027/2023

Maximum : 100 marks

Time : 1 hour and 30 minutes

1. Which carbocation has greater hyper conjugation interaction?

(A) $^{+}CH_3$ (B) $CH_3 - C^{+}H_2$

(C) $(CH_3)_3 C^{+}$ (D) $(CH_3)_2 C^{+}H$

2. Name the transition element which give only +3 oxidation state :

(A) chromium (B) scandium

(C) titanium (D) vanadium

3. Arrange the following in the increasing order of metallic character :
Be, Na, Mg, Al, Rb

(A) Al < Be < Mg < Na < Rb (B) Rb < Na < Mg < Be < Al

(C) Be < Mg < Al < Rb < Na (D) Na < Rb < Be < Al < Mg

4. Which type of nuclear reaction leads to the decrease of atomic number by one?

(A) Alpha decay (B) Beta decay

(C) Electron capture (D) Gamma decay

5. Hybridization of Brf_5 molecule :

(A) sp^3d^2 (B) sp^3

(C) dsp^2 (D) sp^3d

6. Which metals are suitable for photoelectric effect?

(A) Alkaline earth metals (B) Alkali metals

(C) Transition metals (D) Heavy metals

7. Consider the following isoelectronic $Na^+, Mg^{2+}, F^-, O^{2-}$
The correct order of increasing length of their radii is:

(A) $F^- < O^{2-} < Mg^{2+} < Na^+$ (B) $Mg^{2+} < Na^+ < F^- < O^{2-}$

(C) $O^{2-} < F^- < Na^+ < Mg^{2+}$ (D) $Na^+ < F^- < O^{2-} < Mg^{2+}$

8. Which subatomic particle was discovered by the bombardment of beryllium with alpha particles in 1932?

(A) protons (B) neutrons

(C) electrons (D) neutrino

9. What is the shape of IF_7 molecule?

(A) Square pyramidal (B) Pentagonal bipyramidal

(C) Distorted octahedral (D) Trigonal pyramidal

10. The ionization enthalpy of boron is slightly less than that of beryllium. This is because of :

(A) high effective nuclear charge of boron
(B) the 2p electron of boron is more shielded than that of 2s electron of beryllium
(C) the penetration of a 2s electron to the nucleus is less than that of a 2p electron
(D) s electron attracted to the nucleus is less than that of a p electron

11. Calculate the number of atoms in 32g of O_2 :

(A) 1.2046×10^{24} (B) 6.023×10^{23}
(C) 1.8878×10^{24} (D) 7.083×10^{24}

12. Borax dissolves in water to form an alkaline solution. Which compound is responsible for alkaline nature?

(A) $B(OH)_3$ (B) NaOH
(C) B_2O_3 (D) $NaBO_2$

13. Fullerenes are the only pure form of carbon. Which of the following statement substantiate this?

(A) They are cage like molecule
(B) All carbon atoms are equal
(C) Carbon atoms undergo sp^2 hybridization
(D) They have smooth structure without having dangling bonds

14. $[NiCl_4]^{2-}$ has a tetrahedral shape. What is the spin only magnetic moment of $[NiCl_4]^{2-}$?

(A) 4.9 BM (B) 2.83 BM
(C) 3.87 BM (D) 1.73 BM

15. The product obtained by the partial hydrolysis of XeF_6 is :

(A) XeO_3 (B) XeF_4
(C) $XeOF_4$ (D) XeF_2

16. Consider the following reaction

$C_{12}H_{22}O_{11} + A \rightarrow 12C + 11H_2O$

What is A ?

(A) H_2SO_4 (B) H_2O_2
(C) HCl (D) HNO_3

17. Which one is the wrong statement about ozone?

(A) Ozone is thermodynamically unstable
(B) High concentrations of ozone can be dangerously explosive
(C) Change in enthalpy for its decomposition is positive
(D) Gibb's energy change of its decomposition is negative

18. The chelating ligand not used for the treatment of metal toxicity by chelation therapy is :

(A) D-penicillamine (B) Desferrioxime-B

(C) EDTA (D) DMG

19. Out of the following compounds which one is not optically active

(i) $[Co(en)_3]^{3+}$

(ii) $[PtCl_2(en)_2]^{2+}$

(iii) Cis - $[CrCl_2(Ox)_2]^{3-}$

(iv) Trans- $[CrCl_2(Ox)_2]^{3-}$

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

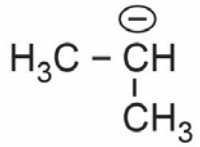
(C) (iv) (D) (iii)

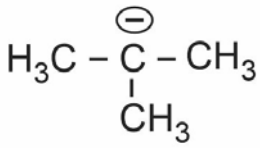
20. The electronic configuration of N is $1s^2\ 2s^2\ 2px^1\ 2py^1\ 2pz^1$ which rule explain this?

(A) Pauli's exclusion principle (B) Hund's rule of maximum multiplicity

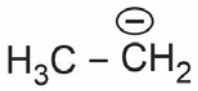
(C) Aufbau principle (D) deBroglie relation

21. Which of the following carbanion is the most stable?

(A) 

(B) 

(C) 

(D) 

22. Addition of HBr to 2-Pentene results in the formation of :

(A) 2-Bromopentane (B) 3-Bromopentane

(C) 2-Bromopentane+3-Bromopentane (D) None of these

23. Which of the following statement is correct regarding the structure of Z-1-bromo-2-chloro propene?

(A) –Br and –Cl are on the opposite side of the double bond

(B) –Br and –Cl are on the same side of the double bond

(C) –H and $-CH_3$ are on the opposite side of the double bond

(D) –Cl and H are on the same side of the double bond

24. The most stable conformation of n-butane is :

(A) CH_3 and CH_3 eclipsed (B) CH_3 and H eclipsed

(C) Gauche staggered (D) Anti staggered

25. Aryl halides are less reactive towards nucleophilic substitution as compared to alkyl halides due to :

(A) Stereoisomerism (B) Tautomerism
(C) Resonance stabilization (D) Inductive effect

26. Which of the following represents a racemic mixture?

(A) 25% (R) -2-butanol, 75% (S) -2-butanol
(B) 75% (R) -2-butanol, 25% (S) -2-butanol
(C) 50% (R)-2-butanol, 50% (S) -2-butanol
(D) None of the above

27. Freon is :

(A) Chlorofluoromethane (B) Chlorofluoroethane
(C) Chlorofluoropropane (D) None of these

28. Which of the following pollutants in water caused Minamata disease?

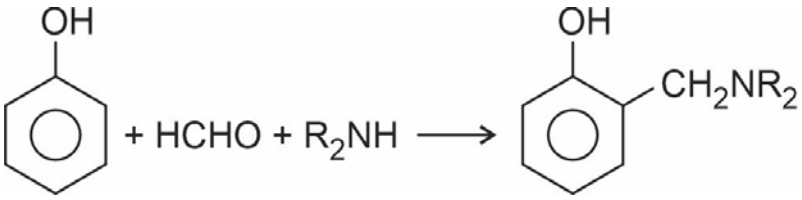
(A) Arsenic (B) Mercury
(C) Lead (D) Cadmium

29. The function of a lubricant is :

(A) To protect against wear (B) To transfer heat
(C) To reduce friction (D) All of these

30. Which of the following adsorbent material used in thin layer chromatography?

(A) Cellulose (B) Alumina
(C) Silica gel (D) All of these

31. 

is an example of :

(A) Mannich reaction (B) Reformatsky reaction
(C) Diels Alder reaction (D) Wittig reaction

32. During reaction of phenol with chloroform in presence of aqueous hydroxide the major product formed is :

(A) o-dihydroxy benzene (B) o-hydroxy benzaldehyde
(C) p-dihydroxy benzene (D) p-hydroxy benzaldehyde

33. The product formed in carbylamine reaction is :

(A) Aldehyde (B) Ketone
(C) Isocyanide (D) Carboxylic

34. Preparation of arylfluorides by heating arenediazonium fluroborates is known as :

(A) Sandmeyer's reaction (B) Schiemann reaction

(C) Gattermann reaction (D) None of these

35. Which of the following is most easily cleaved by HBr?

(A)  (B) 

(C)  (D) 

36. Which of the following is known as Omega-3 fatty acid?

(A) Linoleic acid (B) Linolenic acid

(C) Oleic acid (D) Stearic acid

37. Friedel crafts alkylation proceeds by the formation of a :

(A) Carbocation (B) Carbanion

(C) Chloride ion (D) Hydroxide ion

38. Which of the following is not a 5-membered heterocyclic compound?

(A) Pyrrole (B) Pyridine

(C) Furan (D) Thiophene

39. NBR is a polymer of :

(A) Isoprene (B) Chloroprene

(C) Butadiene and Acrylonitrile (D) Butadiene and Styrene

40. The empirical formula of the hydrocarbon containing 80% carbon and rest hydrogen is:

(A) CH (B) CH_2

(C) CH_3 (D) CH_4

41. Which of the following spectroscopic technique is / are correctly matched with the radiations used for their study?

(i) Vibrational Spectroscopy – IR waves

(ii) Electron Spectroscopy – Gamma rays

(iii) NMR Spectroscopy – Radio waves

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

(C) Only (ii) and (iii) (D) All of the above

42. What is the degree of freedom of water at its melting curve?

(A) 0 (B) 1

(C) 2 (D) 3

43. For a simple cubic crystal x-ray diffraction shows intense reflection for angles at θ_1 and θ_2 which are assigned to planes 110 and 111 planes respectively. The ratio of $\sin\theta_1$ to $\sin\theta_2$ is equal to :

(A) 1 (B) $\frac{2}{3}$

(C) $\frac{\sqrt{2}}{\sqrt{3}}$ (D) $\frac{\sqrt{3}}{\sqrt{2}}$

44. The law which states that heat and work are mutually inter convertible is known as?

(A) Zeroth law of thermodynamics (B) First law of thermodynamics

(C) Second law of thermodynamics (D) Third law of thermodynamics

45. For an isothermal expansion of an ideal gas which of the following is / are true :

(i) $\Delta H = 0$

(ii) $w = -q$

(iii) $\Delta U = 0$

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

(C) Only (ii) and (iii) (D) All of the above

46. The RMS velocity of a gas at 200K is 350 m/s. The RMS velocity of the same gas at a temperature of 800K is :

(A) 350 m/s (B) 700 m/s

(C) 175 m/s (D) 1400 m/s

47. An element exists in two crystallographic modifications with FCC and BCC structure. The ratio of densities of FCC to BCC $(\rho_{FCC} : \rho_{BCC})$ modifications in terms of volume of their unit cell is :

(A) $V_{BCC} : V_{FCC}$ (B) $V_{BCC} : 2V_{FCC}$

(C) $2V_{BCC} : V_{FCC}$ (D) $V_{BCC} : \sqrt{2}\ V_{FCC}$

48. The conductivity of an electrolytic solution of 0.05 mol L^{-1} concentration is found to be 0.0125 $ohm^{-1}\ cm^{-1}$. The molar conductivity of the solution is :

(A) 125 $ohm^{-1}\ mol^{-1}\ cm^2$ (B) 12.5 $ohm^{-1}\ mol^{-1}\ cm^2$

(C) 250 $ohm^{-1}\ mol^{-1}\ cm^2$ (D) 625 $ohm^{-1}\ mol^{-1}\ cm^2$

49. During the process of osmosis, the volume of less concentrated solution is :

(A) Increased (B) Decreased

(C) Unchanged (D) Unpredictable

50. What is the unit of rate constant of a second order reaction?

(A) $L\,mol^{-1}\,S^{-1}$ (B) $L^{-1}\,mol\,S^{-1}$

(C) S^{-1} (D) $L^2\,mol^{-2}\,S^{-1}$

51. An acid solution with pH = 1 is diluted to double its volume by adding water. The pH of the resulting solution will be :

(A) Less than 1
(B) Equal to 1
(C) Between 1 and 2
(D) Equal to 2

52. The defect in which an electron is trapped in place of an anion vacancy in a crystal is known as:

(A) Schottky defect
(B) Frenkel defect
(C) Metal deficiency defect
(D) F-centre

53. Which of the following statement is / are true for Smectic liquid crystals?

(i) They have thread like structure
(ii) They are affected by strong magnetic field
(iii) Their flow is non-Newtonian

(A) Only (iii)
(B) Only (i)
(C) Only (i) and (ii)
(D) Only (i) and (iii)

54. Which of the following statement is/are true about chemical potential?

(i) It is a partial molar property
(ii) It is an Intensive thermodynamic property
(iii) It varies with temperature

(A) Only (i) and (ii)
(B) Only (ii) and (iii)
(C) Only (i) and (iii)
(D) All of the above

55. For a reversible chemical reaction, the ratio between the rate constant of forward reaction and the rate constant of backward reaction is called :

(A) Overall rate of the reaction
(B) Molecularity of the reaction
(C) Order of the reaction
(D) Equilibrium constant of the reaction

56. An aqueous solution of sodium acetate is :

(A) Acidic
(B) Neutral
(C) Basic
(D) Cannot be predicted

57. The law which connects the relationship between pressure and solubility of a gas in a liquid at a given temperature is called:

(A) Henry's law
(B) Raoult's law
(C) Nernst law
(D) Hendersons equation

58. The phenomenon of Phosphorescence is due to :

(A) Triplet to Singlet transition of electron
(B) Singlet to Singlet transition of electron
(C) Triplet to Triplet transition of electron
(D) Internal conversion of electron

59. To which point group does Ammonia molecule belongs to:

(A) C_{2v} (B) D_{2h}

(C) D_{3h} (D) C_{3v}

60. The symmetry operation product $\sigma_v' C_2$ when applied to BF_3 molecule gives :

(A) $C_3^{\ 1}$ (B) S_3

(C) Identity Element (D) σ_h

61. Which of the following compounds are considered for calculating octane and cetane number?

(A) Iso-octane and n-heptane (B) Iso-octane and cetane

(C) Cetane and α-methyl naphthalene (D) Cetane and n-heptane

62. A precipitated material can be converted to a colloidal dispersion by the action of a suitable electrolyte. The process is known as :

(A) Solvation (B) Disintegration

(C) Dilution (D) Peptization

63. $nC + (n+1)H_2 \rightarrow C_nH_{2n+2}$, is a reaction that occurs at high temperature and pressure in the presence of a catalyst. This process is known as :

(A) Fischer -Tropsch process (B) Cracking process

(C) The Bergius process (D) Refining process

64. Which of the following statement is correct?

(A) In the electro osmosis process, the dispersed phase migrates under the influence of applied electric field.

(B) $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$, is an example for calcination process

(C) Chalcopyrite is an ore of Fe

(D) Pitchblende is one of the ores of Titanium

65. Assertion : Ball milling method of synthesizing nanomaterials is a top down method.
Reason : Mechanical pressure is applied to crush big particle to nano size materials.

(A) Both assertion and reason are true

(B) Assertion is true and reason is false

(C) Assertion is false and reason is true

(D) Assertion and reason are false

66. Which among the following compound cannot be employed as a catalyst in liquid/liquid, liquid/solid and liquid/gas type reactions?

(A) Quaternary ammonium salts (B) Crown ethers

(C) Carbonic anhydrase (D) Phosphonium compounds

67. The specific volume ratios of Ni, Cr, Al and W are 1.6, 2, 2.3 and 3.6 respectively. Which among the following metals will have higher oxidation corrosion rate?

(A) Ni (B) Cr

(C) Al (D) W

68. A refractory material should possess all the properties below except, :

(A) Minimum thermal spalling (B) Chemical inertness

(C) Higher porosity (D) Low electrical conductivity

69. Which statement is not correct for the chlor-alkali process?

(A) Chloride loses electrons at the anode

(B) Hydrogen gas is produced at the cathode

(C) Hydroxide ions are produced at the cathode

(D) Ion exchange membrane allows the passage of sodium ions and hydroxide ions

70. What will be the charge on the particles of a protein sol if it is dispersed in an acidic medium?

(A) Neutral (B) Positive

(C) Negative (D) No charge

71. Which technique is most used in clinical laboratories to analyze immuno assays?

(A) Refractometry (B) Nephelometry

(C) Polarimetry (D) Potentiometry

72. The compound which is used for rose fragrance is :

(A) Aniline (B) Ethyl benzene

(C) Ethyl acetate (D) Phenyl ethyl alcohol

73. Thermosetting polymers can be moulded in :

(A) Compression moulding (B) Transfer moulding

(C) Both (A) and (B) (D) None of the above

74. Which among the following statements are true?

(i) Vulcanization is a process involving the crosslinking of polymer chains using 5% sulphur at a temperature of 140-180°C.

(ii) In the vulcanization process plastic rubber is converted into the elastic rubber.

(iii) Peroxide and urethane vulcanization are two non-sulphur vulcanization processes.

(iv) Vulcanization process was discovered by Charles Goodyear in 1839

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

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

75. Low supersaturation results in :

(A) Faster growth and larger size crystal
(B) Slower growth and smaller size crystal
(C) Both (A) and (B)
(D) None of the above

76. Nitration of chlorobenzene results in:

(A) 70% para and 30% ortho isomer as products
(B) 30% para and 70% ortho isomer as products
(C) 100% meta isomer as product
(D) 40% each of ortho and para isomers and 20% meta isomer as products

77. Temperature at a distant place can be measured by using :

(A) Resistance thermometers
(B) Glass thermometers
(C) Bimetallic thermocouple
(D) Pressure spring thermometers

78. The process used for obtaining high purity liquid is :

(A) Distillation
(B) Evaporation
(C) Rectification
(D) Boiling

79. Match the following :

(a)	Dioctyl phthalate	(i)	Cigarette filters
(b)	Vinyl acetate	(ii)	Decaffeination of coffee beans
(c)	Cellulose acetate	(iii)	Adhesives
(d)	Ethyl acetate	(iv)	Plasticizer in plastics

(A) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
(B) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
(C) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
(D) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

80. Benzenesulfonic acid on treatment with sulphuric acid under Argon gas purging yields :

(A) Benzenesulphonic acid
(B) Benzenesulphonic acid and sulphur trioxide
(C) Benzene and sulphur trioxide
(D) Sulphur trioxide and sulphuric acid

81. Displacement pump is classified on the basis of :

(A) Efficiency
(B) Type of power
(C) Type of Service
(D) Mechanical operation of principle

82. The three elements of the fire triangle are :

(A) Oxygen, Fuel and Water
(B) Fuel, Oxygen and Heat Source
(C) Heat Source, Fuel and Water
(D) Earth, Oxygen and Fuel

83. Which of the following fire extinguisher is suitable for live electrical fire?

(A) Water (B) Foam
(C) Halon (D) Sand

84. The act which regulates the transportation of hazardous waste is :

(A) NEPA (B) NIPA
(C) RCRA (D) NCL

85. A toxic substance produced by plant or animal origin is specially referred to as :

(A) toxin (B) toxicant
(C) toximent (D) toxicognent

86. The most common cause of blue baby syndrome is :

(A) Excess Chloride in drinking water (B) Nitrate contaminated drinking water
(C) Presence of Arsenic in drinking water (D) Sulphate contaminated packed food

87. The radioactive isotope that is normally used in ionization smoke detectors is :

(A) Lead -208 (B) Uranium -235
(C) Amarecium-241 (D) Thorium-230

88. NFPA 72 is related to :

(A) Fire alarm systems (B) Hydrogen technologies code
(C) Mobile foam apparatus (D) Dry chemical extinguishing system

89. The act/rule that protest the right of workers in contingencies such as sick, maternity, temporary or permanent physical disability and death due to employment injury is :

(A) The Employee's State Insurance Act 1971
(B) The Workers Compensation Act 1951
(C) The Personal Safety Act 1948
(D) The Employee's State Insurance Act 1948

90. An industrial chemical process for converting mercaptans in sour gasoline into disulfides is known as :

(A) Lawyer's Sweetening process (B) Doctor's Sweetening process
(C) Mond's Sweetening process (D) Newton's Sweetening process

91. 1 BTU (British Thermal Unit) is approximately ———————— Calorie :

(A) 15 (B) 1538
(C) 252 (D) 0.25

92. The element which is not used as a nuclear fuel is :

(A) Thorium (B) Cadmium
(C) Uranium (D) Plutonium

93. The correct statement regarding a moderator in a nuclear reactor is/are :

(i) It is used to slow down the fast moving secondary neutrons produced during the fission

(ii) Heavy water and graphite are the commonly used moderators.

(iii) A breeder reactor does not require a moderator.

(iv) Cadmium rod is the most common moderator.

(A) (i) alone is correct (B) (i) and (ii) are correct

(C) All except (iv) are correct (D) All the four are correct

94. The oil refinery which is run under ONGC in India is :

(A) Panipat (B) Vishakapatnam

(C) Cochi (D) Tatipaka

95. The fuel with lowest calorific value among the following is :

(A) Anthracite coal (B) Lignite

(C) Petrol (D) Diesel oil

96. The reference fuel mixture used to assign octane number and cetane number are respectively:

(A) iso-Octane and n- Heptane, n-Hexadecane and 1-Methyl naphthalene

(B) n-Hexadecane and 1-Methyl naphthalene, iso-Octane and n-Heptane

(C) iso-Octane and n- Heptane, n-Hexadecane and 2-Methyl naphthalene

(D) n-Octane and iso- Heptane, n-Hexadecane and 1-Methyl naphthalene

97. The components common in water gas and producer gas are:

(A) Carbon dioxide and Hydrogen (B) Hydrogen and Carbon monoxide

(C) Nitrogen and Carbon monoxide (D) Carbon dioxide and Nitrogen

98. The correct statement regarding copper chloride sweetening process is :

(i) Petroleum refining process.

(ii) A slurry of clay and cupric chloride is used.

(iii) Mercaptans are oxidized during this process.

(iv) Viscous disulfides are formed during this process

(A) All except (iv) are correct (B) (i) and (ii) are correct

(C) All except (iii) are correct (D) All the four are correct

99. The largest tidal energy producing area in India, Khambhat coast and the gulf of Khambhat is located in the state of :

(A) Gujarat (B) Maharashtra

(C) Goa (D) Karnataka

100. The biggest thermal power plant in India is:

(A) Tiroda, Maharashtra (B) Talcher, Odisha

(C) Vindhyachal, Madhya Pradesh (D) Mundra, Gujarat

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