CET(PG)-2015

Sr. No. : 245051

Question Booklet Series : A

Important : Please consult your Admit Card / Roll No. Slip before filling your Roll Number on the Test Booklet and Answer Sheet.

Roll No. *In Figures* *In Words*

O.M.R. Answer Sheet Serial No.

Signature of the Candidate :

Subject : M.E. (Chemical with specialization in Environmental Engg.)

Time : 90 minutes **Number of Questions : 75** **Maximum Marks : 75**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO

INSTRUCTIONS

1. Write your Roll No. on the Question Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Subject and Series Code of Question Booklet on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point / Black Gel pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. To open the Question Booklet remove the paper seal gently when asked to do so.
5. Please check that this Question Booklet contains **75** questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of test.
6. Each question has four alternative answers (A, B, C, D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point / Black Gel pen.**
7. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Sheet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the questions given in the Question Booklet.
9. Negative marking will be adopted for evaluation i.e., 1/4th of the marks of the question will be deducted for each wrong answer. A wrong answer means incorrect answer or wrong filling of bubble.
10. For calculations, use of simple log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the sheets marked "Rough Work" at the end of the Question Booklet be used.
12. The Answer Sheet is designed for **computer evaluation**. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e., not following the instructions completely, shall be of the candidate only.**
13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so, would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistance or found giving or receiving assistance or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
16. **Telecommunication equipment such as pager, cellular phone, wireless, scanner, etc., is not permitted inside the examination hall. Use of calculator is not allowed.**

SEAL

1. A steel cylinder of volume 2 m^3 contains methane gas at 50°C and 250 kPa absolute. How many kilograms of methane are in cylinder ?

(A) 1.49 kg
(B) 2.98 kg
(C) 3.42 kg
(D) 5.28 kg

2. For NH3 reactors the material of construction is :

(A) carbon steel
(B) stainless steel
(C) cast steel
(D) none of these

3. Hardness of water is of two kinds : Temporary hardness and permanent hardness. Temporary hardness is caused by the presence of :

(A) Soluble bicarbonates of calcium, magnesium and iron
(B) Soluble chlorides of calcium and magnesium
(C) Soluble sulfates of calcium and magnesium
(D) Soluble bicarbonates of sodium and potassium

4. A particle 'A' of dia 10 microns settles in an oil of specific gravity 0.9 & viscosity 10 poise under strokes law. A particle 'B' with dia 20 microns settling in the same oil will have a settling velocity :

(A) Same as that of 'A'
(B) One-fourth as that of 'A'
(C) Twice as that of 'A'
(D) Four times as that of 'A'

5. Energy requirement (per unit mass of material crushed/ground) is highest for :

(A) Jaw crusher
(B) Rod mill
(C) Fluid energy mill
(D) Ball mill

6. A certain thermocouple has time constant of 2 sec. If the process temperature changes suddenly from 800°C to 900°C, the temperature reading in an indicator attached to thermocouple after 6 sec will be (in °C)

(A) 860
(B) 900
(C) 890
(D) 895

7. The second order system with transfer function $\frac{4}{s^2 + 2s + 1}$ has a damping ratio of :

(A) 2.0
(B) 0.5
(C) 1.0
(D) 4.0

8. Secondary nutrients in fertilizers are :

(A) baron, copper, manganese
(B) calcium, molybdenum, zinc
(C) iron, sulfur, molybdenum
(D) calcium, magnesium, sulfur

9. **Cyclohexane is made by catalytic hydrogenation of :**

(A) acetylene (B) ethylene

(C) benzene (D) phenol

10. **Measurement of sub-zero temperature in industry is done by :**

(A) thermocouple (B) resistance thermometer

(C) gas thermometer (D) bimetallic thermometer

11. **For an ideal fluid flow the Reynolds number is :**

(A) 2100 (B) >4000

(C) 0 (D) infinity

12. **The sulfur and ash content in coal can be reduced by :**

(A) pulverization (B) grinding

(C) washing (D) none of these

13. **Actual flame temperature is always less than the adiabatic flame temperature due to :**

(A) heat losses (B) incomplete combustion

(C) both (A) and (B) (D) neither (A) or (B)

14. **The octane number of n-heptane is :**

(A) 0 (B) 10

(C) 100 (D) >100

15. **Hot water (0.01 m^3 /min) enters the tube side of a counter current shell and tube heat exchanger a 80°C and leaves at 50°C. Cold oil (0.05 m^3/min) of density 800 kg/m^3 and specific heat o 2 kJ/kg.K enters at 20°C. The log mean temperature difference in °C is approximately**

(A) 32 (B) 37

(C) 45 (D) 50

16. **Economy of an evaporator is :**

(A) the number of pounds of solvent vaporized per pound of steam fed to the unit

(B) the number of pounds of solvent vaporized per hour

(C) the number of pounds of steam consumed per hour

(D) none of these

17. **Brittle materials are :**

(A) weak in tension but strong in compression (B) strong in tension but weak in compression

(C) weak in tension as well as in compression (D) strong in tension as well as in compression

18. In low carbon steels, the carbon content is restricted to a maximum of :

(A) 0.1 %
(B) 0.25 %
(C) 1.0 %
(D) 4.0 %

19. Nylon 6 is produced by polymerizing caprolactam in presence of catalytic amount of :

(A) ammonia
(B) hydrocyanic acid
(C) water
(D) hydrofluoric acid

20. The length to diameter ratio of most rotary driers is around :

(A) 1 to 1.5
(B) 4 to 10
(C) 50 to 100
(D) none of these

21. At 500K, the rate of a bimolecular reaction is ten times the rate at 400 K. The Activation energy, from collision theory, for the given reaction is :

(A) 8707 cal/mol
(B) 9150 cal/mol
(C) 8707 J/mol
(D) 9150 J/mol

22. In a manometer using mercury as manometric fluid and measuring the pressure of water in a conduit, the manometric rise is 0.2 m. The specific gravity of mercury is 13.55. The water pressure in m of water is :

(A) 14.55×0.2
(B) 13.55×0.2
(C) 12.55×0.2
(D) none of the above

23. An object with specific gravity 4 weighs 100N in air. When it is fully immersed in water its weight will be :

(A) 25 N
(B) 75 N
(C) 50N
(D) None of the above

24. In a steady flow of incompressible fluid, as the diameter is doubled, the velocity will :

(A) be halved
(B) be doubled
(C) increase four fold
(D) decrease four fold

25. The velocity along the centre line in laminar flow through a pipe of 8 cm dia is 2 m/s. The velocity at a radius of 2 cm in m/s is :

(A) 1
(B) 1.5
(C) 1.414
(D) 1/1.414

26. What is the normal range of exit cone angle of a venturimeter ?

(A) 7 to 15
(B) 2 to 5
(C) >25
(D) 15 to 25

27. Minimum reflux ratio in a distillation column results in :

(A) optimum number of trays
(B) maximum condenser size
(C) minimum reboiler size
(D) minimum number of trays

28. **The design gas velocity is usually selected as _____ % of the flooding gas velocity.**

(A) 10–20 (B) 30–40

(C) 70–80 (D) 90–100

29. **In a packed column the height of an overall gas-phase transfer unit is 1.2 ft. The absorption factor is 1.6. What is the value of HETP?**

(A) 1.2 ft (B) 1.5 ft

(C) 2.8 ft (D) 1.92 ft

30. **The interfacial area per unit volume of dispersion, in a gas-liquid contactor, for fractional hold-up of gas =0.1 and the gas bubble diameter = 0.6 mm is given by (in m^2/m^3)**

(A) 500 (B) 600

(C) 800 (D) 1000

31. **Steam distillation is used to :**

(A) reduce the number of plates (B) avoid thermal decomposition of a component

(C) increase the efficiency of separation (D) increase the total pressure of distillation

32. **The relative volatility of A in a mixture of A & B is $\alpha_{AB} = 1.5$. What is the mole fraction of B in the first droplet of liquid condensed from an equimolar saturated vapour mixture of A and B?**

(A) 0.4 (B) 0.5

(C) 0.6 (D) 0.7

33. **Equivalent diameter of a particle is the diameter of the sphere having the same :**

(A) ratio of surface to volume as the actual volume (B) ratio of volume to surface as the particle

(C) volume as the particle (D) None of these

34. **The binding material in soap is :**

(A) Glyceride (B) Rosin

(C) Borax (D) NaCl

35. **Hydrogenation of oil in the presence of nickel catalyst is :**

(A) endothermic reaction (B) exothermic reaction

(C) homogeneous reaction (D) none of these

36. **Multistage centrifugal pumps are generally used for :**

(A) high head (B) low head but high discharge

(C) highly viscous liquid (D) slurries of high solid concentration

37. **The purpose of floating head in a heat exchanger is to :**

(A) avoid buckling of tubes (B) provide support for tubes

(C) decrease the pressure drop (D) facilitates its lengthening, if needed

38. **What is the order of a chemical reaction whose rate is determined by the variation of one concentration term only ?**

(A) zero (B) first

(C) second (D) third

39. **Response of a linear control system for a change in load is called :**

(A) transient response (B) sinusoidal response

(C) servo problem (D) regulator problem

40. **Flapper nozzle is a/an _____ controller.**

(A) pneumatic (B) hydraulic

(C) electronic (D) none of these

41. **Floatation is carried out as generally at a pH value of :**

(A) less than 7 (B) greater than 7

(C) 0 to 14 (D) nothing in particular

42. **As pressure approaches zero , the ratio of fugacity to pressure for a gas approaches :**

(A) zero (B) unity

(C) infinity (D) an indeterminate value

43. **Gibbs phase rule finds application , when heat transfer occurs by :**

(A) conduction (B) convection

(C) radiation (D) condensation

44. **The purpose of stabilizer in PVC is :**

(A) to prevent thermal degradation (B) to improve impact strength

(C) to get faster and complete fusion (D) all of these

45. **Which of the following is true for the reaction** $H_2O(s) \leftrightarrow H_2O(\ell)$ **at 273 °K and at 101.3 kPa ?**

(A) $\Delta S = 0$ (B) $\Delta H = 0$

(C) $\Delta H = \Delta U$ (D) $\Delta H = T\Delta S$

46. **The ratio of fugacity of a material to its pressure is known as :**

(A) Chemical Potential (B) Activity

(C) Fugacity coefficient (D) Activity coefficient

47. **Maximum screening efficiency is achieved by :**

(A) grizzly screen (B) trammel screen

(C) vibratory screen (D) gyratory screen

48. The pressure gauge of CO_2 tank reads 51.0 psi. At the same time barometer reads 28.0 in Hg. What is the absolute pressure in the tank in psia ?

(A) 64.8 psia (B) 79.0 psia

(C) 64.2 psia (D) 84.3 psia

49. 0.145 g of a gas had a volume of 60 cm^3. What is its molecular mass? (1 mol gas = 24 dm^3 at room temp./press.) ?

(A) 29 (B) 116

(C) 58 (D) 30

50. Given the reaction between hydrogen and chlorine to form hydrogen chloride :

$$H_{2(g)} + Cl_{2(g)} \Rightarrow 2HCl_{(g)}$$

What volume of hydrogen in cm^3 is needed to make 100 cm^3 of hydrogen chloride ?

(A) 200 (B) 150

(C) 50 (D) 100

51. The pressure exerted by a gas in sealed container is 100 kPa at 17°C. It was found that the container might leak if the internal pressure exceeds 120 kPa. Assuming constant volume, at what temperature in °C will the container start to leak ?

(A) 75 (B) 100

(C) 80 (D) 65

52. A solution of specific gravity 1.0 consists of 35% 'A' by weight and remaining 'B'. If the specific gravity of 'A' is 0.7, the specific gravity of 'B' is :

(A) 1.25 (B) 1.3

(C) 1.3 (D) 1.2

53. Consider a homogeneous reaction of the type $A \xrightarrow{k_1(1st\ order)} R$ and also : $A \xrightarrow{k_2(2nd\ order)} S$. R is the desired product and its concentration is to be maximized by selection of a proper reactor. Which reactor system will you choose in order to get the highest R – concentration (under otherwise uniform conditions) ?

(A) Batch reactor (B) PFR

(C) Single CSTR (D) Five CSTRs in series

54. A series reaction of the type $A \xrightarrow{k_1(1st\ order)} R \xrightarrow{k_2(1st order)} S$; $k_1 = 1.0$ and $k_2 = 1.0$ is being conducted in a mixed reactor. The value of $\frac{C_{R,max}}{C_{A,0}}$ is :

(A) 0.10 (B) 0.20

(C) 0.25 (D) 0.50

55. **Which of the following relationship between E and F is/are correct ?**

(A) $F = \frac{dE}{dt}$ (B) $E = Fdt$

(C) $E = \int_0^\infty F\,dt$ (D) $E = \frac{dF}{dt}$

56. **The segregation model will give the highest conversion for reaction order :**

(A) less than one (B) equal to one

(C) greater than one (D) equal to zero

57. **An endothermic second order reaction is carried out in an adiabatic PFR. The rate of heat generation is :**

(A) maximum at the inlet of the reactor (B) maximum at the outlet of the reactor

(C) maximum at the centre of the reactor (D) constant throughout reactor

58. **A homogeneous liquid phase reaction is conducted in a batch stirred reactor at a speed of agitation of 500 rpm. If the speed of agitation is doubled :**

(A) the reaction rate will double

(B) the reaction rate will be halved

(C) the reaction rate will remain unaffected

(D) the reaction rate will decrease by a factor less than two

59. **The inside of a home is to be maintained at 22°C with a heat pump , while the outside temperature in the winter 2°C. Calculate the amount the energy requires for the heat pump ?**

(A) 4.18×10^9 kJ (B) 6.78×10^4 kJ

(C) 1.20×10^3 kJ (D) Need additional data

60. **The Clapeyron equation can be used.....**

(A) vapor - liquid equilibrium only

(B) solid-liquid equilibrium only

(C) solid vapor equilibrium only

(D) equilibrium between any two coexisting phases

61. **The values of C_p and C_v for a monatomic gas are :**

(A) 5 and 3 (B) 3.987 and 1.987

(C) 0.66 and 1.987 (D) None of the above

62. **Consider a uniformly tapered steel rod of circular cross-section of 1 m length. The diameter of the rod at one end is 5 cm and that at the other and is 2.5 cm. If the heat flux at the end of larger cross-section is 2500 Kcal/m². hr the heat flux at the other end is equal to :**

(A) 2500 kcal/m².h (B) 5000 kcal/m².h

(C) 7500 kcal/m².h (D) 10,000 kcal/m².h

63. **Prandtl number is a ratio of :**

(A) molecular diffusivity to thermal diffusivity (B) molecular diffusivity to momentum diffusivity

(C) momentum diffusivity to thermal diffusivity (D) none of the above

64. **Multiple effect evaporator has a capacity to process 4000 kg of solid caustic soda per day when it is concentrating from 10% to 25% solids. The water evaporated in kg per day is :**

(A) 8,000 (B) 24,000

(C) 60,000 (D) 48,000

65. **A process load change will cause a pure proportional control system to have :**

(A) offset (B) dead zone

(C) no noticeable effect (D) continuous cyclic action

66. **In bigger power stations, the device for preventing the emission of dust from fuel gases is :**

(A) scrubbers (B) cyclonic collectors

(C) electrostatic precipitator (D) gravity settling chamber

67. **When 1 litre/s of gaseous reactant A is introduced into a mixed reactor, the stoichiometry is $A \rightarrow 3R$, the conversion is 50% and under these conditions, the leaving flow rate is 2 litres/s. Mean residence time for this operation is :**

(A) 1 sec (B) 0.5 sec

(C) 2 sec (D) none of these

68. **For two non -interacting first order systems connected in series, the overall transfer function is :**

(A) the product of individual transfer functions (B) the sum of individual transfer functions

(C) the ratio of individual transfer functions (D) none of these

69. **In a continuous distillation column as the reflux ratio is increased, the overhead product purity :**

(A) increases

(B) decreases

(C) may increase or decrease, depending on the system

(D) remains constant

70. **In a fin-tube heat exchanger, fins are placed on the side having :**

(A) maximum heat conductance

(B) minimum thermal resistance

(C) minimum heat conductance

(D) either (A) or (B)

71. **Cavitation will not occur if the sum of the velocity and pressure heads at the suction is :**

(A) zero

(B) much larger than the vapour pressure of the liquid

(C) much smaller than the vapour pressure of the liquid

(D) equal to the vapour pressure of the liquid

72. **Nitrile rubber is a copolymer of :**

(A) butadiene and acetonitrile

(B) butadiene and adiponitrile,

(C) butadiene and acrylonitrile

(D) butadiene, styrene and adiponitrile,

73. **In a ball mill, the optimum diameter of the balls used for grinding is approximately proportional to :**

(A) the feed size

(B) the square of the feed size

(C) the square root of the feed size

(D) none of the above

74. **A "200 - mesh" screen means :**

(A) there are 200 apertures per inch

(B) each aperture of the screen has a diameter of 1/200 inch

(C) each aperture has a diameter of 1/200 cm

(D) none of the above

75. **In a manufacturing unit, break-even point occurs when :**

(A) the total annual rate of production equals the assigned value

(B) the total annual product cost equals the total sales

(C) the annual profit equals the expected value

(D) the annual sales equals the fixed costs