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प्रश्नपुस्तिका क्रमांक
Question Booklet No.

O.M.R. Serial No.

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प्रश्नपुस्तिका सीरीज
Question Booklet Series
C

M.Sc Industrial Chemistry (First Semester)
Examination, February/March-2022
MSIC-101

Analytical Techniques Part A

Time : 1:30 Hours

Maximum Marks-100

जब तक कहा न जाय, इस प्रश्नपुस्तिका को न खोलें

- निर्देश : —
1. परीक्षार्थी अपने अनुक्रमांक, विषय एवं प्रश्नपुस्तिका की सीरीज का विवरण यथास्थान सही- सही भरें, अन्यथा मूल्यांकन में किसी भी प्रकार की विसंगति की दशा में उसकी जिम्मेदारी स्वयं परीक्षार्थी की होगी।
 2. इस प्रश्नपुस्तिका में 100 प्रश्न हैं, जिनमें से केवल 75 प्रश्नों के उत्तर परीक्षार्थियों द्वारा दिये जाने हैं। प्रत्येक प्रश्न के चार वैकल्पिक उत्तर प्रश्न के नीचे दिये गये हैं। इन चारों में से केवल एक ही उत्तर सही है। जिस उत्तर को आप सही या सबसे उचित समझते हैं, अपने उत्तर पत्रक (O.M.R. ANSWER SHEET) में उसके अक्षर वाले वृत्त को काले या नीले बाल प्वाइंट पेन से पूरा भर दें। यदि किसी परीक्षार्थी द्वारा निर्धारित प्रश्नों से अधिक प्रश्नों के उत्तर दिये जाते हैं तो उसके द्वारा हल किये गये प्रथमतः यथा निर्दिष्ट प्रश्नोत्तरों का ही मूल्यांकन किया जायेगा।
 3. प्रत्येक प्रश्न के अंक समान हैं। आप के जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
 4. सभी उत्तर केवल ओ०एम०आर० उत्तर पत्रक (O.M.R. ANSWER SHEET) पर ही दिये जाने हैं। उत्तर पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
 5. ओ०एम०आर० उत्तर पत्रक (O.M.R. ANSWER SHEET) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाय।
 6. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी प्रश्नपुस्तिका बुकलेट एवं ओ०एम०आर० शीट पृथक-पृथक उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें।
 7. निगेटिव मार्किंग नहीं है।

महत्वपूर्ण : — प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्नपुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्ष निरीक्षक को दिखाकर उसी सीरीज की दूसरी प्रश्नपुस्तिका प्राप्त कर लें।

1. Ion exchange capacity amongst anions is found in the order :
 - (A) $\text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{I}^-$
 - (B) $\text{I}^- > \text{SO}_4^{2-} > \text{PO}_4^{3-}$
 - (C) $\text{I}^- > \text{PO}_4^{3-} > \text{SO}_4^{2-}$
 - (D) $\text{SO}_4 > \text{I} > \text{PO}_4^{3-}$

2. Which of the following is a Cation exchanger used in Ion exchange chromatography?
 - (A) Amberlite IR-120 (Functional group- SO_3H)
 - (B) Amberlite IRA-400 (Functional group – $\text{CH}_2\text{-N}^+(\text{CH}_3)_3$)
 - (C) Amberlite IRA-410 (Functional group – $\text{CH}_2 - \text{N}^+ - \text{CH}_2 - \text{CH}_2$)
 - (D) None of the above

3. The secondary electrons radiated back in scanning Electron Microscopy is collected by :
 - (A) Specimen
 - (B) Cathode
 - (C) Anode
 - (D) Vacuum chamber

4. Electron Microscope can give a magnification up to :
 - (A) $100\times$
 - (B) $1500\times$
 - (C) $10,000\times$
 - (D) $400,000\times$

5. Which of the following factors does not affect the rate of filtration ?
 - (A) The drop in pressure from feed side
 - (B) The viscosity of the filtrate
 - (C) The area of the filtering surface
 - (D) Room Temperature

6. Which of the following is the mechanism of Bed Filters ?
- (A) Cake filtration
 - (B) Deep bed filtration
 - (C) Sedimentation
 - (D) All of the above
7. The removal of extracted solute from the organic phase for further preparation for detailed analysis is known as :
- (A) Back washing
 - (B) Stripping
 - (C) Masking
 - (D) Salting out
8. Which of the following equipment works on vacuum :
- (A) Leaf filter press
 - (B) Plate and frame filter press
 - (C) Continuous Rotary Filter
 - (D) Bed Filters
9. In leaf filters. Leaf is a :
- (A) Hollow wire framework covered by a sack of filter cloth
 - (B) Metal plate frame work covered with a plastic
 - (C) Porous plate
 - (D) Screen
10. The driving force in leaf filter is :
- (A) Vacuum
 - (B) Pressure
 - (C) Gravity
 - (D) None of the above

11. What type of filter does not come under the membrane filters ?
- (A) Microfiltration
 - (B) Nanofiltration
 - (C) Ultra filtration
 - (D) Precoat filtration
12. Membrane Filter are made up of :
- (A) Silk
 - (B) Positively charged ions
 - (C) Cellulose acetate
 - (D) Resins
13. In the adsorbents used for TLC like Silica gel G, Alumina gel G, G stands for :
- (A) A binder Gypsum
 - (B) Gel
 - (C) Gas
 - (D) None of the above
14. The stationary phase in TLC is :
- (A) Glass plate
 - (B) Silica gel
 - (C) Liquid held between the glass
 - (D) None of the above
15. Which of the following types of chromatography involves the separation of substances in mixture over a 0.2mm thick layer of an adsorbent ?
- (A) Paper chromatography
 - (B) Column chromatography
 - (C) Thin layer chromatography
 - (D) GLC

16. Which of the statement is correct ?
- (A) Gas chromatography is used to analyze only gases
 - (B) Gas chromatography is used to analyze only liquids
 - (C) Gas chromatography is used to analyze solids, solutions and gases
 - (D) none of the above
17. In Gas chromatography the Electron Capture Detector responds to only those compounds, whose molecules have :
- (A) An affinity for electrons
 - (B) Thermal combination
 - (C) Both of the above
 - (D) None of the above
18. The columns which are preferred for trace analysis and have more sample capacity:
- (A) Open column
 - (B) Open Tubular Column
 - (C) Support coated open Tubular Column
 - (D) None of the above
19. In GLC Electron capture Detector has high sensitivity for :
- (A) Alcohols
 - (B) Halogenated compounds
 - (C) Carbonyl compounds
 - (D) None of the above
20. Pellicular supports is a form of column packing material where :
- (A) Micropores ramify through the particles which are 5 to 10 μ_m in diameter
 - (B) Porous particles are coated on to an inert solid core have diameter about 40 μ_m
 - (C) Where the stationary phase is chemically bonded on to an inert support
 - (D) None of the above

21. Rf value defines :
- (A) The movement of mobile phase
 - (B) The movement of substance
 - (C) The movement of the substances relative to the solvent front in a given chromatographic system
 - (D) None of the above
22. FPLC abbreviation is used for :
- (A) Fast protein liquid chromatography
 - (B) Fast plate liquid chromatography
 - (C) Free path liquid chromatography
 - (D) None of the above
23. Which of the following is not In Situ Method for the estimation of spots in chromatogram in paper chromatography ?
- (A) By densitometer
 - (B) By potentiometry
 - (C) By UV spectrophotometry
 - (D) By measurement of areas
24. Suitable solvent system for paper chromatography where water is stationary phase :
- (A) Chloroform
 - (B) Cyclohexane
 - (C) Benzene
 - (D) n-butanol-acetic acid-water (4:1:5)
25. Counter current chromatography is a type of :
- (A) Solid liquid chromatography
 - (B) Liquid-Liquid chromatography
 - (C) Gas solid chromatography
 - (D) Gas Liquid chromatography

26. Chromatography technique was first invented by :
- (A) M. Tswelt
 - (B) Martin and Synge
 - (C) Jaroslav Heyrovsky
 - (D) None of the above
27. Number of theoretical plates (N) is given by the formula :
- (A) $N = H/L$
 - (B) $N = L/H$
 - (C) $N = L \times H$
 - (D) $N = L + H$
28. In GLC distribution Coefficient is achieved by setting up :
- (A) An adsorption equilibrium between stationary and mobile phase
 - (B) A partition equilibrium between stationary and mobile phase
 - (C) An ion exchange equilibrium between stationary and mobile phase
 - (D) None of the above
29. The partition of a solute between two immiscible solvents is governed by :
- (A) Rate law
 - (B) Distribution law
 - (C) Adsorption
 - (D) None of the above
30. Terms Frontal analysis, elution analysis and displacement analysis used for :
- (A) Chromatogram
 - (B) Solvent extraction
 - (C) Filtration
 - (D) Microscopy

31. In counter current extraction :
- (A) Two immiscible solvents contact each other as they flow through one another in opposite direction
 - (B) Two miscible solvents contact each other as they flow through one another in same direction
 - (C) Two immiscible solvents contact each other as they flow one another in same direction
 - (D) None of the above
32. The distribution coefficient of I_2 between CCl_4 and H_2O is 85. Calculate the concentration of I_2 remaining after extracting 50ml of an aqueous $10^{-3}M$ solution of I_2 with 50 ml of CCl_4
- (A) 5.28×10^{-7}
 - (B) 5.28×10^7
 - (C) 1.16×10^{-5}
 - (D) 1.16×10^5
33. In Transmission Electron Microscope which among the following is used to control beam current and convergence of beam hitting the specimen :
- (A) Sample holder
 - (B) Detectors
 - (C) Aperture
 - (D) Scan coils
34. Which of the following techniques are used in TEM for cellular structure examination ?
- (A) Shadow casting
 - (B) Negative staining
 - (C) Ultrathin sectioning
 - (D) All of the above
35. Most widely used chelating extractant system is :
- (A) CCl_4
 - (B) 8-hydroxyquinoline
 - (C) Carboxylic acid
 - (D) All of the above

36. The solvents which are capable of extracting only non polar species are :
- (A) Inert solvent system
 - (B) Basic extractant system
 - (C) Acidic extractant system
 - (D) Ionic extractant system
37. Which of the following filtration equipment operates under continuous operation ?
- (A) Continuous Rotary Vacuum Filter Press
 - (B) Plate and Frame Filter Press
 - (C) Pressure leaf Filter Press
 - (D) None of the above
38. Which of the following is the cheapest filtration equipment ?
- (A) Pressure leaf filter press
 - (B) Plate and frame filter press
 - (C) Continuous votary vacuum filter press
 - (D) None of the above
39. Slow sand filters require :
- (A) Finer sand
 - (B) Coarse sand media
 - (C) Medium sand media
 - (D) Any type of sand media
40. After cleaning a slow sand filter, the filtered water is not used for :
- (A) 6 hours to 12 hours
 - (B) 12 hours to 18 hours
 - (C) 18 hours to 24 hrs.
 - (D) 48 hrs.
41. AN electron beam passing through an evacuated region can be _____ by making use of elective and magnetic fields.
- (A) Diverge
 - (B) Scattered
 - (C) Focused
 - (D) Reflect

42. The distribution co-efficient of an organic compound A for benzene and water is 10. Find the amount of A extracted if 1.0 gm of it dissolved in 100ml of water is equilibrated in a separating funnel with 100ml benzene :
- (A) 9.09 gm
 - (B) 0.909 gm
 - (C) 0.001 gm
 - (D) 1.01 gm
43. Two types of collision which occurs between a beam of electrons and a jet of gas molecules are :
- (A) Elastic and Inelastic collision
 - (B) Effective and Non effective collision
 - (C) Both of the above
 - (D) None of the above
44. Which of the following process occurs in GLC ?
- (A) Partition
 - (B) Adsorption
 - (C) Ion exchange
 - (D) None of the above
45. What will be HETP in above question ?
- (A) 0.216 Cm/plate
 - (B) 2.16 Cm/plate
 - (C) 0.108 Cm/plate
 - (D) 1.08 Cm/plate
46. On a given 200cm column the sample required 5.30 min. to emerge, an air bubble required 0.50 min. and the time required for the sample to pass the detector was 0.40 min. What is the value of Number of theoretical plates (N) ?
- (A) 1850
 - (B) 1849
 - (C) 2850
 - (D) 2849

47. The effective wavelength for a 100 Kilo volt electron beam is :
- (A) 0.039 \AA
 - (B) 0.39 \AA
 - (C) 0.123 \AA
 - (D) 1.23 \AA
48. Which of the following factors does not enhance the rate and selectivity of an extractron process ?
- (A) By proper choice of extractant
 - (B) By masking the interfering ion
 - (C) By single operation
 - (D) By controlling the temperature
49. Inert solvent system generally extract :
- (A) Ionic species
 - (B) Polar species
 - (C) Non polar species
 - (D) All of the above
50. Which of the following is not requirement of a specimen to be suitable for electron microscopy ?
- (A) It should be stable in evacuated chamber
 - (B) It should be stable upon electron bombardment
 - (C) It should be thin
 - (D) It should be ionize
51. Continuous extraction is used when the distribution ratio is :
- (A) Low
 - (B) High
 - (C) 0.5
 - (D) No effect of distribution ratio in extraction

52. In chromatographic separation of amino acids Ninhydrin is used as :
- (A) Stationary phase
 - (B) Mobile phase
 - (C) Colouring agent
 - (D) None of the above
53. The process of extraction is more complete if it is carried out in :
- (A) Single operation
 - (B) Number of operations
 - (C) Double operations
 - (D) None of the above
54. On the basis of extractable species, the inorganic extraction system is :
- (A) Ion association system
 - (B) Chelate system
 - (C) Both of the above
 - (D) None of the above
55. Which of the following extractants are lighter than water ?
- (A) Butanol
 - (B) Chloroform
 - (C) CCl_4
 - (D) CS_2
56. Co-ordination unsaturated chelates can be extracted by using the solvents :
- (A) Alcohols
 - (B) Ketones
 - (C) Ethers
 - (D) All of the above
57. Which of the following are used as masking agents in extraction process :
- (A) EDTA
 - (B) Citrate
 - (C) Tartarate
 - (D) All of the above

58. Electron microscope is used in the determination of :
- (A) Structure of a molecule
 - (B) Particle size and particle shape
 - (C) Qualitative analysis
 - (D) All of the above
59. The optical column of a typical electron microscope consists of :
- (A) An electron gun
 - (B) A specimen chamber
 - (C) An objective lens and a projector lens
 - (D) All of the above
60. An electron beam (in an electron microscope) passing through an evacuated region can be focused by means of :
- (A) Magnetic field only
 - (B) Electric field only
 - (C) Magnetic field and electric field both
 - (D) Neither magnetic field nor electric field
61. The process of passing the settled water through the beds of granular material is termed as :
- (A) Sedimentation
 - (B) Coagulation
 - (C) Screening
 - (D) Filtration
62. Back washing is :
- (A) Is a form of maintenance of filters
 - (B) Excluding intermittent use of compressed air during process
 - (C) Including intermittent use of compressed air during the process
 - (D) Washing at the back side of the filter

63. Which of the following method is not employed for solid liquid separation ?
- (A) Gravity sedimentation
 - (B) Magnetic separation
 - (C) Filtration
 - (D) Centrifugation
64. During adsorption process of solid liquid separation :
- (A) The adsorbent absorbs liquid in the interior and solid in the exterior
 - (B) The adsorbent absorbs solid in the interior and liquid in the exterior
 - (C) The adsorbent absorbs solid in the interior and the exterior
 - (D) The adsorbent absorbs liquid in the interior and exterior
65. Process in which molecules are separated on the basis of sedimentation is known as:
- (A) Chromatography
 - (B) Centrifugation
 - (C) Evaporation
 - (D) Filtration
66. Which of the following factors does not affect column efficiency ?
- (A) Particle size of column packing material
 - (B) Dimensions of the column
 - (C) Temperature of the column
 - (D) Material of which column is made up of
67. Which statement is true for gradient elution ?
- (A) A series of solvents (one by one) is used for elution
 - (B) Two or more solvents of different dielectric constant are used together that are completely miscible to each other
 - (C) Same polarity solvents are used
 - (D) None of the above

68. Which of the following function is not performed by solvent in chromatography ?
- (A) They serve to introduce the mixture to the column
 - (B) They affect the process of development
 - (C) They hold the solute at one place
 - (D) They are used to remove required content of each zone from mechanically separated
69. Which of the following characteristics is possessed by HPLC and GLC both ?
- (A) Simple and inexpensive equipment
 - (B) Accomodation of non volatile and thermally stable samples
 - (C) Highly selective technique and only small sample is required
 - (D) Rapid
70. The Van Deemter equation is :
- (A) $HETP = A + \frac{B}{\mu} + C\mu$
 - (B) $HETP = A + B\mu + C\mu$
 - (C) $HETP = A\mu + B\mu + C\mu$
 - (D) $HETP = A + \frac{B}{\mu} + \frac{C}{\mu}$
71. Which of the following is not used as collectors in froth floatation process ?
- (A) Xanthates
 - (B) Pine oil
 - (C) Amiline
 - (D) Potassium ethyl xanthate
72. The property required for an ore to be concentrated by electrostatic separation is :
- (A) The ore particle should be magnetic in nature
 - (B) The ore should conduct electricity
 - (C) The ore should be a sulphide ore
 - (D) All of the above

73. During filtration increase in pressure drop forms :
- (A) Denser cake
 - (B) Lighter cake
 - (C) Deeper cake
 - (D) None of the above
74. How a mixture of iron and copper filling be separated ?
- (A) Distillation
 - (B) Screening
 - (C) Electrostatic separation
 - (D) Magnetic separation
75. Which of the following is not a type of Jig ?
- (A) Air operated jig
 - (B) Diaphragm jig
 - (C) Wet magnetic Drum separator
 - (D) Baum jig washer
76. Which of the following statement is not true for a jig ?
- (A) A jig is a mechanical device used for separating materials of different specific gravities
 - (B) It separates by the pulsation of a liquid stream housing through a bed of materials
 - (C) Jigging is a wet process
 - (D) Jigging is a dry process
77. Which of the following helps to get a 3-dimensional image of specimen ?
- (A) SEM
 - (B) TEM
 - (C) Simple Microscope
 - (D) Compound Microscope

78. In which of the following paper chromatographic methods, mobile phase more horizontally over a circular sheet of paper ?
- (A) Ascending paper chromatography
 - (B) Descending paper chromatography
 - (C) Ascending descending paper chromatography
 - (D) Radial paper chromatography
79. Which is not used for the Visualisation of spots on TLC plates ?
- (A) Fluorescence
 - (B) Under microscope
 - (C) Spraying with colouring agents
 - (D) UV radiation (light)
80. The carrier gas which is preferred over Nitrogen and Hydrogen in Gas chromatography is :
- (A) Oxygen
 - (B) Helium
 - (C) Carbon dioxide
 - (D) None of the above
81. Which of the following ion get released from the cation exchange column ?
- (A) Na^+
 - (B) Ca^{2+}
 - (C) H^+
 - (D) Mg^{2+}
82. HPLC is known as :
- (A) High performance low chromatography
 - (B) High pressure liquid chromatography
 - (C) High profit liquid chromatography
 - (D) High pressure low chromatography

83. Which is preferred for regeneration in cation exchange column ?
- (A) H_2SO_4
 - (B) HCl
 - (C) HF
 - (D) HNO_3
84. The exhausted anion exchange column is regenerated by passing a solution of :
- (A) Dil. HCl .
 - (B) Dil. KOH
 - (C) Conc. HCl
 - (D) Dil. NaOH
85. Which coagulant is widely used for sewage treatment ?
- (A) Lime
 - (B) Alum
 - (C) Ferric chloride
 - (D) Ferric sulphate
86. What is the advantage of vacuum filtration ?
- (A) Efficiency
 - (B) Faster than other filtration equipment
 - (C) Cost effective
 - (D) Low power cost
87. In which of the following process chemicals are added to waste water, resulting in a reduction of the forces tending to keep suspended particles apart ?
- (A) Coagulation
 - (B) Flocculation
 - (C) Clarification
 - (D) Sedimentation

88. Flocculation is the process of :
- (A) Gently mixing the water and coagulant allowing the formation of large particles of floc
 - (B) Removing relatively large floating and suspended impurities
 - (C) Flow, which is slowed enough so that gravity will cause the floc to settle
 - (D) Mixture of solids and liquids collected from settling tank
89. The principle of centrifugation is :
- (A) Filtration
 - (B) Sedimentation
 - (C) Evaporation
 - (D) None of the above
90. Which of the following is not a coagulant ?
- (A) Ferrous sulphate
 - (B) Sodium aluminate
 - (C) Sodium sulphate
 - (D) Ferric chloride
91. Ion exchange chromatography is based on the :
- (A) Electrostatic attraction
 - (B) Electrical mobility of ionic species
 - (C) Adsorption chromatography
 - (D) Partition chromatography
92. In anion exchange chromatography :
- (A) The column contains mobile and exchangeable anions
 - (B) The column contains mobile and exchangeable cations
 - (C) The column contains both cations and anions as exchangeable group
 - (D) None of these
93. In chromatographic separations resolution is proportional to the :
- (A) Number of theoretical plates in a column
 - (B) Square root of the number of theoretical plates in a column
 - (C) Square of the number of theoretical plates in column
 - (D) Cube root of the number of theoretical plates in a column

94. Temperature required for activation of TLC plate is :
- (A) 110-120°C
 - (B) 120-130°C
 - (C) 130-140°C
 - (D) 140-150°C
95. Principle of thin layer chromatography is :
- (A) Partition
 - (B) Adsorption
 - (C) Absorption
 - (D) None of the above
96. In chromatographic separations, the components with more affinity towards stationary phases :
- (A) Travel slow
 - (B) Travel fast
 - (C) Do not separate
 - (D) None of the above
97. Which of the following process found effective for purification of liquids containing suspensions ?
- (A) Decantation
 - (B) Centrifugation
 - (C) Crystallization
 - (D) Emulsification
98. Thin layer chromatography is:
- (A) Partition chromatography
 - (B) Adsorption chromatography
 - (C) Electrical mobility of ionic species
 - (D) None of the above

99. After centrifugation of milk, the supernatant is:
- (A) Water
 - (B) Fat
 - (C) Whey
 - (D) Casein
100. In chromatography which of the following can be a mobile phase:
- (A) Solid or liquid
 - (B) Liquid or gas
 - (C) Gas only
 - (D) Liquid only

Rough Work / रफ कार्य

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1. Examinee should enter his / her roll number, subject and Question Booklet Series correctly in the O.M.R. sheet, the examinee will be responsible for the error he / she has made.
 2. **This Question Booklet contains 100 questions, out of which only 75 Question are to be Answered by the examinee. Every question has 4 options and only one of them is correct. The answer which seems correct to you, darken that option number in your Answer Booklet (O.M.R ANSWER SHEET) completely with black or blue ball point pen. If any examinee will mark more than one answer of a particular question, then the first most option will be considered valid.**
 3. Every question has same marks. Every question you attempt correctly, marks will be given according to that.
 4. Every answer should be marked only on Answer Booklet (O.M.R ANSWER SHEET). Answer marked anywhere else other than the determined place will not be considered valid.
 5. Please read all the instructions carefully before attempting anything on Answer Booklet (O.M.R ANSWER SHEET).
 6. After completion of examination please hand over the Answer Booklet (O.M.R ANSWER SHEET) to the Examiner before leaving the examination room.
 7. There is no negative marking.
- Note:** On opening the question booklet, first check that all the pages of the question booklet are printed properly in case there is an issue please ask the examiner to change the booklet of same series and get another one.