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Question1:-For the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$, the following is true

A:-Cayley-Hamilton is satisfied

B:-Eigen values are 1, –1, –1

C:-Value of $A^{50} = \begin{bmatrix} 1 & 0 & 0 \\ 25 & 1 & 0 \\ 25 & 0 & 1 \end{bmatrix}$

D:-Eigen vector matrix is $X = \begin{bmatrix} -1 & 0 & 0 \\ -1 & 0 & -1 \\ 1 & 0 & 1 \end{bmatrix}$

Correct Answer:- Option-C

Question2:-The system of linear equations Ax = b, where $A = \begin{bmatrix} 1 & 1 & 2 & -5 \\ 2 & 5 & -1 & -9 \\ 2 & 1 & -1 & 3 \\ 1 & 3 & 2 & 7 \end{bmatrix}$ and $b = \begin{bmatrix} 3 \\ -3 \\ -11 \\ -5 \end{bmatrix}$ is

A:-Consistent and has infinite number of solutions

B:-Has no solution

C:-Inconsistent and has only one solution

D:-Is not solvable

Correct Answer:- Option-A

Question3:-Total derivative of z = $\tan^{-1}\left(\frac{y}{x}\right)$, (y, x) ≠ (0, 0) is

A:-$\frac{ydx-xdy}{x^2+y^2}$

B:-$\frac{xdy-ydx}{x^2+y^2}$

C:-$\frac{xdx-ydy}{x^2+y^2}$

D:-$\frac{ydx+xdy}{x^2+y^2}$

Correct Answer:- Option-B

Question4:-The degree of homogeneity of the function f(x) = $\frac{x}{x+y}$ is

A:--2

B:-0

C:-1

D:-$\frac{1}{2}$

Correct Answer:- Option-B

Question5:-The linear Taylor Sine Polynomial approximation to the function f(x, y) = $\sqrt{x+y}$ about the point (1, 3) is

A:-$\frac{x}{4} - \frac{y}{4} + 1$

B:-$\frac{x}{4} + \frac{y}{4} + 1$

C:-$\frac{x}{4} + \frac{y}{4} - 1$

D:-$\frac{x}{4} - \frac{y}{4} - 1$

Correct Answer:- Option-B

Question6:-The integrating factor of the differential equation $\cos^2 x \frac{dy}{dx} + y = \tan x$ is

A:-$e^{\tan x}$

B:-e^x

C:-$e^{\cos x}$

D:-x

Correct Answer:- Option-A

Question7:-Which one is not true for the differential equation xdx + ydy + $\frac{xdy-ydx}{x^2+y^2} = 0$?

A:-The equation is exact

B:-$\frac{\delta M}{\delta x} = \frac{\delta N}{\delta y}$

C:-General solution is : $x^2+y^2-2\tan^{-1}\left(\frac{x}{y}\right) = k$

D:-$M = x - \frac{y}{x^2+y^2}, N = y + \frac{x}{x^2+y^2}$

Correct Answer:- Option-B

Question8:-For the second order linear homogeneous equation, L(y) = y″ + 2y′ + 2y = 0, which one is true ?

A:-The solutions are $\phi_1(x) = e^{-x}\cos x, \phi_2(x) = e^x \sin x$

B:-Solutions are linearly independent

C:-Wronskian of the solutions is 0

D:-The equation has no solution

Correct Answer:- Option-B

Question9:-Consider a second order non-homogeneous linear differential equation described by, $L(y) = y'' + a_1(x)y' + a_2(x)y = b(x)$ where a_1, a_2 and b are continuous functions defined on an interval I. The general solution of the equation by using method of variation of parameter is dependent on
I. Complementary function
II. Particular integral
III. Wronskian
IV. None of the above
Which one is true from the following ?

A:-Only I is correct

B:-Only II and III are correct

C:-All are correct except IV

D:-Only IV is correct

Correct Answer:- Option-C

Question10:-For an auxiliary equation of an Euler-Cauchy equation $L(y) = a_0 x^n y^{(n)} + a_1 x^{n-1} y^{(n-1)} + \ldots + a_{n-1} x y' + a_n y = b(x), (a_0 \neq 0)$ where $a_0, a_1, \ldots a_n$ are constants and b is a continuous function on an interval I, which possibility is not true ?

A:-Roots are real and distinct

B:-Roots are real and equal

C:-Roots are complex and conjugate

D:-Roots must be always real

Correct Answer:- Option-D

Question11:-Fourier Sine Series of a function f(x) is defined
(i) When f(x) is odd
(ii) When f(x) is even

(iii) It is defined as $f(x) = \sum_{n=1}^{\infty} b_n \sin\left(\frac{n\pi x}{L}\right)$ when $b_n = \frac{2}{L} \int_0^L f(x) \sin\left(\frac{n\pi x}{L}\right) dx$

(iv) f(x) is an odd periodic function of period 2L in the interval $- L < x < L$
Which one is false from the following ?

A:-Only (ii) is correct

B:-Both (i) and (iv) are correct

C:-Only (iii) is correct

D:-All are correct except (ii)

Correct Answer:- Option-A

Question12:-The Cauchy Integral Theorem for f(z) has the following conditions

A:-The domain D is simply connected

B:-f(z) is analytic

C:-$f'(z)$ is continuous in D

D:-The domain D is multiply connected

Correct Answer:- Option-D

Question13:-Which of the following condition is not true for Taylor Series Expansion of a function f(z)

A:-If f(z) is not analytic, then it can not be expanded in Taylor Series about the point z = z_0

B:-The radius of convergence of the Taylor series is the distance between z_0 and the nearest point at which the function is not analytic if f(z) is analytic in a domain D except at the points $z_1, z_2, \ldots z_n$

C:-Taylor Series is unique

D:-The series is divergent also

Correct Answer:- Option-D

Question14:-Gradient of $f(x,y) = x^2 - 4xy$ at (1, 2) is

A:-– 6i – 4j

B:-6i – 4j

C:-6i + 4j

D:-–6i + 4j

Correct Answer:- Option-A

Question15:-If a force field F is conservative then

A:-curl(F) = 0

B:-There exists a scalar potential function f such that F ≠ grad f

C:-curl(F) ≠ 0

D:-curl(F) = 1

Correct Answer:- Option-A

Question16:-A compound whose molecular weight is 106 and composition on weight basis
C - 85% H_2 - 5% N_2 - 10%
Formula of this compound will be

A:-C_8H_5N

B:-C_5H_8N

C:-$C_4H_3N_2$

D:-C_8H_2N

Correct Answer:- Option-A

Question17:-If a gas mixture contain 0.02 mol. Calculate the mixture density in gram per liter at 27°C and 600 mm Hg. [Assume gas follows ideal gas law]

A:-1.60 gm/liter

B:-0.624 gm/liter

C:-0.02 gm/liter

D:-1.50 gm/liter

Correct Answer:- Option-A

Question18:-The gases entering a reactor contain A and B in mole ratio of 1 : 3. The mole ratio of these gases in the exit stream from the reactor is 1 : 4.5. What volume of gas in m^3 at NTP must enter the reactor to produce 300 kmol of product per hour ? The reaction is A + 2B $\rightarrow$ C

A:-$22400m^3$ /hr

B:-$11200m^3$ /hr

C:-$44800m^3$ /hr

D:-$16200m^3$ /hr

Correct Answer:- Option-C

Question19:-A potassium dichromate solution in water contains 15% $K_2Cr_2O_7$ by weight; 1000 kg of this solution is evaporated to remove 500 kg of water. The remaining solution is cooled to 30°C. Find the $K_2Cr_2O_7$ crystal yield ?
Data given : Solubility of $K_2Cr_2O_7$ is 0.340 kg mole per 1000 kg water (at 30°C)
Atomic weight : K = 39, Cr = 52
[Assume that $K_2Cr_2O_7$ crystal have no water of crystallization]

A:-86%

B:-76%

C:-65%

D:-82%

Correct Answer:- Option-B

Question20:-50 kg/h of methanol liquid at a temperature of 300 K (27°C) is obtained by removing heat from saturated methanol vapour. Find out the amount of heat to be removed in this case.
Data given : Boiling point of methanol = 337 K (64°C)
Latent heat of condensation of methanol = 1100 kJ/kg
Specific heat of methanol = 2.7 kJ/(kg.K)

A:-33.23 kW

B:-26.66 kW

C:-53.23 kW

D:-16.66 kW

Correct Answer:- Option-D

Question21:-Heat of combustion of C_2H_5OH = −1200 kJ/mol. 92 g of C_2H_5OH is completely combusted and heat supplied to water at 298 K (25°C) to convert it to steam at 373 K (100°C) is 2260 kJ/kg. Find the amount of water which could be converted to steam.

A:-0.93 kg

B:-1.15 kg

C:-0.73 kg

D:-1.73 kg

Correct Answer:- Option-A

Question22:-Air at a temperature of 20°C and a pressure of 30 Hg has a relative humidity of 70%. Calculate the molal humidity of this air if its temperature is reduced to 10°C and its pressure increased to 40 Hg, condensing out some of the water.
Data given : Vapour pressure of water : 17.5 mm Hg at 20°C
9.2 mm Hg at 10°C

A:-0.016

B:-0.0091

C:-0.019

D:-0.0051

Correct Answer:- Option-B

Question23:-The Orsat analysis of a flue gas is CO_2 = 12%; O_2 = 8%; N_2 = 80%. Determine the percent excess air used in combustion, the nitrogen present in the flue gas is contributed by air only.

A:-60.33%

B:-50%

C:-62.33%

D:-67.53%

Correct Answer:- Option-A

Question24:-A vertical cylinder with a freely flowing piston contains 0.1 kg air at 1.45 bar and a small electric resister. The resister is wired to an external 15 volt battery. When a current of 2 Amps is passed through a resister for 60 sec, the piston sweeps a volume of $0.02 m^3$. Find rise in temperature of air.
Assume : (1) piston and cylinder are insulated
      (2) Air behaves as an ideal gas with C_v = 700 J/(kg.K)

A:-5 K

B:-6 K

C:-7 K

D:-8 K

Correct Answer:- Option-A

Question25:-10^5 joules of heat are transformed from a reservoir at 402°C to an engine that operates on the carnot cycle. The engine rejected heat to a reservoir at 24°C. Determine the work done by engine.

A:-0.5 × $10^5 J$

B:-0.3 × $10^6 J$

C:-0.6 × $10^5 J$

D:-0.5 × $10^6 J$

Correct Answer:- Option-C

Question26:-At high temperature and pressure N_2 obeys the equation of state P(V − b) = RT. Calculate the fugacity of N_2 at 727°C and 500 atm. If b = 166.28 ml/mol.
Data given : exp (0.101325) = 1.106
exp (1.01325) = 2.754
exp (0.350) = 1.419
exp (3.50) = 33.115

A:-553 atm

B:-1377 atm

C:-709.5 atm

D:-16557.5 atm

Correct Answer:- Option-B

Question27:-At 300 K and total pressure of 51.4 kPa the composition of the system containing two components 1 & 2 at equilibrium is x_1 = 0.4 and y_2 = 0.4. The saturation temperature at the given temperature for pure components are P_1 = 25.7 kPa and P_2 = 10.28 kPa. Calculate the value of G^E /RT for the liquid phase.
Data given : ln (3) = 1.098; ln (3.33) = 1.202; ln (3.67) = 1.3; ln (4) = 1.386

A:-0.515

B:-0.856

C:-1.7

D:-2.3

Correct Answer:- Option-D

Question28:-The enthalpy change of mixing for a binary liquid solution at 298 K and 1 bar is given by the equation ΔH = $x_1 x_2 (60 x_1 + 40 x_2$), where ΔH is in J/mol and x_1 and x_2 are the mol fractions of components 1 and 2 respectively. The enthalpies of the pure liquids at the same temperature and pressure are 200 and 300 J/mol respectively. Determine

numerical values of the partial molar enthalpies at infinite dilution $\overline{H}_1^\infty$ and $\overline{H}_2^\infty$ at 298 K and 1 bar.

A:-420 J/mol and 640 J/mol

B:-240 J/mol and 360 J/mol

C:-440 J/mol and 620 J/mol

D:-260 J/mol and 340 J/mol

Correct Answer:- Option-B

Question29:-The water gas shift reaction, CO(g) + $H_2O(g) \rightarrow CO_2(g) + H_2(g)$ is carried out at 1100 K and 1 bar. The reactants consist of 1 mol of H_2O, 1.5 mol of CO, 1 mol of CO_2. Calculate the fraction of steam reacted in this case if the pressure is increased to 10 bar. Assume the mixture behaves as an ideal gas.
Data given : For the given reaction at 1100 K, ln K = 0

A:-0.50

B:-0.65

C:-0.75

D:-0.70

Correct Answer:- Option-C

Question30:-A system is prepared by partially decomposing $CaCO_3$ into an evacuated space. Determine the number of degrees of freedom for the above mentioned case.

A:-3

B:-1

C:-2

D:-None of the above

Correct Answer:- Option-B

Question31:-A reducing water pipe section has an inlet diameter of 50 mm and exit diameter of 30 mm. If the steady inlet speed is 2.5 m/s, then the exit speed in m/s

A:-2.5

B:-3.5

C:-4.5

D:-7.5

Correct Answer:- Option-D

Question32:-Air flows steadily at low speed through a horizontal nozzle, discharging to atmosphere. The area at the nozzle inlet is 0.1 m^2 and at the exit is 0.02 m^2. Determine the gauge pressure (kPa) required at the nozzle inlet to produce an outlet speed of 50 m/s.

A:-10.48

B:-1.48

C:-4.48

D:-2.48

Correct Answer:- Option-B

Question33:-A simple U-tube manometer is installed across an orifice meter. The manometer filled with mercury (specific gravity 13.6) and the liquid above the mercury is carbon tetrachloride (specific gravity 1.6). The manometer reads 200 mm. What is the pressure difference over the manometer in N/m^2 ?

A:-23536

B:-25536

C:-19536

D:-18536

Correct Answer:- Option-A

Question34:-A pump is used to deliver water to an overhead tank at a flow rate of 4×10^{-3} m^3/s. The pump adds 2 kW to water. If the density of water is 1000 kg/m^3 and acceleration due to gravity is 10 m/s^2, the pump head added to the flow is

A:-10 m

B:-20 m

C:-40 m

D:-50 m

Correct Answer:- Option-D

Question35:-Match the following :

Column A	Column B
(P) Turbulence	(I) Reciprocating pump
(Q) NPSH	(II) Packed bed
(R) Ergun equation	(III) Fluctuating velocity
(S) Rotameter	(IV) Impeller
(T) Power number	(V) Vena contracta

A:-P-III, R-II, T-IV

B:-Q-V, R-II, S-III

C:-P-III, R-IV, T-II

D:-Q-III, S-V, T-IV

Correct Answer:- Option-A

Question36:-With increasing flow rate, the hydraulic efficiency of a centrifugal pump

A:-Monotonically decreases

B:-Decreases and then increases

C:-remains constant

D:-Increases and then decreases

Correct Answer:- Option-D

Question37:-A steady, incompressible, two-domensional velocity field is given by the following components in x-y − plane :
u = 0.205 + 0.97x + 0.851 y
v = -0.509 + 0.953x − 0.97 y
Calculate the x-component of acceleration at the point (x, y) = (2, 1.5)

A:-1.27

B:-2.27

C:-3.27

D:-3.32

Correct Answer:- Option-C

Question38:-The wall of a cold storage consists of three layers - an outer layer of ordinary bricks, 25 cm thick, a middle layer of cork, 10 cm thick and an inner layer of cement, 6 cm thick. The thermal conductivities of the materials are - brick : 0.7, cork : 0.043 and cement : 0.72 W/m°C. The temperature of outer surface of the wall is 30°C and the inner is −15°C. Then, the steady-state rate of heat gain per unit area (W/m^2) of the wall is

A:-15.23

B:-16.27

C:-26.23

D:-2.63

Correct Answer:- Option-B

Question39:-A Horton sphere (a spherical vessel used for cryogenic storage) of 16 m diameter that contains liquid ammonia at 4°C. The tank is insulated with a 10 cm thick layer of polyurethane foam having a thermal conductivity of 0.02 W/m°C. The outer surface temperature of the insulation is 27°C. Find the heat gain by the sphere.

A:-−3746 W

B:-−3476 W

C:-3476 W

D:-3746 W

Correct Answer:- Option-A

Question40:-A metallic ball (ρ= 2700 kg/m^3 and C_p = 0.9 kJ/kg.°C) of diameter 7.5 cm is allowed to cool in air at 25°C. When the temperature of the ball is 125°C, it is found to cool at the rate of 4°C/min. If thermal gradients inside the ball are neglected, the heat transfer coefficient (in W/m^2 .°C) is

A:-2.034

B:-20.22

C:-81.36

D:-203.4

Correct Answer:- Option-B

Question41:-Select the corresponding finite-difference equation for the node (m, n) as shown in the below figure.
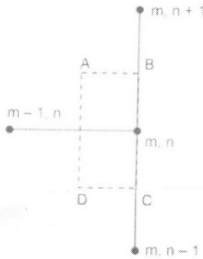
A:-$2T_{m-1,n} + T_{m,n-1} + T_{m,n+1} - 4T_{m,n} = 0$

B:-$T_{m-1,n} + T_{m,n-1} + 2T_{m,n+1} - 4T_{m,n} = 0$

C:-$T_{m-1,n} + 2T_{m,n-1} + T_{m,n+1} - 4T_{m,n} = 0$

D:-$2T_{m-1,n} + T_{m,n-1} + T_{m,n+1} - T_{m,n} = 0$

Correct Answer:- Option-A

Question42:-During the flow of air at T_∞ = 20°C over a plate surface maintained at a constant temperature of T_s = 160°C, the dimensionless temperature profile within the air layer over the plate is given below :
$\frac{T(y)-T_\infty}{T_s-T_\infty} = e^{-3200y}$
If the thermal conductivity of air at film temperature is k = 0.0302 W/m.K, then, the convection heat transfer coefficient is (in W/m^2 .K)

A:-48.4

B:-96.8

C:-133.6

D:-76.8

Correct Answer:- Option-B

Question43:-Water flows through a 20 mm diameter at a rate of 0.01 kg/s entering at 10°C. The tube is wrapped from outside by an electric heating element that produces a uniform heat flux of 15 kW/m^2 . If the exit temperature of the water is 40°C, estimate the heat transfer coefficient (in W/m^2 .K). The thermal conductivity of water is 0.608 W/m.K.

A:-4.36

B:-3.66

C:-19.33

D:-132.5

Correct Answer:- Option-D

Question44:-The spectral distribution of surface irradiation is given below, then what is the total irradiation (in W/m^2) ?
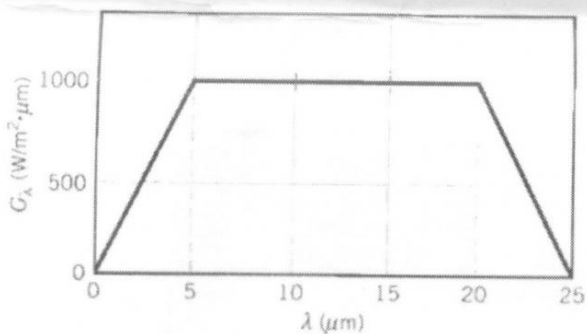
A:-2000

B:-20000

C:-15000

D:-25000

Correct Answer:- Option-B

Question45:-In film type condensation over a vertical tube, the local heat transfer coefficient is

A:-Inversely proportional to the local film thickness

B:-Directly proportional to the local film thickness

C:-Equal to the local film thickness

D:-Independent of local film thickness

Correct Answer:- Option-A

Question46:-The equilibrium distribution of a solute (A) between air and water is y = 1.2 x. The concentration of A in the bulk air is 0.04 mole fraction and that in the bulk aqueous phase is 0.025. What is the overall driving force on gas-phase basis ?

A:-0.03

B:-0.01

C:-0.04

D:-0.02

Correct Answer:- Option-B

Question47:-Enthalpy of moist air having a dry-bulb temperature of 27°C and a humidity of 0.015 kg water vapour/kg of dry air in kJ/kg is

A:-45.5

B:-56.5

C:-65.5

D:-86.5

Correct Answer:- Option-C

Question48:-The following data were obtained for an absorption column : G_s = 90 kmol/h; L_s = 100 kmol/h; y_{n+1}= 0.12; x_n = 0.078; x_{n-1} = 0.06. The equilibrium relations is y = 1.01 x. If the liquid on the tray is well mixed, what will be the murphree tray efficiency ?

A:-44.2%

B:-33.2%

C:-63.2%

D:-72.8%

Correct Answer:- Option-A

Question49:-For the determination of number of theoretical stages required for the given separation using McCabe and Thiele method. What is slope of q-line, if the feed is saturated liquid ?
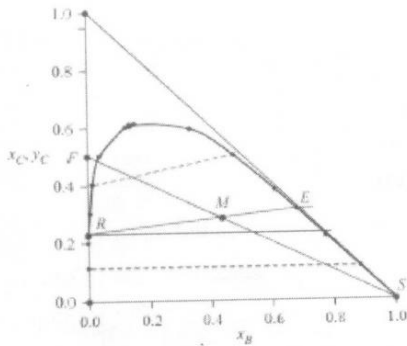
A:-0

B:-1

C:-−1

D:-∞

Correct Answer:- Option-D

Question50:-One thousand kilograms of an aqueous solution containing 50 mass % acetone is to be extracted using 800 kg of chlorobenzene containing 0.5 mass % acetone as the solvent in a single-stage extraction unit. The graphical solution for the extraction unit is given below, what is the fraction of solute removed (in %) ?

A:-71.7

B:-62.7

C:-93.5

D:-83.5

Correct Answer:- Option-A

Question51:-100 kg of solid (on dry basis) is subjected to a drying process for a period of 2500 s. The drying occurs at the constant rate period with the drying rate as N_c= 1.0 × 10^{-3} kg/m^2s. The initial moisture content of the solid is 0.4 kg moisture/kg dry solid. The surface area available for drying 0.04 m^2/kg of dry solid. The moisture content at the end of the drying period is (in kg moisture/kg dry solid).

A:-0.15

B:-0.20

C:-0.25

D:-0.30

Correct Answer:- Option-D

Question52:-Adsorption on zeolite is to be used for reducing a pollutant concentration in wastewater from 0.04 mol/litre to 0.008 mol/litre. The adsorption isotherm at the operating temperature can be expressed as q = $0.025C^{\frac{1}{3}}$, where q is the pollutant concentration in solid (mol/ g solid) and C is the concentration in water (mol/litre). The minimum amount of solid (in grams) required per litre of waste water is

A:-3.2

B:-1.6

C:-6.4

D:-4.8

Correct Answer:- Option-C

Question53:-What kind of diffusional phenomena occurs within seeds during oil extraction ?

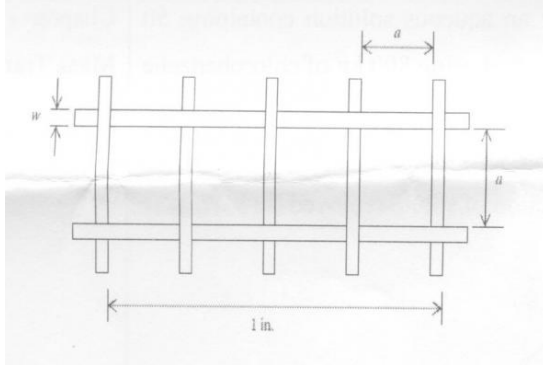A:-Diffusion of solute (C) through non-diffusing solvent (B)

B:-Non-equimolar counter-diffusion of B and C

C:-Equimolar counter-diffusion of B and C

D:-Knudsen diffusion of C in B

Correct Answer:- Option-B

Question54:-What is mesh size (M) from the figure given below ?

A:-M = 2a + w

B:-M = 1/(2a + w)

C:-M = a + w

D:-M = 1/(a + w)

Correct Answer:- Option-D

Question55:-A sample of 200 g of an industrial powder is screened through a series of sieves and the results of the run are presented in below table. Determine the median size (μ m) of the powder.

Table: Screen analysis

Mesh number	Screen Aperture (μm)	Weight retained (g)
10	1700	2.2
14	1180	11.2
18	850	41.2
25	600	52.8
36	425	37.0
52	300	21.6
72	212	11.8
100	150	7.8
150	106	5.4
-150(170)	90	9.0

A:-625

B:-212

C:-425

D:-1000

Correct Answer:- Option-A

Question56:-A crusher is fed with limestone having particles of 2 cm median equivalent diameter and discharges a product consisting of particles of 0.5 cm median equivalent diameter. The equipment operates at a capacity of 1.2×10^4 kg/h consuming a power of 7.46 kW. If the requirements of the process demand a finer size of the product (0.4 cm of median equivalent diameter) decreasing the capacity to 1.0×10^4 kg/h, determine the theoretical power consumption (kW) under the new conditions.
Data : ln 4 = 1.39; ln 5 = 1.61.

A:-3.46

B:-7.21

C:-9.21

D:-4.48

Correct Answer:- Option-B

Question57:-Match the following correctly.
i. Compressive   A. Disc mill
ii. Impact   B. Crushing rolls
iii. Attrition   C. Rotary knife
iv. Cut   D. Hammer mill

A:-i-D, ii-A, iii-B, iv-C

B:-i-C, ii-A, iii-B, iv-D

C:-i-B, ii-D, iii-A, iv-C

D:-i-B, ii-C, iii-D, iv-A

Correct Answer:- Option-C

Question58:-The volumetric flow rate during constant pressure filtration is $\frac{dv}{dt} = \frac{1}{\left(K_c V + \frac{1}{q_0}\right)}$; where V is the total volume of filtrate collected in time t and K_c and q_0 are constants. If V = 1 litre at t = 41.3 s and V = 2.0 litre at t = 108.3, then K_c value is

A:-41.3

B:-82.6

C:-25.7

D:-51.4

Correct Answer:- Option-C

Question59:-Match the equipment in Column A with the corresponding process in Column B :

Column A   **Column B**
P. Centrifugal sifter   I. Mixing
Q. Bowl mill   II. Sedimentation
R. Gravity thickener   III. Screening
S. Two-arm kneader   IV. Grinding

A:-P-I, Q-IV, R-II, S-III

B:-P-III, Q-IV, R-II, S-I

C:-P-IV, Q-I, R-II, S-III

D:-P-IV, Q-III, R-I, S-II

Correct Answer:- Option-B

Question60:-Critical speed of a ball mill depends on

A:-The radius of the mill and the radius of the particles

B:-The radius of the mill and the density of the particles

C:-The radius of the balls and the radius of the particles

D:-The radius of the balls and the radius of the mill

Correct Answer:- Option-D

Question61:-The E-curve for a non-ideal reactor defines the fraction of fluid having age between t and t+dt

A:-At the inlet

B:-At the outlet

C:-In the reactor

D:-Averaged over the inlet and outlet

Correct Answer:- Option-B

Question62:-A first order gaseous phase reaction is catalysed by a non-porous solid. The kinetic rate constant and the external mass transfer co-efficients are k and k_g respectively. The effective rate constant $\left(k_{eff}\right)$ is given by

A:-$k_{eff} = k + k_g$

B:-$k_{eff} = \frac{(k + k_g)}{2}$

C:-$k_{eff} = \left(k k_g\right)^{\frac{1}{2}}$

D:-$1/k_{eff} = \frac{1}{k} + \frac{1}{k_g}$

Correct Answer:- Option-D

Question63:-The reaction 2A + B → 2C occurs on a catalyst surface. The reactants A and B diffuse to the catalyst surface and get converted completely to the product C which diffuses back. Steady state molar flux of A, B and C related by

A:-$N_A = 2N_B = N_C$

B:-$N_A = -\left(\frac{1}{2}\right)N_B = -N_C$

C:-$N_A = 2N_B = -N_C$

D:-$N_A = \left(\frac{1}{2}\right)N_B = N_C$

Correct Answer:- Option-C

Question64:-For a solid-catalyzed reaction, the Thiele modulus is proportional to

A:-$\sqrt{\dfrac{Intrinsic\ reaction\ rate}{Diffusion\ rate}}$

B:-$\sqrt{\dfrac{Diffusion\ rate}{Intrinsic\ reaction\ rate}}$

C:-$\dfrac{Intrinsic\ reaction\ rate}{Diffusion\ rate}$

D:-$\dfrac{Diffusion\ rate}{Intrinsic\ reaction\ rate}$

Correct Answer:- Option-C

Question65:-Which of the following can change if only the catalyst is changed for a reaction system ?

A:-Enthalpy of reaction

B:-Activation energy

C:-Free energy of the reaction

D:-Equilibrium constant

Correct Answer:- Option-B

Question66:-In the manufacture of sulphuric acid by the contact process, the catalytic oxidation of SO_2 is carried out in multiple stages mainly to

A:-Increase the reaction rate by providing inter-stage heating

B:-Increase the overall conversion by providing inter-stage heating

C:-Increase the overall conversion by providing inter-stage cooling

D:-Decrease the overall conversion by removing sulphur trioxide between stages

Correct Answer:- Option-A

Question67:-For which reaction order, the half-life of the reactant is half of the full lifetime (time for 100% conversion) of the reactant ?

A:-Zero order

B:-Half order

C:-First order

D:-Second order

Correct Answer:- Option-C

Question68:-For a solid catalyzed gas-phase reversible reaction, which of the following statements is always true ?

A:-Adsorption is rate limiting

B:-Desorption is rate limiting

C:-Solid catalyst doesn't affect equilibrium conversion

D:-Temperature doesn't affect equilibrium conversion
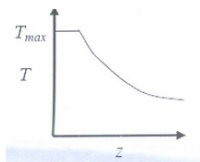
Correct Answer:- Option-B

Question69:-The elementary reversible exothermic gas-phase reaction A + 3B $\Leftrightarrow$ 2C is to be conducted in a non-isothermal, non-adiabatic plug flow reactor. The maximum allowable reactor temperature is T_{max}. To minimize the total reactor volume, the variation of reactor temperature (T) with axial distance from the inlet (z) should be
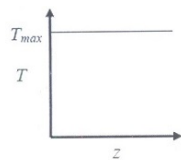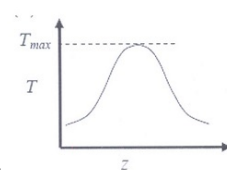

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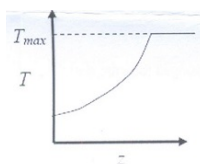
B:-

C:-

D:-

Correct Answer:- Option-B

Question70:-Cascade control comes under the control configuration which uses

A:-One measurement and one manipulate variable

B:-More than one measurement and one manipulate variable

C:-One measurement and more than one manipulate variable

D:-More than one measurement and more than one manipulate variable

Correct Answer:- Option-C

Question71:-An example of an open-loop second order under damped system is

A:-Liquid level in a tank

B:-U-Tube manometer

C:-Thermocouple in a thermo-well

D:-Two non-interacting first order systems in series

Correct Answer:- Option-B

Question72:-The control valve characteristics is selected such that the product of process gain and the valve gain

A:-Is a linearly increasing function of the manipulate variable

B:-Is a linearly decreasing function of the manipulate variable

C:-Remains constant

D:-None of these

Correct Answer:- Option-D

Question73:-A unit IMPULSE response of a first order system with time constant τ and steady K_p, is given by

A:-$\frac{1}{K_p\tau}e^{\frac{t}{\tau}}$

B:-$K_p e^{\frac{-t}{\tau}}$

C:-$\tau K_p e^{\frac{-t}{\tau}}$

D:-$\frac{K_p}{\tau}e^{-\frac{t}{\tau}}$

Correct Answer:- Option-C

Question74:-The bias values for the two controllers, so that no offset occurs in either controller are

A:-Pressure controller : 40% flow controller : 60%

B:-Pressure controller : 33% flow controller : 67%

C:-Pressure controller : 67% flow controller : 33%

D:-Pressure controller : 60% flow controller : 40%

Correct Answer:- Option-C

Question75:-What is the order of response exhibited by a U-Tube Manometer ?

A:-Zero order

B:-First order

C:-Second order

D:-Third order

Correct Answer:- Option-C

Question76:-The variables required to be known in the correlation used for estimating the horse power of centrifugal gas compressor and hence it is

A:-Inlet pressure

B:-Compression rpm

C:-Delivery pressure

D:-None of these

Correct Answer:- Option-A

Question77:-A cylindrical storage tank can have a self supported conical roof

A:-If its diameter is less than 20 m

B:-If its diameter is more than 50 m

C:-Whatever is the diameter

D:-None of the above

Correct Answer:- Option-B

Question78:-The term knuckle radius is associated with

A:-Flat heads

B:-Torispherical heads

C:-Hemispherical heads

D:-Conical heads

Correct Answer:- Option-B

Question79:-Terms used in engineering economics have standard definitions and interpretations. Which one of the following statement is INCORRECT ?

A:-The profitability measure 'return on investment' does not consider the time value of money

B:-A cost index is an index value for a given time showing the cost at that time relative to a certain base time

C:-The six tenth factor rule is used to estimate the cost of the equipment from the cost of a similar equipment with a different capacity

D:-Playback period is calculated based on the playback time for the sum of the fixed and the working capital investment

Correct Answer:- Option-D

Question80:-Given the following statements listed from (P) to (T), select the correct combination of true statements from the choices that follow this list.
(P) Plate columns are preferred when the operation involves liquid containing suspended solids.
(Q) Packed towers are preferred if the liquids have a large foaming tendency.
(R) The pressure drop through packed towers is more than the pressure drop through plate columns designed for the same duty.
(S) Packed columns are preferred when large temperature changes are involved in distillation operations.
(T) Packed towers are cheaper than plate towers if highly corrosive fluids are handled.

A:-T, S, P

B:-P, Q, T

C:-S, R, T

D:-R, Q, S

Correct Answer:- Option-B

Question81:-Temporary hardness in water is caused by the presence of

    A:-Bicarbonate of Ca and Mg

    B:-Sulphate of Ca and Mg

    C:-Chlorides of Ca and Mg

    D:-Nitrates of Ca and Mg

    Correct Answer:- Option-A

Question82:-The amount of standard soap solution required to obtain a permanent leather with a water sample of known volume with constant shaking determines the total hardness in

    A:-Dr. Clark's process

    B:-Hehner's process

    C:-William's process

    D:-Durkheim's process

    Correct Answer:- Option-B

Question83:-The ratio of BOD to ultimate BOD is about

    A:-1/3

    B:-2/3

    C:-3/4

    D:-1.0

    Correct Answer:- Option-B

Question84:-The most suitable solid waste disposal for rural area is

    A:-Land filling

    B:-Deep well injection

    C:-Composting

    D:-Incineration

    Correct Answer:- Option-C

Question85:-The indoor method of composting takes _____ months to complete the process.

    A:-1 and ½

    B:-3

    C:-2

    D:-4

    Correct Answer:- Option-D

Question86:-Which of the following gases is responsible for acid rain ?

    A:-VOC

    B:-NO_x

    C:-SO_2

    D:-CH_4

    Correct Answer:- Option-C

Question87:-The device used for easy separation of dry dust of 10 to 100 μm size is

    A:-Cyclone

    B:-Gravity settling chamber

    C:-Bag filter

    D:-Scrubber

    Correct Answer:- Option-A

Question88:-Pollutant Standard Index (PSI) value in between 101-199 denotes the air quality as

    A:-Good

    B:-Moderate

    C:-Unhealthy

    D:-Hazardous

    Correct Answer:- Option-C

Question89:-Plumbosolvency is a health hazard in the transportation of

    A:-Hard water only

    B:-Soft water only

    C:-Both (1) and (2)

    D:-Water containing plum juices

    Correct Answer:- Option-B

Question90:-Potable water treatment does not involve

    A:-Sedimentation

B:-Coagulation

C:-Disinfection

D:-Softening

Correct Answer:- Option-D

Question91:-Chemical composition of producer gas

A:-CO = 15, CO_2 = 35, H_2O = 25, N_2= 25

B:-CH_4 = 47, CO_2 = 10, H_2 = 13, N_2= 30

C:-H_2O = 15, CO_2 = 25, H_2 = 40, N_2= 20

D:-CO = 30, CO_2 = 5, H_2 = 14, N_2= 51

Correct Answer:- Option-D

Question92:-Match the common name of the chemicals in Group - 1 with their chemical formula in Group -2

Group - 1	Group -2
P. Soda ash	I. $NaHCO_3$
Q. Baking soda	II. $Na_2CO_310H_2O$
R. Caustic soda	III. NaOH
S. Washing soda	IV. Na_2CO_3

A:-P-IV, Q-I, R-III, S-II

B:-P-IV, Q-III, R-II, S-I

C:-P-IV, Q-II, R-III, S-I

D:-P-II, Q-I, R-III, S-IV

Correct Answer:- Option-A

Question93:-Match the chemicals in Group - 1 with their industrial production process in Group - 2

Group - 1	Group - 2
P. Sulphuric acid	I. Solvay process
Q. Nitric acid	II. Wet process
R. Phosphoric acid	III. Contact process
S. Soda ash	IV. Ostwald process

A:-P-III, Q-I, R-IV, S-II

B:-P-III, Q-II, R-IV, S-I

C:-P-III, Q-IV, R-II, S-I

D:-P-III, Q-II, R-I, S-IV

Correct Answer:- Option-C

Question94:-Octane number following the order

A:-Aromatics < Olefins < Isoparaffins < Naphthenes

B:-Olefins < Naphthenes < Isoparaffins < Aromatics

C:-Olefins < Isoparaffins < Naphthenes < Aromatics

D:-Isoparaffins < Naphthenes < Olefins < Aromatics

Correct Answer:- Option-B

Question95:-The setting and hardening of cement paste is due to hydration and hydrolysis of

A:-Tri calcium silicate (C3S)

B:-Di calcium silicate (C2S)

C:-Tri calcium aluminate (C3A)

D:-All the above

Correct Answer:- Option-D

Question96:-The role of phosphorus present in the fertilizers is

A:-Essential for the development of stems and leaves

B:-Stimulates growth and accelerates fruit and seed formation

C:-Essential for the development of starches, sugars and fibers and helps to prevent disease

D:-None of the above

Correct Answer:- Option-B

Question97:-Hydrogen is obtained from methane by a process called

A:-Hydrogenation

B:-Catalytic cracking

C:-Isomerisation

D:-Steam reforming

Correct Answer:- Option-D

Question98:-Match the catalyst used in the production of following chemicals

Group - 1	Group - 2
P. Sulphuric acid	I. Pt/Rh
Q. Nitric acid	II. Ni
R. Ammonia	III. V_2O_5
S. Hydrogenation of oil	IV. Fe

A:-P-III, Q-I, R-IV, S-II

B:-P-III, Q-II, R-IV, S-I

C:-P-III, Q-IV, R-I, S-II

D:-P-IV, Q-III, R-II, S-I

Correct Answer:- Option-A

Question99:-Diesel Index is the

A:-Cetane number $-\frac{10}{0.72}$

B:-Aniline point (°F) $\times \frac{API}{100}$

C:-Cetane number $+\frac{10}{0.72}$

D:-Both (1) and (2)

Correct Answer:- Option-D

Question100:-Polyester is produced by

A:-Reaction between ethylene glycol and terephthalic acid

B:-Oxidation of p-xylene in the presence of a cobalt-sulfate catalyst supplied as a solution of acetic acid

C:-By polymerisation of styrene

D:-By polymerisation of styrene, acrylonitrile and polybutadiene

Correct Answer:- Option-A