EJ/EPH/CH/II/25/12

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

Test Booklet No. :

00581

TEST BOOKLET

CHEMICAL ENGINEERING

Series

A

Time Allowed : 2 Hours

Full Marks : 100

Read the following instructions carefully before you begin to answer the questions :

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.
2. **Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**
3. All questions carry equal marks.
   The Answer-Sheet should be submitted to the Invigilator.
   Directions for giving the answers : Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.
   Example :
   Suppose the following question is asked :
   The capital of Bangladesh is
   (A) Chennai
   (B) London
   (C) Dhaka
   (D) Dhubri
   You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :

   Ⓐ Ⓑ ● Ⓓ

   The example shown above is the only correct method of answering.
4. Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.
5. Please ensure that the Test Booklet has the required number of pages (16) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.
6. No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.
7. 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.
8. No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
9. 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 papers permitted by the Commission.
10. 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.
11. This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.
12. Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.
13. No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

N.B. : There will be negative marking @ 0·25 per 1 (one) mark against each wrong answer.

[No. of Questions : 100]

SEAL

1. Which of the following flow-metering instruments is an area meter?

(A) Venturimeter

(B) Rotameter

(C) Pitot tube

(D) Orifice meter

2. Reynolds' number is the ratio of

(A) viscous forces to gravity forces

(B) viscous forces to inertial forces

(C) inertial forces to viscous forces

(D) inertial forces to gravity forces

3. Priming is needed in a

(A) centrifugal pump

(B) reciprocating pump

(C) gear pump

(D) diaphragm pump

4. Which type of pipe fitting is used to connect three or more pipes?

(A) Elbow

(B) Coupling

(C) Union

(D) Tee

5. The function of a pipe reducer is to

(A) increase the diameter of a pipe

(B) decrease the diameter of a pipe

(C) change the direction of a pipe

(D) seal a pipe

6. The purpose of a check valve is to

(A) regulate fluid pressure

(B) control fluid flow rate

(C) prevent backflow

(D) measure fluid flow

7. What is the advantage of using a rotary drum filter?

(A) High maintenance cost

(B) Low filtration rate

(C) Limited applicability

(D) Continuous operation and high filtration rate

8. The unit of thermal conductivity is

(A) $W/(m\text{-}K)$

(B) $W/(m^2\text{-}K)$

(C) $W/(m^2\text{-}K^4)$

(D) $W/(m\text{-}K^2)$

9. Baffles in shell-and-tube heat exchangers primarily serve to

(A) increase the mixing of fluid

(B) increase heat transfer area

(C) increase heat transfer efficiency by directing the shell-side fluid flow

(D) reduce fouling of the tube surface

10. The thermal conductivity is minimum for

(A) silver

(B) chrome-nickel steel

(C) aluminium

(D) carbon steel

11. In a centrifugal pump, cavitation occurs when pressure of the impeller eye or vane becomes

(A) more than liquid vapour pressure

(B) more than atmospheric pressure

(C) less than atmospheric pressure

(D) less than liquid vapour pressure

12. A multiple-effect evaporator as compared to a single-effect evaporator of the same capacity has

(A) lower heat transfer area

(B) lower steam economy

(C) higher steam economy

(D) higher solute concentration in the product

13. Heat is typically supplied to a tray dryer by

(A) hot air

(B) steam

(C) electricity

(D) gas

14. For separation of a liquid from multi-component mixture, the unit operation used is

(A) absorption

(B) evaporation

(C) filtration

(D) distillation

15. The analysis of fractionating column is facilitated by the use of quantity called

(A) reflux ratio

(B) friction factor

(C) distribution coefficient

(D) thermal diffusivity

16. Which of the following is a part of the bubble-cap assembly?

(A) Electric desalter

(B) Riser

(C) Reflux drum

(D) Reboiler

17. Scaling and salting are common problems of

(A) IC engines

(B) evaporators

(C) conveyors

(D) hoppers

18. Which of the following laws is ***not*** associated with crushing?

(A) Rittinger's law

(B) Kick's law

(C) Fourier's law

(D) Bond's law

19. Ultrafine grinders operate principally by

(A) compression

(B) cutting

(C) impact

(D) attrition

20. Which of the following is ***not*** a size reduction device or equipment?

(A) Hammer mill

(B) Gyratory crusher

(C) Cyclone separator

(D) Fluid energy mill

21. Which of the following mills works on the principle of combined impact and attrition?

(A) Ball mill

(B) Hammer mill

(C) Roller mill

(D) Colloidal mill

22. For conveying of viscous masses, we use

(A) belt conveyor

(B) screw conveyor

(C) chain conveyor

(D) apron conveyor

23. Hummer and Rotex are examples of

(A) froth flotation cells

(B) filters

(C) conveyors

(D) vibrating screens

24. Kneading machine is used to mix

(A) dry masses

(B) liquid slurry

(C) viscous masses

(D) powdery masses

25. Which of the following is ***not*** a source of surface water?

(A) River

(B) Well

(C) Lake

(D) Pond

26. Soda ash (Na_2CO_3) is synthesized primarily through

(A) Bayer's process

(B) Haber's process

(C) Solvay process

(D) Fischer-Tropsch process

27. The most common catalyst used in hydrogenation of vegetable oil is

(A) platinum

(B) nickel

(C) iron

(D) zeolite

28. Which of the following is ***not*** a raw material for the manufacture of ordinary glass?

(A) Hydrogen isocyanide

(B) Soda ash

(C) Limestone

(D) Silica

29. The primary soap making reaction is

(A) saponification

(B) esterification

(C) hydrolysis

(D) hydrogenation

30. The global warming potential of a gas is decided on the basis of

(A) the amount of total long-wave radiation a greenhouse gas can trap

(B) the amount of total long-wave radiation a greenhouse gas can trap in comparison to CO_2 over a period of 100 years

(C) the amount of total long-wave radiation a greenhouse gas can trap in comparison to CH_4 over a period of 100 years

(D) the amount of total long-wave radiation a gas can trap over a period of 1 year

31. The nitrogen compound with the largest production volume in the world is

(A) azidoazide azide

(B) urea-formaldehyde

(C) ammonia

(D) melamine-formaldehyde

32. The first step in sugar production from sugarcane is

(A) clarification

(B) evaporation

(C) crystallization

(D) crushing

33. The widely used catalyst in the manufacturing of sulphuric acid by contact process is

(A) platinum

(B) vanadium pentoxide

(C) alumina

(D) silica gel

34. Which of the following is a cross-linked polymer?

(A) Polyester

(B) Polythene

(C) Nylon-6

(D) Bakelite

35. The Ziegler-Natta catalyst is used for the production of

(A) high-density polyethylene

(B) low-density polyethylene

(C) polyvinyl chloride

(D) polystyrene

36. BOD is a measure of

(A) water temperature

(B) fluoride content in water

(C) the amount of oxygen micro-organisms need to break down organic material in water

(D) the amount of oxygen required to chemically oxidize inorganic compounds in water

37. Which of the following is ***not*** a polyester fibre?

(A) Nylon

(B) Terylene

(C) Dacron

(D) Polyethylene terephthalate (PET)

38. Which of the following is a type of synthetic rubber?

(A) Polyvinyl chloride

(B) Polyisoprene

(C) Styrene-butadiene rubber

(D) Latex

39. Neoprene rubber is chemically known as

(A) butyl rubber

(B) polychloroprene

(C) nitrile rubber

(D) polybutadiene

40. Gypsum is used in cement manufacturing as a

(A) strength enhancer

(B) hardener

(C) catalyst

(D) setting retarder

41. The Fourdrinier machine is used in the manufacturing of

(A) rubber

(B) sugar

(C) cement

(D) paper

42. NPK means a

(A) nitrogenous fertilizer

(B) phosphatic fertilizer

(C) mixed fertilizer

(D) liquid fertilizer

43. Essential oil is usually obtained by

(A) leaching

(B) steam distillation

(C) filtration

(D) evaporation

44. Lime-soda treatment of hard water removes

(A) temporary hardness

(B) permanent hardness

(C) both temporary and permanent hardness

(D) iron content

45. The most widely used coagulant for removing suspended impurities from water is

(A) alum

(B) chlorine

(C) calcium sulphate

(D) bleaching powder

46. The octane number of iso-octane is

(A) 100

(B) 50

(C) 25

(D) 0

47. Aviation Turbine Fuel (ATF) has a distillation range of approximately

(A) 120–140 °C

(B) 150–270 °C

(C) 300–400 °C

(D) 30–90 °C

48. The petroleum product used as a feedstock for producing petro-chemicals is

(A) kerosene

(B) diesel

(C) lubricant

(D) naphtha

49. The most suitable instrument for measuring the temperature of a furnace is

(A) platinum resistance thermometer

(B) optical pyrometer

(C) thermocouple

(D) bimetallic thermometer

50. The act of crushing coal until it becomes powder is called

(A) carbonization

(B) gasification

(C) pulverization

(D) coking

51. The presence of aromatics which causes abnormal ignition delay in diesel engine is indicated by

(A) pour point

(B) softening point

(C) flash point

(D) aniline point

52. The process of transformation of plant material into coal is

(A) carbonization

(B) metamorphism

(C) weathering

(D) sedimentation

53. The maturity of coal can be understood by its

(A) rank

(B) volatile matter content

(C) mineral matter content

(D) moisture content

54. Humic coal mainly originates from

(A) aquatic habitats

(B) terrestrial plant debris

(C) seawater

(D) animal fats

55. The fused cellular porous structure that remains after removal of free moisture and volatile matter from coal is known as

(A) crude

(B) wood charcoal

(C) coke

(D) kerogen

56. High aromatic content in

(A) diesel increases its cetane number

(B) kerosene increases its smoke point

(C) petrol decreases its octane number

(D) petrol increases its octane number

57. LPG is essentially a mixture of varying proportions of

(A) propane and butane

(B) methane and ethane

(C) pentane and hexane

(D) methane and pentane

58. Assam crude is

(A) paraffinic base

(B) naphthenic base

(C) mixed base

(D) asphalt base

59. The viscosity of an oil is the measure of its

(A) combustion quality

(B) resistance to flow

(C) oxidation stability

(D) sulphur content

60. Good quality kerosene exhibits smoke point of

(A) 10–15 mm

(B) 20–25 mm

(C) 30–40 mm

(D) 40–50 mm

61. Which of the following API gravity ranges is typically considered as light crude oil?

(A) 0°–10° API

(B) 10°–22·3° API

(C) 22·3°–31° API

(D) Above 31·1° API

62. Vacuum distillation of crude is carried out under reduced pressure to

(A) increase the boiling point of the fraction

(B) increase the yield of light fractions

(C) decrease the boiling point of the fraction

(D) reduce the viscosity of crude oil

63. Coke oven gas mainly consists of

(A) CH_4 and H_2

(B) CO and N_2

(C) H_2 and N_2

(D) CO and CO_2

64. Heat of combustion of methane is around

(A) 120 MJ/m^3

(B) 65 MJ/m^3

(C) 12 MJ/m^3

(D) 37 MJ/m^3

65. Which of the following gaseous fuels exhibits the highest gross calorific value on per m^3 basis?

(A) Sewage gas

(B) LPG

(C) Producer gas

(D) Natural gas

66. The gas which contributes the maximum to the heating value of natural gas is

(A) CO

(B) CO_2

(C) CH_4

(D) H_2

67. The composition of water gas or blue gas is

(A) H_2 and CO

(B) H_2 and C_2H_6

(C) CH_4 and C_2H_6

(D) CH_4 and H_2

68. One of the examples of non-renewable energy source is

(A) bioenergy

(B) wind energy

(C) energy from tides

(D) nuclear energy from uranium

69. The main product of anaerobic digestion is

(A) bioethanol

(B) biogas

(C) biodiesel

(D) syngas

70. Which of the following is a commonly used unit process to convert unsaturated hydrocarbons into saturated hydrocarbons in petroleum industry?

(A) Oxidation

(B) Dehydrogenation

(C) Hydrogenation

(D) Aromatization

71. The chemical method for processing oilseeds such as groundnut, soybean and rapeseed is

(A) absorption

(B) hydrolysis

(C) polymerization

(D) solvent extraction

72. The main purpose of the Kraft pulping process is to

(A) bleach the pulp

(B) remove lignin from wood fibres

(C) produce mechanical pulp

(D) recycle paper

73. Which of the following fertilizers is a key component in the production of resins and plastics?

(A) Ammonium sulfate

(B) Ammonium nitrate

(C) Potassium nitrate

(D) Urea

74. One of the major residues of sugar-cane industry which can also be used as a valuable feedstock for biofuels production is

(A) molasses

(B) spent lye

(C) bagasse

(D) sucrose

75. Lime is used as basic flux in the manufacture of

(A) steel

(B) brass

(C) bronze

(D) aluminium

76. Which of the following is a typical example of composition analyzer?

(A) Thermocouple

(B) Gas chromatograph

(C) Pitot tube

(D) Bourdon tube

77. A graphic recorder is

(A) analog type recorder

(B) digital type recorder

(C) return-to-zero type recorder

(D) non-return-to-zero type recorder

78. The bulbs of filled system thermometers are usually made up of

(A) rubber

(B) iron

(C) plastic

(D) stainless steel

79. The working principle of a thermopile is based on

(A) Joule's law of heating

(B) Stefan-Boltzmann law

(C) Seebeck effect

(D) Ohm's law

80. The resistance of an NTC (Negative Temperature Coefficient) thermistor

(A) increases with increase in temperature

(B) decreases with increase in temperature

(C) remains constant with temperature

(D) varies randomly with temperature

81. The Reaumur scale is based on the freezing and boiling point of water at

(A) $-32°$ R′ and $60°$ R′

(B) $0°$ R′ and $60°$ R′

(C) $0°$ R′ and $80°$ R′

(D) $10°$ R′ and $80°$ R′

82. In a C-type Bourdon tube, the cross-section of the tube is generally

(A) circular

(B) oval or elliptical

(C) square

(D) triangular

83. Absolute pressure is equal to

(A) gauge pressure + atmospheric pressure

(B) gauge pressure – atmospheric pressure

(C) atmospheric pressure only

(D) gauge pressure only

84. Variable head flow meters work on the principle of

(A) Pascal's law

(B) Newton's second law

(C) Boyle's law

(D) Bernoulli's theorem

85. In radiation level detector, when the liquid level in the tank rises, the amount of radiation received by the detector

(A) is increased

(B) is reduced

(C) is unchanged

(D) remains constant

86. Self-operated controllers work (to automatically adjust a valve) by using the

(A) external electrical power

(B) external mechanical gears

(C) energy from process medium (e.g., temperature and pressure)

(D) battery power

87. The 'dead-end' type self-operated pressure regulator differs from the 'flow type' by having ***no***

(A) relief valve

(B) extra spring adjustment

(C) float mechanism

(D) thermostat bulb

88. Automatic control is the maintenance of a desired value

(A) by using open-loop adjustment

(B) by manually adjusting setpoint

(C) without correcting the differences

(D) by measuring, comparing and correcting the differences

89. In two-position control, the manipulated variable is changed to

(A) continuous intermediate values

(B) either maximum or minimum value

(C) only proportional values

(D) random values depending on disturbance

90. Feedback control generally ***does not*** improve

(A) stability

(B) accuracy

(C) performance

(D) measurement of disturbances

91. A passive transducer

(A) self-generates electrical output from input energy

(B) requires mechanical movement only

(C) requires an external electrical source

(D) requires optical input only

92. A mechanical transducer itself can directly provide output solely in the form of

(A) displacement or movement

(B) voltage

(C) current pulses

(D) light intensity

93. If the air supply above the diaphragm of an air-to-close valve fails, the valve will

(A) fail closed

(B) fail open

(C) remain at last position

(D) burst due to spring force

94. Consider the following statements about derivative control :

(i) It predicts actuating errors before they evolve.

(ii) It improves the stability of the system.

(iii) Its output will be constant (but not zero) when error is constant.

Which statements are correct?

(A) Only (i) and (ii)

(B) Only (ii) and (iii)

(C) Only (i) and (iii)

(D) (i), (ii) and (iii)

95. Which of the following parameters is required for calculation of Reynolds' number for a fluid flowing through a cylindrical pipe?

(A) Acceleration due to gravity (g)

(B) Specific heat at constant pressure

(C) Molar mass of the fluid

(D) Density of the fluid

96. Which of the following statements about float type level indicator is ***not*** correct?

(A) A float rests on the liquid surface and follows the changing level of liquid.

(B) Float is made of corrosion-resisting materials such as stainless steel.

(C) Float type level indicators are suitable for highly viscous liquids.

(D) Floats can be hollow spheres, cylinders, or discs.

97. The McLeod gauge works on the principle of

(A) ionization of residual gases

(B) heat transfer in gases

(C) elastic deformation of diaphragm

(D) compression of a known volume of gas

98. 1 torr is equal to

(A) 100 microns

(B) 1 mm of Hg

(C) $14{\cdot}5 \times 10^{-3}$ psi

(D) 10^{-6} mm of Hg

99. Consider the following statements about reproducibility of instruments :

(i) It refers to degree of agreement between multiple measurements of the same quantity.

(ii) High reproducibility indicates that the instrument's performance is stable and reliable over time.

(iii) Perfect reproducibility ensures accuracy over a short period of time.

Which statements are correct?

(A) Only (i) and (ii)

(B) Only (ii) and (iii)

(C) Only (i) and (iii)

(D) (i), (ii) and (iii)

100. Which of the following controllers is most sensitive and responsive to noise?

(A) Proportional

(B) On-off

(C) Derivative

(D) Integral

SPACE FOR ROUGH WORK

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SEAL

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