

**ADDIS ABABA CITY ADMINISTRATION EDUCATION
BUREAU
GRADE 12 CHEMISTRY MODEL EXAMINATIONS
MESEKEREM 2015/ SEPTEMBER 2022**

NUMBER OF QUESTIONS: 80, TIME ALLOWED:-2 HOURS

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **CHEMISTRY** EXAMINATION. IN THIS EXAMINATION, THERE ARE A TOTAL OF **80 MULTIPLE CHOICE QUESTIONS**. CAREFULLY SELECT THE BEST ANSWER AND **BLACKEN** ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAMINATION PAPER CAREFULLY. USE ONLY **PENCIL** TO MARK YOUR ANSWERS. YOUR ANSWER MARK SHOULD BE **HEAVY AND DARK**, COVERING THE ANSWER SPACE COMPLETELY. PLEASE ERASE ALL UNNECESSARY MARKS COMPLETELY FROM YOUR ANSWER SHEET.

YOU ARE ALLOWED TO WORK ON THE EXAM FOR **2 HOURS**. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING, PUT YOUR PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS.

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAMINATION WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAMINATION HALL AND CANCELLATION OF YOUR SCORE (S).

PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAMINATION.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Given

$$h = 6.626 \times 10^{-34} \text{ J.s}$$

$$\text{Mass of electron} = 9.11 \times 10^{-31} \text{ kg}$$

<i>symbol</i>	<i>H</i>	<i>Li</i>	<i>Be</i>	<i>B</i>	<i>C</i>	<i>N</i>	<i>O</i>	<i>F</i>	<i>P</i>	<i>Cl</i>	<i>As</i>	<i>Eu</i>	<i>Gd</i>	<i>Am</i>	<i>I</i>
<i>Atomic number</i>	1	3	4	5	6	7	8	9	15	17	33	63	64	95	53

DIRECTIONS: Each of the following questions is followed by four possible alternatives. Read each question and carefully **blacken** the letter of your best choice on the separate answer sheet provided.

- The reaction of an anion or a cation of a salt, or both, with water is known as _____.
A. Titration
B. Saturation
C. Hydrolysis
D. Hydration
- During the laboratory session, the 12th grade student named Etsube made an error while conducting an experiment. In which part of the laboratory report writing did she indicate such an error?
A. Conclusion
B. Observation
C. Procedure
D. Result and discussion
- Which pairs of color and wave contains highest wave length?
A. Red and Radio wave
B. Violet and TV wave
C. Blue and x-ray
D. Red and IR Wave
- Which of the following is true about CO₂ molecule?
A. C=O bond is non-polar and CO₂ molecule is non-polar
B. C=O bond is polar and CO₂ molecule is non-polar
C. C=O bond is non-polar and CO₂ molecule is polar
D. C=O bond is polar and CO₂ molecule is polar
- Which of the following is correct about the name Nylon 66 co-polymer?
A. It is discovered in 1966
B. It is the sixth polymer
C. Both the monomers have 6 carbon each
D. The longest chain contains 66 carbons
- The standard state of Aluminum, Nitrogen and Water are _____ respectively.
A. Solid, liquid and gas
B. Solid, gas and liquid
C. Liquid, Solid and gas
D. Liquid, Gas and solid

7. Which batteries are faced with leak out and environmental problem respectively?
- Nickel- cadmium and fuel cells
 - Nickel- cadmium and dry cells
 - Dry cells and Mercury cells
 - Dry cells and fuel cells
8. Which substance is reduced in an alkaline-cell battery?
- Zn(s)
 - $\text{Zn}^{2+}(\text{aq})$
 - $\text{NH}_4^+(\text{aq})$
 - $\text{MnO}_2(\text{s})$
9. Which metal is used to coat iron in galvanizing?
- Al
 - Mn
 - Zn
 - Cr
10. All of the following are the type of chemical bond exist in NH_4Cl . Except?
- Ionic bond
 - Covalent bond
 - Coordinate covalent bond
 - Metallic bond
11. The bond order of a homo nuclear diatomic molecule can be decreased by ____.
- removing electrons from a bonding MO or adding electrons to an anti bonding MO
 - adding electrons to a bonding MO or removing electrons from an anti bonding MO
 - adding electrons to any MO
 - removing electrons from any MO
12. In a typical multiple bond, the σ bond results from overlap of _____ orbitals and the π bond(s) result from overlap of _____ orbitals.
- hybrid, unhybridized
 - unhybridized, hybrid
 - hybrid, hybrid
 - hybrid, hybrid or atomic
13. Molecular Orbital theory correctly predicts Para-magnetism of oxygen gas, O_2 . This is because _____.
- The bond order in O_2 can be shown to be equal to 2.
 - There are more electrons in the bonding orbitals than in the anti bonding orbitals.
 - the energy of the $2p\pi$ MOs is higher than that of the $\sigma 2p$ MO.
 - there are two unpaired electrons in the MO electron configuration of O_2

14. An anti bonding π orbital contains a maximum of _____ electrons.

- A. 1
B. 2
C. 4
D. 6

15. The molecular geometry and hybridization of ICl_4^- are

- A. Square planar and sp^3d^2
B. Square planar and sp^3d
C. Seesaw and sp^3d
D. Seesaw and sp^3d^2

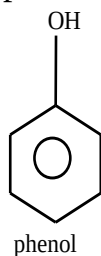
16. Which hybrid orbital doesn't contain unhybridized orbitals?

- A. SP^2
B. SP^3
C. SP
D. SP^3d

17. The π bond in ethylene, H_2CCH_2 , results from the overlap of _____.

- A. SP^3 hybrid orbitals
B. S atomic orbitals
C. SP hybrid orbitals
D. P atomic orbitals

18. Which of the following contains the *correct* types of bond that exist in phenol?



- A. 3 C=C, 3 C-C, 5 C-H and 1 O-H
B. 3 C=C, 3 C-C, 1 C-O, 5 C-H and 1 O-H
C. 6 C-C, 1 C-O, 5 C-H and 1 O-H
D. 4 C=C, 2 C-C, 2 C-O, 5 C-H and 1 O-H

19. Which of the following is **incorrect** about half-filled degenerate orbitals of phosphorus (P)? They have

- A. The same principal quantum number
B. The same azimuthal quantum number
C. The same magnetic quantum number
D. The same spin quantum number

20. What are the four quantum numbers of $5f^8$ orbitals?

	n	l	m_l	m_s
A	5	3	3	$\pm 1/2$
B	5	3	-3	$-1/2$
C	5	2	-2	$-1/2$
D	5	3	1	$1/2$

21. If we compare the four quantum numbers of $3s^1$ and $3s^2$ orbitals the first three quantum numbers are the same except spin quantum number. This concept is more explained by _____.

- A. Pauli's exclusion principle
B. Hund's principle
C. Aufbau principle
D. Heisenberg's principle

22.If the rate of decomposition of HI in to its diatomic elements is 6.0×10^{-5} mol/L.s, what is the rate of formation of iodine in the same reaction?

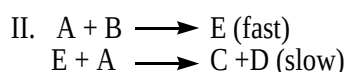
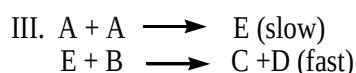
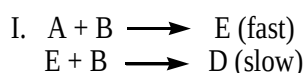
A. 2.5×10^{-5} mol/L.s

C. 6.0×10^{-5} mol/L.s

B. 3.0×10^{-3} mol/L.s

D. 3.0×10^{-5} mol/L.s

23.The rate law for a reaction is found to be $\text{rate} = K[A]^2[B]$, which of the following mechanisms gives this rate law



A. I only

C. III only

B. II only

D. II and III

24.The de Broglie wavelength (in nanometer) of a particle which has a momentum of 13.25×10^{-26} Kg m/s is:

A. 2

C. 4

B. 3

D. 5

25.According to Faraday's second law, the weights of different substances evolved by the passage of the same quantity of electricity are proportional to their _____.

A. Chemical equivalent weight

C. Current supply

B. Chemical equivalent density

D. Volume

26.The preferential discharge of ions during electrolysis is influenced by the_____.

A. Mechanism of electrolysis

C. nature of the electrode

B. electrolytic reactions

D. type of electrolytic cell

27.A simple first order decomposition reaction is 50% completed in 0.693s. How much time would it take for 90.0% completion?

A. 1.26×10^{15} s

C. 2.3s

B. 2.52×10^{-14} s

D. 26.7s

28.For the reaction $A \longrightarrow B$, the rate law is given by $r = k[A]^2$. Increasing the concentration of A by a factor of 3 will cause the rate constant to_____.

A. Increase by a factor of 8

C. Decrease by a factor of 3

B. Increase by a factor of 9

D. Remain the same

29.What is the ratio of $\text{CH}_3\text{COOH} / \text{CH}_3\text{COO}^-$, if the P^{H} of the solution is 5 and the dissociation constant (K_a) of the CH_3COOH is 1.8×10^{-5} ?

A. 5 : 9

C. 4 : 9

B. 9 : 5

D. 9: 4

30. Addition of NH_4Cl to an aqueous solution of NH_3 cause which of the following to occur?

- I. P^{H} of the solution increase
- IV. OH^- concentration increase
- II. P^{H} of the solution decrease
- V. P^{OH} of the solution decrease
- III. Percent ionization of NH_3 decrease

- A. Only IV
- C. II and III
- B. II and IV
- D. II and V

31. The rate law of a reaction is $\text{rate} = k[\text{D}][\text{X}]$. The units of the rate constant are _____.

- A. $\text{L}^{-1} \text{mol s}^{-1}$
- C. MS^{-1}
- B. $\text{L mol}^{-1} \text{s}^{-1}$
- D. $\text{L}^{-1} \text{mol}^{-1} \text{s}$

32. Which ways of expressing concentrations is best for more dilute solution?

- A. Parts per million
- C. percent by mass
- B. Parts per billion
- D. Equivalent mass

33. The rate constants for a reaction at a variety of temperatures are shown in the table below. Calculate the activation energy of the reaction by using the data below. ($R=8.314\text{J/kmol}$)

$\text{LogK (S}^{-1}\text{)}$	$\frac{1}{T} (\text{K}^{-1})$
4	25
3	35
2	45
1	55

- A. 1.9
- C. 19.0
- B. 4.4
- D. 44.0

34. An electron has a spin quantum number, $m_s = +1/2$ and a magnetic quantum number, $m_l = +1$. In which of the following orbital will it NOT be present?

- A. p- orbital
- C. s- orbital
- B. d- orbital
- D. f- orbital

35. Of the following colligative properties, which is the most practical for determining the extent of protein aggregation?

- A. Vapour- pressure lowering C. Boiling point elevation
B. Freezing point depression D. Osmotic pressure

36. At 445°C, K_c for the following reaction is 0.020.



A mixture of H_2 , I_2 , and HI in a vessel at 445°C has the following concentrations: $[\text{HI}] = 2.0 \text{ M}$, $[\text{H}_2] = 0.50 \text{ M}$ and $[\text{I}_2] = 0.10 \text{ M}$ which one of the following statements concerning the reaction quotient, Q_c , is true for the above system?

- A. Q_c is less than K_c ; more HI will be produced.
B. Q_c is greater than K_c ; more HI will be produced.
C. Q_c is less than K_c ; more H_2 and I_2 will be produced.
D. Q_c is greater than K_c ; more H_2 and I_2 will be produced.

37. Which of the following formula represent when soap reacts with hard water?

- A. $2\text{C}_{17}\text{H}_{35}\text{COO}^- \text{Na}^+$ C. $\text{CH}_3(\text{CH}_2)_{10}\text{-CH}_2\text{-OSO}_3^- \text{Na}^+$
B. $(\text{C}_{17}\text{H}_{35}\text{COO})_2\text{Mg}$ D. $\text{CH}_3(\text{CH}_2)_{10}\text{-CH}_2\text{-OSO}_3^- \text{Mg}^{2+}$

38. Which of the following is true about the advantage of detergents over soaps?

- A. Detergents are soluble in water
B. Soaps give lather with only soft water
C. Detergents are environmental friend.
D. Detergents give lather even with hard water

39. Which resonance structure of Cyanate ion (OCN^-) makes the greatest contribution to the resonance hybrid?

- A. $[\text{:}\ddot{\text{O}}\equiv\text{C}-\ddot{\text{N}}:]^-$ C. $[\text{:}\ddot{\text{O}}-\text{C}\equiv\text{N:}]^-$
B. $[\ddot{\text{O}}=\text{C}=\ddot{\text{N}}:]^-$ D. $[\ddot{\text{O}}-\text{C}-\ddot{\text{N}}:]^-$

40. All of the following statements are correct about benzoic acid, **except**?

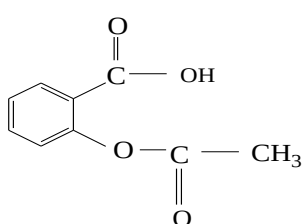
- A. Like other inorganic acid it is liquid in nature
B. It is solid in nature
C. It is the simple aromatic carboxylic acid
D. It is colorless

41. What are the number of phases, components and degree of freedom for the mixture of white powders of sugar and potassium chloride are _____ respectively?

- A. 1,1, and 2 C. 2,2, and 2
B. 1,2, and 3 D. 1,3, and 4

42. Why higher carboxylic acids are almost insoluble in water? This is because
- Hydrogen bond between higher acids and water are increases.
 - Hydrogen bond between higher acids and water are decreases.
 - London force between higher acids and water are decreases.
 - Dipole-dipole force between higher acids and water are increases
43. The unit of K_p for the reaction
- $$\text{NH}_4\text{Cl(s)} \rightleftharpoons \text{NH}_3\text{(g)} + \text{HCl(g)}; \text{ is } \underline{\hspace{2cm}}.$$
- atm
 - 1
 - atm^2
 - $1/\text{atm}$
44. P^{Ka} values of three acids X, Y and Z are 5.7, 2.4 and 8.5, respectively. Which of the following represents the correct order of acid strength?
- $X > Y > Z$
 - $Z > X > Y$
 - $Y > X > Z$
 - $Z > Y > X$
45. Which of the following pairs **correctly** matches the name of polymers and their monomers?
- Neo prene- isoprene and chloroprene
 - Bakelite-alcohol and formaldehyde
 - Nylons-hexanoic acid and adipic acid
 - Butyl Rubber-isobutylene and isoprene
46. Which of the following have the same cell reaction as the electrolysis of dilute NaCl?
- Electrolysis of brine solution
 - Electrolysis of molten NaCl
 - Electrolysis of dilute H_2SO_4
 - Electrolysis of conc. HCl
47. Of the following ions, which has the smallest radius?
- $^{19}\text{K}^+$
 - $^{20}\text{Ca}^{2+}$
 - $^{21}\text{Sc}^{3+}$
 - ^{36}Kr
48. Which of the following electrolysis used to produce NaOH solution?
- Electrolysis of concentrated NaCl
 - Electrolysis of dilute NaCl
 - Electrolysis of molten NaCl
 - Electrolysis of molten Na_2SO_4

49. Which observation(s) reflect(s) colligative properties?
- A 0.5m NaBr solution has a higher vapour pressure than 0.5m BaBr solution
 - A 0.5 m NaOH solution freezes at a lower temperature than pure water
 - pure water freezes at a higher temperature than pure methanol
- only I
 - only II
 - only III
 - I and II
50. If we have three aqueous solution of Na_2SO_4 labeled as 'A', 'B', 'C' with concentrations 0.123m, 0.0123m and, 0.00123m, respectively. The van't Hoff factor for these solutions will be:
- $i_A < i_B < i_C$
 - $i_A > i_B > i_C$
 - $i_A = i_B = i_C$
 - $i_A < i_B > i_C$
51. Which one of the following acid-base definition classify BF_3 as acid?
- Arrhenius
 - Lewis
 - Bronsted-Lowry
 - Hund's principle
52. The ultra violet series that arise when higher energy electrons drop to the ground state is:
- Bracket series
 - Balmer series
 - Lyman series
 - Paschen series
53. Which one of the following is correct about the reaction between Lewis acid and Lewis base?
- They produce salt and water
 - The chemical bond between them is ionic bond
 - The chemical bond between them is metallic bond
 - The chemical bond between them is coordinate covalent bond
54. Acetylsalicylic acid (Aspirin) has the structural formula:



Which functional group (groups) is (are) present in this compound?

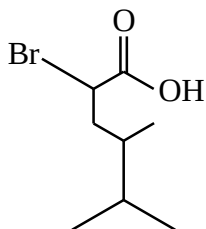
- Aromatic, carboxylic acid, ester
- Aromatic, carboxylic acid
- Carboxylic acid, ester
- Aromatic, ester

55. If the equilibrium constant for the reaction

$$\text{A} + 2\text{B} \rightleftharpoons \frac{4}{3}\text{C} + \text{D}$$
 has a value of 10, what is the value of the equilibrium constant for the reaction
$$4\text{C} + 3\text{D} \rightleftharpoons 3\text{A} + 6\text{B}$$
 at the same temperature?

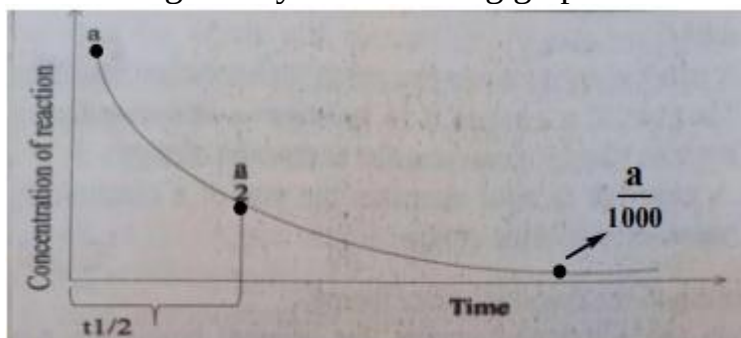
- 0.001
- 1000
- 1/100
- 100

56. An equilibrium that strongly favors products has _____.
 A. a value of $K \gg 1$.
 B. a value of $K \ll 1$.
 C. a value of $Q \ll 1$.
 D. $K = Q$.
57. For which of the following elements is **Hund's rule** used in writing the electron configuration?
 A. B
 B. Li
 C. Be
 D. C
58. Which of the following equation is free from spectator ions?
 A. molecular equations
 B. ionic equation
 C. net ionic equation
 D. balanced equation
59. The main ore of Lead is:
 A. Cinnabar
 B. Hematite
 C. Galena
 D. Chromite
60. The pH of a solution prepared by mixing 50.0 mL of 0.125 M KOH and 50.0 mL of 0.125 M HCl is _____.
 A. 11
 B. 7
 C. 2.4
 D. 3.4
61. What is the coefficient of the permanganate ion when the following equation is balanced? $\text{MnO}_4^- + \text{Br}^- \rightarrow \text{Mn}^{2+} + \text{Br}_2$ (acidic solution)
 A. 1
 B. 2
 C. 3
 D. 5
62. When 4.6 is divided by 12.786 the actual answer is 1.6511. What will be the correct answer?
 A. 1.6
 B. 1.65
 C. 1.7
 D. 16.2
63. The IUPAC name of the following compound is_____.



- A. 2-bromo-4,4-dimethyl hexanoic acid
 B. 2,4,5-trimethylhexanoic acid
 C. 1-hydroxy-2-bromo- 4,5-dimethylhexanoate
 D. 2-bromo-4,5-dimethyl hexanoic acid

64. For a first order reaction, the concentration versus time of the reaction mixture is given by the following graph



If a is the initial concentration of the reactant and its half-life is 0.1 hr., after how many hours would be the concentration of reactant produced to $a/1000$?

- A. 5hr
B. 1hr
C. 3hr
D. 4hr

65. Which of the following is Measuring equipment?

- A. flasks
B. boiling tubes
C. test tubes
D. Pipettes

66. The sanitizer is labeled 83.5% alcohol. How can one scientifically check the concentration?

- A. Experimentation
B. making observation
C. theory
D. data collection

67. Who used “the cathode ray tube” to discover the electron and determine its charge to mass ratio?

- A. R. Millikan
B. J.J. Thomson
- C. J. Chadwick
D.W. Crookes

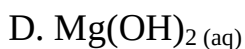
68. The unit of equivalent mass is _____.

- A. eq
B. eq/g
C. eq/mol
D. g/eq

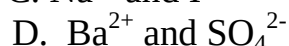
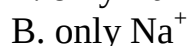
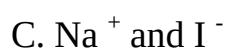
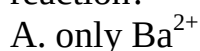
69. Which of the following is true about the relationship between acid and its conjugate base?

- A. Conjugate base has one less H and one more minus charge than the acid.
- B. Conjugate base has one less H and one less minus charge than the acid.
- C. Conjugate base has one more H and one more minus charge than the acid.
- D. Conjugate base has one more H and one less minus charge than the acid.

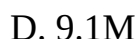
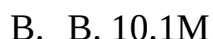
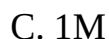
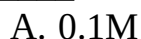
70. In which one of the following aqueous solution does molarity and normality are equal:



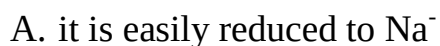
71. Combining aqueous solutions of BaI_2 and Na_2SO_4 produce a precipitate of BaSO_4 . Which ion(s) is/are spectator ions in the reaction?



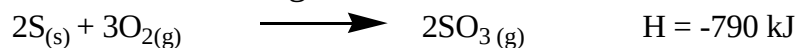
72. A 10.0 ml aliquot of HCl (aq) of unknown concentration was titrated with 0.1 M NaOH (aq). It took 100.0 mL of the base to reach the endpoint of the titration. The concentration (M) of the acid was _____.



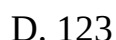
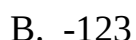
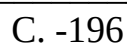
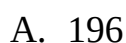
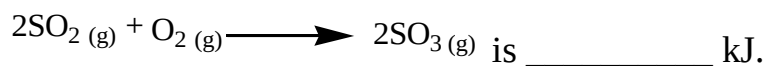
73. Sodium does not occur in nature as Na (s) because _____.



74. Given the following reactions:



Calculate ΔH° (in kJ) for reaction below, the enthalpy of the reaction in which sulfur dioxide is oxidized to sulfur trioxide



75. Of the following, which one is a path function?



76. A rock deposit that contains enough mineral to make it economically feasible to extract and purify to derive a desired product material is known as _____.



77. During the extraction of aluminum by the electrolysis of molten aluminum oxide, what is the purpose of adding cryolite (Na_3AlF_6) to aluminum oxide?
- A. To decrease electrical conductivity
 - B. To increase the melting point
 - C. To lower the melting point
 - D. To increase the amount
78. Which one of the following polymers is formed by condensation polymerization?
- A. Polyvinyl chloride
 - B. polyesters
 - C. Teflon
 - D. polystyrene
79. Natural rubber is too soft and chemically reactive for practical applications. Vulcanization of natural rubber entails _____.
- A. the elimination of a small atom like Sulphur
 - B. cross linking reactive polymer chains with sulfur atoms
 - C. Conversion of a condensation polymer to an addition polymer.
 - D. Increasing the average molecular weight of a condensation polymer.
80. The K_b of ammonia is 1.85×10^{-5} . The pH of a buffer prepared by combining 75.0 mL of 1.00 M ammonia and 75.0 mL of 1.00 M ammonium nitrate is _____.
- A. 4.74
 - B. 13.3
 - C. 6.6
 - D. 9.26