139/2024

Maximum : 100 marks

Time : 1 hour and 30 minutes

1. Which of the following represents the simplest whole number ratio of various atoms present in a compound?

(A) Empirical formula (B) Molecular formula

(C) Mole fraction (D) Molarity

2. Identify the correct set of coefficients for the equation given below :

$a\ C_7H_{16}(l) + b\ O_2(g) \rightarrow c\ CO_2(g) + d\ H_2O(g)$

(A) a = 0, b = 11, c = 7, d = 8

(B) a = 1, b = 10, c = 7, d = 6

(C) a = 1, b = 6, c = 7, d = 2

(D) a = 1, b = 11, c = 7, d = 8

3. The material balance equation for a continuous processes at steady-state is :

(A) input + generation = output – consumption

(B) input + generation = output + consumption

(C) input – generation = output + consumption

(D) input – generation = output – consumption

4. 10 moles of A were present in a system initially and 12 moles of B are added to it. If it undergoes the reaction $2A + 3B \rightarrow 2C$, what are number of moles of C produced?

(A) 8 (B) 6

(C) 4 (D) 12

5. Which of the following is not produced during the complete combustion of a fuel?

(A) CO_2 (B) H_2O

(C) SO_2 (D) CO

6. 100 moles of SO_2 and 100 moles O_2 are fed to a reactor and they react according to $2SO_2 + O_2 \rightarrow 2SO_3$. Find the limiting reactant :

(A) O_2 (B) SO_2

(C) SO_3 (D) None of these

7. According to the drinking water quality specifications (IS : 10500), the desirable pH limit is :

(A) 6.5 to 8.5 (B) 5.5 to 7.5

(C) 6.0 to 8.5 (D) 6.0 to 8.0

8. Given below are a few statements about water. Identify the wrong statement / statements.

(i) Pure water is tasteless, colourless and odourless.

(ii) Hard water does not produce easy and ready lather with soap.

(iii) Hardness level between 60 to 100 ppm is recommended for drinking water.

(iv) Temporary hardness can be removed only by boiling of water.

(v) Permanent hardness cannot be removed by boiling.

(A) (i) and (iii) (B) (iii) and (iv)

(C) (iv) (D) (v)

9. Identify the chemical compound indicated by the following statements :

(i) It is found to be the most insoluble salt that can be precipitated during water treatment.

(ii) It can be used as a primary standard.

(iii) It is chosen as the standard for expressing hardness of water.

(iv) Equivalent weight of it is 50

(A) $CaCl_2$ (B) $CaCO_3$

(C) $CaSO_4$ (D) $MgCl_2$

10. The amount of oxygen required for the complete oxidation of biologically active and biologically inert materials present in one litre sewage water using chemical oxidising agents such as potassium dichromate is called :

(A) Total Suspended Solids (TSS)

(B) Biological Oxygen Demand (BOD)

(C) Chemical Oxygen Demand (COD)

(D) Total Dissolved Solids (TDS)

11. An instrument developed for measuring low turbidities in water :

(A) Nephelometer

(B) Jackson Candle turbidimeter

(C) Spectrophotometer

(D) Polarimeter

12. An instrument that measures the amount of light absorbed by a sample :

(A) Nephelometer (B) Turbidimeter

(C) Spectrophotometer (D) Polarimeter

13. Glycerol can be separated from spent-lye in soap industry by using :

(A) Steam distillation

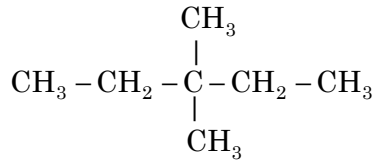
(B) Distillation under reduced pressure

(C) Fractional distillation

(D) Simple distillation

14. Identify 3, 3-Dimethylpentane :

(i) $(CH_3)_2 C(C_2H_5)_2$

(ii) 

(iii) 

(A) (ii) only (B) (ii) and (iii)

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

15. Which of the following is not an aromatic compound?

(A) Benzene (B) Aniline

(C) Butene (D) Naphthalene

16. The concept of microbial fermentation is developed by :

(A) Robert Koch (B) Louis Pasteur

(C) Edward Jenner (D) Antonie Van Leeuwenhoek

17. What is the role of bacterial pili?

(A) DNA replication (B) Nutrient absorption

(C) Gram reaction (D) Adhesion to surfaces

18. Light source preferred for Lovibond comparator to ensure accurate color reading is :

(A) Ultra violet (B) Infra red

(C) Tungsten lamp (D) Fluorescent light

19. ———— is the selective medium used for the isolation of pseudomonas aeruginosa.

(A) Cetrimide Agar (B) MCA

(C) Thayer Martin Agar (D) Selenite F Broth

20. ———— is the method used to detect specific RNA sequences in a sample.

(A) Northern Blot (B) Southern Blot

(C) Western Blot (D) Gene Cloning

21. The enzyme used in PCR technique is :

(A) Transferases (B) Exonucleases

(C) Taq polymerase (D) Reverse transcriptase

22. Which one of the following is a gram negative anaerobic bacterium?

(A) Clostridium tetani (B) Listeria monocytogenes

(C) Bacillus anthracis (D) Porphyromonas gingivalis

23. ———— is an enrichment medium.

(A) Blood Agar (B) Tetrathionate broth

(C) RCM (D) Peptone water

24. During ethanol production, which microorganism is primarily used for fermentation :

(A) Lactobacillus acidophilus (B) Bacillus subtilis

(C) Saccharomyces cerevisiae (D) Acetobacter species

25. Name the nutrient rich medium extracted from malted barley after mashing and before boiling :

(A) Wort (B) Mash

(C) Beer (D) Ale

26. Which raw material used for ethyl alcohol production?

(A) Sulphuric acid (B) Glycerine

(C) Molasses (D) Benzene

27. What is the molecular weight of Ethyl alcohol?

(A) 46 (B) 44

(C) 52 (D) 50

28. What is the use of Bagasse?

(A) As a fuel
(B) As a medicine
(C) As a dye
(D) As a food colour

29. Which of the following separation technique is used in the sugar manufacturing process?

(A) Filtration
(B) Crystallisation
(C) Distillation
(D) Ion exchange

30. What is the temperature of fermentator during production of ethyl alcohol from molasses?

(A) 250 – 300 °C
(B) 10 – 15 °C
(C) 20 – 30 °C
(D) 100 – 150 °C

31. Which is the by product of sugar manufacturing process?

(A) Molasses
(B) Glycerine
(C) Yeast
(D) Kerosene

32. What is the role of sulphur dioxide in sugar manufacturing process?

(A) Catalyst
(B) Bleaching agent
(C) Oxidizing agent
(D) Acidifying agent

33. Which mixer mix solids by repeatedly lifting and dropping the material and rolling it?

(A) Banbury mixer
(B) Muller mixer
(C) Tumbling mixer
(D) Ribbon blender

34. Which of the following is very effective impellers over a wide range of viscosities?

(A) Propellers
(B) Turbines
(C) Paddles
(D) Shaft

35. Generally, what is the relation between turbine diameter and tank diameter in mechanically agitated vessel for gas liquid system?

(A) Diameter of turbine is one - third of the tank diameter
(B) Diameter of the turbine is two - third of the tank diameter
(C) Diameter of the turbine is three - fourth of the tank diameter
(D) Diameter of the turbine is equal to the tank diameter

36. Which of the following is statement is correct?

(A) A propeller is an axial flow, low speed impeller
(B) A propeller is radial flow, high speed impeller
(C) A propeller is axial flow, high speed impeller
(D) A propeller is radial flow, low speed impeller

37. Which equipment mix solids by mechanical shuffling?

(A) Muller mixer (B) Banberry mixer

(C) Ribbon blender (D) Sigma mixer

38. What is the full form of NIOSH in safety?

(A) National industrial organisation of safe health

(B) National institute of safety and health

(C) National institute of occupational safety and health

(D) National instruction for officer's safe health

39. Which of the following statement is correct?

(A) Flash point temperature is higher than the fire point

(B) Fire point is equal to the boiling point

(C) Flash point is equal to the freezing point

(D) The fire point temperature is higher than the flash point

40. In which classification of fire involves solid combustible materials like paper and wood?

(A) Class A fire (B) Class B fire

(C) Class C fire (D) Class D fire

41. What is the best way of avoiding accident?

(A) Working without safety equipment

(B) Observing safety rules related to job and workplace

(C) Doing work in ancient way

(D) Doing work in one's own way

42. In house keeping which of the following denotes the cleanness in **concept of 5S**?

(A) Sort (B) Sustain

(C) Shine (D) Standardize

43. According to the fire triangle what is the combination of fire?

(A) Fuel, Oxygen and heat

(B) Fuel, Oxygen and light

(C) Fuel, Carbon dioxide and heat

(D) Fuel, Light and Nitrogen

44. Which of the following is an **unsafe act** that causes accident?

(A) Wrong design of industry

(B) Poor light

(C) Failure to wear personal protective equipments

(D) Inadequate ventilation

45. In fluids, which of the statement is incorrect?

(A) A fluid is a substance that has a definite shape

(B) A fluid is a substance which is capable of flowing if allowed to do so

(C) A fluid is a substance that has no definite shape of its own, but conforms to the shape of the containing vessel

(D) A fluid is a substance which undergoes continuous deformation when subjected to a shear force

46. If the density of a fluid is affected appreciably by changes in temperature and pressure, the fluid is said to be :

(A) Incompressible fluid

(B) Compressible fluid

(C) Either compressible or incompressible

(D) Neither compressible nor incompressible

47. Density is defined as :

(A) Volume collected per time taken for collection

(B) Volume of the fluid per unit mass

(C) The resistance offered by a fluid to its continuous deformation

(D) Mass of the fluid per unit volume

48. Which of the following is a variable area meter?

(A) Orifice meter (B) Venturi meter

(C) Rotameter (D) Magnetic meter

49. In Venturi meter, which of the following is used to measure the pressure difference?

(A) Rotameter (B) U-tube manometer

(C) Orifice plate (D) Venturi converging section

50. Which device is used to measure the point velocity by measuring the difference between impact pressure and static pressure?

(A) Rotameter (B) Orifice meter

(C) Venturi meter (D) Pitot tube

51. Which of the following statement is/are correct about cathode rays?

(i) They starts from cathode and move towards anode

(ii) They consists of positivity charged particles

(iii) They travel in straight line in the absence of electric or magnetic field

(iv) They travels from anode to cathode.

Choose the correct answer from the codes given below

(A) Only (i) and (ii)

(B) Only (i) and (iii)

(C) Only (ii) and (iii)

(D) All of the above

52. What is the electronic configuration of chromium (Cr)?

(A) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6 4s^2 3d^4$

(B) $1s^2 2s^2 2p^6\ 3s^2 3p^6 4s^1 3d^5$

(C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

(D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^1$

53. What will be the wavelength of a ball of mass 0.1 kilogram moving with a velocity of 100 m/s?

(A) 6.626×10^{-33} m

(B) 6.626×10^{-34} m

(C) 6.626×10^{-30} m

(D) None of the above

54. Identify the **incorrect** statement about azimuthal quantum number :

(A) It defines the three-dimensional shape of the orbital

(B) It can have 'n' values ranging from zero to $(n-1)$

(C) It gives information about the spatial orientation of the orbital

(D) It also called subsidiary quantum number

55. Which of the following type of orbital is spherical shape?

(A) s -orbital

(B) d -orbital

(C) p -orbital

(D) f -orbital

56. Find out **correct** statement with respect to bond order :

(i) Bond order is used to predict the stability of molecule

(ii) If bond order is 2, it indicates presence of double bond

(iii) Bond order is directly proportional to bond length

(iv) Bond order can be an integer or a fraction

Choose the correct answer from the codes given below :

(A) Only (i) and (ii)

(B) Only (i), (ii) and (iii)

(C) Only (i), (ii) and (iv)

(D) Only (iii)

57. Which of the following molecule are excepted from octet rule?

(A) BCl_3, SF_6, NO (B) H_2O, CO_2, O_2

(C) BF_3, Cl_2, F_2 (D) HF, H_2O, CH_4

58. Which of the following molecule has a bent shape according to VSEPR theory?

(A) CO_2 (B) SF_6

(C) H_2O (D) PCl_5

59. What is the main requirement for a molecule to form hydrogen bonds?

(A) High electronegativity

(B) Presence of only single bond

(C) Low Electronegativity

(D) Presence of hydrogen atoms bonded to highly electronegative atoms

60. Which of the following molecules **not** undergoes SP^3 hybridization?

(A) BF_3 (B) H_2O

(C) NH_3 (D) CH_4

61. For the process to occur under adiabatic conditions, the correct condition is :

(A) $\Delta T = 0$ (B) $\Delta P = 0$

(C) $q = 0$ (D) $w = 0$

62. Which of the following statement is/are **correct** about spontaneity?

(i) ΔG determines the spontaneity of reaction

(ii) Spontaneous process always decrease entropy

(iii) Spontaneity is independent of temperature

(iv) Spontaneous process always increases entropy

Choose the correct answer from the codes given below :

(A) Only (i) and (iv)

(B) Only (iii)

(C) Only (i), (ii) and (iii)

(D) Only (ii) and (iii)

63. $C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)\ \Delta H = -1367$ KJ/mol

The above thermochemical reaction indicates.

(A) Endothermic reaction (B) Exothermic reaction

(C) Neutralization reaction (D) None of these

64. Which among the following is/are intensive properties?

(i) Mass

(ii) Temperature

(iii) Enthalpy

(iv) Density

Choose the correct answer from the codes given below :

(A) Only (i), (ii) and (iii)

(B) Only (i)

(C) Only (ii) and (iv)

(D) Only (i) and (iv)

65. What is the pH of a solution with a hydrogen ion concentration $[H+]$ of 0.001 M solution of HCl?

(A) 2 (B) 3

(C) 13 (D) 11

66. What is the effect of increasing the concentration of a reactant on an equilibrium system?

(A) The equilibrium will shift to the left

(B) No effect on equilibrium

(C) The equilibrium will shift to the right

(D) None of these

67. Which of the following statement is/are **incorrect** about equilibrium constant (K) :

(i) It predicts the extent of reaction

(ii) The value of K independent of initial concentrations of reactance and products

(iii) K is the sum of reactant and product concentrations

(iv) K is independent of temperature

Choose the correct answer

(A) Only (i) and (iii)

(B) Only (iii) and (iv)

(C) Only (ii) and (iii)

(D) Only (ii) and (iv)

68. Which of the following is an example of a Lewis base?

(A) Hydroxide ion

(B) Ammonia

(C) Carbonate ion

(D) All of the above

69. In which field, Van't Hoff was awarded the first Nobel prize in Chemistry?

(i) Organic chemistry

(ii) Vital force theory

(iii) Stereo chemistry

(iv) Theory of relativity

(A) (i), (iv)

(B) (i), (iii)

(C) (i), (ii)

(D) (ii), (iii)

70. Represent the shape of HCN molecule from the geometry given below :

(A) Linear

(B) Tetrahedral

(C) Trigonal planar

(D) Pyramidal

71. Select from the following, the highest electronegative organic compound :

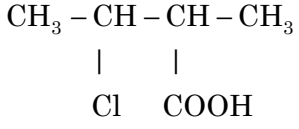
(A) Methane

(B) Ethylene

(C) Acetylene

(D) Propene

72. Give the IUPAC name for the given structure of organic compound :



(A) 2-chloro – butan – 3 – oic acid

(B) 3-chloro – 3 – methyl butan – 1 – oic acid

(C) 1-chloro – 2 – methyl – propan – 2 – oic acid

(D) Butan – 3 – chloro – 2 oic acid

73. Identify the compound which is not a functional isomer for the molecular formula C_3H_6O?

(A) Acetone (B) Methoxy ethene

(C) Propanal (D) Methoxy methane

74. Which is the most reliable test to detect Nitrogen, Sulphur and Halogen in an organic compound?

(A) Duma's method (B) Soda lime test

(C) Chromatography (D) Lassaigne's test

75. Select the convenient method to prepare symmetric Alkanes from the reactions given below :

(i) Decarboxylation

(ii) Wurtz reaction

(iii) Kolbe's electrolytic method

(iv) Hydrogenation of Akenes

(A) (i), (ii) (B) (ii), (iii)

(C) (iii), (iv) (D) none of above

76. *n* – Butane melts at 138 K but *n* – Propane melts at 85.3 K. Propane have low melting point. Identify the correct reason behind it?

(A) Low packing efficiency (B) Symmetric

(C) Weak Van der Waal's force (D) Non-polar

77. Name the reagent used to distinguish Ethylene from Ethane :

(A) Br_2/CCl_4 (B) O_3/Zn dust

(C) $KMnO_4$ / KOH (D) Raney Nickel

78.

$$CH_3 - CH_2 - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3 + KOH \xrightarrow{\text{alcohol}} CH_3 - CH = CH - CH_3$$

Select the name of chemical reaction related to the above reaction :

(i) Markovnikov's rule

(ii) Zaitsev's rule

(iii) β –elimination

(iv) Dehydrogenation

(A) (i), (iv) (B) (i), (ii)

(C) (ii), (iii) (D) (iii), (iv)

79. Certain terms like mole fraction, molality is preferred to express the concentration of solution. Which factor helps to identify it?

(A) Mass (B) Volume

(C) Temperature (D) Pressure

80. Plants absorb water from the soil through their roots. Where this process is applied?

(A) Adsorption

(B) Elevation of boiling point

(C) Osmosis

(D) Azeotrope

81. In the association of Benzoic acid in Benzene, which value of Van't Hoff factor given below is appropriate for it?

(A) 1.5 (B) 1

(C) 0.5 (D) 0

82. From the factors given relating to osmotic pressure of a solution, select the false statement :

(A) directly proportional to mass of solute

(B) inversely proportional to volume

(C) directly proportional to concentration of solution

(D) directly proportional to molar mass of solute

83. For the reaction, $H_2 + Cl_2 \rightarrow 2HCl$, Rate = K, what is the order of this reaction?

(A) First order (B) Second order

(C) Zero order (D) None of the above

84. Value of rate constant in a reaction does not depend on :

(A) Order of reaction (B) Temperature

(C) Concentration (D) Rate of reactions

85. Rate of reaction = K $[NO]^2$ $[Br_2]$. When the concentration of Br_2 is halved, what will be the change in rate of reaction?

(A) halved

(B) decreases 4 times

(C) increases 4 times

(D) doubles

86. On increasing the temperature by 10 K, the rate of reaction doubles. Justify :

(A) As the velocity increases, number of collisions increased more than the threshold value

(B) Activation energy decreases

(C) Chemical bond between reacting molecules become weak

(D) Fraction of colliding molecules increases

87. Which reagent is used for the conversion of Sodium phenoxide to Salicylic acid?

(A) $K_2Cr_2O_7/H^+$ (B) $KMnO_4/H^+$

(C) $CHCl_3/KOH$ (D) CO_2/HCl

88. Carbolic acid is :

(A) An aqueous solution of phenol

(B) Phenyl benzoate

(C) Aqueous solution of formic acid

(D) Aqueous solution of acetic acid

89. The IUPAC name of Anisole is :

(A) 2-phenyl ethanol

(B) Methoxy benzene

(C) Phenyl methanol

(D) Benzyl alcohol

90. Which is the best reagent for the halogenation of alcohols?

(A) $ZnCl_2/HCl$ (B) PCl_3

(C) PCl_5 (D) $SOCl_2$

91. Rectified spirit is :

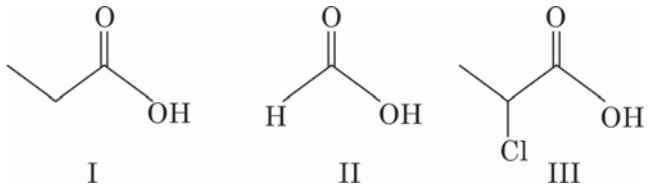
(A) 100% ethanol

(B) 95% ethanol and 5% water

(C) 98% ethanol and 2% water

(D) 95% ethanol and 5% methanol

92. Rank the following carboxylic acids according to their relative acidities :



(A) III > II > I
(B) I > II > III
(C) III > I > II
(D) II > I > III

93. Formaldehyde when treated with KOH gives methanol and potassium formate what is the name of this reaction?

(A) Perkins reaction
(B) Cannizaro reaction
(C) Clemmensen reaction
(D) Rosenmund reaction

94. Which of the following compounds will show positive silver mirror test?

(A) $CH_3CH_2CH_2CHO$
(B) $CH_3CH_2C(=O)-CH_3$
(C) CH_3COOH
(D) Both (A) and (B)

95. Grignard reagent is treated with formaldehyde followed by hydrolysis to form :

(A) Carboxylic acid
(B) Tertiary alcohol
(C) Secondary alcohol
(D) Primary alcohol

96. Which of the following statements about the anomeric carbon in carbohydrate is true?

(A) The anomeric carbon is the carbon that forms the glycosidic bond between two monosaccharides in disaccharides and polysaccharides
(B) In α-D-glucose, the anomeric carbon is the carbon that forms the cyclic hemiacetal structure and determines the α or β configuration based on the position of the hydroxyl group
(C) The anomeric carbon is always the first carbon in a monosaccharide's chain and is involved in forming the ring structure in carbohydrates
(D) The anomeric carbon is the carbonyl carbon in the open-chain form of a monosaccharide that is not involved in ring formation

97. Which of the following statements about protein structure is true?

(A) The primary structure of a protein refers to its three-dimensional shape
(B) The Secondary structure of a protein is stabilized by hydrogen bonds between the backbone amide and carbonyl groups
(C) The tertiary structure of a protein involves interactions between different polypeptide chain
(D) The Quarternary structure of a protein is determined solely by the sequence of amino acids in the polypeptide chain

98. Which of the following statements accurately describes enzyme specificity and its relation to the enzyme-substrate complex ?

(A) Enzymes are highly specific due to the geometric complementarity between the enzyme's active site and the substrate, which ensures that only substrates with matching shapes can blind

(B) Enzymes exhibit specificity through induced fit, where the enzyme undergoes a conformational change upon substrate binding, allowing a broader range of substrates to fit into the active site

(C) Enzyme specificity is primarily determined by the enzyme's overall change distribution with substrates fitting into the active site based on electrostatic interactions alone

(D) Enzymes are non-specific and can catalyze reactions involving a wide variety of substrates due to their flexible active sites, which do not conform to the lock-and-key model

99. Which of the following statements about the DNA double helix structure is not correct?

(A) The two strands of DNA run in opposite directions, meaning one strand is 5' to 3' and the other is 3' to 5'

(B) The backbone of each DNA strand is composed of alternating sugar and phosphate groups, connected by phospho-diester bonds

(C) The nitrogenous bases in DNA pair according to the base-pairing rules, with adenine pairing with thymine and guanine pairing with cytosine

(D) The DNA double helix has a uniform diameter due to the pairing of purines with purines and pyrimidines with pyrimidines

100. Which of the following statements about Vitamin D is true?

(A) Vitamin D is primarily obtained from dietary sources such as citrus fruits

(B) Vitamin D deficiency can lead to bone disorders such as rickets in children and osteomalacia in adults

(C) Vitamin D is a water soluble vitamin that must be regularly consumed in the diet to prevent deficiency

(D) The primary function of Vitamin D is to aid in the synthesis of hemoglobin

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