

National Testing Agency

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Fundamentals of Chemical Engineering

Group Number : 1
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Break time: 0
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Fundamentals of Chemical Engineering

Section Id : 90958255
Section Number : 1
Section type : Online
Mandatory or Optional: Mandatory
Number of Questions: 77
Number of Questions to be attempted: 77
Section Marks: 100
Display Number Panel: Yes
Group All Questions: No

Sub-Section Number: 1
Sub-Section Id: 90958258
Question Shuffling Allowed : Yes

Question Number : 1 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The dimension of 'Power' is

a) $\frac{ML^3}{T^2}$ b) $\frac{MT^2}{L^3}$ c) $\frac{ML^2}{T^3}$ d) $\frac{L^2}{MT^3}$

Options :

1. A

2. B
3. C
4. D

Question Number : 2 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Repeating variable is chosen based on

- a) Geometric and kinematic property only
- b) Kinematic and dynamic property only
- c) Geometric and dynamic property only
- d) None of the above

Options :

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

Question Number : 3 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Degree of freedom is defined as

- a) Number of unknown variables – Number of equations
- b) Number of unknown variables – Number of independent equations
- c) Number of independent equations – Number of unknown variables
- d) Number of equations – Number of unknown variables

Options :

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

Question Number : 4 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

When a flowsheet is scaled, which of the following does not change?

- a) Total mass flowrate of streams
- b) Total molar flowrate of streams
- c) Mass fraction of components in a stream
- d) Molar flowrate of components in a stream

Options :

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

Question Number : 5 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Choose the incorrect statement about extent of reaction

- a) Unit of extent of reaction is moles
- b) Extent of reaction is dimensionless
- c) It is related to conversion
- d) It indicates the progress of a reaction

Options :

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

Question Number : 6 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Identify the correct statement relating overall and per pass conversion

- a) Overall conversion $< 100\%$ for incomplete separation of reactants and products
- b) Overall conversion is based on reactant input to and output from reactor
- c) Single-pass conversion is based on reactant input to and output from the process
- d) Overall conversion is $> 100\%$

Options :

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

Question Number : 7 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Number of intensive variables that can be specified independently for a closed system containing pure liquid water is

- a) 3
- b) 2
- c) 1
- d) 0

Options :

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

Question Number : 8 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

For a binary vapour-liquid system (1 and 2 represents the two components, P is the total pressure, P^{sat} is the vapour pressure, x is the liquid phase composition) of given liquid phase composition at a given temperature, the equation $P = x_1 P_1^{sat} + x_2 P_2^{sat}$ can be used to solve for

- a) Dew point pressure
- b) Bubble point pressure
- c) Dew point temperature
- d) Bubble point temperature

Options :

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

Question Number : 9 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

If the molal humidity of an air sample is 0.4, the absolute humidity of the sample will be

- a. 0.249
- b. 0.643
- b. 0.622
- d. 0.294

Options :

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

Options :

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

Question Number : 13 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The maximum adiabatic flame temperature in air as compared to that in pure oxygen is

- a) Much lower
- b) Much higher
- c) same
- d) either lower or higher, depends on the type of fuel

Options :

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

Question Number : 14 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The adiabatic flame temperature of a fuel is dependent on the initial temperature of

- a) fuel b) air c) both a and b d) neither a nor b

Options :

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

Question Number : 15 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following equations can represent the unsteady state heat conduction in a solid material with constant conductivity.

- (a) $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$
(b) $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2} + \beta \frac{\partial^3 T}{\partial x^3}$
(c) $0 = \alpha \frac{\partial^2 T}{\partial x^2}$
(d) $0 = \alpha \frac{\partial^2 T}{\partial x^2} + \beta \frac{\partial T}{\partial x}$

Options :

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

Question Number : 16 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which one of these is the example of Forced convection ?

- a) Cooling your hot food in front of a fan.
- b) Oceanic circulation.
- c) Boiling of water.
- d) None of these

Options :

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

Question Number : 17 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following conditions determine the forced convection regime?

- a) $Gr_L/Re_L^2 \gg 1$
- b) $Gr_L/Re_L^2 \sim 1$
- c) $Gr_L/Re_L^2 \ll 1$
- d) None of these

Options :

1. A
2. B
3. C

4. D

Question Number : 18 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Consider flow through a rectangular duct of sides a and b , the equivalent diameter for pressure drop calculation and for heat transfer calculation will be respectively?

- a) $(b^2 - a^2)/a, (b - a)$
- b) $(b^2 - a^2)/b, (b - a)$
- c) $(b - a), (b^2 - a^2)/b$
- d) $(b - a), (b^2 - a^2)/a$

Options :

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

Question Number : 19 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Consider a flow over a flat plate and at a distance x from the leading edge local heat transfer coefficient h_x is defined as $(x^3 + 2.5x + 4)$ W/m²K. What will be the average heat transfer coefficient at a distance 0.8 m from the leading edge ?

- a) 5.13 W/m²K
- b) 4.56 W/m²K
- c) 6.78 W/m²K
- d) None of these

Options :

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

Question Number : 20 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which is the correct sequence of boiling regimes when temperature of the heating element is increased in boiling experiments?

- (A): Free convective boiling – film boiling – transition boiling – nucleate boiling
- (B): Free convective boiling – nucleate boiling – transition boiling – film boiling
- (C): Free convective boiling – transition boiling - film boiling – nucleate boiling
- (D): Free convective boiling – transition boiling - nucleate boiling – film boiling

Options :

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

Question Number : 21 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Heat transfer coefficient (h) in the free convective boiling regime varies with temperature difference between the heating element and the liquid (ΔT) as:

- (A): $h \propto \Delta T^2$
- (B): $h \propto \Delta T^{1.25}$
- (C): $h \propto \Delta T^1$
- (D): $h \propto \Delta T^{0.25}$

Options :

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

Question Number : 22 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Identify the correct answer

- a) Mass transfer always takes place in the direction of flow
- b) Mass transfer always takes place due to temperature gradient
- c) Mass transfer always takes place in the opposite direction of flow
- d) Mass and heat transfer are similar processes

Options :

- 1. A
- 2. B

3. C

4. D

Question Number : 23 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Example of mass transfer is

- a) Transportation by rod
- b) Electrical heating system
- c) Dissolution of copper-sulfate crystal in water
- d) Reflection of sun light on a mirror

Options :

1. A

2. B

3. C

4. D

Question Number : 24 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Gas mass diffusivity is proportional to

- a) $T^{3/2}$
- b) $T^{1/2}$
- c) T^2
- d) $T^{4/3}$

Options :

1. A

2. B

3. C

4. D

Question Number : 25 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Penetration theory assumes

- a) Stagnant film at the interface
- b) Eddy contact time is zero
- c) All eddies residence time is same
- d) Eddies have different contact time

Options :

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

Question Number : 26 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the physical significance of NTU?

- a) It indicates difficulty in separation.
- b) It is the number of units required to achieve unit change in the concentration of solute gas.
- c) It gives a measure of the interfacial area of contact in a packed column.
- d) None of these

Options :

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

Question Number : 27 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Height of packing can be evaluated as

- a) $NTU \times HTU$
- b) HTU/NTU
- c) $1/HTU$
- d) None of these

Options :

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

Question Number : 28 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

For stripping, the driving force at the pinch point will be

- a) Maximum.
- b) Zero.
- c) Minimum.
- d) None of these

Options :

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

Question Number : 29 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the physical significance of the stripping factor S ?

- a) It is the ratio of the slopes of the equilibrium line and the operating line.
- b) It is ratio of the individual gas-phase and liquid-phase mass transfer coefficients.
- c) It is fractional absorption of the feed.
- d) None of these

Options :

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

Question Number : 30 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In a solution (A and B); The vapour pressure of A is 265 mmHg and B is 355 mmHg; Find the relative volatility?

- a) 1.38
- b) 0.75
- c) 2
- d) None of the mentioned

Options :

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

Question Number : 31 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Find the reflux ratio if the feed, residue and reflux rate is 100, 40 and 50 mole/hr.

- a) 1.25
- b) 0.83
- c) 1.5
- d) 1

Options :

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

Question Number : 32 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The use of vapour produced from the reboiler is

- a) To strip out more volatile component from liquid
- b) To strip out low volatile component from the liquid
- c) To increase the temperature of the fractionator bottom
- d) None of the mentioned

Options :

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

Question Number : 33 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the relationship between observed and real retention?

- (a) Real retention = observed retention,
- (b) Real retention $>$ observed retention,
- (c) Real retention $<$ observed retention,
- (d) None of the above.

Options :

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

Question Number : 34 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the pore size range in case of Reverse osmosis?

- (a) 2-10 Å,
- (b) 10-20 Å,
- (c) 20-1000 Å,
- (d) >1000 Å.

Options :

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

Question Number : 35 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Adsorption of acetone vapour on activated carbon is

- [a] a highly endothermic process
- [b] an exothermic process
- [c] a slightly endothermic process
- [d] a none of the above

Options :

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

Question Number : 36 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Physical adsorption is

- [a] due to Van der wall forces
- [b] Accompanied by a chemical reaction
- [c] Accompanied by adsorption of heat
- [d] none of the above

Options :

- 1. A
- 2. B

3. C

4. D

Question Number : 37 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

At a given equilibrium pressure, the concentration of adsorbed gas on adsorbent solid

[a] remains constant with change in temperature

[b] increases with increasing temperature

[c] decreases with increase in temperature

[d] decreases linearly with increase in temperature

Options :

1. A

2. B

3. C

4. D

Question Number : 38 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

When hysteresis is observed, the adsorption equilibrium pressure

[a] is always equal to that obtained by adsorption

[b] is always higher than that obtained by adsorption

[c] is always lower than that obtained by adsorption

[d] may be equal to or higher than that obtained by adsorption

Options :

1. A

2. B

3. C

4. D

Question Number : 39 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The nature of the heat generation curve in a nonisothermal CSTR is

- (a) Linear
- (b) Quadratic
- (c) Sigmoidal
- (d) None of the above options

Options :

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

Question Number : 40 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Sustained Oscillation in a non-isothermal CSTR may be encountered at

- (a) Low activation energy (E)
- (b) Low heat of reaction ($-\Delta H_R$)
- (c) Low inlet concentration (c_{A0})
- (d) Low heat removal rate (UA)

Options :

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

Question Number : 41 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Runaway (Upper steady state) reaction condition in a non-isothermal CSTR will occur if:

- (a) Heat Removal Curve Slope = Heat Generation Curve Slope.
- (b) Heat Removal Curve Slope < Heat Generation Curve Slope.
- (c) Heat Removal Curve Slope > Heat Generation Curve Slope.
- (d) None of the above relationship exists

Options :

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

Question Number : 42 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Extinction temperature in a non-isothermal CSTR is defined as:

- (a) The reactor temperature at which the reactor steady state suddenly drops from the upper steady state to lower steady state
- (b) The heating/cooling medium temperature at which the reactor steady state suddenly drops from the upper steady state to lower steady state
- (c) The feed temperature at which the reactor steady state suddenly drops from the upper steady state to lower steady state
- (d) None of the above options

Options :

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

Question Number : 43 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Progressive Conversion model is more appropriate for application in gas-solid non-catalytic reactions when

- (a) The solid reactant is impervious
- (b) The solid product is impervious
- (c) The solid reactant is porous
- (d) None of the above options

Options :

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

Question Number : 44 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

When a gas-solid non catalytic reaction, following shrinking particle model is controlled by gas film diffusion resistance, the reaction completion time for a large particle,

- (a) τ is proportional to R^2
- (b) τ is proportional to $R^{1.5}$
- (c) τ is proportional to R
- (d) None of the above options

Options :

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

Question Number : 45 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

When a gas-solid noncatalytic reaction following unreacted shrinking core model is controlled by chemical reaction, the reaction completion time,

- (a) τ is proportional to R^2
- (b) τ is proportional to $R^{1.5}$
- (c) τ is proportional to R
- (d) None of the above options

Options :

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

Question Number : 46 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In a gas-solid noncatalytic reactor if the solid particles are of uniform and constant size and in mixed flow, and the reaction is controlled by gas-film diffusion resistance, the design equation is

(a) $\overline{X_B} = \frac{\bar{t}}{\tau} (1 - e^{-\frac{\tau}{\bar{t}}})$

(b) $\overline{X_B} = \frac{\tau}{\bar{t}} (1 - e^{-\frac{\tau}{\bar{t}}})$

(c) $\overline{X_B} = \frac{\bar{t}}{\tau} (1 - e^{-\frac{\bar{t}}{\tau}})$

(d) None of the above options

Options :

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

Question Number : 47 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The dimensionless number (D/uL) is called the vessel dispersion number. For perfect mixed flow, the vessel dispersion number is

[a] zero

[b] less than 2100

[c] less than 2

[d] infinite

Options :

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

Question Number : 48 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Transport phenomena is considered as the _____ paradigm in chemical engineering

- a) First
- b) Second
- c) Third
- d) Fourth

Options :

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

Question Number : 49 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Choose the correct pair

- a) Macroscopic balance – differential balance
- b) Microscopic balance – integral balance
- c) First law of thermodynamics – species mass balance
- d) Newton's second law – linear momentum balance

Options :

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

Question Number : 50 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Reynolds transport theorem

- a) Is an algebraic expression
- b) Is a differential equation
- c) Connects system approach and control volume approach
- d) Is an inequality

Options :

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

4. D

Question Number : 51 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Velocity profile is obtained by solving

- a) Integral linear momentum balance
- b) Differential linear momentum balance
- c) Differential mass balance
- d) Integral mass balance

Options :

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

Question Number : 52 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

A term which does not appear in the conservation equation for internal energy is

- a) Rate of accumulation of internal energy per unit volume
- b) Net rate of inflow (or outflow) of internal energy per unit volume
- c) Rate of internal energy addition by conduction per unit volume
- d) None of the above

Options :

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

Question Number : 53 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Rate of work done is given by

- a) Cross product of velocity and force
- b) Dot product of velocity and force
- c) Cross product of distance and force
- d) Dot product of distance and force

Options :

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

Question Number : 54 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Viscous dissipation is

- a) Important when viscosity of fluid is less
- b) Important when velocity gradient is less
- c) Always positive
- d) Always negative

Options :

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

Question Number : 55 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Momentum flux can also be considered as

- a) Potential energy
- b) Kinetic energy
- c) Viscous stress
- d) Pressure

Options :

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

Question Number : 56 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following statements for determining thermal conductivity is true?

- (a) Bromley's equation applies to polyatomic vapour bubbles.
- (b) Chapman-Enskog theory applies liquid.
- (c) Eyring theory applies to monatomic gases.

Options :

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

Question Number : 57 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following statements is true for a given pressure drop?

- (a) Potential flow through a slit has a lower Nu compared to the laminar flow.
- (b) Potential flow through a slit has a higher Nu compared to the laminar flow.
- (c) Potential flow through a slit has a Nu equal to the laminar flow.

Options :

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

Question Number : 58 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Shell momentum balance may be used for

- a) For any type of geometry
- b) Only for simple geometry
- c) When only reactive mass transfer take place
- d) Only for liquid phase mass transfer

Options :

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

Question Number : 59 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Fick's law of diffusion states that mass flux is proportional to the

- a) Concentration gradient
- b) Strength of magnetic field
- c) Density of the solution
- d) Molecular diameter

Options :

- 1. A

- 2. B
- 3. C
- 4. D

Sub-Section Number: 2
Sub-Section Id: 90958259
Question Shuffling Allowed : Yes

Question Number : 60 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Weber number is defined as

- a) Inertia force/pressure force
- b) Surface tension force/pressure force
- c) Inertia force/surface tension force
- d) Viscous force/inertia force

Options :

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

Question Number : 61 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

1744 kg/h of a benzene-toluene mixture enters a distillation column. The top product is 95 mass % benzene and 8 % of benzene in the feed is in the bottom product. The degree of freedom for this process is,

- a) 1
- b) 0
- c) 2
- d) 3

Options :

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

Question Number : 62 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

100 kmol of ethane enters a dehydrogenation reactor. 40 kmol of H_2 leaves the reactor. Moles of ethylene leaving the reactor (in kmol units) is

- a) 0
- b) 100
- c) 60
- d) 40

Options :

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

Question Number : 63 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Electric power required (in kilowatt-hours) to heat all of an aluminum wire (2.5 mm in diameter and length of 5.5 cm) (positioned in a vacuum similar to a light bulb filament) from $25^\circ C$ to $660^\circ C$ (liquid) to be used in a vapor deposition apparatus

- (a) 1.538×10^3 kWhr
- (b) 1.338×10^3 kWhr;
- (c) 1.338×10^5 kWhr
- (d) 1.038×10^5 kWhr

Data: The melting point of Al is $660^\circ C$. (The vapor deposition occurs at temperatures in the vicinity of $900^\circ C$). For Al, $C_p = 20.0 + 0.0135T$, where T is in kelvin and C_p is in $J/(g \text{ mol})(^\circ C)$. The $\Delta H_{\text{fusion}} = 10,670 J/(g \text{ mol})(^\circ C)$ at $660^\circ C$. The density of Al is $19.35 g/cm^3$.

Options :

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

Question Number : 64 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Equal quantities by weight of water at $+50^{\circ}\text{C}$ and of ice at -40°C are mixed together.

What will be the final temperature of the mixture?

- (a) 0K
- (b) 0°C
- (c) 0°F
- (d) 20°C

Data: Heat of fusion of ice at 0°C is 334kJ/kg , Specific heat of ice is 2.108 kJ/kg K .

Options :

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

Question Number : 65 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Carbon monoxide at 200°C is burned under atmospheric pressure with dry air at 500°C in 90% excess air. The products of combustion leave the reaction chamber at 1000°C . Calculate the heat evolved in the reaction chamber in kilo-calories per kg-mole of CO burnt.

Data: $\Delta H_R = 67,636\text{ kcal/kg-mole}$

$C_{P,\text{mean}}$ for CO = 7.017

Air = 7.225

$\text{CO}_2 = 11.92$

$\text{O}_2 = 7.941$

$\text{N}_2 = 7.507$

- (a) 72,753
- (b) 43,121
- (c) 41,262
- (d) 24,515

Options :

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

Question Number : 66 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

In an unsteady state heat conduction in a solid long rod with constant conductivity, on one side (side 1) of the rod we maintain a temperature T_0 , and on the other side (side 2) ambient temperature is T_{amb} . What are the boundary conditions that we should use to solve for the temperature profile?

- (a) Side 1: $T = T_{amb}$
- (b) Side 2: $T = T_0$
- (c) Side 1: $T = T_0$
- (d) Side 2: $T = T_{amb}$

Options :

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

Question Number : 67 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Two plates separated by a distance b form a channel. One of the plates is porous and the other is impermeable. A flow takes place within the channel so that the x component velocity u is a function of x only and its value at the inlet is u_o . there is a uniform inflow v_o through the porous wall to the channel is a function of y only. Considering the flow to be incompressible, which among the following is the expression of u as a function of x and v as function of y .

- (a) $u = u_o - (v_o/b) x; v = v_o - (u_o/b) y$
- (b) $u = u_o + (v_o/b) x; v = v_o - (v_o/b) y$
- (c) $u = u_o - (u_o/b) x; v = v_o + (u_o/b) y$
- (d) $u = u_o + (u_o/b) x; v = v_o + (v_o/b) y$

Options :

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

Question Number : 68 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The boundary conditions are $\frac{dT}{dx}\Big|_{x=B} = 0$ and $T\Big|_{x=B} = \text{constant}$ for solving a heat conduction equation $\frac{\partial^2 T}{\partial x^2} = 0$ with $x \in [-B, B]$. Which of the following statements is true?

- (a) The equation cannot be solved because of insufficient information.
- (b) The equation cannot be solved because the boundary conditions are same.
- (c) The equation can be solved because the boundary conditions are different.

Options :

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

Question Number : 69 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

When can we use lumped system model for unsteady state heat transfer?

- (a) Biot number < 0.1
- (b) $0.1 < \text{Biot number} < 10$
- (c) $10 < \text{Biot number} < 100$
- (d) Biot number > 100

Options :

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

Question Number : 70 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

In an unsteady state heat conduction in a solid long rod with constant conductivity, on one side (side 1) of the rod we maintain a temperature T_0 , and on the other side (side 2) ambient temperature is T_{amb} . What are the boundary conditions that we should use to solve for the temperature profile?

- (a) Side 1: $T = T_{\text{amb}}$
- (b) Side 2: $T = T_0$
- (c) Side 1: $T = T_0$
- (d) Side 2: $T = T_{\text{amb}}$

Options :

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

Question Number : 71 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

In case of low polarization, the film theory model of concentration polarization can be simplified as,

(a) $\frac{C_m - C_p}{C_0 - C_p} = 1 + \frac{v_w}{k}$.

(b) $\frac{C_m - C_p}{C_0 - C_p} = 1 - \frac{v_w}{k}$.

(c) $\frac{C_m - C_p}{C_0 - C_p} = \ln\left(1 + \frac{v_w}{k}\right)$.

(d) $\frac{C_m - C_p}{C_0 - C_p} = \exp\left(1 - \frac{v_w}{k}\right)$.

Options :

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

Question Number : 72 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Consider 1D mass transport (by diffusion only) in x-direction across a long, thin membrane of thickness W . The time dependence of concentration of species A at the upstream yz-surface of membrane is given by $C_0 \exp(-k_c t)$ while the concentration at the downstream surface is held constant. The diffusion coefficient of A in the membrane is given by D_A . Pick the condition at which a pseudo steady-state analysis can be used to model concentration profile of A in the membrane:

a. $1/k_c \gg D_A / W^2$

b. $1/k_c \gg W^2 / D_A$

c. $1/k_c \ll W^2 / D_A$

d. $1/k_c \ll D_A / W^2$

Options :

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

Sub-Section Number: 3
Sub-Section Id: 90958260
Question Shuffling Allowed : Yes

Question Number : 73 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 0

Fresh air (4 mole % water vapour) is mixed with recycled dehumidified air and passed into an air cooler in which some of the water vapour in the mixed feed condenses out as liquid. Part of the dehumidified air leaving the cooler is recycled and the balance is delivered to a room. The moles of water condensed in the air cooler for 100 mol of dehumidified air (1.7 mole % water vapour) delivered to the room is

- a) 1.2
- b) 2.4
- c) 0.6
- d) 4.8

Options :

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

Question Number : 74 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 0

100 kg of an aqueous solution of KNO_3 (60 mass %) at 80°C is fed to a crystallizer where the solution is cooled to 40°C . The saturation concentration of KNO_3 at 40°C is 38.6 mass %. The mass of KNO_3 crystallised out is

- a) 34.9 kg
- b) 40 kg
- c) 38.6 kg
- d) 58.2 kg

Options :

1. A
2. B
3. C

4. D

Question Number : 75 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 0

A metal heating element is horizontally immersed in a water bath. The surface temperature of the metal is 255 °C under steady-state boiling conditions. In a film boiling regime, the boiling and radiation heat transfer coefficient are given as: $h_{\text{boiling}} = 232 \text{ W/(m}^2\text{K)}$ and $h_{\text{rad}} = 51 \text{ W/(m}^2\text{K)}$. What is the heat flux under this condition in kW/m²?

(a): 35.9

(b): 39.9

(c): 41.8

(d): 43.8

Options :

1. A

2. B

3. C

4. D

Question Number : 76 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 0

Adsorption on activated carbon is to be used for reducing phenol concentration in waste water from 0.04 mol/l to 0.008 mol/l. The adsorption isotherm at the operating temperature can be expressed as $q = 0.025 C^{-1/3}$; where q is the phenol concentration in solid (mol/g solid) and C is the phenol concentration in water (mol/l). The minimum amount of solid (in grams) required per liter of waste water (up to one decimal place) is

[a] 6.3-6.5

[b] 63.5 – 65.5

[c] 1.2-1.3

[d] 0.02 – 0.04

Options :

1. A

2. B

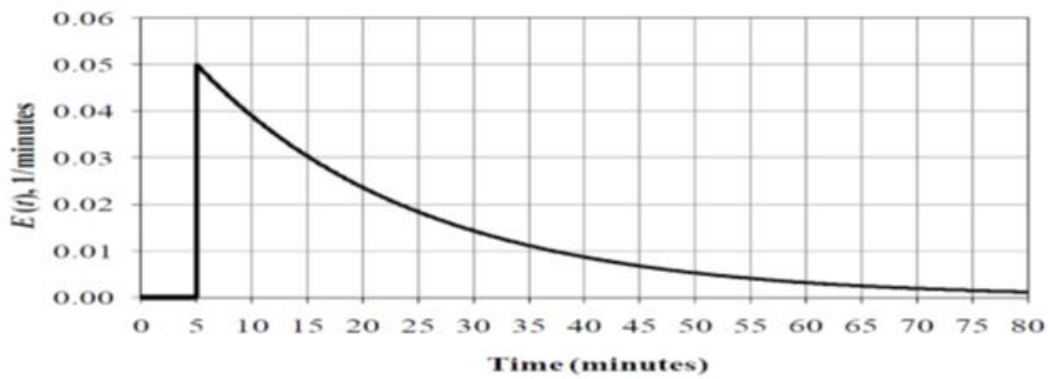
3. C

4. D

Question Number : 77 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 0

A CSTR has a long inlet pipe. A tracer is injected at the entrance of the pipe. The E-curve obtained at the exit of the CSTR is shown in the figure below:



Assuming plug flow in the inlet pipe, the ratio (rounded off to the second decimal place) of the volume of the pipe to that of the CSTR is,

- [a] 0.61-0.64
- [b] 0.39-0.42
- [c] 0.82-0.84
- [d] 0.23-0.27

Options :

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