1. A Fuel oil consisting of 10% (Wt.) hydrogen and 90% (Wt.) carbon is found to give a heat of combustion of 43,000 KJ/Kg, when burned in a constant volume bomb calorimeter. Calculate the constant-pressure heat of combustion of the oil.

(A) –2120.90 KJ/Kg
(B) –3215.12 KJ/Kg
(C) –43061.4 KJ/Kg
(D) –1215.7 KJ/Kg
(E) Answer not known

2. A ideal gas is expanded from 5 bar to 4 bar isothermally at 600 K what is the change in the enthalpy?

(A) 0
(B) 600
(C) 1
(D) 300
(E) Answer not known

3. Calculate the enthalpy of sublimation of Iodine from the following reactions and data

$$H_2(g) + I_2(s) \rightarrow 2HI(g) \Delta H = 57.9\ kJ$$
$$H_2(g) + I_2(g) \rightarrow 2HI(g) \Delta H = -9.2\ kJ$$

(A) 48.7 kJ
(B) 76.3 kJ
(C) 67.1 kJ
(D) 39.5 kJ
(E) Answer not known

4. An automobile tyre is inflated to a pressure of 200 kPa at 273 K. If the pressure inside the tyre is not to exceed 250 kPa, what is the maximum temperature to which the tyre may be heated. (Assume ideal gas law and no change in the volume of air inside the tyre)

(A) 273 K
(B) 300.5 K
(C) 341.25 K
(D) 350 K
(E) Answer not known

5. The available nitrogen content in a urea sample is 45%. Find the actual urea content in the sample.

(A) 48.21% (B) 72.32%

(C) 96.43% (D) 32.14%

(E) Answer not known

6. The first law of Thermodynamics takes the form $W = \Delta H$ when applied to

(A) A closed system undergoing a reversible adiabatic process

(B) An open system undergoing an adiabatic process with negligible changes in kinetic and potential energies

(C) A closed system undergoing a reversible constant volume process

(D) A closed system undergoing a reversible constant pressure process

(E) Answer not known

7. $C_P - C_V = \frac{\beta^2 VT}{K}$ is valid for

β is coefficient of volume expansion

K is coefficient of compressibility

(A) Solids + liquid (B) Ideal gases

(C) Only solids (D) Only liquids

(E) Answer not known

8. The required condition(s) to be met with an ideal solution is/are

(A) $\Delta A_{mix} = 0$ (B) $\Delta S_{mix} = 0$

(C) $\Delta H_{mix} = \Delta V_{mix} = 0$ (D) $\Delta G_{mix} = 0$

(E) Answer not known

9. If equilibrium, the fugacity of a component in a liquid phase is _____ of the fugacity of the component in vapor phase.

(A) Lower than that (B) Twice that

(C) Thrice that (D) Equal to that

(E) Answer not known

10. Activity coefficient of i^{th} species in an ideal solution γ_i is equal to

(A) 0 (B) 1

(C) >1 (D) >2

(E) Answer not known

11. In a catalytic reactor, the reaction $A \rightarrow 2B + C$ takes place in the reactor. The amount of moles recycled IS 996.92. Moles of fresh feed = 100, calculate ratio of recycle to fresh feed.

(A) 8.79 (B) 7.27

(C) 9.97 (D) 10.28

(E) Answer not known

12. The total kilogram of dry air in the final air is 148.41 kg from dehumidifier. Find out the moles of dry air produced.

(A) 15.271 kmol
(B) 7.521 kmol
(C) 5.1177 kmol
(D) 221.12 mol
(E) Answer not known

13. 0.5012 kg of dry air is bypassed per 1 kg dry air passed through the dehumidifier. Hence for each kilogram of dry air the final air obtained is 1.5012 kg of dry air. Since 1 kg of dry air along with the accompanying water vapour has volume of 1.0115 m^3, the kilogram of dry air in the final air is

(A) 148.41 kg
(B) 140.1 kg
(C) 141.7 kg
(D) 142.0 kg
(E) Answer not known

14. The weight of an object is 300 N at a location where the acceleration due to gravity is 900 m/s^2. What is its mass in kilograms?

(A) 33.33 kg
(B) 30.33 kg
(C) 23.33 kg
(D) 20.33 kg
(E) Answer not known

15. The object of by-pass stream is to

(A) Control the composition of final exit stream
(B) Lower the yield
(C) Remove valuable reactants from recycle
(D) Avoid purging
(E) Answer not known

16. Choose the correct equation predicts the effect of pressure on activity.

(A) $\left(\frac{\partial \ln a}{\partial P}\right)_T = \frac{V}{RT}$ (B) $\left(\frac{\partial \ln a}{\partial T}\right)_P = \frac{V^2}{RT}$

(C) $\left(\frac{\partial \ln a}{\partial P}\right)_P = \frac{VP}{RT}$ (D) None of the above

(E) Answer not known

17. Choose some of the widely used activity coefficient equations

(A) Wilson Equations

(B) NRTL Equations

(C) UNIQUAC and UNIFAC Equations

(D) All the above

(E) Answer not known

18. Match the correct pair :

Activity coefficients are functions of

(i) Temperature

(ii) Liquid phase composition

(iii) Based on experiment

(A) (i) only (B) (i) and (ii) only

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

(E) Answer not known

19. Activity is denoted by

(A) $a = \frac{f}{f^\circ}$ (B) $a = \frac{f^\circ}{f}$

(C) $a = 1 + \frac{f^\circ}{f}$ (D) $a = 1 - \frac{f}{f^\circ}$

(E) Answer not known

20. The unit of fugacity is same as that of

(A) Pressure (B) Temperature

(C) Volume (D) Molar concentration

(E) Answer not known

21. Concentration of HNO_3 from 57-60% to 95% can be done by

(A) 90% HCl (B) 92% $mg(SO_4)_2$

(C) 91% NH_3 (D) 93% H_2SO_4

(E) Answer not known

22. In the synthetic ammonia process, the percentage conversion of H_2 and N_2 to NH_3 is

(A) 1 – 10% (B) 8 – 30%

(C) 60 – 80% (D) 85 – 90%

(E) Answer not known

23. Triple superphosphate is chemically represented as

(A) $Ca_3\ F_2\ 3Ca_3\ (PO_4)_2$ (B) $3Ca_3(PO_4)_2$

(C) $Ca(PO_4)_2$ (D) $Ca(H_2\ PO_4)_2$

(E) Answer not known

24. Which of the following is used an internal conditioner during the production of Urea?

(A) Sodium Lignosulfonate

(B) Sodium Sulfite

(C) Sodium Chromate

(D) Sodium Hydroxide

(E) Answer not known

25. The catalyst which is used at 500 – 550°C for ammonia synthesis?

(A) Iron Catalyst (B) Nickel Catalyst

(C) Zinc Catalyst (D) Sulphur Catalyst

(E) Answer not known

26. The essential fertilizer that helps in the growth of fruits in plants is

(A) Nitrogen (B) Phosphorus

(C) Potassium (D) Carbon based materials

(E) Answer not known

27. The term that describes the drying out of roots and damage or even death of the plant is

(A) Root burn
(B) Fertiliser burn
(C) Plant burn
(D) Soil burn
(E) Answer not known

28. Which of the following is incorrectly paired?

(1) Neonicotinoids – Synthetic analogues of the natural insecticide nicotine
(2) Endrin – Used to control mice and voles
(3) DDT – Produced from chloral with chlorobenzene
(4) Endosulphan – Common name for copper (II) aceto arsenite

(A) (1) & (2) & (3)
(B) (1) & (3) & (4)
(C) (3) only
(D) (4) only
(E) Answer not known

29. The biosynthesis of tobacco takes place in the _____ part of the Solanaceae plants.

(A) Stem
(B) Leaves
(C) Flower
(D) Roots
(E) Answer not known

30. Most widely used fumigant is

(A) Carbon disulfide
(B) Hydro cyanic acid
(C) Methyl bromide
(D) Acrylonitrile
(E) Answer not known

31. The catalyst used in DDT manufacture is

(A) 30% H_2SO_4 (B) 98% H_2SO_4

(C) 30% HNO_3 (D) 98% HNO_3

(E) Answer not known

32. The first organic insecticide produced in India is

(A) BHC (B) DDT

(C) 2, 4 – D (D) Parathion

(E) Answer not known

33. Organophosphorus pesticides are gaining importance than chlorinated pesticides due to their

(A) Lesser resistant to insects

(B) Hazard to marine life

(C) Less permanent nature to the weather

(D) Simplified synthesis process

(E) Answer not known

34. Paper which does not require a filler during manufacture is

(A) Bond paper (B) Writing paper

(C) Tissue paper (D) Coloured paper

(E) Answer not known

35. Most easily available fibrous raw material in India is

(A) Cotton rags (B) Cotton linters

(C) Bamboo (D) Bagasse

(E) Answer not known

36. In sulphate pulp manufacture, cooling of the digested chip at the bottom portion of the digestor by injecting cold black liquor is to

(A) Avoid mechanical weakening of fibre
(B) Remove lignin by way of crystallization
(C) Increase the cellulose content
(D) Decrease the cellulose content
(E) Answer not known

37. Fourdrinier machine is used in the manufacture of

(A) Soap
(B) Paper
(C) Detergent
(D) Leather
(E) Answer not known

38. Acetylation of cellulose is carried out with

(A) 50 – 50 mixture of acetic acid-acetic anhydride using H_2SO_4 catalyst
(B) 50 – 50 mixture of acetic acid-cellulose acetate using V_2O_5 catalyst
(C) 25 – 75 mixture of sulfuric acid-acetic anhydride using V_2O_5 catalyst
(D) 25 – 75 mixture of sulfuric acid-acetic anhydride using no catalyst
(E) Answer not known

39. To prepare pulp liquor by the soda process, the principal raw materials used are

(i) $Na_2 CO_3$

(ii) Lime

(iii) Water

(A) (i) only
(B) (i) and (iii) only
(C) (i) and (ii) only
(D) (i), (ii) and (iii)
(E) Answer not known

40. Reuse pulp and paper products contains

(A) 1 – 3% of fibrous starting materials
(B) 2 – 3% of fibrous starting materials
(C) 4 – 6% of fibrous starting materials
(D) 6 – 8% of fibrous starting materials
(E) Answer not known

41. For a second order reaction $2A \rightarrow$ products the concentration of reactant (C_A) at any time 't' to the initial concentration (C_{AO}) is related to the time 't' and rate constant 'k' as

(A) $C_A / C_{AO} = e^{-kt}$
(B) $C_A / C_{AO} = 1 / 1 + k\, C_{AO}\, t$
(C) $C_A / C_{AO} = 1 / k\, C_{AO}\, t$
(D) $C_A / C_{AO} = \dfrac{k\, C_{AO}\, t}{1 + k\, C_{AO}\, t}$
(E) Answer not known

42. For constant density systems, the performance equation to determine conversion are same for

(A) Batch reactor and mixed flow reactor

(B) Plug flow reactor and batch reactor

(C) Mixed flow reactor and plug flow reactor

(D) Batch reactor, plug flow reactor and mixed flow reactor

(E) Answer not known

43. The dimensions of the rate constant (K) for the n^{th} order reaction are

(A) $\text{time}^{-1}\ \text{concentration}^{1-n}$

(B) $\text{time}^{-1}\ \text{concentration}^{n-1}$

(C) $\text{time}^{-1}\ \text{concentration}^{-n}$

(D) $\text{time}^{-1}\ \text{concentration}^{n+1}$

(E) Answer not known

44. For the chemical reaction $A \rightarrow B$, it is found that the rate of the reaction triples when concentration of 'A' is increased 9 times. If rate $\alpha\, C_A^n$, then 'n' for this reaction must be

(A) 3

(B) 9

(C) $\frac{1}{3}$

(D) $\frac{1}{2}$

(E) Answer not known

45. To maximize the formation of R in simultaneous reaction

$A + B \rightarrow R;\ r_R = 2\,C_A^{0.5} C_B^{2}$

$A + B \rightarrow S;\ r_S = 1.4\,C_A\,C_B$

we should have

(A) Low C_A, Low C_B

(B) Low C_A, High C_B

(C) High C_A, Low C_B

(D) High C_A, High C_B

(E) Answer not known

46. Which statement is correct for the variation of the black body emissive power with the wavelength for several temperatures?

(A) At any wavelength, the amount of emitted radiation increases with increasing temperature

(B) The emitted radiation is a discontinuous function of wavelength

(C) As the T increases, the curve shifts to the left to the higher wavelength region

(D) All the above

(E) Answer not known

47. The heat transfer coefficient equation $h = 0.023\left(\frac{x}{d}\right)\left(\frac{dvp}{\mu}\right)^{0.8}\left(\frac{c_p\mu}{k}\right)^{\frac{1}{3}}$

is valid for NR_e

(A) < 2,100

(B) 2,100 – 4,000

(C) < 4,000

(D) > 6,000

(E) Answer not known

48. When the forced and free convection currents are in same direction, the flow is termed as

(A) Potential flow
(B) Compressible flow
(C) Aiding flow
(D) Incompressible flow
(E) Answer not known

49. The rate of heat transfer through a unit thickness of the material per unit area per unit temperature difference is called as

(A) Heat of enthalpy
(B) Isothermal reaction
(C) Thermal conductivity
(D) Non-Isothermal reaction
(E) Answer not known

50. Which of the following is paired correctly?

(i) Emissivity : Depends on surface characteristics

(ii) Emissivity of metallic surfaces : Increase with Temperature

(iii) Non metals : The wavelength dependence of emissivity is weak

(A) (i) and (ii) only
(B) (i) and (iii) only
(C) (ii) and (iii) only
(D) (i), (ii) and (iii)
(E) Answer not known

51. A reversible liquid phase endothermic reaction is to be carried out in PFR. For minimum reactor volume, it should be operated such that the temperature along the length.

(A) Decreases

(B) Increases

(C) Is at the highest allowable temperature throughout

(D) First increase and then decrease

(E) Answer not known

52. The exit age distribution of a fluid leaving a vessel is used to

(A) Study the reaction kinetics

(B) Study the extent of non-ideal flow in a reactor

(C) To study the reaction mechanism

(D) To determine the activation energy

(E) Answer not known

53. The average distance travelled by the turbulent lumps of fluid in a direction normal to the mean flow is termed as

(A) Mean free path

(B) Time smooth velocity

(C) Eddy viscosity

(D) Prandtl mixing length

(E) Answer not known

54. The entropy 'S' is defined as

(A) $dS = \left(\frac{\delta Q}{T}\right)_{\text{int}, rev}$

(B) $dS = \left(\frac{Q}{T}\right)_{rev}$

(C) $dS = \frac{Q_{rev}}{T}$

(D) $dS = \frac{\delta Q_{rev}}{T}$

(E) Answer not known

55. Deviations from the ideal flow patterns cannot be caused by

(A) Channelling of fluid
(B) Recycling of fluid
(C) Stagnant regions in the reactor
(D) Stream lined flow of fluid
(E) Answer not known

56. The Hatta number plays an important role in

(A) Gas absorption with chemical reaction
(B) Gas absorption without chemical reaction
(C) Solvent extraction
(D) Multi component distillation
(E) Answer not known

57. In drying a porous body, when capillary action causes air to be sucked into the pores, then it is termed as

(A) Molecular State
(B) Excited State
(C) Funicular State
(D) Intermediate State
(E) Answer not known

58. Calculate the humidity H, where air in a room is at 26.7°C, pressure of 101.325 kPa and contains water vapour with partial pressure of 2.76 kPa.

(A) 0.01742 kg H_2O/kg air
(B) 0.02226 kg H_2O/kg air
(C) 0.01061 kg H_2O/kg air
(D) 0.00645 kg H_2O/kg air
(E) Answer not known

59. Rayleigh equation applies to _____ distillation.

(A) Differential
(B) Flash
(C) Equilibrium
(D) Molecular
(E) Answer not known

60. If in a catalyst particle, if the resistance due to diffusion through the pores is negligible, then the effectiveness factor is

(A) 0
(B) –1
(C) 1
(D) 2
(E) Answer not known

61. The trade names Nylon, Zytel, Kevlar and Nomex all depict

(A) Polyethylene
(B) Polyester
(C) Polyamides
(D) Poly carbonates
(E) Answer not known

62. Which polymerization technique yields high purity polystyrene?

(A) Bulk polymerization
(B) Solution polymerization
(C) Suspension polymerization
(D) Emulsion polymerization
(E) Answer not known

63. The non-stick pans are coated with

(A) Poly methyl methacrylate
(B) Poly ethylene terephthalate
(C) Poly tetrafluoro ethylene
(D) Poly ethylene furonate
(E) Answer not known

64. Which of the following statements are true about PU elastomers?

(i) Have high abrasion resistance

(ii) Have excellent resistance to aliphatic hydrocarbon fuels

(iii) Have good hydrolytic stability

(A) (i) and (ii) only
(B) (ii) and (iii) only
(C) (i) and (iii) only
(D) (iii) only
(E) Answer not known

65. Butyl rubber is a

(A) Natural rubber
(B) Synthetic rubber
(C) Dipolymer of 2-methyl-1-propene
(D) Compound of 2-methyl-1,3-butadine
(E) Answer not known

66. Which of the following natural resins is not thermo plastic?

(A) Fossil and plant resins
(B) Resin
(C) Shellac
(D) Lignin
(E) Answer not known

67. In an emulsion polymerization, the monomer is broken up into

(A) Globules
(B) Precipitates
(C) Bubbles
(D) Micelles
(E) Answer not known

68. Cross-linked polymers are formed from

(A) Monofunctional groups only
(B) Bifunctional groups only
(C) Trifunctional groups only
(D) Bi and Trifunctional groups
(E) Answer not known

69. Hexamethylene diammonium adipate is commonly called as

(A) Nylon yarn
(B) Nylon 6,6
(C) Nylon salt
(D) Nylon 6
(E) Answer not known

70. The polymer with very high electrical and chemical resistance is

(A) Cellulose acetate
(B) Poly ethylene
(C) Poly propylene
(D) Poly tetra-fluor ethylene
(E) Answer not known

71. _____ was the first synthetic plastic.

(A) Urea-formaldehyde
(B) Cellulase acetate
(C) Cellulase nitrate
(D) Ethyl cellulase plastics
(E) Answer not known

72. In the distillation of coal tar, creosote oils contain

(A) Naphthalene, phenol and cresols

(B) Anthracene, naphthalene and phenol

(C) Phenanthrene, anthracene and phenol

(D) Phenol, xylene and toluene

(E) Answer not known

73. If simultaneous dehydration and desulphurisation of natural gas is desired it is scrubbed with a combination of

(A) Amine, water and sulphuric acid

(B) Amine, water and diethylene glycol

(C) Water, diethylene glycol and sulphuric acid

(D) Amine, diethylenene glycol and sulphuric acid

(E) Answer not known

74. Substances also used in animal nutrition, in the control of plant diseases and in food preservation are

(A) Minerals

(B) Vitamins

(C) Antibiotics

(D) Pure bulk chemicals

(E) Answer not known

75. In fermentation process, maintain _____ insterile area to avoid back diffusion of unsterile air.

(A) Negative pressure

(B) Positive pressure

(C) Vacuum pressure

(D) Less than atmospheric pressure

(E) Answer not known

76. Insulin protein is characterized by high _____ content in the form of cystine.

(A) Phosphorus
(B) Nitrogen
(C) Sulphur
(D) Oxygen
(E) Answer not known

77. Addition of fillers is done in the process of

(A) Mixing
(B) Compounding
(C) Vulcanization
(D) Forming
(E) Answer not known

78. Acrylonitrile is principally made by the

(A) Haber process
(B) Sohio process
(C) Fischer-Tropsch process
(D) DCDA process
(E) Answer not known

79. Rubber latex is an example of

(A) Bingam plastic
(B) Pseudo plastic
(C) Newtanian
(D) Dilatant
(E) Answer not known

80. Match the following :

(a)	Natural polymer	1.	Benzene and Ethylene
(b)	Raw material for styrene	2.	Random copolymer
(c)	Butadiene	3.	From oxidation of alcohol
(d)	Styrene-Butadiene Rubber	4.	Polymer of Isoprene

	(a)	(b)	(c)	(d)
(A)	4	1	3	2
(B)	4	3	1	2
(C)	4	2	1	3
(D)	1	4	3	2

(E) Answer not known

81. Glass is

(A) A crystalline solid

(B) A under cooled liquid

(C) A solid having a definite melting point

(D) A compound of Ca and Na

(E) Answer not known

82. Which of the following is not paired correctly?

Vitreous Enamel

(a) Ceramic mixture containing a large proportions of fluxes, applied used and fused to the metal @ moderate red heat

(b) Opaque in nature

(c) Used as a catalyst

(A) (a) only (B) (b) only

(C) (c) only (D) (a) and (b) only

(E) Answer not known

83. In coloured and coated glass, the chromium oxides produce colours ranging from

(A) Green to Orange
(B) Yellow to Orange
(C) Blue to Orange
(D) Red to Orange
(E) Answer not known

84. Optical instruments are made with

(A) Crookes glass
(B) Soda lime glass
(C) Borosilicate glass
(D) Pyrex glass
(E) Answer not known

85. _____ is a vitrified translucent ware with a hand glaze. Which resists abrasion to the maximum degree?

(A) Earthenware
(B) Chinaware
(C) Porcelain
(D) Whiteware
(E) Answer not known

86. What is the molecular formula and molecular weight for quick lime?

(A) $Ca(OH)_2, mol \cdot wt = 74$
(B) $Ca(OH)_2, mol \cdot wt = 56$
(C) $CaO, mol \cdot wt = 56$
(D) $CaO, mol \cdot wt = 76$
(E) Answer not known

87. Lime is usually sold as a high-calcium quicklime containing

(A) Not less than 90% CaO
(B) Less than 90% CaO
(C) Greater than 90% $Ca(OH)_2$
(D) Less than 90% $Ca(OH)_2$
(E) Answer not known

88. Slaked lime is

(A) NaOH
(B) KOH
(C) CaO
(D) $Ca(OH)_2$
(E) Answer not known

89. The treatment of quicklime obtained on calcination with limited quantity of water is known as

(A) Dehydration
(B) Slaking
(C) Hardening
(D) Soaking
(E) Answer not known

90. The molecular formula for gypsum is

(A) $Ca(OH)_2 \cdot 2H_2O$
(B) $Na_2 SO_4 \cdot 2H_2O$
(C) $CaSO_4 \cdot 2H_2O$
(D) $Mg\, SO_4 \cdot 2H_2O$
(E) Answer not known

91. An ideal refractory should have

(A) Shrinkage ability
(B) Low fusion point
(C) High fusion point
(D) Low resistivity
(E) Answer not known

92. Semivitreous dinnerware called _____ is porous and non translucent with a soft glaze.

(A) Chinaware
(B) Earthenware
(C) Porcelain
(D) Stoneware
(E) Answer not known

93. Chemical formula for potash feldspar

(A) $Al_2O_3 \cdot 2\,SiO_2 \cdot 2H_2O$

(B) $(Mg, Ca)O \cdot Al_2O_3 \cdot 5SiO_2 \cdot nH_2O$

(C) $K_2O \cdot Al_2O_3 \cdot 6SiO_2$

(D) $CaO \cdot Al_2O_3 \cdot 6SiO_2$

(E) Answer not known

94. High refractoriness under load is shown by

(A) Dolamite
(B) Magnesia
(C) Alumina
(D) Silica
(E) Answer not known

95. Which among the following is most widely used in ceramic industries for mining?

(A) Ball mill
(B) Pug mill
(C) Fluid-energy mill
(D) Kick mill
(E) Answer not known

96. Cement mainly contains

(A) $MgO,\ CaO,\ Al_2O_3$
(B) $CaO,\ SiO_2, Al_2O_3$
(C) $MgO,\ Fe_2O_3, CaO$
(D) CaO, Al_2O_3, Fe_2O_3
(E) Answer not known

97. Hydraulic calcium silicates in Portland cement posses the ability to harden by

(A) Drying

(B) Reaction with O_2 in atmosphere

(C) Reaction with N_2 in atmosphere

(D) Reaction with CO_2 in atmosphere

(E) Answer not known

98. Choose one of the following is a Lewis base?

(A) SiO_2 (B) Lime

(C) CO_2 (D) Fe_2O_3

(E) Answer not known

99. With respect to Portland cement, Match the following :

(a) Silica	1. Quick setting
(b) Alumina	2. Strength to cement
(c) Calcium Sulphate	3. Imparts colour
(d) Iron oxide	4. Increases the setting time

	(a)	(b)	(c)	(d)
(A)	2	1	4	3
(B)	4	3	2	1
(C)	3	4	1	2
(D)	3	4	2	1

(E) Answer not known

100. The speed of the rotary kiln used in the cement production is

(A) 0.5 – 1 RPM
(B) 10 – 15 RPM
(C) 20 – 25 RPM
(D) 80 – 90 RPM
(E) Answer not known

101. The general transfer function of a second-order system is

(A) $T^2s^2 + 2ETs + 1$
(B) $\frac{1}{\left(T^2s^2 + 1\right)}$
(C) $\frac{1}{\left(T^2s^2 + 4ETs + 1\right)}$
(D) $\frac{1}{\left(T^2s^2 + 2ETs + 1\right)}$
(E) Answer not known

102. The inverse of integral time constant is known as

(A) Reset time
(B) Reset rate
(C) Integral rate
(D) Integral time
(E) Answer not known

103. When the system possesses an inverse response, its transfer function has

(A) Positive zero
(B) Negative zero
(C) No zeros
(D) Positive pole
(E) Answer not known

104. Which of the following is an example for unbounded input?

(A) Ramp
(B) Sinusoidal
(C) Step
(D) Rectangular pulse
(E) Answer not known

105. Amplitude ratio for a first order system $\frac{k_p}{\tau_p s+1}$ is given as

(A) $\frac{k_p}{\sqrt{\tau_p w+1}}$ (B) $\frac{k_p}{\sqrt{\tau_p^2 w^2+1}}$

(C) $\frac{k_p}{\sqrt{\tau\ p^2 w^2\ +1}}$ (D) $\frac{k_p}{\tau_p w+1}$

(E) Answer not known

106. Measurements are converted into physical quantities using

(A) Transducer (B) Controller

(C) Final control element (D) Summing element

(E) Answer not known

107. Control which is suitable economically if no-off set is tolerable, is

(A) Proportional control

(B) Proportional – integral control

(C) Proportional – integral – derivative control

(D) Proportional – derivative control

(E) Answer not known

108. A feedback control system is unstable if the AR of the corresponding open-loop transfer function is

(A) Less than one at the cross over frequency

(B) Larger than one at the cross over frequency

(C) Equal to one at the cross over frequency

(D) Equal to zero at the cross over frequency

(E) Answer not known

109. Our program tells the CPU to perform what is called on

(A) Segment register
(B) Processor
(C) Interrupt
(D) All the above
(E) Answer not known

110. Fundamental difference between the open and closed loop system is

(A) Actuating signal
(B) Feed back action
(C) Controlled variable
(D) Forward element
(E) Answer not known

111. Which is correct equation for Bragg's law interms of photon energy?

(A) $E = \frac{h\gamma}{2d\sin\theta}$
(B) $E = \frac{hc}{\lambda\sin\theta}$
(C) $E = \frac{hc}{2d\sin\theta}$
(D) $E = \frac{hc}{d\sin\theta}$
(E) Answer not known

112. The "Percent transmission" is simply the transmittance expressed in percentage terms is/are

(A) $\%\ T = 100 \times I_0/I$
(B) $\%\ T = 100 - I/I_0$
(C) $\%\ T = 100 \times I/I_0$
(D) $\%\ T = 100 - I_0/I$
(E) Answer not known

113. The mass spectrum of 1–pentanol gives the base peak at m/z = 42, the possible products are

(A) $[CH_2 = CH_2]^{\bullet+}$, H_2O, $CH_3 - CH = CH_2$

(B) $[CH_3 - CH = CH_2]^{\bullet+}$, H_2O, $[CH_2 = CH_2]^{\bullet+}$

(C) $[CH_3 - CH = CH_2]^{\bullet+}$, H_2O, $CH_2 = CH_2$

(D) $CH_3 - CH = CH_2$, H_2O, $CH_2 = CH_2$

(E) Answer not known

114. Which concentrations of the samples are used to determine in AAS?

(i) ML^{-1}

(ii) $m\ ML^{-1}$

(iii) μML^{-1}

(iv) $m\mu\ ML^{-1}$

(A) (i) (B) (ii)

(C) (iii) (D) (iv)

(E) Answer not known

115. Which light is used to absorb metals in atomic absorption spectroscopy method?

(A) Ultraviolet light (B) X-rays

(C) Microwave (D) γ-rays

(E) Answer not known

116. Which one is not a component of single beam instrument?

(A) Beam splitter
(B) Reference cell
(C) Photo detector
(D) Monochromator
(E) Answer not known

117. Which chromatography is used widely is separation of amino acids from their derivatives?

(A) Adsorption chromatography
(B) Gas chromatography
(C) Thin layer chromatography
(D) Paper chromatography
(E) Answer not known

118. Which carrier gas is used in Gas-liquid chromatography?

(A) Methane
(B) n-butane and isobutane
(C) Acetylene
(D) Argon
(E) Answer not known

119. In, Gas chromatography the stationary phase is

(A) Solid only
(B) Liquid only
(C) Either liquid (or) solid
(D) Gas only
(E) Answer not known

120. The ratio of moisture content of the gas to the maximum moisture the gas can contain at that temperature is

(A) Absolute humidity
(B) Specific humidity
(C) Relative humidity
(D) Actual humidity
(E) Answer not known

121. If radius of a basket centrifuge is halved and the rpm is doubled, then

(A) Linear speed of the basket is doubled

(B) Linear speed of the basket is halved

(C) Centrifugal force is doubled

(D) Capacity of centrifuge is increased

(E) Answer not known

122. Filtrate flow rate in case of a rotary drum vacuum filter (in which $R_m << R_c$) is proportional to the cycle time and

R_m – Filter medium resistance

R_c – take resistance

μ – Filtrate viscosity

(A) $\sqrt{\mu}$

(B) $\frac{1}{\sqrt{\mu}}$

(C) $\frac{1}{\mu}$

(D) $\frac{1}{\mu^2}$

(E) Answer not known

123. Separation of particles of various sizes, shapes and densities by allowing them to settle in a fluid is called

(A) Classification

(B) Froth floatation

(C) Thickening

(D) Flocculation

(E) Answer not known

124. Upto what vertical length can a screw conveyor be used?

(A) 40 m
(B) 30 m
(C) 80 m
(D) 90 m
(E) Answer not known

125. The normal inclination of belt in but conveyors.

(A) 5 – 10°
(B) 2 – 5°
(C) 10 – 20°
(D) 15 – 25°
(E) Answer not known

126. Match the following pair:

(a)	Cut diameter	1.	Filtration
(b)	Specific cake resistance	2.	Cyclone separators
(c)	Size reduction ratio	3.	Storage of solids
(d)	Angle of internal friction	4.	Kick's law

	(a)	(b)	(c)	(d)
(A)	1	2	3	4
(B)	2	1	4	3
(C)	2	3	1	4
(D)	4	2	3	1

(E) Answer not known

127. Cone crusher is a reduction equipment of

(A) Coarse crusher
(B) Intermediate crusher
(C) Ultrafine grinder
(D) Fine crusher
(E) Answer not known

128. Rittinger's number has the unit of

(A) kJ/cm^2 (B) m^2/J

(C) m.kgf/kgm (D) $m.kgf/m^2$

(E) Answer not known

129. The maximum capacity of a given screen in mass per unit time is related to screen opening D, as

(A) Directly proportional to D

(B) Inversely proportional to D

(C) Proportional to the square of D

(D) Proportional to the square root of D

(E) Answer not known

130. In the cyclones, the ratio of centrifugal force to the force of gravity is known as

(A) Friction factor (B) Dilution factor

(C) Separation factor (D) Loading factor

(E) Answer not known

131. An empirical correlation applicable for flow through beds at particle Reynolds number up to about 1.0 is

(A) Kozeny – Carman equation

(B) Blake – Plummer

(C) Leva's

(D) Hagen – Poiseulle's

(E) Answer not known

132. Continuity equation for a fluid of constant density is

(A) $-\rho(\nabla.V)=\frac{D\rho}{Dt}$ (B) $-(\nabla.\rho v)=\frac{\partial\rho}{\partial t}$

(C) $\nabla.v=0$ (D) $\rho\frac{Dv}{Dt}=-\nabla p-[\nabla\tau]+\rho g$

(E) Answer not known

133. Bingham plastic fluid is represented by

(A) $T_v=T_o+k\frac{du}{dy}$ (B) $T_v=k\frac{du}{dy}$

(C) $T_v=T_o+k\frac{dy}{du}$ (D) $T_v=T_o-k\frac{dy}{du}$

(E) Answer not known

134. Bernoulli's equation cannot be applied when the flow is

(A) Stream line (B) Turbulent

(C) Steady state (D) 3 dimensional

(E) Answer not known

135. The printer's ink is an example of

(A) Ideal fluid (B) Newtonian fluid

(C) Bingham plastic (D) Thyxotropic substance

(E) Answer not known

136. The dimension of mass velocity is

M : Mass

T : Time

L : Length

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

(B) $ML^{2}T^{1}$

(C) $M^{-1}L^{-2}T$

(D) $M^{-1}L^{2}T^{-1}$

(E) Answer not known

137. Eckert number is given by

(A) $\frac{u\alpha^2}{c_p\theta_\alpha}$

(B) $\frac{u^2}{2g}$

(C) $\frac{c_p\theta_\alpha}{\mu}$

(D) $\frac{c_p p_\alpha}{\mu}$

(E) Answer not known

138. Match the following :

(a) Froude number 1. $\sqrt{\frac{v}{\sigma / \rho L}}$

(b) Euler number 2. $\frac{v}{\sqrt{k / \rho}}$

(c) Mach number 3. $\frac{v}{\sqrt{p / \rho}}$

(d) Weber number 4. $\frac{v}{\sqrt{Lg}}$

	(a)	(b)	(c)	(d)
(A)	4	1	2	3
(B)	4	3	2	1
(C)	1	2	3	4
(D)	2	1	4	3

(E) Answer not known

139. Identify the incorrect statement

(a) Orificemeters are used for measuring the flow rate of gases

(b) Venturimeter is installed in pipeline only

(c) In orificemeter entire potential energy of the fluid is converted to kinetic energy

(d) In Venturimeter, the flow velocity is measured by noting pressure difference between inlet and throat of venturimeter

(A) (b)

(B) (a)

(C) (c)

(D) (d)

(E) Answer not known

140. Slip of the pump is the

(A) Summation of theoretical discharge and actual discharge
(B) Difference of the theoretical discharge and actual discharge
(C) Product of the theoretical discharge and actual discharge
(D) Ratio of theoretical discharge and actual discharge
(E) Answer not known

141. Mixed esters of poly hydric alcohols are known as

(A) Fats
(B) Oils
(C) Waxes
(D) Soaps
(E) Answer not known

142. The reaction between sulfur trioxide and concentrated sulphuric acid results in the formation of

(A) Oleum
(B) Hypo phosphoric acid
(C) Nitric acid
(D) Hydrogen peroxide
(E) Answer not known

143. Fortified wines contain

(A) 7 – 14% alcohol
(B) 14 – 30% alcohol
(C) 1 – 7% alcohol
(D) 40 – 50% alcohol
(E) Answer not known

144. For the production of ethanol by fermentation, which of the following is used?

(A) Protozova
(B) Algae
(C) Yeast
(D) Virus
(E) Answer not known

145. Which one of the following requires higher energy for the production of absolute alcohol from 10% alcohol?

(A) Conventional dual distillation

(B) Extraction with CO_2

(C) Solvent extraction

(D) Vacuum distillation

(E) Answer not known

146. Wax is

(A) A mixture of glycerides

(B) A mixture of esters of poly hydric alcohols excepting glycerol and fatty acids

(C) Liquid at room temperature

(D) A mixture of glycerides of fatty acids

(E) Answer not known

147. Shaving soap are

(A) Soft potassium soaps with free stearic acid

(B) Metallic soaps compounded with frothing agents

(C) High free alkali soaps

(D) Soap from dye

(E) Answer not known

148. In recovering glycerin from soap plants' the energy requirements are concerned with heat consumptions involved in

(A) Evaporation & Distillation
(B) Extraction & Adsorption
(C) Absorption & Leaching
(D) Sedimentation & Settling
(E) Answer not known

149. In the production of synthetic glycerin, epichloro hydrin is converted to glycerol by reacting it with

(A) HCl
(B) NaOH
(C) HOCl
(D) KOH
(E) Answer not known

150. In fat splitting

(A) Triglyceride is converted into fatty acid and glycerin
(B) Fatty acid is converted into soap
(C) Fatty acid is converted into detergent
(D) Hydrogenation takes place
(E) Answer not known

151. The catalyst used in the two shape catalytic converter for sulphur production by oxidation reduction of H_2S is

(A) Wustite
(B) Bauxite
(C) Hematite
(D) Chalcopyrite
(E) Answer not known

152. Catalyst used in steam reforming of naphtha is

(A) Nickel
(B) Platinum
(C) Silica gel
(D) Rhodium
(E) Answer not known

153. Aniline point test indicates the amount of ———————— present in the kerosene

(A) Paraffins
(B) Iso-paraffins
(C) Aromatics
(D) Olefins
(E) Answer not known

154. All hydrocarbon classes are present in the crude oil, except

(A) Alkenes and alkynes
(B) Alkanes and Naphthenes
(C) Naphthenes and cycloparaffins
(D) Aromatic compounds
(E) Answer not known

155. Petroleum refinery effluent treated by using sour water stripper removes

(A) Hydrogen sulphide and ammonia
(B) Mercaptans and Cyanides
(C) Phenols and oils
(D) Emulsified oil and copper acetate
(E) Answer not known

156. Oxidation of cyclohexane yields

(A) Picric acid
(B) Stearic acid
(C) Adipic acid
(D) Acrylic acid
(E) Answer not known

157. Natural sodium bicarbonate is also known as

(A) Zeolite
(B) Nahcolite
(C) Gypsum
(D) Zinc sulphate
(E) Answer not known

158. In the nitration of benzene to nitro benzene, the mixed acid used is of the following composition

(A) $H_2SO_4(32-39\%)$, $HNO_3(55-60\%)$, $H_2O(8\%)$
(B) $H_2SO_4(55-60\%)$, $HNO_3(32-39\%)$, $H_2O(8.0\%)$
(C) $H_2SO_4(55-60\%)$, $HNO_3(25-30\%)$, $H_2O(10\%)$
(D) $H_2SO_4(10-15\%)$, $HNO_3(32-39\%)$, $H_2O(50\%)$
(E) Answer not known

159. Sodium bicarbonate obtained from the solvay process is not used as baking soda since

(A) It is very dry
(B) It is 99.9% pure
(C) It contains traces of ammonia
(D) The bicarbonate is odourless
(E) Answer not known

160. The most efficient sulphonating agent is

(A) Sulphur dioxide
(B) Sulphuric trioxide
(C) Oleum
(D) Sulphuric acid
(E) Answer not known

161. Coke, coal gas and coal tar are products of

(A) Destructive distillation of wood
(B) Destructive distillation of petroleum
(C) Destructive distillation of coal
(D) Fractional distillation of petroleum
(E) Answer not known

162. The fraction obtained in the range 300 to 350°C during distillation of coal tar is

(A) Light oil
(B) Middle oil
(C) Heavy oil
(D) Anthracene oil
(E) Answer not known

163. ———————— is the leading coal producing state in India.

(A) Bihar
(B) Tamil Nadu
(C) West Bengal
(D) Orissa
(E) Answer not known

164. Solvent processing of coal is termed as

(A) Hydrogenation
(B) Fractionation
(C) Distillation
(D) Solvolysis
(E) Answer not known

165. Pyrite is produced from coal using the ———————— process.

(A) Electrochemical
(B) Chemical reduction
(C) Gasification
(D) Sulfur recovery
(E) Answer not known

166. Acetylene black, a special type of thermal black is used in

(A) Adsorption of moisture
(B) Dry cell batteries
(C) Plastics to decrease thermal conductivity
(D) Electrical equipments as insulators
(E) Answer not known

167. The two main types of coking procedures for coal are

(A) Main product and by-product coking
(B) Beehive and nesting coking
(C) Beehive and by-product coking
(D) Nesting and by-product coking
(E) Answer not known

168. The channel black process of manufacturing carbon black has become almost absolute due to

(A) Low yield
(B) Lesser raw material availability
(C) Lack of man power
(D) Globalization
(E) Answer not known

169. High purity graphite is used in many nuclear reactors as a

(A) Cooling agent
(B) Moderator
(C) Catalyst
(D) Raw material
(E) Answer not known

170. Lampblack is produced out of incomplete combustion which is of ———————— carbon.

(A) Highly crystalline
(B) Semi crystalline
(C) Amorphous
(D) Fine powder
(E) Answer not known

171. Which of the following is not a primary explosive?

(A) Lead Azide
(B) Silver Azide
(C) Diazodi nitro phenol
(D) Nitrogycerine
(E) Answer not known

172. Which of the following is paired correctly?

(i) Colloidal cellulose nitrate-smoke less powder
(ii) Black powder : KNO_3 + Charcoal + Sulfur
(iii) Permissible explosives : High flame temperature of short time duration
(A) (i) and (ii) only
(B) (i) and (iii) only
(C) (ii) and (iii) only
(D) (i), (ii) and (iii)
(E) Answer not known

173. Tri Nitro Toluene (TNT) is relatively

(A) sensitive to shock
(B) insensitive to shock
(C) sensitive to friction
(D) sensitive to heat
(E) Answer not known

174. Which one of the following is not a fundamental type of explosive?

(A) Physical
(B) Chemical
(C) Mechanical
(D) Atomic
(E) Answer not known

175. Anhydrous hydrazine is produced by ———————— distillation process.

(A) Flash
(B) Azeotropic
(C) Vacuum
(D) Steam
(E) Answer not known

176. The possible nuclear reaction is ${}_{92}U^{235} + {}_{0}n^{1} \rightarrow X + Y + Z$ to 3 ${}_{0}n^{1}$ where ${}_{0}n^{1}$ = neutron, X, Y = highly radioactive with mass numbers ranging from 80–160. This nuclear reaction is

(A) Fusion
(B) Fission
(C) Transmutation
(D) First order reaction
(E) Answer not known

177. During the purification of nuclear materials, yellow cake obtained is

(A) impure U_3O_8

(B) impure UF_6

(C) pure U_3O_8

(D) pure UF_6

(E) Answer not known

178. Choose one of the following is not an advanced isotope separation process.

(A) Plasma separation process

(B) Gas centrifuge process

(C) Atomic vapour laser isotope separation process

(D) Molecular isotope separation process

(E) Answer not known

179. Select the correct statement(s) :

(i) The neutron absorbed by ^{238}U, converts the ^{238}U into ^{239}Pu

(ii) ^{239}Pu is man-made nuclear fuel, which can be further fissioned

(iii) A nuclear reactor with a conversion factor above unity is known as breeder reactor

(A) (i) and (ii) only

(B) (i) and (iii) only

(C) (ii) and (iii) only

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

(E) Answer not known

180. Natural radio active element(s) is/are

(i) Cadmium

(ii) Radium

(iii) Thorium

(iv) Uranium

(A) (i), (ii) and (iv) only
(B) (i), (iii) and (iv) only
(C) (ii), (iii) and (iv) only
(D) (i), (ii) and (iii) only
(E) Answer not known

181. Casein precipitated by resin is used for the manufactured of _____

(A) Cheese
(B) Ice cream
(C) Ghee
(D) Curd
(E) Answer not known

182. Buffalo's milk contains

(A) 6.5% fat
(B) 4.1% fat
(C) 25% fat
(D) 2% fat
(E) Answer not known

183. Which of the following is paired correctly :

(i) Whey proteins : Lactalbumin and Lactoglobulin

(ii) Duration for casein to coagulate : Shorter when the concentration of casein is lower that the normal fluid milk

(iii) Coagulation of milk protein is enhanced : by increasing the acidity

(A) (i) and (ii)
(B) (i) and (iii)
(C) (ii) and (iii)
(D) (i), (ii) and (iii)
(E) Answer not known

184. Three essential constituents fruit jelly are
(A) Pectin, Sugar, Citric acid
(B) Lignin, Sugar, Citric acid
(C) Protein, Sugar, Pectin
(D) Protein, Sugar, Lignin

185. Arrange the following dairy products milk equivalents (kg of milk required per kg of dairy product) in increasing order.

(i) Condensed milk

(ii) Powdered milk

(iii) Cheese

(iv) Butter

(A) Condensed milk < Powdered milk < Cheese < Butter

(B) Butter < Cheese < Powdered milk < Condensed milk

(C) Butter < Condensed milk < Powdered milk < Cheese

(D) Condensed milk < Powdered milk < Butter < Cheese

(E) Answer not known

186. The larger portion of the unsaponifiable lipids consists of

(A) Phospholipids

(B) Lipoprotein

(C) Phosphatidic acid

(D) Cholesterol

(E) Answer not known

187. Most sugars when fermented by yeasts produces

(A) Carbon dioxide and water

(B) Carbon monoxide and water

(C) Carbon dioxide and alcohol

(D) Carbon monoxide and alcohol

(E) Answer not known

188. Triesters formed with a single fatty acid

(A) Palmito-aleo-linolein
(B) Tripalmitin
(C) Dipalmitaolein
(D) Triolein
(E) Answer not known

189. Agar agar is also known as

(A) Indian gelatin
(B) American gelatin
(C) Japanese gelatin
(D) African gelatin
(E) Answer not known

190. Aspartame is made by combining

(A) Aspartic acid and phenyl alanine
(B) Acetoacetic acid and phenyl alanine
(C) Sodium ortho sulphonamide and calcium salt
(D) Ascorbic acid and phenyl alanine
(E) Answer not known

191. Potato, Sweet Potato, tapioca belongs to

(A) Tubers
(B) Bulbs
(C) Cuscurbits
(D) Leafy vegetables
(E) Answer not known

192. Fruits are generally rich in

(A) Protein and fat
(B) Moisture
(C) Calories
(D) Iron
(E) Answer not known

193. ———————— sealed in poly ethylene bags have a prolonged shelf-life in the presence of potassium permanganate coated on silica

(A) Citrus fruits
(B) Bananas
(C) Mangoes
(D) Apples
(E) Answer not known

194. Egg yolk is a good natural emulsifier due to its content of

(A) Lactose
(B) Lecithin
(C) Pectin
(D) Glucose
(E) Answer not known

195. During non-enzymatic browning, which acid is responsible for the development of browning reactions in fruit juices and concentrates?

(A) Ascorbic acid
(B) Anthranilic acid
(C) Acetic acid
(D) Cinnamic acid
(E) Answer not known

196. Proteins are ionized at neutral pH to form $R-CH\left(NH_3^+\right)-CO_2^-$ which can act as acid and base at the same time and they are called as

(A) Twinions
(B) Hybridions
(C) Zwitterions
(D) Soloions
(E) Answer not known

197. Identify the important role of Lecithin from the following

(A) Prevents the development of fatty liver
(B) Responsible for brain action
(C) Enhances the Haemoglobin activity
(D) Prevents hair fall
(E) Answer not known

198. The proteins that liberate a non-protein substances besides amino acids during hydrolysis are called

(A) Simple proteins
(B) Conjugated proteins
(C) Derived proteins
(D) Inverse proteins
(E) Answer not known

199. Which of the following is not a structure of the protein?

(A) Primary structure
(B) Quarternary structure
(C) Secondary structure
(D) Ring structure
(E) Answer not known

200. A peptide involved in active transport of amino acids and in redox reactions in food

(A) Tryptophan
(B) Glutathione
(C) Tyrosine
(D) Glutamic acid
(E) Answer not known