

M.E.(Chemical)

1. The remainder when 7^{84} is divided by 342 is
(A) 0 (B) 1 (C) 49 (D) 341
2. $A = \begin{bmatrix} 5 & 0 & 2 \\ 0 & 3 & 0 \\ 2 & 0 & 1 \end{bmatrix}$. The inverse of A is
(A) $\begin{bmatrix} 1 & 0 & -2 \\ 0 & 1/3 & 0 \\ -2 & 0 & 5 \end{bmatrix}$ (B) $\begin{bmatrix} 5 & 0 & 2 \\ 0 & -1/3 & 0 \\ 2 & 0 & 1 \end{bmatrix}$
(C) $\begin{bmatrix} 1/5 & 0 & 1/2 \\ 0 & 1/3 & 0 \\ 1/2 & 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1/5 & 0 & -1/2 \\ 0 & 1/3 & 0 \\ -1/2 & 0 & 1 \end{bmatrix}$
3. Value of the integral $I = \int_0^{\pi/4} \cos^2 x \, dx$ is
(A) $\pi/8 + 1/4$ (B) $\pi/8 - 1/4$
(C) $-\pi/8 - 1/4$ (D) $-\pi/8 + 1/4$
4. Differential equation for the variation of the amount of salt x in a tank with time t is given by $\frac{dx}{dt} + \frac{x}{20} = 10$ where x is in kg and t is in minutes. Assuming that there is no salt in the tank initially, the time (in mins) at which the amount of salt increases to 100 kg is
(A) $10 \ln 2$ (B) $20 \ln 2$ (C) $50 \ln 2$ (D) $100 \ln 2$
5. If 20% managers are technocrats, the probability that a random committee of 5 managers consists of exactly 2 technocrats is
(A) 0.2048 (B) 0.4000 (C) 0.4096 (D) 0.9421

Common Data Q. 6-7.

Solid calcium oxalate dissociates at high temperatures into solid calcium carbonate and carbon monoxide.



The equilibrium pressure of CO between 670 and 700 K is given by $\ln P = 14.4 - (9600/T)$ where P is in atm and T is in K. Assume ideal behaviour and 675 K temperature

6. ΔG° will be
(A) -986 kJ (B) -992 kJ (C) -998 kJ (D) -994 kJ
7. ΔS° will be
(A) 98.7 kJ/K (B) 102.7 kJ/K (C) 108.7 kJ/K (D) 119.7 kJ/K
8. The equation $dU = T \, dS - P \, dV$ is applicable to infinitesimal changes occurring in a/an

- (A) Open system of constant composition
- (B) Closed system of constant composition
- (C) Open system with changes in composition
- (D) Closed system with changes in composition

9. The third law of thermodynamics deals with

- (A) Chemical reactions
- (B) Quantitative equivalence between heat and work
- (C) Rate of change of a process
- (D) Absolute entropy of perfect crystalline substances

10. The two specific heats at constant pressure and at a constant volume are equal at

- (A) 0° C
- (B) 0 K
- (C) 0° F
- (D) 0° R

11. For a reversible adiabatic change, the change in entropy of a system is

- (A) Zero
- (B) Positive
- (C) Negative
- (D) Cannot be determined

12. The minimum number of degree of freedom of any system is

- (A) 0
- (B) 1
- (C) 2
- (D) 3

13. In Vander Wall's equation $P = \frac{RT}{V-b} - \frac{a}{V^2}$, the constants a and b are

- (A) Positive
- (B) Negative
- (C) Zero
- (D) One positive, one negative

14. Fugacity has the same dimensions as that of

- (A) Gibbs free energy
- (B) Pressure
- (C) Temperature
- (D) Fugacity is dimensionless

15. Melting of ice is an example of

- (A) Isothermal process
- (B) Adiabatic process
- (C) Isometric process
- (D) Isochoric process

16. The chemical potential of a pure substance depends upon

- (A) Temperature
- (B) Pressure
- (C) Both (a) and (b)
- (D) Neither (A) nor (B)

17. Drag co-efficient C_D in Stoke's law range is given by

- (A) $C_D = \frac{16}{Re,p}$
- (B) $C_D = \frac{24}{Re,p}$
- (C) $C_D = \frac{18.4}{Re,p}$
- (D) $C_D = \frac{0.079}{R^{0.25}_{e,p}}$

18. In a fluidized bed reactor

- (A) Temperature gradients are very high
- (B) Temperature is more or less uniform
- (C) Hot spots are formed
- (D) Cold spots are formed

19. Power number is the ratio of
(A) Drag stress to inertial stress
(B) Inertial stress to drag stress
(C) Inertial stress to gravitational stress
(D) Gravitational stress to drag stress
20. Foot valves are provided in the suction line of a centrifugal pump to
(A) Avoid priming, every time we start the pump
(B) Remove the contaminants present in the liquid
(C) Minimize the fluctuation in discharge
(D) Control the liquid discharge
21. The schedule number of a pipe is an indication of its
(A) Size (B) Roughness
(C) Material density (D) Wall thickness
22. For turbulent flow of an incompressible fluid through a pipe, the flow rate Q is proportional to $(\Delta P)^n$, where ΔP is the pressure drop. The value of exponent 'n' is
(A) 1 (B) 0 (C) <1 (D) >1
23. A sand mixture was screened through a standard 10 – mesh screen. The mass fraction of the oversize material in feed, overflow and underflow were found to be 0.38, 0.79 and 0.22 respectively. The overall screen effectiveness is
(A) 0.90 (B) 0.58 (C) 0.53 (D) 0.83
24. The critical speed of the ball mill depends upon
(A) The radii of the mill and the ball
(B) The number of balls used
(C) The radius and number of balls
(D) The ratio of the mill and the ball, and the number of balls used
25. The angle of internal friction for free flowing granular material is
(A) 0° (B) 90°
(C) Between 15 and 30° (D) Between 45 and 60°
26. A hammer mill is used for
(A) Crushing (B) Grinding (C) Ultra grinding (D) Cutting
27. For crushing of solids, the Rittinger's law states that the work required for crushing is proportional to
(A) The new surface created (B) The size reduction ratio
(C) The change in volume due to crushing (D) Both (A) and (B)
28. The work index in Bond's law for crushing of solids has the following dimension:
(A) No units (dimensionless) (B) kWh / ton

(C) kW / ton

(D) kWhm^{1/2}/ton

29. A solid sphere and a hollow sphere of same material and size are heated to the same temperature and allowed to cool in the same surroundings. If the temperature difference between the body and that of surroundings is T, then

- (A) Both spheres will cool at the same rate for small values of T
- (B) Both spheres will cool at the same rate for all values of T
- (C) Hollow sphere will cool at a faster rate for all values of T
- (D) Solid sphere will cool at a faster rate for all values of T

30. A furnace is made of a red brick wall of thickness 0.5 m and conductivity 0.7 W/mk. For the same heat loss and temperature drop, this can be replaced by a layer of diatomite earth of conductivity 0.14 W/mk and thickness

- (A) 0.5 m
- (B) 0.1 m
- (C) 0.2 m
- (D) 0.6 m

31. A thin flat plate 2 m x 2 m is hanging freely in air. The temperature of the surrounding is 25°C. Solar radiation is falling on one side of the plate at the rate of 500 W/m². Temperature of the plate will remain constant at 30°C, if the convective heat transfer coefficient (in W/m²°C) is

- (A) 25
- (B) 50
- (C) 100
- (D) 200

32. Heat transfer takes place according to

- (A) Zeroth law of thermodynamics
- (B) First law of thermodynamics
- (C) Second law of thermodynamics
- (D) Third law of thermodynamics

33. A perfect black body

- (A) Is black in color
- (B) Reflects all incident radiation
- (C) Absorbs all incident radiation
- (D) Transmits all incident radiation

34. Baffles are provided in heat exchangers to

- (A) Increase pressure drop
- (B) Decrease pressure drop
- (C) Increase rate of heat transfer
- (D) Decrease vibrations

35. H₂S present in naphtha reformed gas is removed by absorbing with

- (A) Ethanolamine
- (B) K₂CO₃
- (C) HCl
- (D) Vacuum gas oil

36. HETP is numerically equal to HTU, only when the operating line

- (A) Lies below the equilibrium line
- (B) Lies above the equilibrium line
- (C) And equilibrium lines are parallel
- (D) Is far from the equilibrium line

37. Milk is dried usually in a _____ dryer.

- (A) Freeze
- (B) Spray
- (C) Tray
- (D) Rotary

38. Cox chart is useful in the design of

- (A) Distillation column
- (B) Evaporator

(C) Dryer

(D) Crystallizer

39. The absorption factor is defined as

(A) $\frac{L}{mG}$
(C) $\frac{mL}{G}$

(B) $\frac{G}{mL}$
(D) $\frac{LG}{m}$

where L = liquid flow rate, G = gas flow rate and m = slope of the equilibrium line

40. Mass transfer coefficient (K) according to penetration theory varies with mass diffusivity as

(A) $D^{0.5}$

(B) D

(C) 1/D

(D) $D^{1.5}$

41. The rate constant of a reaction depends upon

(A) Time

(B) Temperature

(C) Weight

(D) Mass

42. For the chemical reaction $A \rightarrow B$, it is found that the rate of the reaction increases by a factor of 8 when the concentration of A is doubled. If rate $\propto C_A^n$ then n for this reaction must be

(A) 2

(B) 1/3

(C) 3

(D) 4

43. A batch reactor is characterized by

(A) Constant resident time

(B) The variation in extent of reaction and properties of the reaction mixture with time

(C) Variation in reactor volume

(D) Very low conversion

44. For perfect mixed flow the dispersion number must be

(A) Zero

(B) < 2100

(C) < 2

(D) Infinity

45. For a liquid in plug flow, the eddy diffusivity must be

(A) Zero

(B) Infinity

(C) 1

(D) Between 0 and infinity

46. For identical feed composition and flow rate, N plug flow reactors in series with the total volume V, gives the same conversion as a single

(A) Plug flow reactor of volume V

(B) CSTR of volume V

(C) Plug flow reactor of volume V/N

(D) Plug flow reactor of volume VN

47. For a unit – step change in input, the output of a pure capacitive process

(A) Increases linearly with time in an unbounded fashion

(B) Increases exponentially with time in an unbounded fashion

(C) Decreases linearly with time

(D) Decreases exponentially with time

48. The response of two non interacting tanks of same size and resistance in series is

(A) Under damped

(B) Critically damped

(C) Over damped

(D) Undamped

49. The gain margin and phase margin of an open loop response can be computed from
 (A) A Ziegler-Nichols plot (B) A Nyquist plot only
 (C) Bode plots only (D) Nyquist plot as well as Bode plots
50. For the same domain function $f(t) = e^{-t}$, the Laplace transform of $\int_0^t f(t) dt$ is equal to
 (A) $\frac{s}{s+1}$ (B) $\frac{1}{s(s+1)}$ (C) $\frac{1}{s(s+1)} - 1$ (D) $\frac{1}{s+1}$
51. An inclined tube manometer is _____ sensitive than U tube manometer.
 (A) More (B) Less (C) Equal (D) Equal or less
52. Ratio control is used to control the ratio of flow rates of two streams. It is a special type of
 (A) Feedforward control (B) Feedback control
 (C) Inferential control (D) Cascade
53. Which of the following is the most common type of baffle used in industrial shell and tube heat exchanger?
 (A) 75% cut segmental baffle (B) 25% cut segmental baffle
 (C) Orifice baffle (D) Disc and doughnut baffle
54. In condenser, the cooling water is passed in the tube side in a pass arrangement because
 (A) It reduces heat transfer area (B) More thinner tubes can be used
 (C) Pressure drop is reduced (D) It makes condenser compact
55. The approximate liquid depth in a agitation tank is equal to
 (A) 0.5 d (B) 0.75 d (C) d (D) 2 d
 where d = tank diameter
56. Safety valves are provided in chemical equipments to guard against excessive
 (A) Temperature (B) Pressure/pressure fluctuation
 (C) Turbulence (D) Noise
57. Profit is equal to revenue minus
 (A) Book value (B) Total cost
 (C) Operating cost (D) Salvage value
58. Utilities cost in the operation of chemical process plant comes under the
 (A) Plant overhead cost (B) Fixed charges
 (C) Direct production cost (D) General expenses
59. Producer gas consists mainly of
 (A) CO, CO₂, N₂, H₂ (B) CO, H₂
 (C) H₂, CH₄ (D) C₂H₂, CO₂, H₂
60. Rancidity of the fatty oil can be reduced by its

(A) Decoloration (B) Hydrogenation (C) Oxidation (D) Purification

61. Varnish does not contain

- (A) Pigment (B) Thinner
(C) Dryer (D) Anti-skimming agent

62. The ideal pulp for the manufacture of paper should have high _____ content.

- (A) Cellulose (B) Lignin
(C) Both (A) and (B) (D) Pitch

63. Which of the following coals has the highest calorific value?

- (A) Lignite (B) Sub-bituminous
(C) Anthracite (D) Peat

64. DDT stands for

- (A) Diethyl-diphenyl-trichloromethane (B) Dichloro-diphenyl-trichloromethane
(C) Diphenyl-dichloro-trichloromethane (D) Dichloro-diphenyl-trichloroethane

65. Nylon 6-6 is manufactured from

- (A) Hexamethylenediamine and adipic acid
(B) Hexamethylenediamine and maleic anhydride
(C) Caprolactum
(D) Dimethylteripthalate and ethylene glycol

66. Alum is commercially produced from

- (A) Gypsum (B) Feldspar (C) Galena (D) Bauxite

67. Fourdrinier machine is used in the manufacture of

- (A) Sugar (B) Paper
(C) Alcohol from molasses (D) Phenol formaldehyde

68. Which of the following sugars is the sweetest?

- (A) Glucose (B) Fructose (C) Sucrose (D) Lactose

69. Feed for reforming is generally

- (A) Naphtha or straight run gasoline (B) Reduced crude
(C) Vacuum gas oil (D) Atmospheric gas oil

70. The most important property for a jet fuel is its

- (A) Viscosity (B) Freezing point
(C) Calorific value (D) Flash point

71. Operating principle of cyclone separator is based on the action of _____ dust particles.

- (A) Diffusion of (B) Centrifugal force on
(C) Gravitational force on (D) Electrostatic force on

72. Which of the following dust collection equipments is the least efficient (for sub-micron particles)
- (A) Dust catcher (gravity type) (B) Cyclone separator
(C) Bag filter (D) Hollow wet scrubber
73. Which of the following is the most efficient for removal of very finely divided suspended solids and colloidal matter from the polluted water stream?
- (A) Sedimentation tank (B) Circular clarifier
(C) Mechanical flocculation (D) Chemical coagulation
74. The killer gas which caused Bhopal gas tragedy in 1984 was
- (A) Phosgene (B) Methyl isocyanate
(C) Carbon monoxide (D) Sulphur dioxide
75. World's worst radioactive pollution was caused by nuclear reactor disaster which occurred in
- (A) Arizona (USA) (B) Chernobyl (undivided USSR)
(C) Pennsylvania (USA) (D) Moscow, USSR

x-x-x