

PGCET-2023

Seat No. _____

SUB: Chemical Engineering

Time: 1 Hour 30 minutes

Instructions:

1. Ensure that all pages are printed.
2. Use Black ball pen only
3. Change in option is not allowed
4. There is no negative marking
5. Use of non-programmable scientific calculator is allowed

1.	Steady flow occurs, when the			
	A	conditions change steadily with time	B	conditions do not change with time at any point
	C	rate of the velocity change is constant	D	conditions are the same at the adjacent points at any instant
2.	kinematic viscosity has the dimensions			
	A	L^2T^{-1}	B	L^2T
	C	MLT^{-1}	D	$ML^{-1}T^{-1}$
3.	The flow of water in a pipe of diameter 300 cm can be measured by			
	A	orifice plate	B	rota meter
	C	venturi meter	D	pitot tube
4.	$f = 16/N_{Re}$, is valid for			
	A	steady flow	B	turbulent flow
	C	laminar flow through open channel	D	none of these
5.	Cavitation occurs in a centrifugal pump when the suction pressure is			
	A	equal to vapor pressure of the liquid at that temperature	B	greater than the vapor pressure of the liquid at that temperature
	C	less than the vapor pressure of the liquid at that temperature	D	equal to the velocity head
6.	The head loss due to sudden contraction is proportional to			
	A	velocity head	B	turbulence
	C	velocity	D	none of these

7.	The ratio of actual discharge to theoretical discharge through an orifice is			
	A	$1/C_c C_v$	B	$C_c C_v$
	C	$C_c - C_v$	D	C_v/C_c
8.	A relief valve			
	A	unloads a pump	B	provides back pressure for a cylinder
	C	is a directional control valve	D	none of these
9.	For laminar flow of a shear thinning liquid in a pipe, if the volumetric flow rate is doubled, the pressure gradient will increase by a factor of			
	A	2	B	1
	C	< 2	D	1/2
10.	Equal masses of CH_4 and H_2 are mixed in an empty container. The partial pressure of hydrogen in this container expressed as the fraction of total pressure is			
	A	1/9	B	1/3
	C	5/9	D	8/9
11.	A gas occupies a volume of 283 c.c at 10°C . If it is heated at 20°C at constant pressure, the new volume of the gas will be _____ c.c.			
	A	283	B	293
	C	566	D	586
12.	The effect of pressure on the heat capacity of the gases _____ is negligible.			
	A	below the critical temperature	B	at pressure below one atmosphere
	C	both (A) & (B)	D	neither (A) nor (B)
13.	In continuous filtration at a constant pressure drop, filtrate flow rate varies inversely			
	A	square root of the velocity	B	square of the viscosity
	C	washing time only	D	filtration time only
14.	Reduction ratio of crushers is the			
	A	determining factor for minimum dia of the feed and the product	B	ratio of feed opening to discharge opening
	C	ratio of discharge opening to feed opening	D	none of these

15.	For transporting pasty material, one will use a/an			
	A	bucket elevator	B	belt conveyor
	C	apron conveyor	D	screw conveyor
16.	Power required to drive a ball mill with a particular ball load is proportional to			
	A	D	B	$D^{1.5}$
	C	$D^{2.5}$	D	$D^{0.5}$
17.	The term 'angle of nip' is concerned with the operation of			
	A	gyratory	B	jaw
	C	roll	D	froth filtration
18.	Which of the following is not accomplished by agitation of liquids in agitators?			
	A	blending of immiscible liquids	B	dispersing gas in liquid
	C	suspending solid particles	D	dispersing immiscible liquids in form of emulsion
19.	Which of the following coals has the highest calorific value?			
	A	peat	B	lignite
	C	anthracite	D	sub-bituminous
20.	The gasification reaction represented by, $C + H_2O = CO + H_2$, is a/an _____ reaction			
	A	autocatalytic	B	endothermic
	C	exothermic	D	none of these
21.	Vanillin is a type of			
	A	flavor	B	dye
	C	anti-pyretic drug	D	food preservative
22.	Heat flux through several resistance in series is analogous to the current flowing through several			
	A	capacitors in series	B	resistances in parallel
	C	capacitors in parallel	D	resistances in series

23.	Prandtl number is a ratio of			
	A	thermal diffusivity to momentum diffusivity	B	momentum diffusivity to thermal diffusivity
	C	thermal diffusivity to mass diffusivity	D	momentum diffusivity to mass diffusivity
24.	The purpose of providing expansion bellows in the shell of tubular exchanger is to			
	A	account for the uneven expansion of shell and tube bundles	B	facilitate increase of shell length, if needed
	C	impart structural strength	D	increase the heating load
25.	In counter flow compared to parallel flow,			
	A	less surface area is required for a given heat transfer rate	B	LMTD is greater
	C	both (A) and (B)	D	more surface area is required for a given heat transfer rate
26.	In an extended surface heat exchanger, fluid having lower co-efficient			
	A	should not be used as it gives very high pressure drop	B	can flow either inside or outside the tubes
	C	flows through the tubes	D	flows outside the tubes
27.	Trap is used to remove _____ from steam pipe lines			
	A	condensate	B	steam
	C	non-condensable	D	none of these
28.	The wavelength at which the maximum monochromatic emissive power occurs for a black body is			
	A	independent of T	B	$\propto 1/T$
	C	$\propto T$	D	$\propto T^4$
29.	Modes of heat transfer in which the fluid moves under the influence of changes in fluid pressure produced by external work is called			
	A	natural convection	B	forced convection
	C	radiation	D	conduction

30.	The critical radius of insulation for a spherical shell is			
	A	K/h_0	B	h_0/K
	C	$2K/h_0$	D	$2K h_0$
31.	Which of the following has the minimum absorptivity?			
	A	coal dust	B	iron plates
	C	refractory bricks	D	aluminium foil
32.	Molecular diffusion is caused by			
	A	thermal energy of the molecules	B	activation energy of the molecules
	C	transfer of molecules from low concentration to high concentration region	D	potential energy of the molecules
33.	Operating velocity in a packed tower is usually _____ the flooding velocity			
	A	equal to	B	half
	C	twice	D	less than
34.	For absorbers, high pressure drop results in			
	A	better gas liquid contact	B	increased efficiency
	C	high operating cost	D	enhanced contact time
35.	In a binary system, separation is very efficient, when the relative volatility is			
	A	1	B	< 1
	C	0	D	> 1
36.	When the feed to a distillation column is a saturated liquid, slope of the feed line is			
	A	0	B	∞
	C	1	D	none of these
37.	As reflux ratio increases, the slope of the operating line for rectifying section			
	A	increases	B	decreases
	C	remains constant	D	cannot be predicted

38.	The solvent used in liquid extraction should not have high latent heat of vaporization, because			
	A	it will decompose while recovering by distillation	B	its recovery cost by distillation may be prohibitatively high
	C	it cannot be recovered by distillation	D	the pressure drop and pumping cost will be very high
39.	Sides of equilateral triangular co-ordinates (on which ternary liquid system is plotted) represent			
	A	partially miscible ternary system	B	a pure component
	C	a binary system	D	a ternary system
40.	The falling rate period in the drying of a solid is characterized by			
	A	decreasing temperatures	B	increase in rate of drying
	C	increasing temperatures both on the surface and within the solid	D	none of these
41.	Which of the following parameters remains constant during chemical dehumidification?			
	A	Humidity	B	partial pressure of vapor
	C	wet bulb temperature	D	dry bulb temperature
42.	The equilibrium liquid composition compared to the vapor composition in case of azeotropic mixture is			
	A	same	B	less
	C	more	D	either more or less, depend on the system
43.	Transfer function of transportation lag is			
	A	e^{sT}	B	$1/(sT + 1)$
	C	e^{-sT}	D	$s/(s^2 - 1)$
44.	The frequency at which maximum amplitude ratio is attained is called the _____ frequency			
	A	natural	B	resonant
	C	corner	D	cross-over

45.	Thermocouple is suitable for measuring			
	A	very high temperatures only	B	very low temperatures only
	C	liquid temperatures only	D	both high and low temperatures only
46.	Critically damped system means that the damping co-efficient is			
	A	1	B	0
	C	< 1	D	>1
47.	A controller action in which there is a continuous relation between value of the controlled variable and the value of the output signal of the controller is called the _____ action.			
	A	derivative	B	proportional
	C	integral	D	none of these
48.	Which of the following has got the smallest maximum deviation among, P, PI, PD and PID controllers?			
	A	PID	B	PD
	C	PI	D	P
49.	For isothermal reversible compression of an ideal gas			
	A	$dQ = dE$	B	only $\Delta E = 0$
	C	only $\Delta H = 0$	D	$\Delta E = \Delta H = 0$
50.	Fugacity and pressure are numerically equal, when the gas is			
	A	in ideal state	B	in standard state
	C	at high pressure	D	at low temperature
51.	“Dry ice” is			
	A	moisture free ice	B	solid carbon dioxide
	C	solid helium	D	none of these
52.	If two gases have same reduced temperature and reduced pressure, then they will have the same			
	A	critical temperature	B	mass
	C	volume	D	none of these

53.	In a PV diagram (for an ideal gas), an isothermal curve will coincide with an adiabatic curve (through a point), when			
	A	$C_p < C_v$	B	$C_p > C_v$
	C	$C_p = C_v$	D	$C_p \gg C_v$
54.	A nozzle is a device, which			
	A	increases kinetic energy and decreases pressure	B	reduces kinetic energy and increases pressure
	C	increases both kinetic energy and pressure	D	reduces both kinetic energy and pressure
55.	In a first order reaction, the time required to reduce the concentration of reactant from 1 mole/liter to 0.5 mole/liter will be _____ that required to reduce it from 10 moles/liter to 5 moles/liter in the same volume.			
	A	less than	B	same as
	C	more than	D	data insufficient
56.	A space time of 3 hours for a flow reactor means that			
	A	it takes 3 hours to dump the entire volume of the reactor with feed	B	3 reactor volumes of feed can be processed every hour
	C	the time required to process one reactor volume of feed (measured at specified conditions) is 3 hours	D	conversion is cent per cent after 3 hours
57.	Which of the following is the most suitable for very high pressure gas phase reaction?			
	A	tubular flow reactor	B	stirred tank reactor
	C	batch reactor	D	fluidized bed reactor
58.	For an autocatalytic reactor, the suitable reactor set up is			
	A	PFR in series	B	CSTR in series
	C	PFR reactor followed by CSTR	D	CSTR reactor followed by PFR
59.	A chemical reaction, $A \longrightarrow 3B$ is conducted in a constant pressure vessel. Starting with pure A, the volume of the reaction mixture increase 3 times in 6 minutes. The fractional conversion is			
	A	1	B	0.67
	C	0.5	D	0.33

60.	An irreversible first order reaction is being carried out in a CSRT and PFR of same volume. The liquid flow rates are same. The relative conversion will			
	A	depends on temperature	B	be more in PFR than CSTR
	C	be more in CSTR than PFR	D	be same in both reactors
61.	Half life period of decomposition of a liquid 'A' by irreversible first order reaction is 12 minutes. The time required for 75 % conversion of 'A' is _____ minutes			
	A	6	B	15
	C	18	D	24
62.	A first order reaction is to be treated in a series of two mixed reactors. The total volume of the two reactors is minimum, when the reactors are			
	A	of such sizes that the ratio of their volumes is < 10	B	of different sizes
	C	equal in size	D	of such sizes that the ratio of their volumes is < 5
63.	If a solid-gas non-catalytic reaction occurs at very high temperature, the rate controlling step is the _____ diffusion.			
	A	film	B	pore
	C	ash layer	D	none of these
64.	'n' number of PFR in series with a total volume 'V' gives the same conversion as one PFR of volume			
	A	$V * n$	B	V/n
	C	V	D	$1/V$
65.	The force due to wind load acting on a tall vessel depends upon its			
	A	height	B	shape
	C	outside diameter	D	all of these
66.	Which of the following is not a component of the fixed capital for a chemical plant facility?			
	A	process equipments	B	raw materials inventory
	C	utilities plants	D	emergency facilities

67.	In water chemical treatment plant, use of chlorination ensures			
	A	removal of permanent hardness	B	pH control
	C	disinfection	D	taste and odor control
68.	Particles having diameter greater than 75 μm (1 micrometer = 10^{-6} mm) are called			
	A	dust	B	grit
	C	smoke	D	powder
69.	Scale formation in boiler is controlled by			
	A	reduction in hardness, silica and alumina in feed water	B	preheating of feed water
	C	eliminating H ₂ S in feed water	D	keeping the pH value of feed water just below 7
70.	presence of _____ in water stream are harmful to aquatic life			
	A	heavy metals and cyanides	B	soluble and toxic organics
	C	suspended solids	D	all of these
71.	Cetane number of a diesel fuel is the measure of its			
	A	oxidation stability	B	smoke point
	C	ignition delay	D	viscosity
72.	Catalyst used in the catalytic cracking is			
	A	nickel	B	silica-alumina
	C	silica gel	D	vanadium pentoxide
73.	Fluidizing is a _____ process.			
	A	fluidized bed	B	moving bed
	C	regenerative	D	non-regenerative and fixed bed
74.	H/C ratio (by weight) for the same number of carbons atom is the highest in case of			
	A	naphthenes	B	aromatics
	C	olefins	D	paraffins

75.	Reforming converts			
	A	naphthenes into aromatics	B	naphthenes into paraffin
	C	olefins to paraffins	D	aromatics to naphthenes
76.	Which of the following is the most important property for a jet fuel?			
	A	pour point	B	cloud point
	C	freezing point	D	calorific value
77.	Epoxy resin is			
	A	a polyester	B	a good abrasive
	C	not used for surface coating	D	an elastomer
78.	_____ is a natural fibre.			
	A	dacron	B	cellulose
	C	teflon	D	nylon-6
79.	Lubricants can be used to			
	A	form a seal in compressors	B	remove contaminants by flushing and to insulate transformers, switchgears etc.
	C	transmit power hydraulically	D	All of these
80.	With increase in the molecular weight of aromatic present in kerosene, its smoking tendency			
	A	increases	B	decreases
	C	remains constant	D	is unpredictable
81.	The probability for a Certain event is _____.			
	A	0	B	1
	C	Between 0 and 1	D	Not defined
82.	The probability that a prime number selected at random from the numbers 1, 2, 3, ... ,10			
	A	3/10	B	1/2
	C	2/5	D	3/5

83.	In a binomial distribution, if there are 50 trials and the probability of success is 0.7 then the value of the variance is ____.			
	A	0.21	B	10.5
	C	15	D	35
84.	The Bisection method is also known as ____.			
	A	Binary Chopping	B	Quaternary Chopping
	C	False Position method	D	Method of tangents
85.	Which of the following is Eigen value of the matrix $A = \begin{bmatrix} 1 & 2 \\ 0 & 5 \end{bmatrix}$			
	A	- 1	B	0
	C	1	D	2
86.	The function $f(z)$ for a complex variable $z = x + iy$; $i = \sqrt{-1}$, is given as $f(z) = (x^3 - 3xy^2) + i v(x, y)$. This function $f(z)$ is analytic for $v(x, y) =$ ____.			
	A	$(3xy^2 - y^3) + \text{constant}$	B	$(3x^2y^2 - y^3) + \text{constant}$
	C	$(x^2 - 3x^2y) + \text{constant}$	D	$(3x^2y - y^3) + \text{constant}$
87.	The function $y = 2 - 3x $ is			
	A	continuous for all $x \in R$ and differentiable for all $x \in R$ except $x = 2/3$	B	continuous for all $x \in R$ and differentiable for all $x \in R$ except $x = 3/2$
	C	continuous for all $x \in R$ except $x = 3/2$ and differentiable for all $x \in R$	D	continuous and differentiable for all $x \in R$
88.	If $x^2 \frac{dy}{dx} + 2xy = \frac{2 \ln x}{x}$ with $y(1) = 0$ then find $y(e)$.			
	A	e	B	1
	C	$1/e$	D	$1/e^2$

89.	Stoke theorem connects			
	A	line integral and surface integral	B	Surface integral and volume integral
	C	line integral and volume integral	D	gradient of a function and its surface integral
90.	Apply Trapezoidal rule to evaluate integral $\int_0^{\pi} (\sin x + \cos x) dx$ with three subintervals. The value of the integral is _____			
	A	1.7	B	1.8
	C	1.9	D	2.1
91.	In usual notations, $L\{u(t+2)\} = \underline{\hspace{2cm}}$			
	A	$\frac{e^{-2s}}{s^2}$	B	$\frac{e^{2s}}{s^2}$
	C	$\frac{e^{-2s}}{s}$	D	$\frac{e^{2s}}{s}$
92.	Inverse Laplace transform of $\frac{1}{(s+3)^6}$ is _____.			
	A	$e^{-6t} \frac{t^3}{3!}$	B	$e^{-3t} \frac{t^6}{6!}$
	C	$e^{-3t} \frac{t^5}{5!}$	D	$e^{-3t} \frac{t^6}{5!}$
93.	The particular integral of the differential equation $(D^2 + 4)y = \sin 2x$ is _____			
	A	$-\frac{x}{4} \cos 2x$	B	$\frac{x}{4} \cos 2x$
	C	$-\frac{x}{4} \sin 2x$	D	$\frac{x}{4} \sin 2x$
94.	If $f(x) = \frac{x^2 - x}{2x}$; $x \neq 0$ and $f(0) = k$ and if it is continuous at $x = 0$ then $k = \underline{\hspace{2cm}}$			
	A	-1	B	-1/2
	C	0	D	None of these

95.	The integral $\int_{-2}^2 \frac{1}{x+1} dx$ is _____		
	A	$\ln 3$	B 0
	C	$8/9$	D divergent
96.	In usual notations, $\frac{\partial(u,v)}{\partial(x,y)} \frac{\partial(x,y)}{\partial(u,v)} =$ _____		
	A	1	B -1
	C	0	D None of these
97.	Which of the following statements are true in general? Statement 1: Singular matrix is always a square matrix. Statement 2: Every square matrix is symmetric matrix. Statement 3: Every square matrix satisfies its own characteristic equation.		
	A	Only statement 1	B Statement 1 and 2
	C	Statement 1 and 3	D All of above
98.	If the mean of a Poisson distribution is 49 then the standard deviation is _____		
	A	0	B 7
	C	49	D None of these
99.	Which of the following method is used to find solution of Ordinary Differential Equation?		
	A	Bisection Method	B Newton Raphson method
	C	Successive approximation method	D Euler's method
100.	For a function $f(x, y)$, the Stationary point is a point for which _____		
	A	$f_x = 0$	B $f_y = 0$
	C	$f_x = 0$ and $f_y = 0$	D None of these