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Subject Code :

0 6

Test Booklet No. : 00294

## TEST BOOKLET CHEMICAL ENGINEERING

Time Allowed : 2 (Two) Hours

Full Marks : 200

### INSTRUCTIONS

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Subject Code shall be written legibly and correctly in the space provided on the Answer Sheet with black ball pen.
2. Space provided for Series in the Answer Sheet is not applicable for Optional Subject. So the space shall be left blank.
3. All questions carry equal marks. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet.
4. No candidate shall be admitted to the Examination Hall/Room 20 minutes after commencement of distribution of the paper. The Supervisor of the Examination Hall/Room will be the time-keeper and his/her decision in this regard is final.
5. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
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7. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected paper permitted by the Commission.
8. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
9. After you have completed filling in all your responses on the Answer Sheet and the Examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.
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11. Smoking inside the Examination Hall/Room is strictly prohibited.
12. This Test Booklet contains one sheet (two pages) for Rough Work at the end.

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[ No. of Questions : 100 ]



1. Which of the following is a unit operation?

- (A) Sublimation  
(B) Sulphonation  
(C) Pyrolysis  
(D) Hydrolysis

4. Shear stress in a fluid flowing in a round pipe

- (A) varies parabolically across the cross-section  
(B) remains constant over the cross-section  
(C) is zero at the centre and varies linearly with radius  
(D) is zero at the wall and increases linearly to the centre

2. Which of the following is **not** equivalent to standard atmospheric pressure?

- (A) 1.01325 Pa  
(B) 1.0135 bar  
(C) 760 mm Hg  
(D)  $1.01325 \times 10^5 \text{ N/m}^2$

5. With increase in the temperature, viscosity of a liquid

- (A) increases  
(B) decreases  
(C) remains constant  
(D) None of the above

3. One mole of a compound contains

- (A) one molecule of the substance  
(B) one atom of the substance  
(C)  $6.023 \times 10^{23}$  molecules  
(D)  $22.4 \times 10^3$  molecules

6. Hydraulic radius is the ratio of

- (A) wetted perimeter to flow area  
(B) flow area to wetted perimeter  
(C) flow area to square of wetted perimeter  
(D) square root of flow area to wetted perimeter

7.  $f = \frac{16}{N_{Re}}$  is valid for

- (A) turbulent flow  
(B) laminar flow through an open channel  
(C) steady flow  
(D) None of the above



8. Limiting reactant for a chemical equation is the reactant that is

- (A) present in excess of the stoichiometric amount
- (B) present exactly as per stoichiometric amount
- (C) present in the smallest stoichiometric amount
- (D) not having any relation with stoichiometry

9. When chemical reaction occurs in a process, then usually the number of independent material balances and the number of atomic species

- (A) is different
- (B) is equal
- (C) may or may not matter
- (D) is irrelevant

10. The amount of air or oxygen required for bringing a process into complete combustion is called

- (A) theoretical air or oxygen
- (B) excess air or oxygen
- (C) practical requirement
- (D) None of the above

11. With rise in temperature, the heat capacity of a substance

- (A) increases
- (B) decreases
- (C) remains unchanged
- (D) either (A) or (B) depends on the substance

12. A stream bled off to remove an accumulation of inerts or unwanted material in the process is called

- (A) bypass stream
- (B) purge stream
- (C) recycle stream
- (D) process stream

13. In general, a gas that exists below its critical temperature is called

- (A) a critical gas
- (B) a condensate
- (C) a vapour
- (D) a smoke



14. Gibbs' phase rule is given by

- (A)  $F + C = P + 2$
- (B)  $F - C = P - 2$
- (C)  $F = C + P + 2$
- (D)  $F = C - P + 2$

15. The forces acting on a particle settling in a fluid are

- (A) gravitational and buoyant forces
- (B) centrifugal and drag forces
- (C) gravitational or centrifugal, buoyant and drag forces
- (D) external, drag and viscous forces

16. If more than two branches of pipes are to be connected at the same point, then which of the following is used?

- (A) Elbow
- (B) Union
- (C) Tee
- (D) None of the above

17. Pressure drop in a packed bed for laminar flow is given by

- (A) Kozeny-Carman equation
- (B) Blake-Plummer equation
- (C) Leva's equation
- (D) None of them

18. How many atoms are there per unit cell in a body-centred cubic lattice system?

- (A) 2
- (B) 3
- (C) 4
- (D) 6

19. A material is able to retain the deformation permanently by virtue of its

- (A) elasticity
- (B) plasticity
- (C) ductility
- (D) malleability

20. Which one is a non-magnetic material?

- (A) Cobalt
- (B) Nickel
- (C) Zinc
- (D) None of the above



21. Which metal is protected by the layer of its own oxide?

- (A) Iron
- (B) Silver
- (C) Calcium
- (D) Aluminium

22. The viscosity of atmospheric air may be about \_\_\_\_\_ centipoise.

- (A) 1.5
- (B) 15
- (C) 150
- (D) 0.015

23. The quantity of heat required to evaporate 1 kg of a saturated liquid is called

- (A) specific heat
- (B) 1 kcal
- (C) 1 calorie
- (D) latent heat

24. The softest material in Mohs scale is

- (A) talc
- (B) gypsum
- (C) rubber
- (D) iron

25. Teflon is corroded by

- (A) hydrochloric acid (10%)
- (B) hydrochloric acid (95%)
- (C) sulphuric acid
- (D) None of the above

26. Vena contracta formed during flow of a liquid through an orifice meter has

- (A) minimum liquid cross-section
- (B) more diameter compared to orifice diameter
- (C) minimum velocity of fluid stream
- (D) None of the above

27. "The total volume occupied by a gaseous mixture is equal to the sum of the pure component volume." This is

- (A) Dalton's law
- (B) Amagat's law
- (C) Gay-Lussac law
- (D) Avogadro's law

28. Plunger pumps are used for

- (A) higher pressure
- (B) slurries
- (C) viscous mass
- (D) None of the above



29. The total energy at a point comprises of \_\_\_\_\_ energy.
- (A) potential and kinetic
  - (B) pressure
  - (C) internal
  - (D) All of the above
30. An example of non-Newtonian fluid may be
- (A) ideal gas
  - (B) thin liquid
  - (C) thick, long-chain hydrocarbon
  - (D) None of the above
31. Which is **not** a dimensionless parameter?
- (A) Reynolds number
  - (B) Froude number
  - (C) Atomic number
  - (D) Mach number
32. The concept of boundary layer that provides important links between ideal-fluid flow and real-fluid flow was given by
- (A) Reynolds
  - (B) Prandtl
  - (C) Mach
  - (D) Hagen
33. As per classification of materials, 'fiber glass' may be classified under
- (A) metals
  - (B) ceramics
  - (C) composites
  - (D) polymers
34. The volume of atoms in a unit cell divided by total volume of the unit cell is known as
- (A) atomic number
  - (B) atomic packing factor
  - (C) coordination number
  - (D) crystal index
35. Which among the following is **not** a carbon polymorph?
- (A) Diamond
  - (B) Pearl
  - (C) Graphite
  - (D) Fullerene
36. Perspex is
- (A) Acrylic sheet
  - (B) an elastomer
  - (C) an alloy of tin and lead
  - (D) an aluminium foil clad with bakelite



37. Atmospheric corrosion of metals results from their

- (A) slow oxidation
- (B) fast oxidation
- (C) fast hydration
- (D) slow hydration

38. Boiler feed-water is treated to prevent

- (A) scaling and corrosion
- (B) foaming and priming
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

39. Which of the following is **not** a renewable energy?

- (A) Solar energy
- (B) Wind energy
- (C) Nuclear energy
- (D) Geothermal energy

40. Glass is corroded by

- (A) fluorine (dry or wet)
- (B)  $H_2SO_4$
- (C)  $H_3PO_4$
- (D) None of the above

41. Which of the following produces maximum pressure difference for transportation of gases?

- (A) Vacuum pump
- (B) Blower
- (C) Fan
- (D) Compressor

42. The number of gram equivalent of solute dissolved in one litre of solution is called its

- (A) normality
- (B) molarity
- (C) molality
- (D) None of the above

43. Rubber-lined pumps can be used to pump

- (A) caustic soda
- (B) chlorinated brine
- (C) hypochloric acid
- (D) All of the above

44. In flue gas analysis by Orsat's apparatus, carbon monoxide is absorbed by

- (A) cuprous chloride
- (B) potassium hydroxide
- (C) alkaline pyrogallol solution
- (D) None of the above



45. Emission of dense white smoke out of the chimney of a thermal power plant is an indication of the use of
- (A) less air for combustion
  - (B) correct amount of air for combustion
  - (C) too much air for combustion
  - (D) pulverised coal in boilers
46. A coal that softens and fuses on heating is
- (A) classified
  - (B) carbonised
  - (C) caking
  - (D) non-caking
47. The calorific value is highest for
- (A) producer gas
  - (B) water gas
  - (C) coke-oven gas
  - (D) blast-furnace gas
48. Addition of a non-volatile solute to a solvent produces a \_\_\_\_\_ in its solvent.
- (A) freezing point elevation
  - (B) boiling point depression
  - (C) vapour pressure lowering
  - (D) None of the above
49. Recycling in a chemical process facilitates
- (A) increased yield
  - (B) enrichment of product
  - (C) heat conservation
  - (D) All of the above
50. Deaeration of water in its treatment is necessary as it
- (A) minimises its turbidity
  - (B) helps in controlling its taste and odour
  - (C) minimises its corrosiveness
  - (D) None of the above
51. The most widely and commonly used coagulant for removal of suspended impurities in water is
- (A) bleaching powder
  - (B) slaked lime
  - (C) alum
  - (D) copper sulphate
52. Contact process
- (A) yields acid of higher concentration than chamber process
  - (B) yields acid of lower concentration than chamber process
  - (C) is obsolete
  - (D) eliminates absorber



53. Bromine is used in the preparation of

- (A) fire extinguishing compounds
- (B) fireproofing agents
- (C) dyes and antiknock compounds
- (D) All of the above

54. The hottest part of a flame lies in its

- (A) non-luminous zone
- (B) luminous zone
- (C) yellow zone
- (D) zone of unburnt gases

55. When coal is heated in absence of air, it is called

- (A) deoxidation
- (B) gasification
- (C) coalification
- (D) carbonisation

56. Which is the most commonly used molten metal for cooling of nuclear reactor?

- (A) Calcium
- (B) Sodium
- (C) Mercury
- (D) Zinc

57. Turbulent flow generally occurs in cases involving

- (A) highly viscous fluid
- (B) very narrow passages
- (C) very slow motion
- (D) None of the above

58. Cement mainly contains

- (A)  $\text{CaO}$ ,  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$
- (B)  $\text{MgO}$ ,  $\text{SiO}_2$ ,  $\text{K}_2\text{O}$
- (C)  $\text{Al}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{Fe}_2\text{O}_3$
- (D)  $\text{CaO}$ ,  $\text{MgO}$ ,  $\text{K}_2\text{O}$

59. Absorption of  $\text{SO}_3$  in 97%  $\text{H}_2\text{SO}_4$  is

- (A) exothermic
- (B) endothermic
- (C) not possible
- (D) None of the above

60. Which form of energy source has the highest potential in Assam compared to all States of India?

- (A) Wind power
- (B) Solar power
- (C) Hydropower
- (D) Biomass power



61. Find the odd one out.

- (A) Digboi Refinery
- (B) Numaligarh Refinery
- (C) Guwahati Refinery
- (D) Bongaigaon Refinery

62. Penetrating index and softening points are determined for

- (A) gasoline
- (B) kerosine
- (C) bitumen
- (D) gas oil

63. Mercury is transported in metal containers made of

- (A) aluminium
- (B) lead
- (C) iron
- (D) nickel

64. 'Sour' crude means the crude oil contains

- (A) wax
- (B) paraffins and asphalts
- (C) nitrogen compounds
- (D) sulphur compounds

65. Washing soda is

- (A)  $\text{Na}_2\text{CO}_3$
- (B)  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$
- (C)  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
- (D)  $\text{NaHCO}_3$

66. The main purpose of galvanizing iron sheets is to

- (A) harden the surface
- (B) increase the glossiness and luster
- (C) prevent the action of water
- (D) prevent the action of oxygen

67. Ammonia synthesis reaction is

- (A) exothermic
- (B) endothermic
- (C) autocatalytic
- (D) None of the above

68. A material is called ductile if it can be

- (A) drawn into wire
- (B) hammered into a thin sheet
- (C) fractured without deformation
- (D) made lustrous by heating it



69. Which is an amorphous material?

- (A) Glass
- (B) Mica
- (C) Brass
- (D) Cast iron

70. Which of the following is the easiest to crack?

- (A) Paraffin
- (B) Olefin
- (C) Naphthene
- (D) Aromatic

71. Laminar flow of a Newtonian fluid ceases to exist, when Reynolds number exceeds

- (A) 4000
- (B) 2100
- (C) 1500
- (D) 3000

72. Head developed by a centrifugal pump depends on its

- (A) speed
- (B) impeller diameter
- (C) Both (A) and (B)
- (D) None of the above

73. The most commonly used joint in underground pipeline is the

- (A) sleeve joint
- (B) coupling
- (C) flange
- (D) expansion joint

74. Flow measurement in open channels is done by

- (A) venturi meter
- (B) orifice meter
- (C) weir
- (D) rotameter

75. The catalyst used in catalytic reforming is

- (A) platinum on alumina
- (B) nickel
- (C) iron
- (D) aluminium chloride

76. When you completely burn the coal sample in a muffled furnace at 700°C–750°C and weigh the residue you get

- (A) volatile matter
- (B) fixed carbon
- (C) ash content
- (D) mineral matter



77. Pick the correct statement from the following :
- (A) Synthesis gas is a mixture of  $\text{CO}$ ,  $\text{CO}_2$  and  $\text{H}_2$ .
  - (B) Synthesis gas is a mixture of  $\text{CO}_2$  and  $\text{H}_2$ .
  - (C) Synthesis gas is a mixture of  $\text{O}_2$  and  $\text{H}_2$ .
  - (D) None of the above
78. The specific type of uranium used to produce nuclear energy most efficiently is
- (A) U-233
  - (B) U-234
  - (C) U-235
  - (D) U-236
79. A hydel project that captures the kinetic energy of water without large reservoir or even dam is called
- (A) conventional project
  - (B) run-of-the-river project
  - (C) micro-hydro project
  - (D) conduit project
80. A solution with reasonably permanent pH is called a/an
- (A) non-ideal solution
  - (B) colloidal solution
  - (C) buffer solution
  - (D) ideal solution
81. Which of the following **cannot** be determined by ultimate analysis of coal?
- (A) Total carbon
  - (B) Fixed carbon
  - (C) Hydrogen
  - (D) Oxygen
82. Which among the following is a unit process?
- (A) Distillation
  - (B) Hydrogenation of oils
  - (C) Absorption
  - (D) Humidification
83. Which acid is used to the greatest extent for metal pickling?
- (A) Sulphuric acid
  - (B) Hydrochloric acid
  - (C) Nitric acid
  - (D) Phosphoric acid
84. For an ideal gas,  $C_p - C_v = ?$
- (A)  $R^2$
  - (B)  $R/2$
  - (C)  $R$
  - (D)  $2R$



85. Kerosine should have
- low smoke point
  - high smoke point
  - high aromatic content
  - low paraffin content
86. Priming is needed in a
- reciprocating pump
  - gear pump
  - centrifugal pump
  - diaphragm pump
87. The catalyst used in Fischer-Tropsch process is
- nickel
  - zinc oxide
  - alumina
  - thorium oxide
88. Drag force on the float of a rotameter
- $\propto Q$
  - $\propto \sqrt{Q}$
  - $\propto Q^2$
  - is constant
89. The percent available chlorine in a good commercial sample of bleaching powder is
- 15% to 17%
  - 35% to 37%
  - 53% to 56%
  - 69% to 71%
90. Cement setting under water employs a/an \_\_\_\_ process.
- hydration
  - decomposition
  - oxidation
  - reduction
91. Triple superphosphate is made by reacting phosphoric rock with
- phosphoric acid
  - nitric acid
  - sulphuric acid
  - hydrochloric acid
92. After feeding raw materials to the kiln till production of cement clinkers, what is the correct order of reaction zones?
- Calcining-Drying-Clinkering
  - Drying-Calcining-Clinkering
  - Clinkering-Drying-Calcining
  - Clinkering-Calcining-Drying



93. A turbine is used to convert
- kinetic energy to mechanical energy
  - mechanical energy to hydraulic energy
  - hydraulic energy to mechanical energy
  - None of the above
94. Junker's calorimeter is used to determine the calorific value of
- gaseous fuel
  - liquid fuel
  - pulverised coal
  - solid fuel
95. The main constituent of natural gas is
- $\text{CH}_4$
  - $\text{C}_2\text{H}_2$
  - $\text{C}_2\text{H}_4$
  - $\text{C}_2\text{H}_6$
96. Which of the following fraction of a crude will have maximum API (i.e.,  $^\circ\text{API}$ )?
- Diesel
  - Gasoline
  - Atmospheric gas oil
  - Vacuum gas oil
97. DCDA process is the most recent process for the manufacture of
- $\text{HNO}_3$
  - $\text{H}_2\text{SO}_4$
  - $\text{HCl}$
  - None of the above
98. The widely used method for conditioning of boiler feed-water is
- cold lime process
  - coagulation
  - hot lime process
  - sequestration
99. In a centrifugal pump, the liquid enters the pump
- at the centre
  - at the bottom
  - at the top
  - from the sides
100. The most common method of producing hydrogen from hydrocarbon is known as
- steam reforming
  - partial oxidation
  - steam blowing
  - complete oxidation