MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF JUNIOR SCIENTIFIC OFFICER (CHEMISTRY) (CONTRACT) UNDER HOME (FORENSIC) DEPARTMENT. MAY, 2016.

PAPER – I

Time Allowed : 2 hours | Full Marks : 150

All questions carry equal marks of 2 each.

Attempt all questions.

1. Which of the following is incorrect about the de-Broglie relationship?

(a) $h = \lambda p$ (b) $h/\nu = \lambda m$

(c) $E_{kinetic} = h\nu / 2\lambda$ (d) $E_{kinetic} = 2h\nu / \lambda$

2. The correct order of radii is

(a) $N < Be < B$ (b) $Na < Li < K$

(c) $F^- < O^{2-} < N^{3-}$ (d) $Fe^{3+} < Fe^{2+} < Fe^{4+}$

3. According to Band theory of bonding, conduction occurs in very good conductor because

(a) Valence band is full.

(b) Valence band and conduction band overlap.

(c) Band gap is appreciable.

(d) Band gap is large.

4. The maximum number of electrons that may be found in the 'L' shell of an atom is

(a) 6 (b) 8

(c) 10 (d) 18

5. The bond length in O_2, O_2^+ and O_2^- species follows the order

(a) $O_2^- < O_2 < O_2^+$ (b) $O_2^+ < O_2 < O_2^-$

(c) $O_2^- < O_2^+ < O_2$ (d) $O_2 < O_2^+ < O_2^-$

6. In ClF_3, Chlorine involves

(a) sp^3d hybridisation (b) sp^3d^2 hybridisation

(c) sp^3 hybridisation (d) sp^2 hybridisation

7. Which of the following has the largest lattice energy?

(a) KF (b) CsF

(c) NaF (d) RbF

8. A solid is made of two elements X and Z. The atoms Z are in ccp arrangement while atoms X occupy all the tetrahedral sites, the formula of the compound is

(a) XZ (b) X_2Z

(c) XZ_2 (d) X_2Z_3

9. $108 + 7.2 = 14.583$. The correct answer to this proper number of significant digits is
   (a) 15 (b) 14.58
   (c) 4.5 (d) 14

10. Aliphatic and aromatic aldehydes can be differentiated by
   (a) Schiff's test (b) Fehling's test
   (c) 2, 4-DNP test (d) Carbylamine test

11. If pK_{in} of an indicator is 10.5, the pH transition range for which it is most suitable is
   (a) 8.5 – 10.5 (b) 10.5 – 12.5
   (c) 10.0 – 11.0 (d) 9.5 – 11.5

12. In the third group of qualitative analysis, the precipitating reagent is NH_4Cl/NH_4OH. The function of NH_4Cl is to
   (a) Increase the ionization of NH_4OH
   (b) Suppress the ionization of NH_4OH
   (c) Convert the metal ion into their respective chlorides
   (d) Stabilize the hydroxides of third group cations

13. When the ionic product of a solution exceeds the solubility product, the solution becomes
   (a) Saturated
   (b) Unsaturated
   (c) A colloid
   (d) Super saturated and precipitation of salt occurs

14. Which of the following molecules will not show IR spectrum?
   (a) H_2 (b) HCl
   (c) CH_4 (d) H_2O

15. An Electromagnetic radiation which has energy of 50 kJ mol^{-1} falls in the region of
   (a) Infrared (b) Visible
   (c) Ultraviolet (d) Microwave

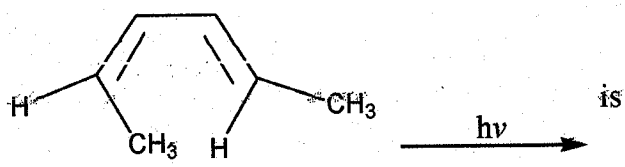
16. In the UV spectrum of cyclohexanone, the absorption at $\lambda_{max} \approx 215$ nm is due to the transition of
   (a) $\sigma \rightarrow \sigma^*$ (b) $n \rightarrow \sigma^*$
   (c) $n \rightarrow \pi^*$ (d) $\pi \rightarrow \pi^*$

17. In S_N2 reaction there is
   (a) Partial racemisation (b) Complete racemisation
   (c) Complete inversion (d) A little inversion and mostly racemisation

18. For a reaction between alkyl halide and OH^-, increase in solvent polarity generally
   (a) Increases the rate of S_N1 reaction
   (b) Decreases the rate of S_N1 reaction
   (c) Increases the rate of S_N2 reaction
   (d) Does not alter the rate of S_N1 and S_N2 reaction

19. The Hofmann rearrangement has an intermediate that is electronically similar to that in the
   (a) Claisen rearrangement (b) Fries rearrangement
   (c) Beckmann rearrangement (d) Pinnacol rearrangement

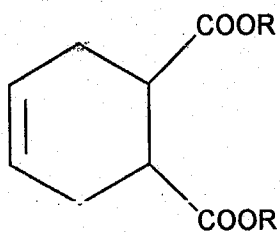
20. The major product for the reaction



is

(a) Cis- 3,4 – dimethyl cyclobutene
(b) Trans- 3,4 – dimethyl cyclobutene
(c) Trans, trans- 2,4 – hexadiene
(d) Cis- cis- 2,4 – hexadiene

21. Which one of the following can be easily synthesised by Diels-alder reaction?

(a)


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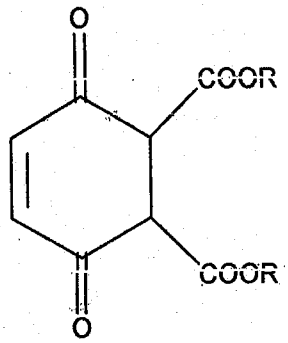

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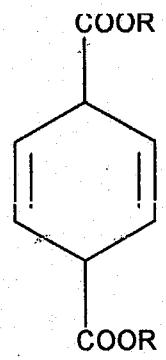

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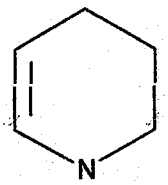


22. For a chemical reaction obeying Arrhenius equation, straight line is obtained by plotting (k = rate constant)

(a) k vs. T
(b) Log k vs. T
(c) Log k vs. T^{-1}
(d) Log k vs. Log T

23. For a hypothetical reaction A → B, the rate constant is 0.25 sec^{-1}. If the concentration of A is reduced to half, then the value of rate constant is

(a) 0.30 sec^{-1}
(b) 0.50 sec^{-1}
(c) 0.25 sec^{-1}
(d) 0.125 sec^{-1}

24. For an electrolytic solution of 0.05 M strength, the conductivity has been found to be 0.0110 Scm^{-1}. The molar conductivity is

(a) 0.055 Scm^2mol^{-1}
(b) 550.0 Scm^2mol^{-1}
(c) 0.220 Scm^2mol^{-1}
(d) 220.0 Scm^2mol^{-1}

25. The Gold number of four colloids A, B, C and D are 0.005, 0.1, 0.01, and 0.5 respectively. The decreasing power of their protective power is

(a) DCBA (b) ABCD

(c) DBCA (d) ACBD

26. According to Freundlich adsorption isotherm, which of the following is correct?

(a) $\frac{x}{m} \propto p^1$

(b) $\frac{x}{m} \propto p^{1/n}$

(c) $\frac{x}{m} \propto p^0$

(d) All the above are correct for different ranges of pressure

27. For which of the following conductometric titrations, there is no suitable indicator?

(a) Strong acid against a strong base (b) Weak acid against a strong base

(c) Weak base against a strong acid (d) Weak base against a weak acid

28. The instability of nucleus is due to

(a) high e/p ratio (b) high n/p ratio

(c) low e/p ratio (d) low n/e ratio

29. Which of the following projectiles is the best for bombarding the nuclide?

(a) α - particle (b) Proton

(c) Deuteron (d) Neutron

30. The easily fissionable isotope of uranium is with mass number

(a) 235 (b) 238

(c) 237 (d) 236

31. The radiant energy of sun is due to

(a) Disintegration (b) Nuclear fission

(c) Nuclear fusion (d) Combustion

32. The radioactive isotope having $t_{1/2} = 2.3$ days was received after 9.2 days. It was found that 300 mg of the isotope was left in the container. The initial amount of the isotope was

(a) 1200 mg (b) 2400 mg

(c) 3600 mg (d) 4800 mg

33. Zeolite is the broad term used to describe a family of minerals called

(a) Trisilicates (b) Tectosilicates

(c) Tetrasilicates (d) Pentasilicates

34. Which one is not the application of green chemistry in our daily life?

(a) Use of liquid carbon dioxide along with a surfactant for dry cleaning of clothes

(b) Ban smoking at public places

(c) Use of H_2O_2 as bleaching agent in presence of TAML activators

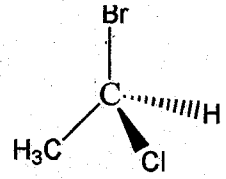
(d) Synthesis of molecules in ionic liquids

35. Which one is not a green solvent?
(a) Liquid carbon dioxide (Supercritical CO_2) (b) Liquid ammonia
(c) Ionic liquids (d) Water

36. Racemic mixture is optically inactive due to
(a) Presence of plane of symmetry (b) Presence of axis of symmetry
(c) External compensation (d) Internal compensation

37. The least energetic conformation of cyclohexane is
(a) Boat form (b) Half chair form
(c) Chair form (d) Twisted form

38. The chirality of the compound is



(a) R (b) S
(c) E (d) Z

39. Maltose is a disaccharides which is made up of
(a) Glucose + Fructose (b) Glucose and Glucose
(c) Glucose + Galactose (d) None of these

40. Compounds having the same chemical formula but differ in the spatial arrangement around a single carbon atom are known as
(a) Anomers (b) Epimers
(c) Tautomers (d) None of these

41. Amino acids can be readily detected and quantified by reaction with
(a) Aldrin (b) Dihydrin
(c) Ninhydrin (d) Felhydrin

42. The non–amino acid part of a conjugated protein is usually called
(a) Apoprotein (b) Comanion
(c) Prosthetic group (d) Apoenzyme

43. The number of milligrams of potassium hydroxide required to saponify 1g of fat under the specified conditions is known as
(a) Saponification value (b) Rancidity value
(c) Ester value (d) None of these

44. In the structure of nucleic acid, glycosidic bond is form between C-1 of sugar and
(a) N-6 of purine (b) N-7 of purine
(c) N-1 of pyrimidine (d) N-7 of pyrimidine

45. The distance between each base pair in Z-DNA is
(a) 0.27 nm (b) 0.37 nm
(c) 0.32 nm (d) 0.73 nm

46. The T ψ C arm of tRNA contain an unusual base known as

(a) Pseudouracil (b) Dipseudouracil

(c) Hydrouracil (d) Dihydrouracil

47. The technique that resolves proteins by mass, charge or binding activity is

(a) Paper chromatography (b) Liquid chromatography

(c) Gas chromatography (d) Capillary electrophoresis

48 Mass spectrometry helps to determine

(a) Equivalent weight (b) Molecular weight

(c) Atomic weight (d) All of these

49. Which of the following in SDS PAGE breaks disulfide linkage?

(a) Sodium Dodecyl sulphate (b) TEMED

(c) EDTA (d) β- mercaptoethanol

50. The most commonly used buffer for DNA electrophoresis is

(a) TAE (b) TBE

(c) Etbr (d) Both (i) and (ii)

51. Beer-Lambert law deals with the linear relationship between absorbance of an absorbing species with its

(a) Concentration (b) Molecular weight

(c) Atomic weight (d) None of these

52. During muscle contraction, which of the following does not change in length?

(a) I-band (b) A-band

(c) H-band (d) Z-disc

53. When the CO_2 concentration increases in the blood, the affinity of Hb for O_2 is reduced. This phenomenon is called

(a) Haldane effect (b) Bohr effect

(c) Oxygen equilibrium curve (d) None of these

54. Which portion of adrenal gland is responsible for the synthesis of catecholamines?

(a) Medulla (b) Zonareticulata

(c) Zonaglomerulosa (d) Zonafasciculata

55. Which of the following proteins belongs to thick filament protein?

(a) Actin (b) Troponin complex

(c) Tropomyosin (d) c-proteins

56. At resting potential, the concentration of Na+ inside the axoplasm is

(a) 40 mM (b) 50 mM

(c) 400 mM (d) 440 Mm

57. Intercalated disc is found in

(a) Smooth muscle (b) Skeletal muscle

(c) Cardiac muscle (d) None of these

58. Melanocyte stimulating hormone (MSH) is secreted by

(a) Pars distalis (b) Pars tuberalis

(c) Pars intermedia (d) Pars nervosa

59. Which of the following granulocytes is responsible for allergy?

(a) Eosinophil (b) Basophil
(c) Neutrophil (d) All of these

60. The number of ATP molecules produced at substrate-level phosphorylation during glycolysis equals to

(a) 2 (b) 4
(c) 6 (d) 8

61. Oxidation of fatty acids in most cell types occur in

(a) Peroxisomes (b) Mitochondria
(c) Golgi apparatus (d) Endoplasmic reticulum

62. Synthesis of most of the ATP generated in aerobic oxidation is carried out by

(a) Electron transport chain (b) Citric acid cycle
(c) Glycolysis (d) None of these

63. Which of the following is a disorder of amino acid metabolism?

(a) Alkaptonuria (b) Phenylketonuria
(c) Albinism (d) None of these

64. In the eukaryotes, citric acid cycle occurs in

(a) Cytoplasm (b) Mitochondria
(c) Golgi body (d) Nucleus

65. A complete catalytically active enzyme together with its bound coenzyme or and metal ions is called

(a) Apoenzyme (b) Apoprotein
(c) Co-factor (d) Holoenzyme

66. Enzymes are made up of

(a) Proteins (b) RNA
(c) Both (a) and (b) (d) None of these

67. The amount of energy required to bring all the molecules in one mole of a substance at a given temperature to the transition state is known as

(a) Gibbs free energy (b) Activation energy
(c) Threshold energy (d) None of these

68. In uncompetitive inhibition, the degree of inhibition may increase when the ES complex increases, here

(a) Vmax does not change while Km changes (b) Km does not change while Vmax changes
(c) When Vmax increase, Km also increases (d) When Vmax increases, Km decreases

69. Which of the following enzyme is involved in the conversion of glucose to glucose -6- phosphate?

(a) Hexokinase (b) Pyruvate kinase
(c) Succinate dehydrogenase (d) Aldolase

70. The molecular weight of nuclear pore complex is about

(a) 50 - 100 Dalton (b) 150 - 200 Dalton
(c) 300 - 400 Dalton (d) 500 - 360 Dalton

71. Protein translocation in mitochondria is carried out by

(a) TIM complexes (b) TOM complexes
(c) TIM and TOM complexes (d) None of these

72. The leading strand of DNA is synthesized continuously in the direction of

(a) 3'- 5'
(b) 5'- 3'
(c) Both 3'- 5' and 5'- 3'
(d) None of these

73. The vectors have originated independently from replicating

(a) Plastids
(b) Plasmids
(c) Viruses
(d) Both (b) and (c)

74. The 5' cap on most eukaryotic mRNAs is a

(a) 5-methyl guanosine residues
(b) 7-methyl guanosine residues
(c) 5-methyl adenosine residues
(d) 7-methyl adenosine residues

75. Which of the following is an initiation and stop codon?

(a) AUG and UAA
(b) GUA and UGA
(c) AGU and UAG
(d) UAG andGAU

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