Salale University

College of Natural Sciences

Department of Chemistry

Second Model Exit Exam

Name of student's: _____**ID No**: _____

Time Allowed: 3:00 Hrs.

Instructions

Dear students please read the instructions given below before doing anything else.

- Make sure the exam is totally contains **100 number of questions**.
- The exam includes Analytical part, Inorganic part, Organic part and Physical chemistry part
- Write your **Name and ID No** on the cover page
- Make sure your mobile is **switch off**

Choose the correct answer from the given alternative

1. The equilibrium produced on heating carbon with steam give hydrogen molecule and carbon monoxide gas what will be the equilibrium expression

   A. $K_{eq} = [H_2]\,[CO]/[H_2O]$

   B. $K_{eq} = [H_2]\,[CO]$

   C. $K_{eq} = [H_2][CO]/[H_2O]\,[C]$

   D. $K_{eq} = [H_2O][CO]/\,[C]$

2. What is the effect of increasing pressure on the equilibrium of

   $$\mathbf{C(s) + O_2(g) \rightleftharpoons CO_2(g)}$$

   A. The equilibrium position shifts to right

   B. The equilibrium position shifts to right

   C. No effect

   D. More CO_2 will produced

3. Consider the following reaction

   $$\mathbf{A + 2B \rightleftharpoons C + D \quad \Delta H = -250\ KJ\ mol^{-1}}$$

   Which one of the following true about the effect of change in temperature

   A. Increasing temperature favours forward reaction

   B. Increasing temperature backward reaction

   C. Increasing temperature results into more production of C and D

   D. Change of temperature has no effect

4. What is the pH of a 0.40 M NH_3 solution? The K_b for NH_3 is 1.8×10^{-5}

   A. 11.47 **C.** 10.23

   B. 2.57 **D.** 4.73

5. What happens to the pH of water solution of HNO_2 if $NaNO_2$ is added to the solution of HNO_2?

   A. Increasing pH **C.** Has no impact

   B. Decreasing pH **D.** High concentration of H^+ results

6. Which one of the following salt decrease the pH of water when dissolved in water

   A. KNO_3 **B.** NH_4NO_3 **C.** $NaSO_4$ **D**. CH_3COOK

7. Before determining the amount of Na_2CO_3 in an unknown sample, a student decides to check her procedure by analyzing a sample known to contain 98.76% w/w Na_2CO_3. Five replicate determinations of the %w/w Na_2CO_3 in the standard were made with the following results 98.71%, 98.59%, 98.62%, 98.44% and 98.58%. Which one of the following true about mean for these five trials at the 95% confidence level ($\alpha = 0.05$)? The critical value for t(0.05,4), as found in table 3.2 is 2.78.

A. The experimental mean is Significantly different from the accepted value 98.76% w/w

B. The value 98.76% w/w Na_2CO_3 is not significantly different from mean of experimental value

C. The null hypothesis which says the experimental result should be retained is correct

D. None

8. Which of the following is true regarding classical methods of sample analysis?

A. Classical is traditional methods

B. It has higher precision compared to instrumental method.

C. It is known as the physical method

D. It has high ability to perform trace analysis.

9. All of the following are classified as an instrumental method of analysis except one.

A. Spectroscopy **C.** Chromatography

B. B.Electro- analytical analysis **D.** Gravimetry analysis

10. From the following part of gas chromatography where the analyte separation occurs?

A. In column **B.** In the detector **C.** Temperature control oven **D.** Gas supplier

11. Which one of the following is correct about reverse partition chromatography?

A. For nonpolar stationary phase and polar mobile phase is used for polar solutes.

B. For polar stationary phase and non-polar mobile phase is used for nonpolar solutes.

C. For nonpolar stationary phase and polar mobile phase is used for nonpolar solutes.

D. For polar stationary phase and polar mobile phase is used for nonpolar solutes.

12. One of the following is the advantage of using dropping mercury electrode.

A. The surface area is highly reproducible. **C.** The capillary is easily plugged.

B. It is easily oxidized. **D.** None of above.

13. Which one is incorrect about is incorrect about amperometry?

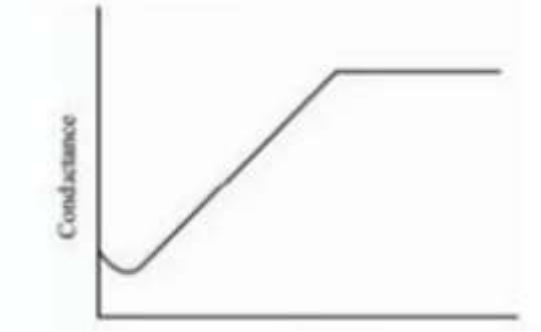
A. It is rapid and simple instrument

B. Accuracy is higher in amperometry titration than polarography.

C. Due to co-precipitation inaccuracy results may obtained.

D. When titrant and analyte undergo electrolytic reaction amperometry titration is properly performed.

14. The following conductometric titration curve represents.



A. Strong acid strong base titration

B. Weak acid strong base titration

C. Strong acid weak base titration

D. Weak acid weak base titration

15. One of the following indicate particle properties of electromagnetic radiation (EMR)

A. Frequency of EMR

B. Amplitude of EMR

C. Absorption of EMR

D. Speed of EMR

16. Which of the following analytical method is used to measure the analyte concentration depending on the quantity of light received by the analyte?

A. Spectroscopy

B. Decantation

C. Potentiometery

D. None of the above

17. The λ of $\boldsymbol{\sigma}$ to $\boldsymbol{\sigma}$ * transitions lies in the

A. IR region

B. Visible region

C. UV region

D. None of the above

18. One of the following cannot indicate the difference between UV and IR

A. Uv has a shorter wavelength as compared to visible light while IR has a longer wavelength as compared to visible light.

B. Uv has high frequency and more energy per photon as compared to IR

C. Uv case electronic energy within the molecule while IR cause rotational and vibration transition of a molecule.

D. Uv is used determine functional group of a molecule while IR is used to determine mass of a molecule

19. Which one of the following does not show the difference between absorption spectroscopy and emission spectroscopy?

A. Absorption spectroscopy depends on ground state electron while emission spectroscopy depends on exited state electron

B. Electromagnetic radiation is used as source in absorption spectroscopy while sample is used as source in emission spectroscopy

C. Transition from ground to excited state in absorption spectroscopy while transition taking place from Excited to ground state in emission spectroscopy

D. Heat is released in absorption spectroscopy while heat is absorbed in emission spectroscopy

20. Which one of the following is the correct order of instrumentation in AAS

A. Hallow cathode lamp, atomizer, monochromator, detector, read out device

B. Atomizer, hallow cathode lamp, monochromator, detector, read out device

C. Hallow cathode lamp, monochromator, atomizer , detector, read out device

D. Atomizer, monochromator, A detector, read out device, Hallow cathode lamp

21. The relative abundance of each isotope in mass spectroscopy is indicated by

A. The heights of the peaks

B. Number of isotopes

C. The position of signal

D. Retention time of signal

22. Which one of the following statements is true about migration of molecule in electrophoresis.

A. The rate of migration decreases with increasing net charge.

B. The rate of migration increases with resistance.

C. The rate of migration increases with increasing current.

D. All

23. In ascending paper chromatography dye travel l7 cm and the solvent travel 10 cm, calculate the retention factor.

A. 0.75 **B.** 1.7 **C.** 1.43 **D.** 0.588

24. In an infrared (IR) spectrum, which of the following functional groups has the highest frequency?

A. Ketone **B.** Aldehyde **C.** Ester **D.** Alcohol

B. Aldehyde

25. Which one the following types sample container is used in UV spectroscopy

A. Glass **B.** Quartz **C.** Flame D. A and B

26. An acid is a compound that gives H+ ions in water and bases are a compound that gives OH – ions in water. This concept is stated by:

A. Lewis theory **C.** Bronsted- Lowery theory

B. Arrhenius theory **D.** Usanovich's theory

27. Which one of the following characteristics of the transition metals is associated with higher catalytic activity?

A. High enthalpy of atomization **C.** Color of hydrate ions

B. Paramagnetic behavior **D.** Variable oxidation states

28. Concerning metallic bonds, which of the following statements is true?

A. They form between metals and nonmetals

B. They form a lattice-like structure

C. They form between negative and positive ions

D. They form between electronegative only

29. The rule which states that ‘‘no two electrons in an atom can have the same set of quantum numbers’’ is known as _____.

A. Valence bond theory **C.** Aufbau’s principle

B. Hund's rule **D.** The Pauli exclusion principle

30. According to Pearson’s HSAB concept, the species in which characterized by large in size, low positive charge and high polarizability.

A. Hard acid **B.** Soft acid **C.** Hard base **D.** Soft base

31. During the reaction of hard bases, which of the following characteristics of the donor atom?

A. Small size and low electronegativity

B. Large size and low electronegativity

C. Small size and high electronegativity

D. Large size and high electronegativity

32. When hard and soft acid bases are combined, what type of interaction forms the covalent bond?

A. Hard acids and hard bases **C.** Soft acids and soft bases

B. Hard acids and soft bases **D.** Soft acids and hard bases

33. Which of the following complex ions is the most stable according to the HSAB principle?

A. $[Co(CN)_5F]^{3-}$ **B.** $[Co(NH_3)_5F]^{2+}$ **C.** $[Co(CN)_5CI]^{3-}$ **D.** $[Co(NH)_5I]^{2+}$

34. Why are magnetic moments of trivalent lanthanide ions not affected by ligands in comparison to those of 3d transition metal ion?

A. Lanthanides are heavier than 3d metal ions

B. Lanthanides show high coordination number

C. Properties of lanthanide ions are smaller

D. f-electrons are more deep-seated than d-electrons

35. Based on valence bond theory what is the hybridization of the metal orbitals in the complex of $[Co(OH_2)_6]^{2+}$?

A. d^2sp^3 **B.** sp^2d **C.** dsp^2 **D.** sp^3d^2

36. Which of the following chemicals is **No**t used in the preparation of $[Ni\ (NH_3)_6]I_2$?

A. Ammonia **B.** Ethanol **C.** Starch indicator **D.** Iron cyanide

37. When methyl chloride is added to an organometallic compound, which of the following does not undergo oxidative addition?

A. $[Rh(CO)_2I_2]^-$ **C.** $[\eta^5\text{-}CpRh(CO)_2]$

B. $[Ir(PPh_3)_2\ (CO)Cl]$ **D.** $[\eta^5\text{-}Cp_2Ti(Me)Cl]$

38. In terms of IUPAC nomenclature, which is the correct name for the complex of $[CrCl_2(H_2O)_4]NO_3$?

A. Dichlorotetraaqueouschromium(III)nitrate

B. Tetraaquadichlorochromate(II)nitrate

C. Dichlorotetraaqueouschromium(IV)nitrate

D. Tetraaquadichlorochromium(III)nitrate

39. Calculate the magnetic moment for the spine-only contribution value for $Cu(H_2O)_6]Cl_2$ and $TiCl_4$, respectively?

A. 1.73 & 1.2 BM **B.** 1.73 & 0 BM **C.** 1.4 & 3.4 BM **D.** 1.73 & 1.4 BM

40. Which of the following glass is differ by its basic raw material composition?

A. Extra clear glass **B.** Patterned glass **C.** Laminated glass **D.** Toughened glass

41. Which of the following method is used for purification during synthesis process of urea?

A. Reducing pressure **B.** Increasing temperature **C.** Adding water **D.** Evaporation

42. In terms of crystal field theory, what will be the crystal field stabilization energy of the complexes $[Cr(OH_2)_6]Cl_3$ and $[MnCl_4]^{2-}$, respectively?

A. 0 Δo & 1.2 Δt **C.** 0.2 Δo & -0.6 Δt

B. 1.2 Δo & 0 Δ t **D.** -1.6 Δo & -0.8 Δo

43. Why gypsum is added to cement?

A. To control the setting time **C.** To binding

B. To give strength **D.** To bleaching

44. Which of the following statements is false?

A. Transition elements have larger atomic radii than the preceding IA and IIA elements in the same period because transition elements have electrons in their d orbitals.

B. Electrons in inner shells screen, or shield, electrons in outer shells from the full effect of the nuclear charge

C. The atomic radii of representative elements decrease from left to right across a period (horizontal row in the periodic table).

D. Within a family (vertical group in the periodic table) of representative elements atomic radii increase from top to bottom

45. A chemical bond formed by two atoms sharing one or more pairs of electrons is called a (or an) ____ bond

A. Coordinate covalent **B**. Nonpolar **C.** Ionic **D.** Covalent

46. How many lone pairs of electrons are there on the Xe atom in the XeF_2 molecule?

A. Four **B.** Three **C.** Zero **D.** Two

47. Which of the following statements concerning polar molecules is false?

A. There must be an odd number of polar bonds so that their polarities not cancel.

B. A molecule with symmetrically arranged polar bonds can be polar if the central atom is bonded to atoms of different elements.

C. If there is more than one polar bond, they must not be symmetrically arranged so that their polarities cancel.

D. There must be at least one polar bond or one unshared pair of electrons on the central

48. Which of the following statements about multiple bonds is true?

A. A sigma bond results from the side-on overlap of p atomic orbitals.

B. sp^3 hybridization in carbon is associated with one double bond and two single bonds

C. A double bond consists of two sigma bonds.

D. sp^2 hybridization in carbon is associated with one double bond and two single bonds.

49. Which one of the following statements is not applicable to ionic solids?

A. Ionic solids have high melting points.

B. Most ionic solids are hard and brittle.

C. Ionic solids are usually excellent conductors of electric current.

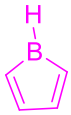
D. The units that occupy the lattice points are ions.

50. Which of the following raw materials not used for advanced ceramics?

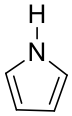
A. Nuclear fuels **B.** Artificial bones **C.** Cement **D.** Cutting tools

51. Which one of the following species doesn't have aromatic characteristics?

A. 

B. 

C. 

D. 

52. Which one of the following is not a typical reaction of aromatic compounds?

A. Electrophilic substitution reaction **C.** Nucleophilic substitution reaction

B. Sandmeyer reaction D. Addition reaction

53. 2, 2-dimethoxy propane can be prepared from?

A. An acetone and one mole of water

B. An acetone and two moles of water

C. An acetaldehyde and two moles of methanol

D. An acetone and two moles of methanol

54. Which one of the following methods used to produce directly secondary and tertiary amines?

A. Gabriel synthesis **C.** Catalytic reduction of alkyl azide with H_2

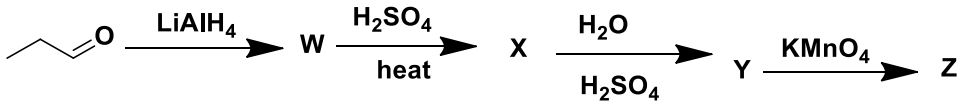
B. Reduction of amides with $LiAlH_4$ **D.** Catalytic reduction of a nitrile with H_2

55. Grignard reagent + A ⟶ Primary alcohols (after work up). Which one of the following substances is denoted by A?

A. Ketone **C.** Formaldehyde

B. Aldehyde **D.** Acetic anhydride

56. What is the **final product or Z** from the following reaction?



A. Acetone **C.** Acetic acid

B. Acetaldehyde **D.** Propanoic acid

57. Which one the following oxidized agent used to oxidize primary alcohol to a carboxylic acid?

A. Chromic acid **C.** Swern Oxidation

B. Collins reagent **D.** Pyridinium dichromate

58. Which one of the following is necessary true about α-D-fructose?

A. It is a dextrorotatory sugar
C. It is the open chain form of fructose
B. It is an aldohexose sugar
D. It is a ketohexose sugar

59. Which of the following organic compound is less acidic?

A. Cyclohexanol
C. Benzoic acid
B. Phenol
D. p-chlorophenol

60. In the preparation of aspirin, which compound is used as the main starting material?

A. Salicylic acid
C. Sulfuric acid
B. Acetic acid
D. Sodium hydroxide

61. What product(s) would you expect from **sulfonation of the toluene**?

A. Benzene sulfonic acid
C. *m*-methylbenzene sulfonic acid
B. *o/p*-methylbenzene sulfonic acid
D. *No reaction*

62. What is the purpose of adding sulfuric acid during the synthesis of aspirin?

A. To catalyze the reaction
C. To increase the solubility of aspirin
B. To neutralize the base
D. To precipitate impurities

63. What is the purpose of adding a drying agent like anhydrous sodium sulfate during extraction?

A. To remove water from the mixture
B. To enhance the solubility of the organic compound
C. To neutralize acidic impurities
D. To increase the yield of the reaction

64. Which of the following techniques relies on the differences in boiling points of organic compounds to separate them from a mixture?

A. Distillation
C. Chromatography
B. Extraction
D. Filtration

65. Which **one has not same melting point**?

A. (1S, 3R)-1,3-dimethyl cyclohexane and (1S, 3S)-1,3-dimethyl cyclohexane

B. (1S,3S)-1,3-dimethyl cyclohexane and (1R,3R)-1,3-dimethyl cyclohexane

C. (1S,3S)-1,3-dimethyl cyclohexane and (1S,3S)-1,3-dimethyl cyclohexane

D. (1R,3R)-1,3-dimethyl cyclohexane and (1S,3S)-1,3-dimethyl cyclohexane

66. Which of the following methods is commonly used to convert an alcohol into an alkene?

A. Dehydration with concentrated sulfuric acid

B. Hydroboration-oxidation

C. Reduction with lithium aluminum hydride ($LiAlH_4$)

D. Oxidation with chromic acid (H_2CrO_4)

67. Anisole can be cleaved to what alkyl halide and alcohol by the help of HBr?

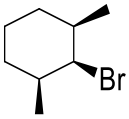
A. aryl halide and phenol

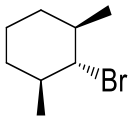
B. methyl alcohol and aryl halide

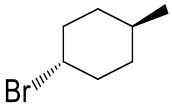
C. Methyl halide and phenol

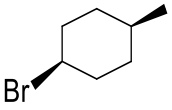
D. Vinyl halide and phenol

68. Which one is fast to undergo E2 reaction with KOH?

A. 

B. 

C. 

D. 

69. The decomposition of carbon disulfide, CS_2, to carbon monosulfide, CS, and sulfur is first order with $k = 2.8 \times 10^{-7}\ s^{-1}$ at 1000°C.

$$CS_2 \longrightarrow CS + S$$

What is the half-life of this reaction at 1000°C?

A. 2.5×10^{6} s

B. 4.7×10^{-6} s

C. 3.8×10^{5} s

D. 5.0×10^{7} s

70. Which one of the statement is correct about ideal gas properties?

A. There are no intermolecular forces between the gas particles.

B. The volume occupied by the particles is negligible compared to the volume of the container they occupy.

C. The only interactions between the particles and with the container walls are perfectly elastic collisions.

D. All

71. If an electric motor produces 20 KJ of energy each second as mechanical work and lost 5KJ as heat to the surrounding, what is the change in internal energy?

A. -25 KJ **B.** -15 KJ **C.** 25 KJ **D.** 15 KJ

72. Which of the following observations is incorrect about the order of a reaction?

A. Order of a reaction is always a whole number

B. The stoichiometric coefficient of the reactants doesn't affect the order

C. Order of reaction is the sum of power to express the rate of reaction to the concentration terms of the reactants.

D. Order can only be assessed experimentally

73. What is the name of an ideal-gas process in which no heat is transferred?

A. Isochoric **B.** Isothermal **C.** Isobaric **D.** Adiabatic

74. Electrons are lost by the

A. Reducing agent as it undergoes oxidation.

B. Reducing agent as it undergoes reduction.

C. Oxidizing agent as it undergoes oxidation.

D. Oxidizing agent as it undergoes reduction

75. _____a process in which volume of a system remains constant.

A. Isobaric **B**. Isopiestic **C**. Isochoric **D.** Isothermal

76. An increase in the conductivity equivalent of a solid electrolyte with dilution is primarily due to

A. increased ionic mobility of ions

B. all electrolyte ionization with natural dilution

C. increase in both ion numbers and ionic mobility

D. A rise in ion counts

77. _____a types of boundary that allows the passage of both matter and energy.

A. permeable wall **B.** Adiabatic wall **C.** Diathermal wall **D**. Isolated wall

78. _____states that the volume of a gas is inversely proportional to the pressure at constant temperature.

A. Boyle's Law **B.** Charles' Law **C**. Gay-Lussac's Law **D.** Combined Gas Law

79. When the concentration of reactant molecules is increased, the rate of reaction increases. The best explanation is: As the reactant concentration increases,

A. the average kinetic energy of molecules increases.

B. the frequency of molecular collisions increases.

C. the rate constant increases.

D. the activation energy increases.

80. In an operating electrochemical cell the function of a salt bridge is to

A. Allow hydrolysis to occur.

B. Allow a non-spontaneous reaction to occur.

C. Permit the migration of ions within the cell.

D. Transfer electrons from the cathode to the anode

81. From the following quantity which one is intensive property?

A. Internal Energy **C.** Temperature

B. Heat **D.** Volume

82. The overall rate of a reaction is determined by

A. the rate of fastest intermediate step

B. the sum total of the rates of all intermediate steps

C. the average of the rates of all the intermediate steps

D. the rate of slowest intermediate step

83. From the following quantity which one is a path function?

C. Internal Energy **C.** Enthalpy

D. Heat **D.** Volume

84. Which statement is in correct about adsorption?

A. is mainly a consequence of surface energy

B. process which takes place, when one substance enters the volume or bulk of another substance

C. the condition which occurs on the surface of the substrate

D. A&C

85. How much will the boiling point of water change when 2.00 g of urea (60.1 g/mol) is dissolved in 150 g of water? K_b of water = 0.52 ℃/$_m$

A. 0.222 ℃ **B.** 0.115 ℃ **C.** 0.0022 ℃ **D.** 0.017 ℃

86. Among the following which one are not categories under major environmental issue?

A. Loss of Biodiversity **C.** Land Degradation

B. Ozone Depletion **D.** Space exploration

87. Among the following subdivision of ultraviolet radiation which one has the shortest wavelength?

A. UV-A **B.** UV-B **C.** UV-C **D.** None of them

88. One of the following is not greenhouse gas

A. Water vapor **B.** Oxygen **C.** Carbon dioxide **D.** Nitrous oxide

89. One of the following methods is used for removal of CO from the atmosphere.

A. By reducing the smoke from vehicles **C.** Using soil microorganisms

B. By limestone slurry process **D.** All

90. Among the following statements which one is against to the principles of green chemistry?

A. Synthesis of pesticide **C.** Design for energy efficiency

B. Use of renewable feedstock **D.** Green solvents and auxiliaries

91. Which of the following factors is responsible for soil pollution?

A. Excessive use of automobiles **C.** The use of CFC

B. Wastes from industries **D.** Replacing perchloroethylene with CO_2 solvent

92. One of the following is not a control mechanism for soil pollution?

A. Promoting the use of organic manure

B. Oil extraction

C. Re-forestation

D. Dispose of pharmaceutical product in the places authorized for the purpose.

93. The set of written directions detailing how to apply a method to a particular sample, including information in proper sampling, handling of interest and validating results is _____.

A. Method **B.** Procedure **C.** Protocol **D.** Technique

94. _____is the process by which a representative fraction of a material targeted for analysis is collected.

A. Technique **B.** Sampling **C.** Analyte **D.** Analyzing

95. If the students are asked to analyze vitamin C in a given fruit, which titrant is used during titration?

A. HCl **B.** $CaCO_3$ **C.** NaOH **D.** SO_3

96. In an infrared (IR) spectrum, which of the following functional groups has the highest frequency?

A. Ketone **B.** Aldehyde **C.** Ester **D.** Alcohol

97. Which one the following types sample container is used in UV spectroscopy

A. Glass **B.** Quartz **C.** Flame **D.** A and B

98. Among the following gases one **is not** responsible for ozone layer depletion?

A. Chlorofluorocarbons **B.** Methane **C.** Tetrachloroethene **D.** Oxygen atom

99. Among the following gas pollutants, which one causes a reduction in oxygen transportation in our body?

A. Carbon mono dioxide **B.** Nitric oxide **C.** Methylene chloride **D.** All

100. Among the following which one is the coldest atmospheric layer?

A. Stratosphere **B.** Troposphere **C.** Mesosphere **D.** Ionosphere