

PGCET-2022

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.	Friction factor for a hydraulically smooth pipe at $N_{Re} = 2100$ is f_1 . If the pipe is further smoothened (i.e., roughness is reduced), the friction factor at the same value of N_{Re} , will			
	A	Increase	B	Remain unchanged
	C	Decrease	D	Increase or decrease depending on the pipe material
2.	Horsepower requirement for given pump capacity depends upon the			
	A	Specific gravity of the liquid	B	Suction lift
	C	Discharge head	D	All (A), (B) and (C)
3.	Froude number is the ratio of			
	A	Shear stress to gravitational stress	B	Drag stress to shear stress
	C	Inertial stress to shear stress	D	Inertial stress to gravitational stress
4.	Reynolds number for water flow through a tube of I.D. 5 cm is 1500. If a liquid of 5 centipoise viscosity and 0.8 specific gravity flows in the same pipe at the same velocity, then the pressure drop will			
	A	Increase	B	Decrease
	C	Remain same	D	Data insufficient to predict pressure drop
5.	Which is not a variable head meter?			
	A	Venturimeter	B	Pitot tube
	C	Rotameter	D	None of these
6.	Angle of nip of the crushing rolls does not depend upon the			
	A	Diameter of the rolls	B	Speed of the rolls

	C	Product size	D	Feed size
7.	Arrange the following size reduction equipment in the decreasing order of the average particle size produced by each of them.			
	A	Jaw crusher, Ball mill, Fluid energy mill	B	Ball mill, Jaw crusher, Fluid energy mill
	C	Fluid energy mill, Jaw crusher, Ball mill	D	Fluid energy mill, Ball mill, Jaw crusher
8.	Filtration rate through a filter cake is proportional to (where, S = filtering surface R = specific cake resistance μ = viscosity of the filtrate)			
	A	S	B	$1/R$
	C	$1/\mu$	D	All (A), (B) & (C)
9.	Mesh indicates the number of holes per			
	A	Square inch	B	Linear inch
	C	Square foot	D	Linear foot
10.	_____ is the most commonly used 'filter aid'.			
	A	Diatomaceous earth	B	Fuller's earth
	C	Vermiculite	D	Semi-plastic clay
11.	Glauber's salt is chemically			
	A	Calcium sulphate	B	Potassium sulphate
	C	Potassium chlorate	D	None of these
12.	Transportation of 35% oleum during winter suffers from the problem of freezing, which can be overcome by the addition of small quantity of			
	A	Nitric acid	B	Hydrochloric acid
	C	Methyl alcohol	D	Formic acid
13.	Grignard reagent is chemically known as			
	A	Ethyl magnesium chloride	B	Methyl magnesium chloride
	C	Dichlorophenol	D	Monochloroacetic acid
14.	Conversion of SO_2 to SO_3 in Monsanto 4-pass converter is about _____ percent.			
	A	80	B	90

	C	98	D	100
15.	Which of the following is not a food additive?			
	A	Citric acid	B	Invertage
	C	Benzoyl peroxide	D	Ammonium chloride
16.	A system undergoes a change from a given initial state to a given final state either by an irreversible process or by a reversible process, then (where, ΔS_1 and ΔS_R are the entropy changes of the system for the irreversible and reversible processes respectively)			
	A	ΔS_1 is always $< \Delta S_R$	B	ΔS_1 is sometimes $> \Delta S_R$
	C	ΔS_1 is always $> \Delta S_R$	D	ΔS_1 is always $= \Delta S_R$
17.	Throttling process is a/an _____ process.			
	A	Reversible and isothermal	B	Irreversible and constant enthalpy
	C	Reversible and constant entropy	D	Reversible and constant enthalpy
18.	First law of thermodynamics is mathematically stated as			
	A	$dQ = dE + dW$	B	$dQ = dE - dW$
	C	$dE = dQ * dW$	D	$dW = dQ + dE$
19.	The quantitative effect of temperature on chemical equilibrium is given by the			
	A	Le-Chatelier's principle	B	Van't-Hoff equation
	C	Arrhenius equation	D	None of these
20.	In the ammonia synthesis reaction, $N_2 + 3H_2 \rightleftharpoons 2NH_3 + 22.4 \text{ kcal}$, the formation of NH_3 will be favored by			
	A	High temperature	B	Low pressure
	C	Low temperature only	D	Both low temperature and high pressure
21.	Dittus-Boelter equation cannot be used for molten metals mainly due to its very low			
	A	Prandtl number	B	Grashoff number
	C	Thermal conductivity	D	Viscosity

22.	Three materials A, B and C of equal thickness and of thermal conductivity of 20, 40 & 60 kcal/hr. m. °C respectively are joined together. The temperature outside of A and C are 30°C and 100°C respectively. The interface between B and C will be at a temperature of _____ °C.			
	A	40	B	95
	C	70	D	50
23.	For a cold dilute feed to produce thick viscous liquor, backward feeding as compared to forward feeding results in			
	A	Increased economy	B	Decreased economy
	C	Lower capacity	D	No effect on economy
24.	Leidenfrost point is a term concerned with the			
	A	Condensation of the saturated vapor on a cold surface	B	Concentration of a corrosive solution by evaporation
	C	Heat transfer between two highly viscous liquids	D	Boiling of a liquid on a hot surface
25.	Which of the following is the most widely used heat insulating material for pipelines carrying steam?			
	A	Tar dolomite bricks followed by asbestos	B	Fireclay refractory followed by aluminum sheet
	C	Cotton followed by aluminum foil	D	85% magnesia cement and glass wool
26.	It takes 6 hours to dry a wet solid from 50% moisture content to the critical moisture content of 15%. How much longer it will take to dry the solid to 10% moisture content, under the same drying conditions? (The equilibrium moisture content of the solid is 5%).			
	A	15 min	B	51 min
	C	71 min	D	94 min
27	Which of the following gas-liquid contacting devices incurs the least pressure drop for a particular duty?			
	A	Grid tray tower	B	Perforated tray tower
	C	Wetted wall tower	D	Bubble cap tower
28	For which of the following unit operations, Lewis number is of significance?			
	A	Adsorption	B	Binary distillation
	C	Humidification	D	Gas absorption
29	_____ is used as an 'entrainer' for the separation of acetic acid-water mixture by distillation.			
	A	Furfural	B	Benzol
	C	Butyl acetate	D	Hexane
30	Channeling is most severe			
	A	In towers packed with stacked packing	B	In towers packed randomly with crushed solids
	C	In dumped packing of regular units	D	At very high liquid flow rate

31	Bode diagram is a plot of			
	A	$\log (AR)$ vs. $\log (f)$ and (ϕ) vs. $\log (f)$	B	$\log (AR)$ vs. f and $\log \phi$ vs. f
	C	AR vs. $\log (f)$ and ϕ vs. $\log (f)$	D	None of these
32	Dead zone is the			
	A	Same as time constant	B	Same as transportation lag
	C	Maximum change in the variable that does not change the reading of the instrument	D	None of these
33	Dilatometer is used to measure			
	A	Stress	B	Strain
	C	Deflection	D	Contraction/expansion due to changes in temperature
34	The transfer function of a second order system is			
	A	$1/(T^2s^2 + 2\xi T_s + 1)$	B	$1/(T^2s^2 + 2T_s + 1)$
	C	$1/(T^2s^2 + 2\xi T + 1)$	D	None of these
35	Which of the following controllers has the least maximum deviation?			
	A	P -controller	B	P - I controller
	C	P - I - D controller	D	P - D controller
36	With increase in temperature, the equilibrium conversion of a reversible exothermic reaction			
	A	Decreases	B	Increases
	C	Remain unaffected	D	Decreases linearly with temperature
37	A space velocity of 5 hr^{-1} means that			

	A	A fixed conversion of a given batch of feed takes 5 hours	B	After every 5 hours, reactor is being filled with the feed
	C	Five reactor volumes of feed (at specified conditions) are being fed into the reactor per hour	D	Cent per cent conversion can be achieved in at least 5 hours
38	If Thiele modulus is _____, then the pore diffusion resistance in a catalyst may be considered as negligible.			
	A	0	B	∞
	C	< 0.5	D	> 0.5
39	For a zero order chemical reaction, the			
	A	Half life period is directly proportion to the initial concentration of the reactants	B	Plot of products concentration with time is a straight line through the origin
	C	Products concentration increases linearly with time	D	All the options
40	Backmixing is most predominant in			
	A	A well stirred batch reactor	B	A plug-flow reactor
	C	A single CSTR	D	CSTRs connected in series
41	Minimum recommended baffle spacing in a shell and tube heat exchanger is about (where, D = shell diameter)			
	A	$0.2 D$	B	$0.5 D$
	C	$0.66 D$	D	$0.80 D$
42	Which tube arrangement in a heat exchanger would facilitate highest heat transfer rate?			
	A	Square pitch	B	Diagonal square pitch
	C	Triangular pitch	D	Heat transfer rate is independent of tube arrangement
43	Smoker's equation for the calculation of number of equilibrium stages in a continuous binary distillation column is used, when the			

	A	Relative volatility is close to one (e.g., separation of close boiling isomers)	B	Feed is not at its bubble point
	C	Number of equilibrium stages in only stripping section is to be calculated	D	Number of equilibrium stages required is likely to be very small
44	The safe distance of habitation from a hazardous chemical plant (TLV of its product < 1000 ppm) should be about _____ kms.			
	A	1	B	5
	C	15	D	25
45	Hazards associated with the relief valve leakage for extremely hazardous material storage can be taken care of by providing			
	A	Rupture diaphragm	B	Dikes
	C	Surge chamber	D	None of these
46	Which of the following is not a component of depreciation cost?			
	A	Loss due to obsolescence of the equipment		Loss due to decrease in the demand of product
	C	Repairs and maintenance cost		Loss due to accident/breakdown in the machinery
47	Gantt chart (or Bar chart) is helpful in			
	A	Efficient utilization of manpower and machines	B	Preparing production schedule
	C	Efficient dispatching of products	D	Inventory control
48	Out of the following, the depreciation calculated by the _____ method is the maximum.			
	A	Diminishing balance	B	Straight line
	C	Sum of the years digit	D	Sinking fund
49	The total investment in a project is Rs. 10 lakhs and the annual profit is 1.5 lakhs. If the project life is 10 years, then the simple rate of return on investment is			
	A	15%	B	10%

	C	1.5%	D	150%
50	Equipment installation cost in a chemical process plant ranges from _____ percent of the purchased equipment cost.			
	A	10 to 20	B	35 to 45
	C	55 to 65	D	70 to 80
51	A standard test for determination of hardness in water is termed as _____ test.			
	A	EDTA	B	Total count
	C	Electrometric	D	Presumptive
52	Black smoke coming out of the chimney of a furnace is an indication of the use of _____ in the furnace.			
	A	Low amount of excess combustion air	B	Large quantity of excess combustion air
	C	Hydrocarbon fuel	D	Pulverized coal as fuel
53	CFC (chloro fluoro carbon) is very highly reactive in causing depletion of ozone layer in the atmosphere. Each atom of chlorine liberated from CFC is capable of decomposing _____ molecules of ozone.			
	A	10^2	B	10^5
	C	10^9	D	10^{15}
54	In water treatment, alum $[Al_2(SO_4)_3]$ is used for the process of			
	A	Filtration	B	Coagulation
	C	Sedimentation	D	Disinfection
55	Ceramic recuperators are generally made of			
	A	Silicon carbide	B	Calcium carbide
	C	Fireclay bricks.	D	High alumina bricks.
56	In petroleum refining, the process used for conversion of hydrocarbons to aromatics is			
	A	Catalytic cracking	B	Catalytic reforming
	C	Hydrotreating	D	Alkylation
57	Which is the most undesirable component in kerosene?			
	A	Aromatics	B	<i>i</i> -paraffins
	C	<i>n</i> -paraffins	D	Naphthenes
58	_____ chloride present in crude petroleum as impurity is the most prolific producer of HCl during distillation.			
	A	Potassium	B	Calcium
	C	Magnesium	D	Sodium

59	LSHS is a type of furnace oil, which		
	A	Is more viscous than high viscosity furnace oil (HVFO)	B Stands for low sulphur heavy stock
	C	Is an ideal fuel for metallurgical furnaces due to its lower sulphur content (< 1%)	D All the options
60	Petroleum liquid fuels having flash point greater than 66°C is considered as safe during storage and handling. Which of the following has flash point > 66°C?		
	A	Naphtha	B Petrol
	C	Kerosene	D Heavy fuel oil
61	Rexine (also called artificial leather), which is used for making table cover, automobile seat cover, shoes etc. is made by coating thick cloth with molten		
	A	Teflon	B PVC
	C	Bakelite	D SBR
62	Most commonly used rubber vulcanization agent is		
	A	Bromine	B Platinum
	C	Sulphur	D Alumina
63	Which of the following rubbers has the widest service temperature range (-75 to 275°C)?		
	A	Butyl rubber	B Silica rubber
	C	Nitrile rubber	D Silicone rubber
64	_____ tubes are good substitute for human blood vessels on heart by-pass operation.		
	A	PVC	B Polythene

	C	Teflon/Dacron	D	Polystyrene
65	'Cox' chart which is useful in the design of a distillation column (particularly suitable for petroleum hydrocarbons) is a plot of the			
	A	Temperature vs. log (vapor pressure)	B	Vapor pressure vs. log (temperature)
	C	Log (temperature) vs. log (vapor pressure)	D	Vapor pressure vs. temperature
66	Sodium _____ has inverted solubility curve i.e. its solubility increases with the lowering of temperature.			
	A	Thiosulphate	B	Bisulphite
	C	Chloride	D	Carbonate (monohydrate)
67	1 gm mole of methane (CH ₄) contains			
	A	6.02×10^{23} atoms of hydrogen	B	4 gm atoms of hydrogen
	C	3.01×10^{23} molecules of methane	D	3 gms of carbon
68	Pick out the wrong statement:			
	A	A vapor is termed as a saturated vapor, if its partial pressure equals its equilibrium vapor pressure	B	A vapor whose partial pressure is less than its equilibrium vapor pressure, is termed as a 'superheated vapor'
	C	The temperature at which a vapor is saturated is termed as the boiling point	D	The difference between the existing temperature of a vapor and its saturation temperature (i.e. dew point) is called its 'degree of superheat'
69	Pick out the correct statement.			
	A	Heat of solution is always positive	B	At equilibrium, ΔG is zero

	C	For the reaction, $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$, ΔG is less than ΔE	D	The heating of water in a beaker is an example of an isolated system
70	Vapor pressure of water at 100°C is about _____ bar.			
	A	0.1013	B	1.013
	C	10.13	D	101.3
71	The value of $(C_p - C_v)$ for a real gas obeying Vander Wall's equation is			
	A	R	B	$> R$
	C	$< R$	D	$0.5 R$
72	For the gaseous phase reaction, $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$, $\Delta H = + 80 \text{ kJ/kg. mole}$; the decomposition of NO is favored by			
	A	Increasing the concentration of N_2	B	Decrease in temperature
	C	Increase in pressure	D	Decrease in pressure
73	One kilowatt-hour energy is equivalent to			
	A	1000 J	B	360 kJ
	C	3600 kJ	D	3600 kW/sec
74	In centrifugal pumps, cavitation occurs, when pressure of the impeller eye or vane becomes			
	A	Less than atmospheric pressure	B	More than liquid vapor pressure
	C	More than atmospheric pressure	D	Less than liquid vapor pressure
75	Mercury is an ideal barometric fluid mainly due to its			
	A	High density	B	Very low vapor pressure
	C	Low compressibility	D	Low capillary action
76	Pick out the wrong statement:			

	A	Friction losses in pipe fittings are generally expressed in terms of velocity heads	B	Blowers develop a maximum pressure of 2 atmospheres
	C	Fanning friction factor in case of turbulent flow of liquids in pipe depends upon relative roughness & Reynolds number	D	Greater is the kinematic viscosity of the liquid, greater is the thickness of the boundary layer
77	Steam distillation is not recommended to be used, if the			
	A	Azeotropic mixture is to be separated and the final product is miscible with water	B	Liquids decompose, if distilled directly at atmospheric pressure
	C	Material cannot be distilled by indirect heating even under low pressure, because of the high boiling temperature	D	Material to be distilled is thermally unstable or has the tendency to react with other components associated with it, at the boiling temperature
78	Which of the following method is most commonly used in fluid mechanics for analysis?			
	A	Control volume analysis	B	Langragian method
	C	Eulerian Method	D	None of the mentioned
79	In case of _____ reactions, the reaction rate does not decrease appreciably as the reaction proceeds.			
	A	Catalytic	B	Auto catalytic
	C	Series	D	Parallel
80	For nearly isothermal operation involving large reaction time in a liquid-phase reaction, the most suitable reactor is a _____ reactor.			
	A	Stirred tank	B	Tubular flow
	C	Batch	D	Fixed bed
81	Which of the following matrix is in reduced row echelon form?			
	A	$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix}$	B	$\begin{bmatrix} 1 & 4 & 5 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$

	C	$\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	D	none of above
82	The system of linear equations $x - 2y + z = 4$, $3x + 5y + z = 6$, $6x - y + 4z = 2$ has			
	A	a unique solution	B	infinitely many solutions
	C	no solution	D	none of above
83	What is an integrating factor of $(x^3 + y^3)dx - x y^2 dy = 0$?			
	A	$3y^2$	B	$-y^2$
	C	$\frac{1}{x^4}$	D	x^4
84	The general solution of $x^2 \left(\frac{dy}{dx} \right)^2 - 4y^2 = 0$ is...			
	A	$(x^2 y - c)(y + xc) = 0$	B	$(x^2 y - c)(y - x^2 c) = 0$
	C	$(xy^2 - c)(y^2 - xc) = 0$	D	none of these
85	If $y_1 = x$ is one of the solutions of $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 0$ then the second solution y_2 is given by			
	A	$-\frac{1}{2x}$	B	$\frac{1}{2x}$
	C	$\frac{1}{x}$	D	$-\frac{1}{x}$
86	The differential equation $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = \sin(\log x)$ represents....			
	A	Bernoulli's equation	B	Newton's equation
	C	Legendre's homogeneous linear equation	D	Cauchy's homogeneous linear equation

87	If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then $\text{curl } \vec{r} = \dots$			
	A	0	B	$\vec{0}$
	C	\vec{r}	D	$x + y + z$
88	The line integral of \vec{F} is independent of the path of integral, if \vec{F} is a/an			
	A	solenoidal	B	rotational
	C	scalar field	D	none of these
89	The Laplace transform of $\frac{e^{-t} - e^{2t}}{t}$ is.....			
	A	$\log\left(\frac{s-2}{s-1}\right)$	B	$\log\left(\frac{s+2}{s-1}\right)$
	C	$\log\left(\frac{s-2}{s+1}\right)$	D	$\log\left(\frac{s+2}{s+1}\right)$
90	Which of the following methods is not an indirect method for solving a system of simultaneous linear equations?			
	A	Gauss-Jordan	B	Gauss-Seidel
	C	Gauss-Jacobi	D	relaxation
91	False position method to solve non-linear equations numerically is also known as.....			
	A	Secant	B	Regula Falsi
	C	method of tangents	D	none of these
92	The formula of numerical integration obtained from Newton-Cotes' quadrature formula by putting $n = 3$ is known as			
	A	Simpson's one-third rule	B	Gaussian quadrature formula
	C	Simpson's three-eighth rule	D	trapezoidal rule
93	Which of the following methods is one of the predictor-corrector method to solve first order linear differential equation numerically?			
	A	Adams-Bashforth method	B	Runge-Kutta fourth order method
	C	Taylor's series method	D	Picard's method

94	The coefficient of z^{-1} in the Laurent's expansion of $f(z) = \frac{1}{z^2(1-z)}$ in the range $ z < 1$ is...		
	A	2	B does not exist
	C	1	D none of above
95	Which of the following functions is entire function?		
	A	e^z	B $1/z$
	C	$\log z$	D $z \operatorname{Im} z$
96	A bounded entire function is constant. This is stated in theorem.		
	A	Liouville's	B Morera's
	C	Cauchy's integral	D Cauchy's residue
97	In which distribution mean, median and mode coincide?		
	A	Normal	B Exponential
	C	Poisson	D Binomial
98	A man is known to speak truth 3 out of 4 times. He throws a die and reports that number appeared on die is six. The probability that the number appeared is actually a six is....		
	A	$\frac{3}{4}$	B $\frac{1}{4}$
	C	$\frac{3}{8}$	D $\frac{5}{8}$
99	The kurtosis is measured by $\beta_2 = \dots\dots\dots$, where μ_i is i^{th} moment $\dots\dots\dots$,		
	A	$\frac{\mu_4}{\mu_2}$	B $\frac{\mu_2}{\mu_4^2}$
	C	$\frac{\mu_4^2}{\mu_2^2}$	D $\frac{\mu_4}{\mu_2^2}$
100	The function $f(x, y) = xy + \frac{27}{x} + \frac{27}{y}$ has		
	A	local maxima at (3, 3)	B local minima at (3, 3)
	C	local maximum value is equal to 27	D none of these