4. ✖ $2\pi\sqrt{\frac{\delta}{g}}$

Question Number : 17 Question Id : 8616631217 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The equation of motion for forced vibration with viscous damping system is

Options :

1. ✖ $\frac{d^2x}{dt^2}+\frac{k}{m}x=0$

2. ✖ $\frac{d^2x}{dt^2}+\frac{k}{m}x=F\sin\omega t$

3. ✖ $\frac{d^2x}{dt^2}+\frac{c}{m}\frac{dx}{dt}+\frac{k}{m}x=0$

4. ✔ $\frac{d^2x}{dt^2}+\frac{c}{m}\frac{dx}{dt}+\frac{k}{m}x=F\sin\omega t$

Question Number : 18 Question Id : 8616631218 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

During taking a turn a cyclist inclines at an angle with the normal to the road. The equilibrium is maintained due to

Options :

1. ✖ Weight of the cyclist

2. ✖ Centrifugal force alone

3. ✖ Centrifugal force and gyro-couple

4. ✔ Weight of the cyclist, centrifugal force and gyro-couple

Question Number : 19 Question Id : 8616631219 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A rod of length l, and diameter D, is rigidly fixed at the upper end and is hanging vertically. The total extension produced in the rod due to its own weight is

Options :

1. ✖ $\frac{wl^2}{2AE}$

2. ✖ wl

3. ✔ $\frac{wl^2}{2E}$

4. ✖ $\frac{wl^2}{AE}$

Question Number : 20 Question Id : 8616631220 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A cantilever of length l, carrying a load whose intensity varies uniformly from zero at free end to w per unit length at the fixed end. The deflection at the free end is

Options :

1. ✖ $\frac{wl}{2}$

2. ✖ $\frac{wl^2}{2}$

3. ✖ $\frac{wl^3}{24EI}$

4. ✔ $\frac{wl^4}{30EI}$

Question Number : 21 Question Id : 8616631221 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Polar modulus of a shaft section is the

Options :

1. ✔ Ratio of polar moment of inertia of the shaft section to the maximum radius

2. ✖ Ratio of polar moment of inertia of the shaft section to the minimum radius

3. ✖ Multiplication of polar moment of inertia of the shaft section to the maximum radius

4. ✖ Multiplication of polar moment of inertia of the shaft section to the minimum radius

Question Number : 22 Question Id : 8616631222 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Buckling factor of the column is the ratio of the

Options :

1. ✖ Crushing stress to the least radius of gyration

2. ✔ Equivalent length to the least radius of gyration

3. ✖ Least radius of gyration to the crushing stress

4. ✖ Least radius of gyration to the equivalent length

Question Number : 23 Question Id : 8616631223 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The longitudinal strain of the thin cylindrical shells is

Options :

1. ✖ $\frac{pD}{2tE}\left(1-\frac{1}{m}\right)$

2. ✖ $\frac{pD}{tE}\left(\frac{1}{2}-\frac{1}{2m}\right)$

3. ✔ $\frac{pD}{2tE}\left(\frac{1}{2}-\frac{1}{m}\right)$

4. ✖ $\frac{pD}{tE}\left(1-\frac{1}{2m}\right)$

Question Number : 24 Question Id : 8616631224 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

For a shaft, carrying a weight at the center, the critical speed is

Options :

1. ✖ $\sqrt{\frac{g}{k\times W}}$

2. ✔ $\sqrt{\frac{k\times g}{W}}$

3. ✖ $\sqrt{\frac{W}{k\times g}}$

4. ✖ $\sqrt{\frac{k\times W}{g}}$

Question Number : 25 Question Id : 8616631225 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In rotating horizontal shafts, there are large vibrations when the shafts are rotating at a speed which is

Options :

1. ✖ One-fourth of critical speed

2. ✖ One-third of critical speed

3. ✔ One-half of critical speed

4. ✖ Two-third of critical speed

Question Number : 26 Question Id : 8616631226 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The effort applied at the end of the handle of a screw jack to lift the load W, is

Options :

1. ✖ $\frac{Wd}{2L}\tan(\alpha-\phi)$

2. ✖ $W\tan(\alpha+\phi)$

3. ✖ $\frac{Wd}{2L}\tan(\phi-\alpha)$

4. ✔ $\frac{Wd}{2L}\tan(\alpha+\phi)$

Question Number : 27 Question Id : 8616631227 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Self-locking machine is one which has efficiency

Options :

1. ✖ 100%

2. ✔ Less than 50%

3. ✖ More than 50%

4. ✖ More than 75%

Question Number : 28 Question Id : 8616631228 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The angular momentum of a particle is the

Options :

1. ✖ Linear momentum per unit angle

2. ✖ Product of the mass with its angular velocity

3. ✖ Moment of the product of the mass and the angular velocity about and origin

4. ✔ Cross product of the position vector and the linear momentum

Question Number : 29 Question Id : 8616631229 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The virtual work done by external active forces on an ideal mechanical system in equilibrium is ___ for any and all virtual displacements consistent with the constraints

Options :

1. ✖ Unity

2. ✖ Twice

3. ✖ Infinite

4. ✔ Zero

Question Number : 30 Question Id : 8616631230 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

When more members are present than are needed to prevent collapse, the truss is _____

Options :

1. ✔ Statically indeterminate

2. ✖ Complex trusses

3. ✖ Statically determinate

4. ✖ Simple trusses

Question Number : 31 Question Id : 8616631231 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a turning operation, the approach angle is 30° and the back rake is 8°. Calculate the side rake so that the cutting can be considered as orthogonal.

Options :

1. ✖ 10.24°

2. ✔ 13.67°

3. ✖ 15.12°

4. ✖ 16. 42°

Question Number : 32 Question Id : 8616631232 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The melting point of steel having 4.3% (by weight) carbon is

Options :

1. ✖ 910 °C

2. ✖ 1539 °C

3. ✖ 1400 °C

4. ✔ 1147 °C

Question Number : 33 Question Id : 8616631233 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What is the name of the surface that is generated with linear interpolation of two curves?

Options :

1. ✖ Bezier surface

2. ✖ B-spline surface

3. ✖ Planar surface

4. ✔ Ruled surface

Question Number : 34 Question Id : 8616631234 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Calculate the total inventory cost of an item in a manufacturing firm with the following details:

Total annual consumption of item = 10000 kg

Ordering cost = Rs.100

Unit cost of item= Rs. 20 per kg

Carrying and storage cost = 10%

Options :

1. ✖ Rs. 1000

2. ✖ Rs. 1500

3. ✔ Rs. 2000

4. ✖ Rs. 2500

Question Number : 35 Question Id : 8616631235 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

During the tensile deformation of metallic materials, strain hardening ensures

Options :

1. ✔ Uniform elongation

2. ✖ Lowest ductility

3. ✖ Minimum stiffness

4. ✖ Maximum modulus

Question Number : 36 Question Id : 8616631236 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What is the Euler characteristic of a tetrahedron?

Options :

1. ✖ 1

2. ✔ 2

3. ✖ 3

4. ✖ 4

Question Number : 37 Question Id : 8616631237 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The crystal structure of iron at 972°C

Options :

1. ✖ Base centered cubic

2. ✖ Body centered cubic

3. ✔ Face centered cubic

4. ✖ Diamond cubic

Question Number : 38 Question Id : 8616631238 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the angle of disorientation of a boundary between the grains is more than 15°, then it is a _____

Options :

1. ✖ Sub-grain boundary

2. ✖ Low-angle grain boundary

3. ✔ High-angle grain boundary

4. ✖ Dislocation

Question Number : 39 Question Id : 8616631239 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Plastic working of metallic materials at room temperature results in the following

Options :

1. ✖ Dislocation free microstructure

2. ✔ Increases dislocation density

3. ✖ Increases ductility

4. ✖ Poor surface finish

Question Number : 40 Question Id : 8616631240 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the number of control points are four. What can be the degree of the resulting B-spline curve?

Options :

1. ✖ Cubic

2. ✖ Quadratic

3. ✖ Linear

4. ✔ Independent of the number of control points

Question Number : 41 Question Id : 8616631241 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What are the inputs required to model a Coon's surface patch?

Options :

1. ✖ Two curves and two points

2. ✖ Two curves and two slopes

3. ✔ Four curves

4. ✖ Six curves

Question Number : 42 Question Id : 8616631242 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

During orthogonal machining with a cutting tool having 8° rake angle, the chip thickness is measured to be 0.4 mm, the uncut chip thickness being 0.14 mm. Determine the magnitude of the shear strain

Options :

1. ✔ 2.95

2. ✖ 0.77

3. ✖ 0.35

4. ✖ 1. 43

Question Number : 43 Question Id : 8616631243 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a shaper, length of stroke is 300 mm, number of double strokes per minute is 40 and ratio of return time to cutting time is 1:2. Find the cutting speed

Options :

1. ✖ 6 m/min

2. ✖ 12 m/min

3. ✔ 18 m/min

4. ✖ 24 m/min

Question Number : 44 Question Id : 8616631244 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The straight bar of length 150 mm is supported horizontally by two supports in a measurement. What should be the distance of each support from center to minimize the error?

Options :

1. ✔ 43.275 mm

2. ✖ 86.55 mm

3. ✖ 63.45 mm

4. ✖ 31.735 mm

Question Number : 45 Question Id : 8616631245 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A hole and shaft are having a nominal size of 30 mm. maximum and minimum clearance in the assembly are 0.15 and 0.06 mm respectively. the hole tolerance is double the shaft tolerance. what is the higher limit of the hole when it follows hole basis system?

Options :

1. ✖ 30.00 mm

2. ✖ 30.03 mm

3. ✔ 30.06 mm

4. ✖ 30.15 mm

Question Number : 46 Question Id : 8616631246 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A 25 mm diameter steel bar was turned at 300 rpm using an HSS tool. Tool failure occurred after 10 min. when the speed was decreased to 250 rpm, the tool failed in 52.5 min. assuming that Taylor's equation applies, find the approximate expected tool life at a cutting speed of 275 rpm

Options :

1. ✖ 12 min

2. ✖ 16 min

3. ✔ 22 min

4. ✖ 31 min

Question Number : 47 Question Id : 8616631247 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

With a solidification factor of 1.08×10^6 Sec/m^2, the solidification time for a spherical casting of 200 mm diameter is --------

Options :

1. ✖ 10 min

2. ✖ 12 min

3. ✖ 16 min

4. ✔ 20 min

Question Number : 48 Question Id : 8616631248 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In orthogonal cutting, the chip thickness ratio $r = \frac{\text{uncut chip thickness}}{\text{chip thickness}}$. For a tool with rake angle α, the shear angle $\emptyset$ increases when:

Options :

1. ✖ r decreases and α decreases

2. ✖ r increases and α increases

3. ✔ r decreases and α increases

4. ✖ r increases and α decreases

Question Number : 49 Question Id : 8616631249 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a sheet metal forming process, the punch diameter is 50 mm, maximum blank diameter is 100 mm and initial thickness of the flat sample is 50 mm, what is the limiting draw ratio?

Options :

1. ✖ 0.2

2. ✔ 2.0

3. ✖ 0.3

4. ✖ 3.0

Question Number : 50 Question Id : 8616631250 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which welding process produces the deepest penetration into the base metal under similar joint conditions?

Options :

1. ✖ Gas Tungsten Arc Welding

2. ✖ Submerged Arc Welding

3. ✖ Laser Beam Welding

4. ✔ Electron Beam Welding

Question Number : 51 Question Id : 8616631251 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which of the following is NOT a primary mechanism of material removal in Electrical Discharge Machining (EDM)

Options :

1. ✖ Thermal melting and vaporization by spark energy

2. ✔ Electrochemical dissolution in the dielectric

3. ✖ Re-solidification and flushing of molten droplets

4. ✖ No direct mechanical contact

Question Number : 52 Question Id : 8616631252 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In rolling of metals, when reduction per pass is increased while all other conditions are kept constant, the required rolling force

Options :

1. ✖ decreases due to smaller contact length

2. ✔ Increases because deformation zone and strain work increase

3. ✖ Remains constant

4. ✖ Becomes zero at large reductions

Question Number : 53 Question Id : 8616631253 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A cube of 5 cm side solidifies in 100 s. What time will a cube of 10 cm side take?

Options :

1. ✖ 200 s

2. ✔ 400 s

3. ✖ 800 s

4. ✖ 1600 s

Question Number : 54 Question Id : 8616631254 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A strip of 200 mm wide and 10 mm thick is reduced to 8 mm in one pass. Roll diameter = 500 mm, average flow stress = 200 MPa. Rolling load is:

Options :

1. ✖ 0.625 MN

2. ✖ 0.825 MN

3. ✖ 1.000 MN

4. ✔ 1.265 MN

Question Number : 55 Question Id : 8616631255 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In wire drawing, initial diameter = 10 mm, final diameter = 8 mm, flow stress = 400 MPa, ideal deformation stress is approximately:

Options :

1. ✖ 40 MPa

2. ✖ 80 MPa

3. ✖ 140 MPa

4. ✔ 180 MPa

Question Number : 56 Question Id : 8616631256 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A hole of 25H7 is to be checked. IT7 tolerance = 0.021 mm. Hole limits are:

Options :

1. ✔ 25.000 – 25.021 mm

2. ✖ 24.979 – 25.000 mm

3. ✖ 25.021 – 25.042 mm

4. ✖ 24.979 – 25.021 mm

Question Number : 57 Question Id : 8616631257 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A slab of width 100 mm and thickness 10 mm is rolled to a thickness of 8 mm. The roll radius is 250 mm, and the rotational speed is 10 rpm. The average roll pressure is 400 MPa. The roll separating force (in kN) is

Options :

1. ✖ 294.4

2. ✔ 494.4

3. ✖ 694.4

4. ✖ 894.4

Question Number : 58 Question Id : 8616631258 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In an AJM process, the nozzle diameter is 0.5 mm, and the stand-off distance is 1 mm. The abrasive flow rate is 3 g/min. If the stand-off distance is increased to 2 mm, the new abrasive flow rate (in g/min) to maintain the same MRR is approximately

Options :

1. ✖ 0.75

2. ✖ 1.5

3. ✖ 6

4. ✔ 10

Question Number : 59 Question Id : 8616631259 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a face milling operation, a cutter with 10 teeth and 100 mm diameter is used. The cutting speed is 125 m/min and the feed per tooth is 0.1 mm. The table feed (in mm/min) is

Options :

1. ✖ 125

2. ✖ 250

3. ✔ 398

4. ✖ 796

Question Number : 60 Question Id : 8616631260 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The ratio of the maximum shear strain rate in the workpiece to the shear strain rate in the primary shear zone during machining is

Options :

1. ✖ 1

2. ✖ 2

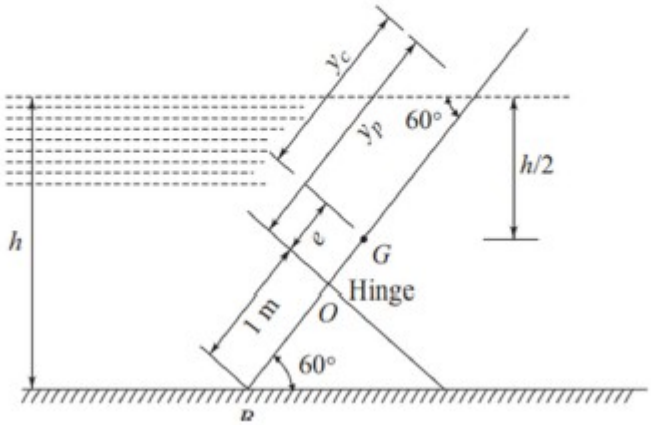
3. ✖ 3

4. ✔ 4

Question Number : 61 Question Id : 8616631261 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Figure shows a flash board. Find the depth of water h at the instant when the water is just ready to tip the flash board.



Options :

1. ✖ $h = 3\sqrt{3}$

2. ✔ $h = 3\sqrt{3}/2$

3. ✖ $h = 3\sqrt{2}$

4. ✖ $h = 3\sqrt{2/3}$

Question Number : 62 Question Id : 8616631262 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

For stable equilibrium of floating bodies, the center of gravity has to:

Options :

1. ✖ be always below the center of buoyancy

2. ✖ be always above the center of buoyancy

3. ✖ be always above the metacenter

4. ✔ be always below the metacenter

Question Number : 63 Question Id : 8616631263 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The velocity field of a two-dimensional incompressible flow is given as:

$$u = 3x + 2y,\ v = ay + bx$$

where u and v are the velocity components in the x and y directions (in m/s), and a and b are constants. Using the differential form of the continuity equation, determine the relationship between a and b so that the flow satisfies the continuity equation.

Options :

1. ✖ $a = 2, b = -3;$

2. ✖ $a = -2, b = 3;$

3. ✔ $a = -3, b = 3;$

4. ✖ $a = 3, b = -2;$

Question Number : 64 Question Id : 8616631264 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Water flows steadily through a pipe that rises vertically upward. At point 1 (lower section), the pipe diameter is 20 cm, the pressure is 180 kN/m², and the velocity is 2 m/s. At point **2** (upper section), which is 4 m higher, the pipe diameter reduces to 10 cm. Assuming no losses and $\rho = 1000$ kg/m^3, g=9.81 m/s^2, find the pressure at point 2.

Options :

1. ✖ 105.5 kN/m²

2. ✖ 108.4 kN/m²

3. ✔ 110.8 kN/m²

4. ✖ 120.2 kN/m²

Question Number : 65 Question Id : 8616631265 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The drag force (F) experienced by a sphere moving through a fluid depends on: Fluid density (ρ), Velocity of the sphere (V), Diameter of the sphere (D), Dynamic viscosity of the fluid (μ)

Options :

1. ✔ 2

2. ✖ 3

3. ✖ 4

4. ✖ 5

Question Number : 66 Question Id : 8616631266 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The Reynolds number for flow of oil through a 5 cm diameter pipe is 1700. The kinematic viscosity, $v = 1.02 \times 10^{-6}$ m^2/s. What is the velocity at a point 0.625 cm away from the wall.

Options :

1. ✖ 0.0101 m/s

2. ✖ 0.0202 m/s

3. ✔ 0.0303 m/s

4. ✖ 0.0404 m/s

Question Number : 67 Question Id : 8616631267 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In the entrance region of a pipe, the boundary layer grows and the inviscid core accelerates. This is accompanied by the fluid's pressure drop per unit length is

Options :

1. ✖ lower compared to the fully developed region

2. ✖ same compared to the fully developed region

3. ✖ Lower or same compared to the fully developed region

4. ✔ higher compared to the fully developed region

Question Number : 68 Question Id : 8616631268 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A nozzle is designed to expand air isentropically to atmospheric pressure from a large tank in which properties are held constant at 5 °C and 304 kPa (abs). The desired flow rate is 1 kg/s. Determine the exit density.

Options :

1. ✖ 1.23 kg/m^3

2. ✔ 1.73 kg/m^3

3. ✖ $2.23\ kg/m^3$

4. ✖ $2.73\ kg/m^3$

Question Number : 69 Question Id : 8616631269 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Hot water is to be cooled as it flows through the tubes exposed to atmospheric air. Fins can be attached in order to enhance the heat transfer. Would you recommend attaching the fins

Options :

1. ✖ inside

2. ✔ outside

3. ✖ either side

4. ✖ both sides

Question Number : 70 Question Id : 8616631270 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which effect tends to increase the fin tip heat loss relative to the insulated tip assumption?

Options :

1. ✖ Decreasing convective coefficient h (ambient calmer)

2. ✖ Increasing fin thickness uniformly (larger Ac)

3. ✖ Shortening fin length L drastically

4. ✔ Increasing tip heat transfer by adding a small exposed tip area or a convection-enhancing cap

Question Number : 71 Question Id : 8616631271 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A flat plate of length L is placed in a steady, incompressible laminar flow of air at velocity U_∞. The plate is maintained at a uniform surface temperature $T_s > T_\infty$. The Prandtl number of air is Pr = 0.7. The local thermal boundary layer thickness at distance x from the leading edge is given approximately by:

$$\frac{\delta_t}{\delta} = C \cdot Pr^{-1/3}$$

where C is constants, and δ is the velocity boundary layer thickness.
At a certain point on the plate, it is observed that the ratio of thermal boundary layer thickness to velocity boundary layer thickness is 0.81. If the free-stream fluid is changed to oil with Pr = 18.9, determine the new ratio of thermal boundary layer thickness to velocity boundary layer thickness at the same stream wise location x.

Options :

1. ✖ 0.081

2. ✖ 0.027

3. ✖ 0.81

4. ✔ 0.27

Question Number : 72 Question Id : 8616631272 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Statement (I): In a boundary layer formed by uniform flow past a flat plate, the pressure gradient in the x direction is zero.

Statement (II): In a boundary layer formed by uniform flow past a flat plate, the pressure gradient in the y direction is negligible.

Options :

1. ✖ Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

2. ✔ Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)

3. ✖ Statement (I) is true but Statement (II) is false

4. ✖ Statement (I) is false but Statement (II) is true

Question Number : 73 Question Id : 8616631273 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a pipe, laminar flow in a fully developed region with constant heat flux from the pipe wall, bulk mean temperature of fluid

Options :

1. ✔ and pipe wall temperature increase in the flow direction

2. ✖ and pipe wall temperature decrease in the flow direction

3. ✖ remains constant, but pipe wall temperature increases in the flow direction

4. ✖ increases but pipe wall temperature remains constant

Question Number : 74 Question Id : 8616631274 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A counterflow heat exchanger is used to cool oil ($c_{p,h} = 2.5$ kJ/kg-K) from 150°C to 80°C using water ($c_{p,c} = 4.18$ kJ/kg-K) entering at 25°C with a mass flow rate of 1 kg/s. The overall heat transfer coefficient U = 500 W/m^2-K, and the required heat transfer area is 10 m^2. If the heat exchanger were changed from counterflow to parallel flow, but all other conditions remain unchanged, which of the following statements is correct?

Options :

1. ✖ The effectiveness will increase because parallel flow has higher initial temperature difference.

2. ✔ The required area will increase, as the LMTD in parallel flow is smaller than in counterflow.

3. ✖ The NTU will decrease because the capacity rate ratio Cr changes.

The heat transfer rate remains unchanged, as only flow arrangement changes, not inlet temperatures.

4. ✖

Question Number : 75 Question Id : 8616631275 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

You have three diffuse, gray surfaces forming an enclosure: surface **A** (area $A_A = 2\ m^2$), surface **B** (area $A_B = 3\ m^2$), and the remaining enclosure surface **C** (area $A_C = 10\ m^2$). You are given the following geometric view-factors (all values dimensionless): $F_{A\to C} = 0.6$, $F_{B\to C} = 0.7$. Assume surfaces A and B are planar (so self–view factors $F_{A\to A} = F_{B\to B} = 0$). Which of the following statements is correct?

Options :

1. ✖ $F_{A\to B} = 0.40$.

2. ✖ $F_{B\to A} = 0.30$.

3. ✔ The supplied data are geometrically inconsistent (no physical configuration of diffuse surfaces can satisfy both given numbers).

4. ✖ $F_{A\to B} = 0.45$.

Question Number : 76 Question Id : 8616631276 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Two large parallel gray plates, Plate A and Plate B, are facing each other with an emissivity $\varepsilon_A = 0.6$ and $\varepsilon_B = 0.4$. A radiation shield Plate S with emissivity $\varepsilon_S = 0.2$ on both sides is placed exactly midway between them. The surroundings are at 0 K, and the plates are maintained at fixed temperatures: $T_A = 800\ K$, $T_B = 400\ K$. Assume the view factors between facing surfaces are unity, and all surfaces are large and parallel. Determine the equivalent radiative resistance.

Options :

1. ✖ $R_{eq} = \frac{1}{\varepsilon_A} + \frac{1}{\varepsilon_S} + \frac{1}{\varepsilon_B} - 2$

2. ✔ $R_{eq} = \frac{1}{\varepsilon_A} + 2\left(\frac{1}{\varepsilon_S} - 1\right) + \frac{1}{\varepsilon_B} - 2$

3. ✖ $$R_{eq} = \frac{1}{\varepsilon_A} + 2\left(\frac{1}{\varepsilon_S}\right) + \frac{1}{\varepsilon_B} - 2$$

4. ✖ $$R_{eq} = \frac{1}{\varepsilon_A} + \frac{1}{\varepsilon_S} + \frac{1}{\varepsilon_B}$$

Question Number : 77 Question Id : 8616631277 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

At a certain pressure, a pure substance exists as a saturated liquid–vapor mixture. The temperature is held constant, and more heat is added to the system at this same pressure. Which of the following statements is most accurate regarding the process?

Options :

1. ✖ The temperature and pressure will increase until the substance becomes superheated vapor.

2. ✔ The temperature remains constant while the quality (dryness fraction) increases until all liquid evaporates.

3. ✖ The temperature decreases slightly because the heat is used for the phase change.

4. ✖ The specific volume remains constant while the quality changes during evaporation.

Question Number : 78 Question Id : 8616631278 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A thermally insulated, rigid container is divided into two equal compartments by a removable partition.

- Compartment 1: 2 kg of water at 200°C and 2 MPa (compressed liquid).
- Compartment 2: 1.5 kg of saturated vapor of the same substance at 200°C.

The partition is suddenly removed, and the system is allowed to reach equilibrium.
Neglect kinetic and potential energy changes.

Which of the following statements is correct about the final equilibrium state?

Options :

1. ✖ The final temperature must remain exactly 200°C because both compartments initially had the same temperature (Zeroth Law).

2. ✔ The final temperature may differ from 200°C, but total internal energy remains constant due to the First Law for an adiabatic, closed system.

3. ✖ Both temperature and internal energy will increase, because mixing of vapor and liquid always generates heat internally.

4. ✖ The final temperature will decrease below 200°C because expansion of vapor causes cooling.

Question Number : 79 Question Id : 8616631279 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

A closed system contains 1.5 kg of an ideal gas (assume Cv = 0.75 kJ/kg·K, R = 0.287 kJ/kg·K). The gas initially has a pressure of 500 kPa and temperature of 400 K. The gas undergoes a polytropic expansion with n = 1.3, and the final pressure is 100 kPa. Calculate the Work transfer (W) during this process.

Options :

1. ✖ $W = -176.65\ kJ$

2. ✔ $W = 176.65\ kJ$

3. ✖ $W = -83.32\ kJ$

4. ✖ W = 83.32 kJ

Question Number : 80 Question Id : 8616631280 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A heat engine operates between a hot source at $T_H = 900$ K and a cold sink at the ambient temperature $T_0 = T_C = 300$ K. During one cycle the engine receives $Q_H = 12{,}000$ kJ from the hot source and rejects $Q_C = 8{,}000$ kJ to the cold sink. Which of the following statements is correct?

Options :

1. ✖ The entropy generation per cycle is Sgen = 4.00 kJ/K.

2. ✖ The process is reversible because the work equals the Carnot work for these temperatures.

3. ✔ The entropy generation per cycle is Sgen = 13.333 kJ/K

4. ✖ The entropy generation is zero.

Question Number : 81 Question Id : 8616631281 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A closed system undergoes a process in which it interacts with the surroundings maintained at T0=300 K and P0=100 kPa.
During the process:

- The system receives 500 kJ of heat from a reservoir at 600 K.
- The system does 120 kJ of boundary work on the surroundings.
- There is no change in kinetic or potential energy, and the process ends at the dead state (equilibrium with surroundings).

Which of the following statements is most correct?

Options :

1. ✖ The maximum useful work (availability) from the given heat input is 250 kJ, and the irreversibility is 250 kJ.

2. ✖ The maximum useful work (availability) from the given heat input is 300 kJ, and the irreversibility is 80 kJ.

3. ✖ The maximum useful work (availability) from the given heat input is 250 kJ, and the irreversibility is 120 kJ.

4. ✔ The maximum useful work (availability) from the given heat input is 250 kJ, and the irreversibility is 130 kJ.

Question Number : 82 Question Id : 8616631282 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

For a closed, simple compressible system, which of the following thermodynamic relations is always valid, irrespective of the process, assuming only reversible processes and equilibrium states?

Options :

1. ✖ $\left(\frac{\partial U}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V - P$

2. ✖ $\left(\frac{\partial H}{\partial P}\right)_T = -T\left(\frac{\partial V}{\partial T}\right)_P - V$

3. ✔ $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$

4. ✖ $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P - P$

Question Number : 83 Question Id : 8616631283 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A 2 kmol sample of nitrogen gas (N_2) is stored in a 2.5 m^3 rigid tank at 350 K. The compressibility factor (ratio of real pressure to that of ideal pressure) for nitrogen at these conditions is given as 0.92. The universal gas constant, R = 8.314 kJ/(kmol·K). Determine the pressure of the gas and identify the deviation percentage relative to real gas.

Options :

1. ✔ P = 1.92 MPa, %deviation = 8.7%

2. ✖ P = 1.92 MPa, %deviation = 7.7%

3. ✖ P = 1.83 MPa, %deviation = 8.7%

4. ✖ P = 1.83 MPa, %deviation = 9.7%

Question Number : 84 Question Id : 8616631284 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A steam power plant is modified by adding one reheater and one closed feedwater heater. Consider the following four statements about the effects of regeneration and reheat on the plant performance:

1. Regeneration increases the thermal efficiency of the cycle by reducing the average heat supplied during the constant-pressure heat addition process in the boiler.
2. Reheating always increases the cycle thermal efficiency, irrespective of the initial and reheat pressures chosen.
3. In an ideal closed feedwater heater, the extracted steam completely condenses to a saturated liquid at the heater pressure.
4. Reheating reduces the moisture content of the steam at the turbine exhaust, thereby protecting the turbine blades.

Which of the following combinations of the above statements is correct?

Options :

1. ✔ 1, 3, and 4 only

2. ✖ 1 and 4 only

3. ✖ 1, 2, and 4 only

4. ✖ 2, 3, and 4 only

Question Number : 85 Question Id : 8616631285 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

An internal combustion engine operates on an ideal Otto cycle with the following specifications: Compression ratio, r = 16, Initial pressure and temperature before compression, $P_1 = 1$ bar, $T_1 = 300$ K. Heat added per kg of air during combustion, $q_{in} = 1800$ kJ/kg. Ratio of specific heats, $\gamma = 1.4$, specific heat at constant volume $C_v = 0.718$ kJ/kg-K. Determine the cycle thermal efficiency.

Options :

1. ✔ 67.0%

2. ✖ 60.8%

3. ✖ 56.3%

4. ✖ 53.6%

Question Number : 86 Question Id : 8616631286 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A refrigerator operates between -5°C (268 K) and 35°C (308 K). The actual COP of the refrigerator is 60% of the maximum possible COP. If the refrigerator absorbs 1200 kJ/min of heat from the refrigerated space, determine the power input required to run the refrigerator.

Options :

1. ✖ 4.65 kW

2. ✔ 4.98 kW

3. ✖ 5.63 kW

4. ✖ 6.24 kW

Question Number : 87 Question Id : 8616631287 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A vapor compression refrigeration system using R-134a operates between an evaporator temperature of –8°C and a condenser temperature of 40°C. The refrigerant enters the compressor as slightly wet vapor and leaves as superheated vapor. The following statements are made about the cycle:

1. Increasing the degree of subcooling of liquid before throttling increases the COP of the cycle.
2. Increasing the degree of superheating at the compressor inlet always increases the COP.
3. Throttling is an irreversible process, and it reduces the COP.
4. If the refrigerant leaves the compressor as saturated vapor (instead of superheated vapor), the COP is higher for the same pressure limits.

Which combination of statements is correct?

Options :

1. ✔ 1, 3, and 4 only

2. ✖ 1 and 2 only

3. ✖ 2, 3, and 4 only

4. ✖ 1, 2, 3, and 4

Question Number : 88 Question Id : 8616631288 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Air at 25°C, 1 atm, and 50% relative humidity is considered. The saturation vapor pressure of water at 25°C is 3.17 kPa. Find the actual partial pressure of water vapor in the air.

Options :

1. ✖ 6.34 kPa

2. ✖ 3.17 kPa

3. ✔ 1.585 kPa

4. ✖ 0.585 kPa

Question Number : 89 Question Id : 8616631289 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A steam turbine stage is designed to work purely on the impulse principle. Which of the following statements is correct for this turbine stage?

Options :

1. ✖ The pressure drop occurs entirely in the moving blades, and the fixed blades only guide the steam.

2. ✖ The pressure drop is equally shared between the fixed and moving blades.

3. ✖ The moving blades increase both pressure and velocity of steam.

4. ✔ The pressure drop occurs entirely in the fixed blades (nozzles), while the moving blades experience only a change in kinetic energy.

Question Number : 90 Question Id : 8616631290 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A Francis turbine operates under the following conditions, Net head: $H = 60$ m, Power output: $P = 20$ MW, Overall efficiency: $\eta = 90\%$. Assume the velocity coefficient $C_v = 0.98$, speed ratio $u/V = 0.46$, and flow ratio $\phi = 0.95$. Determine the approximate peripheral speed of the Francis turbine if the turbine speed is 150 rpm.

Options :

1. ✔ 15.78 m/s

2. ✖ 34.32 m/s

3. ✖ 17.16 m/s

4. ✖ 7.89 m/s

PART B

Question Number : 91 Question Id : 8616631291 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In the question below given four statements followed by three Conclusions number I, II and III. You have to take the given statements to be true even if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements desire gardening commonly known facts.

Statements: Some plates are spoons.
All spoons are forks.
All forks are bowls.
Some bowls are utensils.

Conclusions: I. Some plates are bowls.
II. All spoons are bowls.
III. Some forks are utensils.

Options :

1. ✖ Only I follows

2. ✖ Only II follows

3. ✖ Only I and III follow

4. ✔ Only I and II follow

Question Number : 92 Question Id : 8616631292 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

From the given answer figures, select the one in which the question figure is hidden/embedded.

Question Figure:

Options :

1. ✔ 

2. ✖ 

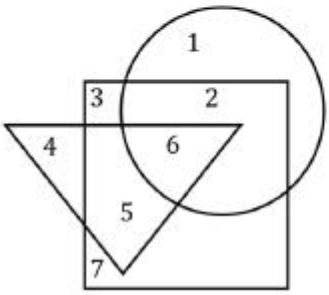
3. ✖ 

4. ✖ 

Question Number : 93 Question Id : 8616631293 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

When a survey was made regarding the preferences in the watching of TV channel, a few said that they watch only ZEE TV channel, the others liked only Sun TV channel, while others Asianet TV channel. A small percentage said that they watch all the three TV channels. In the figure given below the circle indicates the Asianet TV channel, the square Z TV and the triangle the Sun TV channel. Which number in the figure indicates the fact that some people watch all the three TV channels?



Options :

1. ✖ 2

2. ✖ 5

3. ✔ 6

4. ✖ 3

Question Number : 94 Question Id : 8616631294 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If 27 March, 1995 was a Mon day, then what days of the week was 1 November, 1995?

Options :

1. ✖ Monday

2. ✖ Sunday

3. ✖ Tuesday

4. ✔ Wednesday

Question Number : 95 Question Id : 8616631295 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Ashok started walking towards South. After walking 50 metres he took a right turn and walked 30 metres. He then took a right turn and walked 100 metres. He again took a right turn and walked 30 metres and stopped. How far and in which direction was he from the starting point?

Options :

1. ✖ 50 metres South

2. ✖ 150 metres North

3. ✖ 180 metres East

4. ✔ 50 metres North

Question Number : 96 Question Id : 8616631296 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a certain code language 'ROUTINE' is written as 'VMRGFLI'. How will be 'CRUELTY' written in that code language?

Options :

1. ✖ VPVCZRL

2. ✖ VPCVZRL

3. ✖ WPCVZRL

4. ✔ BGOVFIX

Question Number : 97 Question Id : 8616631297 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Thirty-six vehicles are parked in a parking lot in a single row. After the first car, there is one scooter. After the second car, there are two scooters. After the third car, there are three scooters and so on. Work out the number of scooters in the second half of the row.

Options :

1. ✖ 10

2. ✖ 12

3. ✔ 15

4. ✖ 17

Question Number : 98 Question Id : 8616631298 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In the following number series, a wrong number is given. Find out that wrong number.
10, 11, 24, 75, 303, 1525,9156

Options :

1. ✖ 24

2. ✖ 1525

3. ✖ 75

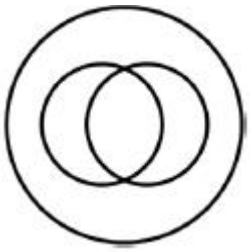
4. ✔ 303

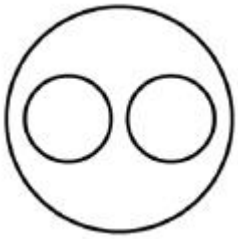
Question Number : 99 Question Id : 8616631299 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

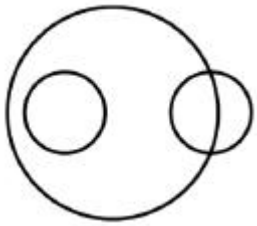
Correct Marks : 3 Wrong Marks : 1

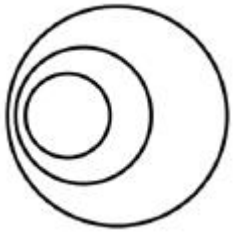
Which of the following figures represents the relation between 'Sparrows', 'Birds' and 'Crows'?

Options :

1. ✖ 

2. ✔ 

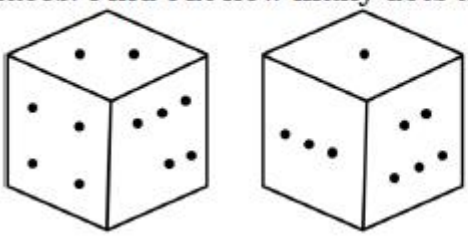
3. ✖ 

4. ✖ 

Question Number : 100 Question Id : 8616631300 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Study the two different positions of a cube given below with dots from 1 to 6 marked on its faces. Find out how many dots are there on the face opposite to that containing 4 dots.



Options :

1. ✖ 1

2. ✖ 2

3. ✔ 3

4. ✖ 5