Sr. No. : 110112

CET (PG) – 2017

Booklet Series Code : A

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

(In Figures) (In Words)

Roll No. : | | | | | | | .....

O.M.R. Answer Sheet Serial No. : | | | | | | |

Signature of the Candidate : .....

Subject : M.Sc. Industrial Chemistry

Time : 90 Minutes] **[Maximum Marks : 75**

No. of Questions : 75] **[Total No. of Printed Pages : 16**

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.**

1. **Consider the following half cell reactions :**

$Cl_2 + 2e^- \rightarrow 2Cl^-$ $E^\circ = 1.36$ V and $Fe^{+3} + e^- \rightarrow Fe^{+2}$ $E^\circ = 0.77$ V

Which of the following reactions may occur spontaneously ?

(A) $Cl_2 + 2Fe^{+2} \rightarrow 2Cl^- + 2Fe^{+3}$ (B) $Cl_2 + 2Fe^{+3} \rightarrow 2Cl^- + 2Fe^{+2}$

(C) $2Cl^- + 2Fe^{+3} \rightarrow Cl_2 + 2Fe^{+2}$ (D) $2Cl^- + 2Fe^{+2} \rightarrow Cl_2 + 2Fe^{+3}$

2. **Consider the following reaction :**

$$PbO_2 + Pb + 4H^+ \rightarrow 2Pb^{+2} + 2H_2O$$

Which substance is the reducing agent in the above reaction ?

(A) PbO_2 (B) Pb

(C) H^+ (D) Pb^{+2}

3. **The zero point energy of a simple harmonic oscillator is equal to :**

(A) 0 (B) $h\nu$

(C) $\frac{1}{2}h\nu$ (D) $3/2h\nu$

4. **How many fundamental vibrational frequencies are expected from $CHCl_3$ molecule ?**

(A) 8 (B) 9

(C) 10 (D) 11

5. **The values of the van der Waals constant *a* for the gases N_2, O_2, NH_3 and CH_4 are 1.39, 1.36, 4 and 2.253 dm^6 atm mol^{-2} respectively. The gas which can be most easily liquefied is :**

(A) N_2 (B) O_2

(C) NH_3 (D) CH_4

6. **In an X-ray diffraction pattern if the reflections from the crystal planes 110, 100, 210, 211 are absent, the crystal lattice is :**

(A) Primitive (simple) cubic (B) End centred cubic

(C) Body centred cubic (D) Face centred cubic

7. **The coordination number of copper in the complex formed by adding excess of ammonia in copper sulphate solution is :**

(A) 4 (B) 3

(C) 2 (D) 6

8. **The rate of reaction between A and B increases by a factor of 1000 when concentration of A is changed from 0.5 mol L^{-1} to 5 mol L^{-1}. The order of reaction with respect to A is :**

(A) 0 (B) 1

(C) 2 (D) 3

9. **The orbital structure of singlet carbene and triplet carbene is :**

(A) Linear and Linear (B) Linear and Bent

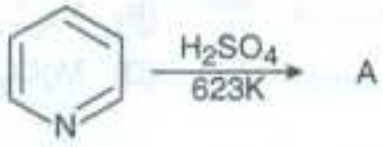
(C) Bent and Linear (D) Bent and Bent

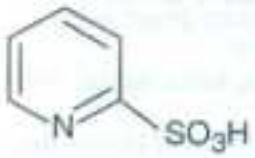
10. **An organic reaction used to convert an aromatic aldehyde and an anhydride to an α, β unsaturated carboxylic acid using sodium acetate and a base is known as :**

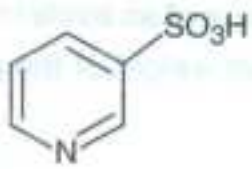
(A) Knoevenagel condensation (B) Perkin condensation

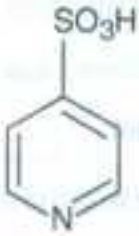
(C) Cannizzaro reaction (D) Mannich reaction

11. **Predict the product A in the following reaction :**



(A) 

(B) 

(C) 

(D) 

12. **Arrange the following compounds in the increasing order of shielding of the methyl protons : CH_3F, $(CH_3)_3N$, CH_3OCH_3, CH_3CH_3 :**

(A) CH_3F, $(CH_3)_3N$, CH_3OCH_3, CH_3CH

(B) CH_3F, CH_3OCH_3, CH_3CH_3 $(CH_3)_3N$

(C) CH_3F, CH_3OCH_3, $(CH_3)_3N$, CH_3CH_3

(D) $(CH_3)_3N$, CH_3F, CH_3OCH_3, CH_3CH_3

13. **Treatment of Grignard reagent with α, β unsaturated carbonyl compound in the presence of cuprous chloride gives :**

(A) 1, 2 addition product (100%)

(B) 1, 4 addition product (100%)

(C) 1, 2 addition product (major) and 1, 4 addition product (minor)

(D) 1, 2 addition product (major) and 1, 4 addition product (minor)

14. Which salt shows maximum osmotic pressure in its 1 m solution ?

(A) $AgNO_3$ (B) Na_2SO_4

(C) $(NH_4)_3PO_4$ (D) $MgCl_2$

15. An element form of an oxide in which the oxygen is 20% of the oxide by weight. The equivalent weight of the given element will be :

(A) 32 (B) 40

(C) 60 (D) 128

16. XeF_4 has a shape of :

(A) Spherical (B) Trigonal bipyramid

(C) Square planar (D) Tetrahedral

17. The correct order of increasing C-O bond length in CO, CO_3^{2-}, CO_2 is :

(A) $CO_3^{2-} < CO_2 < CO$ (B) $CO_2 < CO_3^{2-} < CO$

(C) $CO < CO_3^{2-} < CO_2$ (D) $CO < CO_2 < CO_3^{2-}$

18. Which metalloenzyme is used in nitrogen fixation ?

(A) Superoxide Dismutase (B) Carbonic anhydrase

(C) Zymase (D) Nitrogenase

19. Dicobaltoctacarbonyl is used as a catalyst in :

(A) Robinson condensation reaction (B) Monsanto reaction

(C) Hydroformylation reaction (D) Wacker process

20. The point group of ammonia molecule is :

(A) C_{3h} (B) C_{3V}

(C) D_{3h} (D) D_{3VA}

21. **When the wavelength of incident X-rays increases, the angle of diffraction :**

(A) decreases (B) increases

(C) remains constant (D) shows no systematic variation

22. **Finned tube heat exchangers :**

(A) give larger area per tube

(B) use metal fins of low thermal conductivity

(C) facilitate very large temperature drop through tube wall

(D) are used for smaller heat load

23. **Temperature profile in steady state heat transfer is :**

(A) asymptotic (B) hyperbolic

(C) parabolic (D) linear

24. **Drying operation under vacuum is carried out to :**

(A) dry those materials which have very high unbound moisture content

(B) reduce drying temperature

(C) increase drying temperature

(D) dry materials having high bound moisture content

25. **At minimum reflux ratio for a given separation :**

(A) number of plates is zero

(B) number of plates is infinity

(C) minimum number of the theoretical plates is required

(D) separation is most efficient

26. **Ammonia synthesis gas is produced from natural gas by :**

(A) thermal cracking
(B) steam reforming
(C) partial oxidation
(D) hydrogenation

27. **Urea is represented as :**

(A) $NH_2.CO.NH_2$
(B) $NH_3CO.CH_3$
(C) $NH.CO_2.NH$
(D) $NH_3.CO_2.NH_3$

28. **Which of the following does not come under the category of 'secondary nutrient' for plant growth ?**

(A) Calcium
(B) Magnesium
(C) Sulphur
(D) Oxygen

29. **In any spontaneous process :**

(A) only F decreases
(B) only A decreases
(C) both F and A decrease
(D) both F and A increase

30. **When pressure is applied on the system, ice ↔ water, then :**

(A) equilibrium cannot be established
(B) more ice will be formed
(C) more water will be formed
(D) evaporation of water will take place

31. **During combustion of gaseous fuels, deficiency of air :**

(A) lengthens the flame

(B) tends to shorten the flame

(C) does not affect the flame length

(D) increases the flame temperature

32. **The monomer of poly vinyl chloride (PVC) is :**

(A) chloroethene

(B) ethylene dichloride

(C) ethyl chloride

(D) chloroform

33. **Neoprene is chemically known as :**

(A) polybutadiene

(B) styrene butadiene rubber (SBR)

(C) polyurethane

(D) polychloroprene

34. **Zeigler-Natta catalyst ($AlR_3 - AlCl_3$) is used in the polymerisation of :**

(A) vinyl acetate

(B) vinyl chloride

(C) propylene

(D) styrene

35. **Laminar flow of a Newtonion fluid ceases to exist, when the Reynolds number exceeds :**

(A) 4000

(B) 2100

(C) 1500

(D) 3000

36. **Which of the following denotes the effect of compressibility in fluid flow ?**

(A) Weber number
(B) Mach number
(C) Euler number
(D) Reynolds number

37. **If the discharge of a centrifugal pump is throttled, then its suction lift :**

(A) increases
(B) decreases
(C) remains unchanged
(D) data insufficient to predict

38. **Which is the most undesirable component in kerosene ?**

(A) Aromatics
(B) *i*-paraffins
(C) *n*-paraffins
(D) Naphthenes

39. **Visbreaking process is used mainly for making :**

(A) high cetane diesel
(B) high octane gasoline
(C) fuel oil
(D) smoke free kerosene

40. **In petroleum refining, the process used for conversion of hydrocarbons to aromatics is :**

(A) catalytic cracking
(B) catalytic reforming
(C) hydrotreating
(D) alkylation

41. **In the case of infinitely long uniformly charged sheet, the magnitude of electric field intensity at any point P, (at a distance "r") :**
(A) is directly proportional to distance "r"
(B) is inversely proportional to the distance "r"
(C) is independent of distance "r"
(D) is directly proportional to distance "r^2"

42. **A charged particle is moving linearly in forward direction and enters in a transverse magnetic field. The trajectory of charged particle in the magnetic field region will be :**
(A) circular (B) parabolic
(C) linear (D) spiral

43. **According to the laws of radioactive decay, the activity of a radioactive substance can be substantially enhanced by :**
(A) increasing its temperature (B) increasing its pressure
(C) decreasing its temperature (D) does not depend on physical conditions

44. **Generally, with increase in temperature from room temperature to 100°C, the electrical conductivity of metals and semiconductors :**
(A) decreases and increases respectively
(B) increases and decreases respectively
(C) decreases for both cases
(D) increases for both cases

45. **According to quantum mechanics, the lowest energy state of a particle in a box of finite length "L" has an energy of :**
(A) $\frac{h}{8mL^2}$ (B) $\frac{h^2}{8mL^2}$
(C) $\frac{h^2}{8mL}$ (D) $\frac{h^2}{8m^2L^2}$

46. **Light amplification by stimulated emission of radiation can be achieved in a :**
(A) two level system (B) three level system
(C) four level system (D) both (B) and (C)

47. One electron volt is equal to :

(A) 1.6×10^{-19} Volt (B) 1.6×10^{-19} Joule

(C) 1.6×10^{-19} Coulomb (D) 1.6×10^{-19} Watt

48. Two photons, each moving with speed of light i.e. "*c*", are heading towards each other. Their relative speed will be :

(A) $2c$ (B) $c/2$

(C) c (D) zero

49. Suppose a solid sphere of radius "R" is cut into four equal parts by slicing it through its diameters. The total surface area of one of the four parts will be :

(A) πR^2 (B) $2\pi R^2$

(C) $3\pi R^2$ (D) $4\pi R^2$

50. The value of the Plank's constant *h* is 6.626×10^{-34} Joule-second. Its dimensions are :

(A) ML^2T^{-1} (B) ML^2T^{-2}

(C) MLT^{-1} (D) ML^2T^{-3}

51. Photons follow the :

(A) Maxwell-Boltzmann statistics (B) Fermi-Dirac statistics

(C) Bose-Einstein statistics (D) Both (B) and (C)

52. A metallic wire of length "L" and area of cross-section "S" has resistance "R". The wire is cut into four equal pieces by its length. Then, these four pieces are connected in parallel by joining their ends. The effective resistance of the resulting network will be :

(A) R/4 (B) R/8

(C) r/12 (D) R/16

53. Which of the following can be used for studying the crystal structure of crystalline materials ?

(A) Gamma rays (B) Ultraviolet rays

(C) Infrared rays (D) X-rays

54. **Observation of rainbow in the sky is manifestation of :**

(A) reflection of white light (B) refraction of white light

(C) total internal reflection of white light (D) diffraction of white light

55. **According to theory of photoelectric effect, maximum kinetic energy of photoelectrons for a specific material depends upon :**

(A) intensity of incident light (B) frequency of incident light

(C) electrical conductivity of material (D) stopping potential

56. **Which of the following crystal structures has least packing fraction ?**

(A) Simple cubic (B) Body centered cubic

(C) Diamond (D) Face centered cubic

57. **A car moves to and fro between two points A and B with speeds of 60 km/h and 40 km/h respectively, without stopping at any point. The average speed of the car for the whole journey is :**

(A) 50 km/h (B) 52 km/h

(C) 48 km/h (D) 56 km/h

58. **The wavelength of an electron moving with $c/2$ (c is speed of light) will be of the order of :**

(A) 10^{-6} m (B) 10^{-9} m

(C) 10^{-12} m (D) 10^{-15} m

59. **A solid sample has the property that, when cooled below a certain temperature, it expels any small applied magnetic field from within the material. Which of the following best describes this sample in the cooled state ?**

(A) Ferromagnet (B) Paramagnet

(C) Anti-ferromagnet (D) Diamagnet

60. **The value of the integral $\int_0^\infty x^9 \exp(-x^2)\,dx$ is :**

(A) 12 (B) 24

(C) 36 (D) 48

61. The equation $x^3 - 11x + 20 = 0$ has :
(A) a multiple root
(B) three real roots
(C) three distinct real roots
(D) one real and a pair of complex roots

62. What are the possible degrees of polynomials irreducible over real numbers ?
(A) all positive integers
(B) all positive even integers
(C) 1 and 2
(D) 1 only

63. If A is a real symmetric matrix, then all Eigen values of A are :
(A) real
(B) purely imaginary
(C) non-real complex numbers
(D) either 1 or -1

64. Which one of the following sets has the least upper bound property ?
(A) The set of all rational numbers
(B) The set of all irrational numbers
(C) The set of all negative rational numbers
(D) The set of all natural numbers

65. Which one of the following is false ?
(A) There exists a binary operation which is associative but not commutative
(B) There exists a binary operation which is commutative but not associative
(C) There exists a binary operation which is neither commutative nor associative
(D) One of the above is false

66. The rank of a matrix A is equal to :
(A) the number of non-zero rows of A
(B) the number of zero rows of A
(C) maximum number of linearly independent rows of A
(D) maximum number of linearly dependent rows of A

67. The curvature of the curve $r(t) = (2\cos(t), 2\sin(t))$ at t is :
(A) 2 (B) 1 (C) 1/2 (D) $t/2$

68. The cubic $x^3 + px + q$ has three distinct real roots if :
(A) $4p^3 + 27q^2 < 0$
(B) $4p^3 + 27q^2 = 0$
(C) $4p^3 + 27q^2 > 0$
(D) $4p^3 + 27q^2 \leq 0$

69. The GCD of $x^3 + x^2 + x + 1$ and $x^4 - 1$ is :

(A) $x - 1$ (B) $x + 1$

(C) $x^4 - 1$ (D) $x^3 + x^2 + x + 1$

70. If (x_n) is a monotone sequence of real numbers, then it is :

(A) convergent (B) Cauchy

(C) bounded (D) convergent only if it is bounded above

71. The Laplace transformation of cos t is :

(A) $\frac{1}{(s^2+1)}$ (B) $\frac{s}{(s^2+1)}$

(C) $\frac{1}{(s^2-1)}$ (D) $\frac{s}{(s^2-1)}$

72. Which of the following is invariant under elementary row transformations on a matrix A ?

(A) Rank of A (B) Inverse of A

(C) Determinant of A (D) Adjoint of A

73. The principle argument of the complex number $-1 - i$ is :

(A) $-\frac{\pi}{4}$ (B) $\frac{\pi}{4}$

(C) $-\frac{3\pi}{4}$ (D) $\frac{5\pi}{4}$

74. The remainder on dividing $x^{10} - 6x^7 + 9x - 2$ by $x - 1$ is :

(A) 0 (B) 1

(C) 2 (D) 3

75. Every system of m-linear equations with real coefficients and n variables has a solution if :

(A) $m = n$ (B) $m < n$

(C) $m > n$ (D) $m \geq n$