Andhra Pradesh State Council of Higher Education

Notations :

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

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

Question Paper Name :	Chemical Engineering 20th July 2022 Shift 1
Duration :	120
Total Marks :	120
Display Marks:	No
Share Answer Key With Delivery Engine :	Yes
Calculator :	None
Magnifying Glass Required? :	No
Ruler Required? :	No
Eraser Required? :	No
Scratch Pad Required? :	No
Rough Sketch/Notepad Required? :	No
Protractor Required? :	No
Show Watermark on Console? :	Yes
Highlighter :	No
Auto Save on Console?	Yes
Change Font Color :	No
Change Background Color :	No
Change Theme :	No
Help Button :	No
Show Reports :	No
Show Progress Bar :	No
Is this Group for Examiner? :	No
Examiner permission :	Cant View
Show Progress Bar? :	No

Chemical Engineering

Section Id :	90030019
Section Number :	1
Mandatory or Optional :	Mandatory
Number of Questions :	120
Section Marks :	120
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0

Question Number : 1 Question Id : 9003002161 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

10000 Kg of an equimolar mixture of benzene and toluene is fractionated to yield a distillate containing 97.5 % (by wt) of benzene and a residue with 97.5 % (by wt) of toluene. What is the mass of benzene in the residue ?

Options :

1. ✖ 114.0 Kg
2. ✖ 125.0 Kg
3. ✖ 4497.78 Kg
4. ✔ 95.5 Kg

Question Number : 2 Question Id : 9003002162 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

It is noticed that a weighing machine gives a reading, always 0.5 less than the actual value, over its entire span. What is this called?

Options :

1. ✖ Sensitivity
2. ✔ Zero drift

3. ✖ Constant error

4. ✖ Poor reproducibility

Question Number : 3 Question Id : 9003002163 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Remedial measure for flooding in a plate column is

Options :

1. ✖ Increasing the liquid flow rate

2. ✖ Lowering of gas pressure

3. ✖ Increasing the gas flow rate

4. ✔ Shut Down and Restart after cleaning

Question Number : 4 Question Id : 9003002164 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which one of the following is law of mobile equilibrium, as the temperature rises

Options :

1. ✖ The rate also increases

2. ✖ The change accompanied by heat liberation is promoted

3. ✔ The change accompanied by heat absorption is promoted

4. ✖ There will be a general shift in equilibrium

Question Number : 5 Question Id : 9003002165 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Velocity Profile in a pipe for laminar flow of a bingham plastic fluid is

Options :

1. ✔ Flat profile with parabolic ends near the wall

2. ✖ Flat near the wall and parabolic in the middle

3. ✖ Total parabolic

4. ✖ Total flat

Question Number : 6 Question Id : 9003002166 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The highest specific energy requirement is for size reduction in

Options :

1. ✖ Rod Mill

2. ✖ Ball Mill

3. ✔ Fluid Energy Mill

4. ✖ Jaw Crusher

Question Number : 7 Question Id : 9003002167 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A

Think Time : N.A Minimum Instruction Time : 0

For an elementary liquid phase reaction, $A \longrightarrow B$ with a rate constant k, the performance equation of a CFSTR is

Options :

1. ✗ $KT = X_A(1+X_A) / (1-X_A)$

2. ✗ $kT = X_A / (1 - X_A)^2$

3. ✓ $kT = X_A / (1 - X_A)$

4. ✗ $kT\ C_{AO} = X_A / (1 - X_A)$

Question Number : 8 Question Id : 9003002168 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which controller can return the controlled variable back to the exact set point following a disturbance

Options :

1. ✗ Proportional Controller

2. ✗ Proportional Derivative Controller

3. ✗ Feed forward configuration

4. ✓ Proportional Integral Controller

Question Number : 9 Question Id : 9003002169 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A simplified representation of a series reaction, $A \rightarrow R \rightarrow S$, with rate constants k_1 and k_2 and $K_2 << k_1$, is

Options :

1. ✔ $A \rightarrow S$, with k_2

2. ✖ $A \rightarrow S$, with $(k_1 - k_2)$

3. ✖ $A \rightarrow S$, with k_1

4. ✖ $A \rightarrow R$, with k_1

Question Number : 10 Question Id : 9003002170 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

10 moles of a gas at 500 K, in a cylinder-piston assembly, are isothermally expanded from 6 bar to 1 bar. Find the work done, in joules, by the gas

Options :

1. ✖ 7448 J

2. ✔ 74483 J

3. ✖ 8958 J

4. ✖ 24942 J

Question Number : 11 Question Id : 9003002171 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For a hollow cylinder, with r_i (inside) and r_o (outside) radii, resistance to heat flow is

Options :

1. ✖ $(r_o - r_i) / k A_i$ (A_i is area based on inside radius)

2. ✗ $(r_o - r_i) / k A_m$ (A_m is arithmetic mean area)

3. ✗ $(r_o - r_i) / k A_o$ (A_o is area based on outside radius)

4. ✓ $(r_o - r_i) / k A_{gm}$ (A_{gm} is geometrical mean area)

Question Number : 12 Question Id : 9003002172 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Prandtl numbers for liquid metals are

Options :

1. ✗ High

2. ✓ Low

3. ✗ Nearly unity

4. ✗ Comparable to that of other liquids

Question Number : 13 Question Id : 9003002173 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For turbulent flow past a flat plate and zero form drag, friction factor f and Coburn factor j_D are related as

Options :

1. ✓ j_D is lower than f

2. ✗ j_D is more than f

3. ✗ j_D is equal to f

4. ✗ both are not related

Question Number : 14 Question Id : 9003002174 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

100 kg of a 35 % solution of Sodium sulfate in water is cooled to form $Na_2SO_4 .10H_2O$ crystals, leaving behind a 12 % salt solution. All compositions are on weight basis. Find the mass of crystals formed. Molecular weight of sodium sulfate is 142.

Options :

1. ✗ 28.85 kg

2. ✗ 79.27 Kg

3. ✓ 71.65 Kg

4. ✗ 52.15 Kg

Question Number : 15 Question Id : 9003002175 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

An actual heat engine generates 3744 kW of power, absorbing 10000 kW heat at 375 °C and discarding residual heat at 40 °C. What is its efficiency, as a fraction of Carnot efficiency?

Options :

1. ✗ 0.42

2. ✗ 0.79

3. ✓ 0.72

4. ✗ 0.89

Question Number : 16 Question Id : 9003002176 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A dam of width 40 m is used to hold water in a reservoir. For a water level of 12 m, what is the force acting on the dam? Take g = 9.8 m/s^2 and fluid density as 1000 kg/m^3

Options :

1. ✓ 24.3×10^6 N

2. ✗ 1.57×10^6 N

3. ✗ 54×10^6 N

4. ✗ 6.08×10^6 N

Question Number : 17 Question Id : 9003002177 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Of all the variants of polyethylene, which will have more branching?

Options :

1. ✗ LLDPE

2. ✗ HDPE

3. ✗ LDPE

4. ✓ HLDPE

Question Number : 18 Question Id : 9003002178 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The heat flux across a film of liquid caught between two parallel plates, present at 40°C and 30°C, is 3500 W/m^2. Find the film thickness. Thermal conductivity of the liquid is 0.14 W/(m-K)

Options :

1. ✗ 0.25 mm
2. ✓ 0.4 mm
3. ✗ 0.4 cm
4. ✗ 0.45 cm

Question Number : 19 Question Id : 9003002179 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A first order instrument recorded 45.7 % of the ultimate value in 4700 sec of exposure.

Find its time constant.

Options :

1. ✗ 7.33 min
2. ✗ 8 min
3. ✗ 12 min
4. ✓ 10 min

Question Number : 20 Question Id : 9003002180 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A distillation column receives a two-phase feed. If the slope of the q-line is 1.86, what fraction of the feed is in vapor phase?

Options :

1. ✖ 0.35
2. ✖ 0.468
3. ✔ 0.65
4. ✖ 0.532

Question Number : 21 Question Id : 9003002181 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two tanks of equal cross section are connected by a 1.5 m long pipe and a valve. Initial levels of fluid in the tanks are 8 m and 4 m. Valve is opened and the levels are allowed to equalize. What is the energy loss due to flow? Fluid viscosity is 1 kg /m-sec and the density is 1000 kg/m^3. Take g as10 m/s^2

Options :

1. ✖ 2×10^4 J
2. ✔ 4×10^4 J
3. ✖ $8 X 10^4$ J
4. ✖ 3×10^4 J

Question Number : 22 Question Id : 9003002182 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Find the terminal velocity for a particle of 0.2 mm, density, 2500 Kg $/m^3$, settling in water of density 1000 Kg $/m^3$ and viscosity 1 cP. Take g =10 m/s^2

Options :

1. ✔ 3.33×10^{-2} m/s
2. ✖ 33.3×10^{-2} m/s
3. ✖ 0.6×10^{-2} m/s
4. ✖ 166.67 m/s

Question Number : 23 Question Id : 9003002183 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two equal sized mixed reactors are connected in series to conduct $A \rightarrow B$. Desired final conversion is x. Rate of the reaction is $-(1 + X_A)^{-1}$. Pure A is fed to the first reactor. What intermediate concentration (leaving reactor 1) will minimize the total volume of the reactors

Options :

1. ✖ 0.5 (1-x)
2. ✖ 0.2 x
3. ✖ 1-x
4. ✔ 0.5 x

Question Number : 24 Question Id : 9003002184 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A 2-input,2-output process is described in Laplace transforms as

$(1+T_1 s)\ Y_1 = K_1X_1 + K_2X_2$ and $(1 + T_2 s)\ Y_2 = K_3X_2 + K_4X_1$

Where X_1 & X_2 are inputs and Y_1 & Y_2 are outputs. Find the gains associated with Y_1/X_2 and Y_2/X_2

Options :

1. ✗ K_2 and $K_2 + K_3K_4$

2. ✓ K_2 and $K_3 + K_2K_4$

3. ✗ K_2 and K_3

4. ✗ K_2 and $K_3 + K_1K_4$

Question Number : 25 Question Id : 9003002185 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In the SO_2 to SO_3 converter of contact sulfuric acid process, which of the following will improve equilibrium conversion to SO_3

Options :

1. ✓ Decrease in temperature, decrease in SO_2/O_2 mole ratio

2. ✗ Increase in temperature, increase in SO_2/O_2 mole ratio

3. ✗ Decrease in temperature, increase in SO_2/O_2 mole ratio

4. ✗ Increase in temperature, decrease in SO_2/O_2 mole ratio

Question Number : 26 Question Id : 9003002186 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A

Think Time : N.A Minimum Instruction Time : 0

A cube, a sphere and a cylinder (length = diameter), all of the same material and equal mass are at 400°C initially. If they are all dropped into a water bath at 25°C at the same time, which will cool first ?

Options :

1. ✗ Cylinder
2. ✗ Sphere
3. ✓ Cube
4. ✗ All equal

Question Number : 27 Question Id : 9003002187 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Bypassing is usually practiced for the following reason

Options :

1. ✗ Smaller equipment
2. ✓ Operational flexibility
3. ✗ Lower cost
4. ✗ Wastage avoidance

Question Number : 28 Question Id : 9003002188 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For heat transfer, inner to outer, in a fluid flowing through an annular space, what is the equivalent diameter ? Inner dia 0.9 m and outer dia 1.1 m

Options :

1. ✗ 1.0 m

2. ✗ 0.36 m

3. ✓ 0.49 m

4. ✗ 0.22 m

Question Number : 29 Question Id : 9003002189 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

50 m^3/min. of air is to be compressed from 101.3 kPa to 4.052 kPa, following a path of $PV^{1.25}$. For a compressor operating at 75 % efficiency, what is the power requirement?

Options :

1. ✓ 143.84 kW

2. ✗ 107.88 kW

3. ✗ 80.91 kW

4. ✗ 162.54 kW

Question Number : 30 Question Id : 9003002190 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two discs of benzoic acid are exposed(all sides), separately, to large quantities of air and water under turbulent conditions at 297 K. The mass transfer coefficients for benzoic acid in air and water are 0.47 $x10^{-2}$ and $0.9x10^{-3}$ m/s, respectively. Solubility of benzoic acid in water is 0.0246 $kmol/m^3$. Equilibrium vapor pressure of benzoic acid is 0.04 kPa. Which system will leave behind a thinner benzoic acid disc

Options :

1. ✖ Benzoic acid-air

2. ✖ Both are equivalent

3. ✖ Geometry of arrangement needed

4. ✔ Benzoic acid – water

Question Number : 31 Question Id : 9003002191 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A liquid is flowing through a pipe of length L at a flow rate of m, over a pressure drop of 2 Pa. Suddenly, the pipe is punctured midway and the liquid leaks at the rate of m / 2.

Neglecting the friction in the pipe, what is the new pressure drop across the pipe for the same inflow

Options :

1. ✔ 1.25 Pa

2. ✖ 1.50 Pa

3. ✖ 1.00 Pa

4. ✖ 2.00 Pa

Question Number : 32 Question Id : 9003002192 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A gas phase reaction, $C_2H_6 \rightarrow C_2H_4 + H_2$, conducted in a mixed flow reactor discharges a stream with products and some unconverted ethane. How many degrees of freedom does the system have?

Options :

1. ✖ 3
2. ✔ 2
3. ✖ 1
4. ✖ 4

Question Number : 33 Question Id : 9003002193 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The relation between power number and Reynolds number for a mixing tank under laminar conditions is

Options :

1. ✖ Directly proportional
2. ✔ Inversely proportional
3. ✖ Directly proportional to Re^2
4. ✖ Inversely proportional to Re^2

Question Number : 34 Question Id : 9003002194 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A zero Biot number means

Options :

1. ✗ High temperature gradient internally

2. ✗ High thermal resistance inside

3. ✗ High thermal resistance at the surface

4. ✓ Uniform temperature throughout the system

Question Number : 35 Question Id : 9003002195 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

An exothermic isomerization reaction is conducted in an adiabatic reactor at the rate of 1000 Kg/hr. Pure reactant is taken initially at 200°C. Heat capacities of reactant product are equal at 45 J/mol-K. Temperature of the reaction is 600°C. If the heat of reaction is 27 kJ/mol of reactant, what is the fractional completion of the reaction?

Options :

1. ✗ 0.50

2. ✗ 0.70

3. ✓ 0.67

4. ✗ 0.60

Question Number : 36 Question Id : 9003002196 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A

Think Time : N.A Minimum Instruction Time : 0

In a packed bed operated under turbulent conditions, the superficial velocity is doubled.

Frictional pressure drop will then show

Options :

1. ✔ 4-flod increase

2. ✖ 2-fold increase

3. ✖ 2-fold decrease

4. ✖ Increase by square root of 2 times

Question Number : 37 Question Id : 9003002197 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The instrument suitable for the measurement of very small temperature changes is

Options :

1. ✖ Radiation thermometer

2. ✖ Expansion thermometer

3. ✔ Resistance Thermometer

4. ✖ Thermocouple

Question Number : 38 Question Id : 9003002198 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

As the liquid to gas flow rate in a counter current absorption columns increased, number of

theoretical stages required for the same separation

Options :

1. ✗ Additional information needed

2. ✗ Does not change

3. ✗ increases

4. ✓ decreases

Question Number : 39 Question Id : 9003002199 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A radio-active material decays to half the initial concentration, following a first order reaction in 48 sec. What is the rate constant of the reaction?

Options :

1. ✗ 69.25 sec^{-1}

2. ✓ 0.0288 sec^{-1}

3. ✗ 0.5 sec^{-1}

4. ✗ 0.0144 sec^{-1}

Question Number : 40 Question Id : 9003002200 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A system with the characteristic equation, $10\,s^3 + 14\,s^2 + 7s + Kc = 0$ is stable for

Options :

1. ✓ $Kc < 8.8$

2. ✖ Kc < 9.8

3. ✖ Kc > 8.8

4. ✖ Kc < 7.8

Question Number : 41 Question Id : 9003002201 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Hydrotreating of crude oil is practiced

Options :

1. ✖ To treat with water

2. ✖ To improve anti knock property

3. ✔ To remove sulfur and nitrogen

4. ✖ To remove water

Question Number : 42 Question Id : 9003002202 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Thiele modulus for a solid catalyzed reaction is proportional to

Options :

1. ✖ Square root of the ratio of rate of diffusion to rate of reaction

2. ✔ the ratio of rate of reaction to rate of diffusion

3. ✖ Square root of the ratio of rate of reaction to rate of diffusion

4. ✖ The ratio of rate of diffusion to rate of reaction

Question Number : 43 Question Id : 9003002203 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Pressure drop is over estimated by 8 % in the use of an orifice meter. What is the percentage error in the measured flow rate

Options :

1. ✗ +8.00

2. ✗ -3.92

3. ✗ +2.00

4. ✓ + 3.92

Question Number : 44 Question Id : 9003002204 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Sphericity of a cylindrical particle, 2 mm in diameter and 5 mm length is

Options :

1. ✓ 0.80

2. ✗ 0.96

3. ✗ 0.21

4. ✗ 0.45

Question Number : 45 Question Id : 9003002205 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Visbreaking of a fuel oil helps in

Options :

1. ✖ Decrease in viscosity and increase in pour point

2. ✖ Increase in viscosity and increase in pour point

3. ✔ Decreasing both viscosity and pour point

4. ✖ Increase in viscosity and decrease in pour point

Question Number : 46 Question Id : 9003002206 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A 40 mole % - 60 mole % liquid mixture of components 1 & 2 is in equilibrium with its vapor. EVP of components 1 and 2 are 280 and 200 k Pa, respectively. Find y_2.

Options :

1. ✖ 0.502

2. ✖ 0.483

3. ✖ 0.498

4. ✔ 0.517

Question Number : 47 Question Id : 9003002207 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

At constant T& P, molar density of a binary system of 1 & 2 is given by $\dot{\rho} = 1 + x_2$, where x_2 is the mole fraction of component 2. What is the value of partial molar volume of component 1 at infinite dilution?

Options :

1. ✗ 0.25
2. ✓ 0.75
3. ✗ 0.50
4. ✗ 1.00

Question Number : 48 Question Id : 9003002208 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How are effectiveness factor, ε , and the Thiele modulus, φ, related for an isothermal first order catalytic reaction in a very long cylindrical pore

Options :

1. ✓ $\varepsilon = 1 / \varphi$
2. ✗ $\varepsilon = \varphi$
3. ✗ $\varepsilon = \varphi^2$
4. ✗ $\varepsilon = 1/ \varphi^2$

Question Number : 49 Question Id : 9003002209 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Methane is burnt in excess air and the final analysis of the discharge on dry basis is CO_2 – 8.69, CO – 0.46, O_2 – 4.8, and N_2 – 86.05. What is the % excess of air used?

Options :

1. ✗ 28.74

2. ✗ 26.23

3. ✓ 25.00

4. ✗ 52.46

Question Number : 50 Question Id : 9003002210 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Methane is burnt in excess air and the final analysis of the discharge on dry basis is CO_2 – 8.69, CO – 0.46, O_2 – 4.8, and N_2 – 86.05. How many moles of oxygen are consumed for water formation per 100 moles of dry gas formed ?

Options :

1. ✗ 18.30

2. ✗ 16.46

3. ✗ 8.69

4. ✓ 9.15

Question Number : 51 Question Id : 9003002211 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Thermocouple in a thermal well is an example for

Options :

1. ✔ An interacting second order system
2. ✖ A non-interacting second order system
3. ✖ A natural second order system
4. ✖ An underdamped second order system

Question Number : 52 Question Id : 9003002212 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following shows the greatest deviation from ideality at 350 K and 1 atm pressure. Antonnie equation for component 1 is $\ln P^{sat} = 11.78 - 3541/(T+1.23)$

Options :

1. ✖ $x_A = 0.5, p_A = 0.25$
2. ✖ $x_A = 0.5, y_A = 0.25$
3. ✔ $x_A = 0.35, y_A = 0.60$
4. ✖ $x_A = 0.5, y_A = 0.50$

Question Number : 53 Question Id : 9003002213 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A filtration unit is being operated at constant pressure in an industrial unit. If a higher solid concentration feed, obtained by evaporating half the solvent, is used, what will be the impact on filtration time. Neglect filter medium resistance

Options :

1. ✔ reduction by a factor of 2

2. ✖ increase by a factor of 2

3. ✖ reduction by a factor 4

4. ✖ reduction by a factor of $\sqrt{2}$

Question Number : 54 Question Id : 9003002214 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A suggested process modification is expected to yield a net cash flow of INR 250,000 at the end of each year for a period of 3 years. Company's policy demands a minimum return of 10%. What is the highest cost that can be allowed for the modification now?

Options :

1. ✖ INR 600 000

2. ✔ INR 621 500

3. ✖ INR 750 000

4. ✖ INR 833 333

Question Number : 55 Question Id : 9003002215 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The catalyst used in the oxidation of xylene to Phthalic anhydride is

Options :

1. ✖ Silver

2. ✗ Palladium

3. ✗ Platinum

4. ✓ V_2O_5

Question Number : 56 Question Id : 9003002216 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A gas phase reaction, A→ R + S, is conducted in a PFR, with a feed containing 80 mole % A and 20 mol % inert. If the conversion of A is 60 %, what fraction of A is converted?

Options :

1. ✗ 0.21

2. ✓ 0.27

3. ✗ 0.25

4. ✗ 0.167

Question Number : 57 Question Id : 9003002217 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two spherical particles, made up two different materials, have the same outer diameter. First sphere, S is completely solid and the second one, H, is hollow with an inner diameter half the outer diameter. If their terminal velocities in a fluid of density ρ are equal, find the ratio of densities, ρ_H/ρ_S of the two particles

Options :

1. ✗ 1.00

2. ✗ 0.875

3. ✓ 1.143

4. ✗ 0.5

Question Number : 58 Question Id : 9003002218 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A wet sheet, 25 cm x 25 cmx 1 cm and weighing 1 Kg, was dried in a laboratory drier. Drying took place from both the sides The weight of sheet after 600 sec of drying was found to be 0.75 Kg. From this information, what is the expected time of drying from an initial weight of 4 Kg to a final weight of 3 kg of 1 m x 1 m x 1 cm sheet, exposed only one side. Assume similar drying conditions and whole drying is under constant drying rate period.

Options :

1. ✗ 150 sec

2. ✗ 2400 sec

3. ✗ 600 sec

4. ✓ 300 sec

Question Number : 59 Question Id : 9003002219 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A start-up wanted to sell its products at a selling price of Cs per unit. Its total production cost is 0.6 Cs per unit. Later, the company is forced to lower its selling price by 10%, to boost up the sales. All else remaining the same, by what percentage will this increase the payout time?

Options :

1. ✔ 11 %
2. ✖ 9 %
3. ✖ 10 %
4. ✖ 66 %

Question Number : 60 Question Id : 9003002220 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A process with a transfer function , $6/(Ts+1)^3$ is put in a feed forward loop. If a disturbance, $2 / (Ts+1)$ is expected, what will be the transfer function of controller for perfect disturbance rejection ?

Options :

1. ✖ $3 / (Ts+1)^2$
2. ✔ $3 (Ts+1)^2$
3. ✖ $0.33(Ts+1)^2$
4. ✖ $3 / (Ts+1)$

Question Number : 61 Question Id : 9003002221 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A

Think Time : N.A Minimum Instruction Time : 0

Two long concentric cylinders, one inside the other, have their surface areas in the ratio of 0.5 . What are their view factors, F_{21} and F_{22} ?

Options :

1. ✖ 0.5 & 1.0

2. ✖ 1.0 & 0.5

3. ✔ 0.5 & 0.5

4. ✖ 1.0 & 1.0

Question Number : 62 Question Id : 9003002222 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A first order reaction, $A \rightarrow B$ is conducted in a packed bed reactor with 6 mm pellets. In a given time, a conversion of 74 % is realized under strong pore diffusion regime. What will be the conversion if 15 mm pellets replace the 6 mm pellets, all else remaining the same ?

Options :

1. ✖ 29.6 %

2. ✔ 74 %

3. ✖ 66.6 %

4. ✖ Additional information needed.

Question Number : 63 Question Id : 9003002223 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Acrylonitrile is usually derived from

Options :

1. ✔ Propylene
2. ✖ Butylene
3. ✖ Ethane
4. ✖ Ethylene

Question Number : 64 Question Id : 9003002224 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The dependence of Pressure drop across a non-compressible cake and specific surface area of the solid particles (Sp) is given by

Options :

1. ✖ Δ P proportional to Sp
2. ✔ Δ P proportional to Sp^2
3. ✖ Δ P proportional to 1 / Sp^2
4. ✖ Δ P proportional to 1 / Sp

Question Number : 65 Question Id : 9003002225 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For a liquid phase reaction, ΔH_{298} and ΔG_{298} are given as 5420 and 7350 J/mol, respectively. Find the equilibrium constant at 80°C

Options :

1. ✖ 19.492

2. ✗ 19.472

3. ✗ 19.502

4. ✓ 19.482

Question Number : 66 Question Id : 9003002226 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The controller that produces slow, oscillatory response is

Options :

1. ✓ Proportional Integral Controller

2. ✗ Proportional Controller

3. ✗ Proportional Integral Derivative Controller

4. ✗ Proportional Derivative Controller

Question Number : 67 Question Id : 9003002227 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Major ingredient of Talcum powder is

Options :

1. ✗ Hydrated sodium aluminum silicate

2. ✗ Hydrated aluminum silicate

3. ✓ Hydrated magnesium silicate

4. ✗ Hydrated zinc silicate

Question Number : 68 Question Id : 9003002228 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A hollow spherical metallic component, of diameter 75 mm is cooled in air, at 25°C. When the temperature of the component is 150°C, the cooling rate is 0.0833 °C/sec. There are no thermal gradients inside the component. what is the value of heat transfer coefficient? Metal density is 2500 Kg/m^3 and its heat capacity 0.82 kJ/Kg-°C

Options :

1. ✖ 0.0171 W/m^2-°C

2. ✔ 17.1 W/m^2-°C

3. ✖ 102.6 W/m^2-°C

4. ✖ 18.04 W/m^2-°Cl

Question Number : 69 Question Id : 9003002229 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The feed to a differential distillation unit contains 75 mole % of more volatile component. If the distillation is conducted till the residue contains 50 mole % more volatile component, what fraction of the system is vaporized? The equilibrium distribution is $y = 0.75\ x + 0.3$

Options :

1. ✖ 0.67

2. ✖ 0.87

3. ✖ 0.41

4. ✔ 0.13

Question Number : 70 Question Id : 9003002230 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A piece of equipment costing INR 100 000/- is expected to have a 10 year life and zero salvage value. What is the book value of the equipment at the end of 5 years, if double declining balance method is used to calculate depreciation?

Options :

1. ✖ INR 26214

2. ✖ INR 40960

3. ✔ INR 32768

4. ✖ INR 50000

Question Number : 71 Question Id : 9003002231 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A fluidized bed, 0.7 m dia and 0.7 m high, of spherical particles has a porosity of 0.43.

Pressure drop per unit length of the bed is given by

$$\Delta P / L \text{ (in N/m}^3) = 4.6 \times 10^5\, U_{mf} + 0.9 \times 10^7\, U_{mf}^2, \qquad U_{mf} \text{ in m/s}^2.$$

Determine the minimum fluidization velocity, in m/s.

Options :

1. ✔ 0.0127

2. ✖ 0.0253

3. ✖ 0.076

4. ✖ 0.0013

Question Number : 72 Question Id : 9003002232 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A reactant P reacts on a solid to yield R & S as per the reactions

$A \rightarrow R, \quad -r_A = k_1 C_A \qquad \text{and} \quad A \rightarrow S, \quad -r_A = k_2 C_A^2$

What will be the ratio of instantaneous fractional yield, in the presence and absence of pore diffusion ? Assume negligible film resistance

Options :

1. ✖ $= k_1 / k_2$

2. ✖ < 1

3. ✖ > 1

4. ✔ $= 1$

Question Number : 73 Question Id : 9003002233 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Air is passed over a catalyst at a very high temperature for oxidation. The following reactions take place : $N_2 + O_2 \rightarrow 2\,NO$ and $N_2 + 2O_2 \rightarrow 2NO_2$.

The discharge is found to contain 2 moles NO2 for every 3 moles of NO. Oxygen is completely converted. Find the percentage conversion of nitrogen

Options :

1. ✖ 26.6

2. ✖ 38.0

3. ✔ 30.4

4. ✖ 52.7

Question Number : 74 Question Id : 9003002234 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

An equimolar methanol-water system is in equilibrium with its vapor at 50°C and 80 kPa. Equilibrium vapor pressures of methanol and water are 80°C and 20 kPa, respectively. Vapor composition of methanol is 0.76. What is the excess Gibbs free energy of the liquid mixture?

Options :

1. ✖ 578 J/mol

2. ✖ 1312 J/mol

3. ✖ 902 J/mol

4. ✔ 1481 J/mol

Question Number : 75 Question Id : 9003002235 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

While calculating relative volatility of a binary mixture, a student, by oversight, used mass fractions and reported a value of 2.1. The molecular weights of more volatile and less volatile components are 78 and 92. What will be the relative volatility if mole fractions are used.

Options :

1. ✖ 0.85

2. ✔ 2.10

3. ✖ 2.48

4. ✖ 1.78

Question Number : 76 Question Id : 9003002236 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A first order system, upon introduction of 2 units impulse, provided a response of $3e^{-0.6t}$.

Determine the gain and time constant of the system

Options :

1. ✔ 2.55 and 100 sec

2. ✖ 5.01 and 100 sec

3. ✖ 5.01 and 36 sec

4. ✖ 2.55 and 36 sec

Question Number : 77 Question Id : 9003002237 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A slab of thickness t is insulated on one side (x = 0) and the other edge (x = t) is maintained

at a temperature T. An internal heat source generates a uniform heat load at the rate of q w/m^2

Assuming steady conditions and 1- dimensional heat conduction, find the heat flux at x = t

Options :

1. ✖ 0.5 q t

2. ✔ q t

3. ✗ $q\,t^2$

4. ✗ $2\,q\,t$

Question Number : 78 Question Id : 9003002238 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A liquid phase reaction, $A \rightarrow R + S$ is conducted in a CSTR at a constant temperature of 40°C. $C_{A0} = 12$ mol/L and after a space time of 4 minutes, $C_{AM} = 5$ mol/L. The reaction is kinetically represented by $-r_A = k\,C_A^{0.5}$, mol/L-min

A PFR of the same volume is hooked on to the CSTR, after CSTR. What is the exit concentration C_{AP} of the PFR.

Options :

1. ✗ 1.3417

2. ✗ 0.6708

3. ✗ 0.8190

4. ✓ 0.4500

Question Number : 79 Question Id : 9003002239 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For a control system, as the roots of the characteristic equation are shifted towards the imaginary axis, the response will become

Options :

1. ✗ Slow and steady

2. ✗ Slow and oscillatory

3. ✔ Fast and oscillatory

4. ✖ Fast and stable

Question Number : 80 Question Id : 9003002240 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Knuckle radius is a term frequently used with

Options :

1. ✔ Torispherical head

2. ✖ Conical head

3. ✖ Hemispherical head

4. ✖ Flat head

Question Number : 81 Question Id : 9003002241 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Once fluidized, the bed height (H) changes with bed voidage (ε) as

Options :

1. ✖ Proportional to ε

2. ✖ Proportional to $(1 - \varepsilon)^{0.5}$

3. ✔ Proportional to $(1- \varepsilon)$

4. ✖ Proportional to $(1 - \varepsilon)^2$

Question Number : 82 Question Id : 9003002242 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A drop of liquid shrinks in size due to a reaction, while falling from a height, according to

$D = D_o (1 - t / t_o)$, where D and D_o are diameters at zero time and at time t, respectively.

Assuming that the drop is travelling at its terminal velocity under Stokes law, at what

distance does the drop vanish? $\Delta\rho$ = density difference and μ = viscosity

Options :

1. ✖ $g D_o^2 \Delta\rho\ \ t_o / 18_u\mu$

2. ✔ $g D_o^2 \Delta\rho\ \ t_o / 54_u\mu$

3. ✖ $g D_o^2 \Delta\rho\ \ t_o / 36\ \mu$

4. ✖ $g D_o \Delta\rho\ \ t_o / 54_u\mu$

Question Number : 83 Question Id : 9003002243 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the present worth of cash flow of INR 25000/- received at the end of each year for

10 consecutive years. Take rate of interest as 8 % compounded annually.

Options :

1. ✔ INR 167919

2. ✖ INR 181355

3. ✖ INR 152678

4. ✖ INR 204555

Question Number : 84 Question Id : 9003002244 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The difference between stagnation and static pressures at the same location in the steady and incompressible flow of a fluid is 24 mm Hg. What is the fluid velocity ? Fluid density is 1.20 Kg/m^3, mercury density is 13600 Kg/m^3 and g is 10 m/s^2

Options :

1. ✖ 51.7 m/s

2. ✔ 73.7 m/s

3. ✖ 80.8 m/s

4. ✖ 5440 m/s

Question Number : 85 Question Id : 9003002245 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For a reaction, the half-life of the reaction is half of the full lifetime (100% conversion).

Find the reaction order

Options :

1. ✖ First order

2. ✖ Half order

3. ✖ Second order

4. ✔ Zero order

Question Number : 86 Question Id : 9003002246 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two infinitely large parallel plates, P & Q are placed at a distance of d apart in vacuum. Temperatures of the two plates are Tp and Tq (Tp>Tq). If an infinitely large thermal shield S is placed in parallel and exactly at the midpoint, in between P & Q by what fraction does the steady state radiative heat flux decrease. Assume that the emissivities of all plates are equal

Options :

1. ✖ 0.25

2. ✖ 0.75

3. ✔ 0.5

4. ✖ 0.0

Question Number : 87 Question Id : 9003002247 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For a pure liquid, equilibrium vapor pressure changes with temperature at 0.12 bar / °K, in the temperature range of 250 to 350 K. The boiling point of the liquid under 1 bar pressure is 300 K. What is the boiling point of the liquid under 3 bar pressure

Options :

1. ✖ 336.0 K

2. ✖ 349.4 K

3. ✖ 266.7 K

4. ✔ 316.7 K

Question Number : 88 Question Id : 9003002248 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

An activated charcoal adsorbent is used to reduce phenol concentration in waste waters from 0.05 to 0.01 mol/L. The adsorption isotherm is represented by $y = 0.027\, x^{0.33}$, where x is the phenol concentration in solid (mol/g solid) and y is the phenol concentration in water (mol/L). Find the minimum adsorbent required per liter of waste water.

Options :

1. ✖ 5.77 g

2. ✔ 6.77 g

3. ✖ 7.77 g

4. ✖ 5.91 g

Question Number : 89 Question Id : 9003002249 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Steam at 100°C is condensing on a vertical steel plate, causing a laminar condensate flow. Assuming that the physical properties of condensate and steel do not change much, what is the ratio of Nusselt numbers , Nu_A / Nu_B, at two locations , A & B, present at 20°C and 60°C, respectively

Options :

1. ✔ 1.19

2. ✖ 0.84

3. ✗ 2.51

4. ✗ 2.11

Question Number : 90 Question Id : 9003002250 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A centrifugal pump delivers water at $25\ m^3/S^2$ from a tank, at ground level to another tank at a height of H, through a vertical pipe of 20 cm diameter. Both the tanks are open to the atmosphere. The pump receives 92 kW of power and is 80 % efficient. Given fanning friction factor is 0.00375, $g=10\ m/s^2$, water density = 1g/cc. What is the maximum H that the water can be delivered?

Options :

1. ✗ 29.44 m

2. ✗ 27.18 m

3. ✓ 21.89 m

4. ✗ 26.27 m

Question Number : 91 Question Id : 9003002251 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two tenders for the supply and installation of a distillation column were received.

Quote 1 : Installed cost – INR 125 lakhs, Cost of cooling - INR 6 lakhs/year and cost of steam INR 12 lakhs per year

Quote 2 : Installed cost – INR 110 lakhs, Cost of cooling - INR 8 lakhs/year and cost of steam INR 18 lakhs per year

Annual fixed charges, in both the cases, are 10 % of the installed cost. How much is the total annual cost of the better option?

Options :

1. ✔ INR 30.5 lakhs
2. ✖ INR 37.0 lakhs
3. ✖ INR 18 lakhs
4. ✖ INR 26 lakhs

Question Number : 92 Question Id : 9003002252 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

At 25°C, activated carbon adsorbs, at partial pressures of 15 and 85 mm Hg, acetone in the amounts of 0.1 and 0.4 g acetone/g carbon, respectively. Assuming the applicability of Langmuir isotherm, estimate the adsorption, Kg acetone/ Kg carbon at 50 mm Hg partial pressure.

Options :

1. ✖ 0.25 Kg/Kg
2. ✖ 0.15 Kg/Kg
3. ✖ 0.366 Kg/Kg
4. ✔ 0.273 Kg/Kg

Question Number : 93 Question Id : 9003002253 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A gas follows virial equation of state, $Z = 1 + 1.2 \times 10^{-4} P/RT$. Find the Residual Gibbs free energy, g^R, at 30°C and 250 KPa

Options :

1. ✗ 0.0012 J/mol

2. ✗ 0.120 J/mol

3. ✓ 0.0119 J/mol

4. ✗ 0.099 J/mol

Question Number : 94 Question Id : 9003002254 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a shell and tube heat exchanger, a cold fluid undergoing a temperature change from 25°C (T_A) to 85°C (T_B) causes the condensation of steam at 120°C (T_H).

Energy balance for the exchanger : $\ln [(T_H - T_A)/(T_H-T_B)] = UA / m\ Cp$

For heat transfer coefficient : $Nu = 0.023\ Re^{0.8}\ Pr^{0.33}$.

A is the heat transfer area, m is the mass flow rate of the cold fluid and Cp is the heat capacity.

Resistance to heat transfer lies, mostly, on the tube side. Wall resistance is negligible.

If the mass flow rate of the cold fluid is doubled, what will be its outlet temperature.

All other parameters remain the same

Options :

1. ✗ 77°C

2. ✗ 90°c

3. ✗ 75°C

4. ✓ 80°C

Question Number : 95 Question Id : 9003002255 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The open loop transfer function of a process is given by $G_{OL} = Kc\ e^{-2s}/S$

What is the ultimate gain of the controller for closed loop stability

Options :

1. ✗ 1.047
2. ✓ 0.785
3. ✗ 1.571
4. ✗ 0.628

Question Number : 96 Question Id : 9003002256 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Fanning friction factor, f, is proportional to $Re^{-0.2}$ for a flow through a smooth pipe. By what factor does the pressure drop vary if the velocity is doubled, all else remaining constant

Options :

1. ✓ 3.48
2. ✗ 1.15
3. ✗ 4.59
4. ✗ 2.30

Question Number : 97 Question Id : 9003002257 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which performance criterion helps in designing a controller that can handle large errors in the controlled variable?

Options :

1. ✖ One quarter decay ratio

2. ✔ Integral of the square of the error (ISE)

3. ✖ Integral of the absolute value of error (IASE)

4. ✖ Integral of time-weighted absolute error (ITAE)

Question Number : 98 Question Id : 9003002258 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a steady state flow process, sulfuric acid , at 25°C and a flow rate of 8 Kg/h, and water, at 10°C and 12 Kg/h flow rate are mixed to form aqueous sulfuric acid.

If the final solution leaves at 50°C, what will be the heat removal rate ?

$Cp_{,water,298}$ = 4.184 KJ/Kg-K, $Cp_{,\ aqu.H2SO4,298}$ = 2.8 KJ/Kg solution-K

ΔH mixing, 298 = - 700 KJ/Kg H_2SO_4

Options :

1. ✖ 4953 KJ /h

2. ✖ 5600 KJ /h

3. ✖ 4200 KJ /h

4. ✔ 3447 KJ /h

Question Number : 99 Question Id : 9003002259 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a closed system, an ideal gas is adiabatically and irreversibly compressed from 2 bar, 300 K to 5 bar. taking 1.5 times more work than the reversible work, between the same pressure levels and the same initial temperature. Cp = 3.5 R and Cv = 2.5 R. What is the temperature of the gas at the final pressure?

Options :

1. ✗ 300 K

2. ✗ 389 K

3. ✓ 434 K

4. ✗ 396 K

Question Number : 100 Question Id : 9003002260 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many theoretical stages, at the least, are required for separating an equimolar mixture in to a distillate containing a distillate with 90 mole % of more volatile and a residue containing 90 mole % of the less volatile components. The relative volatility of the system is constant at 1.63

Options :

1. ✓ 9

2. ✗ 8

3. ✗ 10

4. ✗ 7

Question Number : 101 Question Id : 9003002261 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Natural rubber is mainly

Options :

1. ✔ Polyisoprene
2. ✖ Polystyrene
3. ✖ Polyvinyldene
4. ✖ Polybutadiene

Question Number : 102 Question Id : 9003002262 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which valve causes the highest friction loss

Options :

1. ✖ Gate valve
2. ✖ Butterfly valve
3. ✖ Ball valve
4. ✔ Globe valve

Question Number : 103 Question Id : 9003002263 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following closures provide the strongest shape

Options :

1. ✖ Conical head

2. ✖ Torispherical head

3. ✔ Hemispherical head

4. ✖ Flat head

Question Number : 104 Question Id : 9003002264 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a single stage extraction, 10 kg of solvent , with 1 mol % solute are mixed with 30 Kg of feed containing 20 mole % solute. An extract with 50 mole % solute and a raffinate with 5 mole % solute are obtained. What is the mass ratio of extract to raffinate collected?

Options :

1. ✖ 0.286

2. ✔ 0.295

3. ✖ 0.272

4. ✖ 0.333

Question Number : 105 Question Id : 9003002265 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Following a pulse tracer input, the concentration of the tracer in the exit stream followed the trend : $C(t) = t$ $(0<t<1)$, $C(t)= -t$ $(1<t<2)$ and $C(t) = 0$ $(t>2)$.

What is the mean residence time in the reactor?

Options :

1. ✖ 1/8

2. ✖ 3/8

3. ✔ 1

4. ✖ 1/3

Question Number : 106 Question Id : 9003002266 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a heat exchanger, the raio of outer diameter to inner diameter of a tube is 1.2. If the overall heat transfer coefficient based on inner area is U_o, what will be the overall heat transfer coefficient based on outer area?

Options :

1. ✖ 0.69 U_o

2. ✖ 1.44 U_o

3. ✖ 1.2 U_o

4. ✔ 0.83 U_o

Question Number : 107 Question Id : 9003002267 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which one of the following fluids is a reference for cetane number of fuels

Options :

1. ✖ Iso octane

2. ✔ Hexadecane

3. ✗ n-heptan

4. ✗ n-hexane

Question Number : 108 Question Id : 9003002268 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How are specific speed(RPM), N, and Head m/Kg),H, related

Options :

1. ✓ N is proportional to 1 / $H^{0.75}$

2. ✗ N is proportional to 1/ $H^{0.5}$

3. ✗ N is proportional to $H^{-0.75}$

4. ✗ N is proportional $H^{0.62}$

Question Number : 109 Question Id : 9003002269 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a tray column, mole fractions of more volatile component in the vapor entering and leaving a tray are 0.45 and 0.52, respectively. The equilibrium relation is y = 2x. What is the Murphree efficiency, if the mole fractions of more volatile component n the liquid entering and leaving the tray are 0.34 and 0.29

Options :

1. ✗ 1.40

2. ✗ 0.70

3. ✗ 0.34

4. ✔ 0.54

Question Number : 110 Question Id : 9003002270 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The total cost of an equipment in terms of the operating variables, x and y, is

$C_T = x + 10000 / xy + 2y + 8$. What is the optimal value of C_T

Options :

1. ✔ 89.43

2. ✖ 81.43

3. ✖ 75.86

4. ✖ 97.43

Question Number : 111 Question Id : 9003002271 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For what values of a and b the equations $x+2y+3z = 4$, $x+3y+4z = 5$, $x+3y+az = b$ have an infinite number of solutions

Options :

1. ✔ $a = 4, b = 5$

2. ✖ $a \neq 4, b \neq 5$

3. ✖ $a \neq 4, b = 5$

4. ✖ $a = 4, b \neq 5$

Question Number : 112 Question Id : 9003002272 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Eigen values of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ are

Options :

1. ✗ 0, 0, - 14

2. ✗ 1, 4, 9

3. ✗ 0, 6, 8

4. ✓ 0, 0, 14

Question Number : 113 Question Id : 9003002273 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The value of Cauchy's mean value theorem for $f(x) = 1/x^2$ and $g(x) = 1/x$ defined on [a, b], $0 < a < b$ is

Options :

1. ✗ (a-b)/2

2. ✗ √(ab)

3. ✗ (a+b)/2

4. ✓ 2ab/(a+b)

Question Number : 114 Question Id : 9003002274 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A

Think Time : N.A Minimum Instruction Time : 0

Value of normal vector to the surface $x^2 y + 2xz^2 = 8$ at the point (1, 0, 2)

Options :

1. ✗ $i + j + 8k$

2. ✗ $4(i + j) + 3k$

3. ✓ $8i + 8k$

4. ✗ $8i + 8j - k$

Question Number : 115 Question Id : 9003002275 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

General Solution of $\frac{d^2y}{dx^2} + 4y = 0$

Options :

1. ✓ $y = C_1 \mathrm{Cos}2x + C_2 \mathrm{Sin}2x$

2. ✗ $y = C_1 \mathrm{Cos}2x - C_2 \mathrm{Sin}2x$

3. ✗ $y = C_1 e^{2x} + C_2 e^{-2x}$

4. ✗ $y = C_1 e^{2x} - C_2 e^{-2x}$

Question Number : 116 Question Id : 9003002276 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

General Solution of Sinpx Cosy = Cospx Siny + p

Options :

1. ✗ $y = cx + \text{Sin}y$

2. ✓ $y = cx - \text{Sin}^{-1}c$

3. ✗ $y = cx + \text{Sin}^{-1}c$

4. ✗ $y = cx - \text{Sin}c$

Question Number : 117 Question Id : 9003002277 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $f(z) = \frac{e^{2z}}{z-2}$, and C: $|z| = 3$. The value of $\int_c f(z)dz$ is

Options :

1. ✗ $2\pi i$

2. ✗ $2\pi i\, e^{-4}$

3. ✗ $-2\pi i$

4. ✓ $2\pi i\, e^{4}$

Question Number : 118 Question Id : 9003002278 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If $f(z) = \frac{e^{2z}}{(z-1)^3}$, then the Residue at $z = 1$ is

Options :

1. ✗ πe^{4}

2. ✓ $2e^{2}$

3. ✖ $-2 \pi i e^4$

4. ✖ e^2

Question Number : 119 Question Id : 9003002279 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The Probability of getting no head in 10 tosses of fair coin is

Options :

1. ✔ .01

2. ✖ .02

3. ✖ .03

4. ✖ .04

Question Number : 120 Question Id : 9003002280 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Using Newton- Raphson method, the iterative formula for $1/\sqrt{N}$ is

Options :

1. ✖ $1/2\,(x_n + N/x_n)$

2. ✖ $1/2\,(x_n + N/x_n)$

3. ✖ $1/2\,(x_n + Nx_n)$

4. ✔ $1/2\,(x_n + 1/Nx_n)$