OROMIA EDUCATION BUREAU

FIRST ROUND MODEL EXAM FOR GRADE 12 STUDENTS, **2017/2025.**

TIME ALLOWED: $2\frac{1}{2}$

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS *CHEMISTRY* **FIRST ROUND MODEL EXAM** FOR **GRADE 12.** IN THIS BOOKLET, THERE ARE TOTAL OF **80** MULTIPLE CHOICE QUESTIONS.

THERE IS ONLY ONE BEST ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE GIVEN ALTERNATIVES AND WRITE THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET PROVIDED.

YOU ARE ALLOWED TO WORK ON THE EXAM QUESTIONS FOR $2\frac{1}{2}$ hours **ONLY.**

WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING ON THE QUESTIONS AND PUT DOWN YOUR PEN/PENCIL AND WAIT FOR WHAT YOU MIGHT BE TOLD TO DO.
ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAM WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAM HALL AND CANCELLATION OF YOUR SCORE.

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

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

➢ **PHYSICAL CONSTANTS**

- ✦ Gas constant R= 8.314 J mol⁻ K⁻ = 0.0821 Latmmol⁻¹K⁻¹
- ✦ Avogadro''s number = 6.023×10^{23} mol⁻
- ✦ Plank''s constant h=6.626×10^{-34} Js⁻,
- ✦ Rydberg constant= -2.18×10^{-18} J
- ✦ Log 2.7=0.43, log1.8=0.255
- ✦ Kb (NH₃)=Ka (CH₃COOH)=1.8×10^{-5}
- ✦ Speed of light, C = 3×10^{8} m/s
- ✦ Faradays constant, F = 96500 C/mol
- ✦ Mass of an electron = 9.11×10^{-31} Kg
- ✦ Charge of electron= 1.6×10^{-19} C

➢ **Atomic Number (Z) and Atomic Weight (A)**

Element	H	He	Li	Be	B	C	N	O	F
Z	1	2	3	4	5	6	7	8	9
A	1.0	4.0	6.9	9.01	10.8	12.0	14.0	16.0	19.0
Element	Ne	Na	Mg	Al	P	S	Cl	Ar	K
Z	10	11	12	13	15	16	17	18	19
A	20.2	23.0	24.3	26.98	31.0	32.1	35.5	39.95	39.0
Element	Ca	Mn	Cr	Cu	Zn	Br	Ag	I	pb
Z	20	25	24	29	30	35	47	80	82
A	40.08	54.9	52	63.55	65.38	79.90	108	200.6	207

➢ **Standard *reduction potential values of selective species***

- ✓ $E^0(Zn^{2+}/Zn)$_____-0.76v
- ✓ $E^0(Cr^{3+}/Cr)$ _____-0.74v
- ✓ $E^0(Pb^{2+}/Pb)$ _____0.13v
- ✓ $E^0(Ni^{2+}/Ni)$ _____-0.25v
- ✓ $E^0(Al^{3+}/Al)$ _____-1.66v
- ✓ $E^0(Mg^{2+}/Mg)$ ____-2.37v
- ✓ $E^0(Fe^{2+}/Fe)$ _____-0.44V

- ✓ $E^0(Ag^+/Ag)$ _____0.8v
- ✓ $E^0(Mn^{2+}/Mn)$ ___-1.18v
- ✓ $E^0(Cu^{2+}/Cu)$ ____0.34v
- ✓ $E^0(Ca^{2+}/Ca)$ ____-2.87
- ✓ $E^0(Au^{3+}/Au)$ ___1.5v
- ✓ $E^0(Cd^{2+}/Cd)$ ____-0.4V

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1. Which of the following is correct about the postulates of Thomson's experiment?
   A. Cathode rays are made of positively charged particles, later called electrons.
   B. Electrons are NOT present in all atoms of all elements.
   C. Electrons have a very large mass compared to the atom.
   D. Cathode rays travel in straight lines and can be deflected by electric and magnetic fields

2. Imagine you are a scientist in the 19th century and want to improve Dalton's Atomic Theory. Which of the following new experiments would best refine his ideas?
   A. Designing a cathode ray tube experiment to identify subatomic particles.
   B. Proposing that all atoms are made of fire, water, air, and earth
   C. Conducting an experiment to prove that atoms cannot form compounds.
   D. Showing that atoms of the same element have completely different masses.

3. The atomic mass of element A is 91 atomic mass unit. The only naturally occurring isotopes of element A are A-90 and A-94. The percent abundance in naturally occurring sample of element A are
   A. 31 % A-90 and 69 % A-94
   B. 75 % A-90 and 25 % A-94
   C. 69 % A-94 and 31 % A-90
   D. 20 % A-94 and 80% A-90

4. Which of the following statements best explains the relationship between electrons energy levels and the emission spectra of atoms?
   A. Electrons absorb energy on jumping from lower to higher energy level
   B. Electron emit energy on revolving around the nucleus
   C. Electron absorb energy on revolving around the nucleus
   D. The emission spectra are unrelated to electron transitions but depend on atomic size.

5. Which one of the following sets of quantum numbers could be those of the distinguishing (last) electron of Cr at s-orbital?
   A. $n = 3$, $l = 0$, $ml = 0$, ms = +1/2
   B. $n = 3$, $l = 2$, $ml = -1$, ms = +1/2
   C. $n = 4$, $l = 1$, $ml = 3$, ms = -1/2
   D. $n = 4$, $l = 0$, $ml = 0$, ms = -1/2

6. A radio station broadcasts at a frequency of 100 MHz. What is the wavelength of the radio waves? *(Speed of light, c = 3.00 × 10⁸ m/s)*
   A. 3.0×10^{-2} m
   B. 3.0 m
   C. 3.0×10^6 m
   D. 3.0×10^{-3} m

7. The photoelectric effect can be observed when:
   A. Light with low intensity shined on a metal surface.
   B. Light of sufficient frequency shining and ejects electrons from a metal
   C. Electrons jump to higher energy levels when exposed to light
   D. The intensity of light is increased with decreasing frequency

8. Which of the following molecules is correctly matched with its geometry?
   A. IF_5 – Trigonal pyramidal
   B. PCl_3 – Trigonal bipyramidal
   C. BrF_3 – T-shape
   D. SF_4 – Square pyramidal

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9. Which of the following is TRUE about periodic trend of elements
    A. Ionization energy increases down a group
    B. Atomic size decreases across a period
    C. Both atomic size and electron affinity have the same periodic trend.
    D. Effective nuclear charge increase down a group.

10. Which of the following best describes the nature of chemical bonds?
    A. A repulsive force that separate atoms
    B. A temporary interaction between particles
    C. An attractive force that holds atoms or ions together
    D. A force that change atomic nuclei

11. Which of the following condition favors the formation of an ionic bond?
    A. Low ionization energy of metal and high electron affinity of non-metal
    B. High ionization energy of metal and low ionization energy of non-metal
    C. High electron affinity of metals and low ionization energy of non-metal
    D. Large atomic size of nonmetal

12. The electron set geometries of NH_3 and H_2O molecules are distorted tetrahedral but bond angle in water is less than that of ammonia. Why?
    A. LP-LP of H_2O repeal strongly than LP-BP of NH_3 does
    B. LP-BP of H_2O repeal strongly than LP-BP of NH_3 does
    C. Generally lone pair-lone pair repulsion is weaker than lone pair-bond pair repulsion
    D. H_2O is polar and NH_3 is non-polar

13. Which of the following is NOT true of about properties of metallic bonding?
    A. It gives rise to excellent electrical conductivity
    B. Valence electrons are free to move throughout the structure
    C. The conductivity of electric current is due to the presence free ions
    D. The strength of metallic bond affect physical properties of metals

14. Which of the following is correctly describes the hybridization of the central atom in PCl_5?
    A. sp^3 hybridization   C. sp^2 hybridization
    B. sp^3d hybridization   D. sp hybridization

15. According to Molecular orbital theory, which of the following species does NOT Exist?
    A. O_2^{2-} B. He_2 C O_2 D. C_2

16. Which of the following molecules is the WRONG combination arrangement of the molecules with their respective molecular geometry?

Molecule/ion	designation- Type	Hybridization
A. CH4	AX_4	SP^3
B. H_2O	AX_2E_2	Sp^2
C. CO_2	AX_2	Sp
D. $BeCl_2$	AX_2	Sp

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17. Given the following polyatomic and diatomic molecules arbitrarily

CH_4, NH_3, H_2S, CH_4, OF_2, NF_3, H_2O, CO_2, N_2, HF, HBr

Which one of the following set of molecules is described the correct intermolecular force of attraction?

Options	Set of molecules	Intermolecular force
A	CH_4, CCl_4, N_2, CO_2	London force
B	CO_2, H_2O, HF, NF_3	Hydrogen bonding
C	H_2S, CCl_4, NF_3, HBr, N_2	Dipole - dipole force
D	H_2S, NF_3, CCl_4, HBr, N_2	Dipole - dipole force

18. Which of the following molecule contain a two pi bond and two sigma bonds ONLY?

    A. CO   B. CH_4 C. HCN   D. H_2O

19. Which of the following shapes is configuring for molecule, SO_3?

    A.   B   C   D
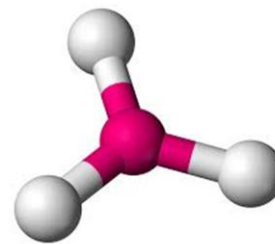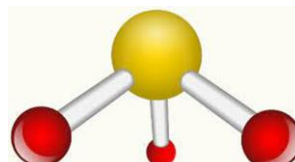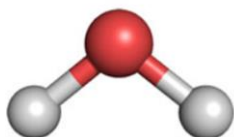
20. Which of the following compound would have the same electrolysis of water

    A. Concentrated NaCl (aq)   C. Molten Al_2O_3

    B. Diluted HCl (aq)   D. Concentrated NaCl

21. The pressure of a gas in a cylinder when heated to a temperature of 250 K is 1.5 atm. What is the initial temperature of the gas if its initial pressure was 1.0 atm?

    A. 166.67 K   B. 300K   C. 200K   D. 100K

22. The correct increasing order of rate of diffusion of gases PH_3, O_2, CH_4, NH_3, HCl is:

    A. O_2, $< HCl < PH_3 < NH_3 < CH_4$ C. $HCl < PH_3 < O_2 < NH_3 < CH_4$

   B. $CH_4 < NH_3 < PH_3 < O_2 < CH_4$ D. $PH_3 < CH_4 < NH_3 < HCl < O_2$

23. Which of the following statements is TRUE about alkanes and alkenes?

    A. Alkanes are unsaturated hydrocarbons, while alkenes are saturated hydrocarbons.

    B. Alkanes and alkenes are both saturated hydrocarbons.

    C. Alkanes are saturated hydrocarbons, while alkenes are unsaturated hydrocarbons.

    D. Alkanes and alkenes are both unsaturated hydrocarbons.

24. How does the kinetic energy of gas particles compare to that of liquid and solid particles?

    A. Gas particles have the least kinetic energy

    B. Gas particles have the most kinetic energy

    C. Gas particles have the same kinetic energy as solids

    D. Gas particles have no kinetic energy

25. According to the given the diagram below, as the temperature of the substance increase, which phase change will occur?
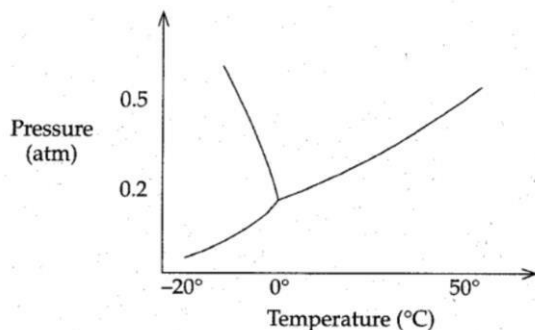
A. Gas to liquid

B. Gas to Gase

C. Liquid to solid

D. Liquid to gas

26. Which of the following precondition of the reaction is necessarily important?
   A. Proper orientation
   B. Ineffective collision
   C. High activation energy
   D. Minimum pressure

27. For the chemical reaction $H_2 + Br_2 \rightarrow 2HBr$, what can be said of the relative rates of consumption of the reactants when compared to the formation of product?
   A. HBr will be produced at half the rate that bromine is consumed.
   B. HBr will be produced at the same rate that bromine is consumed.
   C. Br_2 and H_2 will be consumed at different rates.
   D. HBr will be produced at twice the rate that bromine is consumed

28. Why does power zinc react faster with hydrochloric acid than a solid block?
   A. Powdered zinc has lower energy
   B. Powdered zinc has a higher surface area for collision
   C. The solid block has more atoms
   D. Solid blocks dissolved faster

29. Which of the following is TRUE regarding the concentration of products, for a chemical reaction that is already at equilibrium, assuming no disruptions to the equilibrium?
   A. The concentrations of product and reactant are equal
   B. The rate of forward and backward reaction are equal at equilibrium
   C. The rate of forward and backward reaction are constant but may not be equal
   D. The concentrations of products will change continually because of reversibility.

30. If the reaction quotient Qc has a smaller value than the related equilibrium constant, Kc:
   A. The reaction is at equilibrium.
   B. The reaction is not at equilibrium, and will make more products at the expense of reactants.
   C. The reaction is not at equilibrium, and will make more reactants at the expense of products.
   D. The value of Kc will decrease until it is equal to Qc

31. What does Le chaterlier's principle state about equilibrium?
   A. A system at equilibrium will always remain unchanged at any condition
   B. If a system at equilibrium is disturbed, it will shift to oppose the disturbance.
   C. Equilibrium is only affected by temperature changes.
   D. The addition of a catalyst will change the equilibrium position

32. For the reaction $CO\ (g) + H_2O\ (l) \rightleftharpoons CO_2\ (g) + H_2\ (g)$, how does adding CO_2 affect equilibrium?
   A. The reaction shift to toward products
   C. No change occur
   B. The reaction shift toward the reactants
   D. The reaction stop

33. Which of the following cause the greatest shift in equilibrium to the left for the hypothetical reaction given: $A(g) \rightleftharpoons B\ (g) + C(g)$.
   A. Increases pressure
   C. Decrease temperature
   B. Adding catalyst
   D. Adding more PCl_5

34. Which of the following correctly defines alcohol?
   A. hydrocarbon containing an oxygen atom
   B. A compound containing a hydroxyl(-OH) group attached to a carbon atom
   C. A compound with an oxygen atom bonded to two alkyl groups
   D. A compound containing carbonyl (-C=O) group

35. Alcohols **A**, **B** and **C** all have the composition $C_4H_{10}O$. Molecules of alcohol **A** can be oxidized to an aldehyde; molecules of alcohol **B** can be oxidized to a ketone; and molecules of alcohol **C** can be oxidized to neither an aldehyde nor a ketone. What is the correct the structural formulas molecules A, B, and C respectively?

choice	Structural formula of **A**	Structural formula of **B**	Structural formula of **C**
A	1-butanol	2-butanol	2-methyl-2-propanol
B	2-butanol	1-butanol	Ether
C	3-buthabnol	2-butanol	1-butanol
D	2-mthylbutanol	2-butanol	Ether

36. Which one of the following about alcohol NOT true?
   A. dihydric and the trihydric alcohols have higher boiling points than monohydric alcohols of similar molecular size
   B. The solubility of alcohols in water increases with increasing carbon number.
   C. The water solubility of dihydric and trihydric alcohols are higher than those of monohydric alcohols of similar molecular mass.
   D. The boiling point of a branched isomer is lower than that of its isomeric straight-chain alcohol.

37. Which of the following is NOT a physical property of saturated monocarboxylic acids?
   A. High boiling point
   C. Soluble in water (lower members)
   B. Weakest intermolecular force
   D. Oily or waxy nature (higher members)

38. The statement accurately describes the chemical composition of fats?
   A. Esters of glycerol with three saturated fatty acids
   B. Esters of glycerol with one saturated fatty acids.
   C. Esters of glycerol with three unsaturated fatty acids.
   D. Esters of glycerol with two fatty acids

39. Given the following set of compounds, alcohol and carboxylic acids. Select which one is correctly arranged in increasing order of their boiling points.

➢ $CH_3CH_2CH_2 CH_2OH$, $CH_3CH(CH_3)CH_3$, $CH_3(CH_2)_5COOH$, $CH_3C(CH_3)_2COOH$

A. $CH_3C(CH_3)_2COOH < CH_3CH_2CH_2 CH_2OH < CH_3(CH_2)_5COOH < CH_3CH(CH_3)CH_3$
B. $CH_3(CH_2)_5COOH < CH_3CH(CH_3)CH_3 < CH_3C(CH_3)_2COOH < CH_3CH_2CH_2CH_2OH$
C. $CH_3CH(CH_3)CH_3 < CH_3CH_2CH_2CH_2OH < CH_3(CH_2)_5COOH CH_3C(CH_3)_2COOH$
D. $CH_3CH(CH_3)CH_3 < CH_3CH_2CH_2CH_2OH < CH_3C(CH_3)_2COOH < CH_3(CH_2)_5COOH$

40. Which of the following is correct about the discovery of subatomic particles?
   A. The experiment of nucleus discovery is cathode ray experiment
   B. Neutron is discovered by JJ.Thomson
   C. Nucleus is discovered by alpha particle scattering experiment
   D. Proton is discovered by discharge tube experiment

41. An element has three isotopes:
   Isotope 1: mass = 10 amu, abundance = 2%
   Isotope 2: mass = 20 amu, abundance = 95%
   Isotope 3: mass = 30 amu, abundance = 3%

Which of the following is the most likely atomic mass for this element without any calculation?
   A. About 23.00 amu, because it is the average mass of the isotopes.
   B. About 20.00 amu, because the heaviest isotopes is the most abundant.
   C. About 25.00 amu, because it's the median mass of the isotopes.
   D. About 10.00 amu, because the lightest isotope is the least abundant.

42. What is the period and group of the element with atomic number 19? (Und)
   A. It is Period 2, Group IA and p block element
   B. It is Period 3, Group IA and s block metal
   C. It is Period 2, Group IIA and transition metal
   D. It is Period 3, Group IIIA and d block element

43. How does atomic radius change as you move down a group in the periodic table, and why
   A. It decreases due to stronger nuclear attraction.
   B. It remains constant because electron shielding has no effect.
   C. It increases due to available of more number of shell
   D. It decreases because valence electrons experience more attraction from the nucleus.

44. Which of the following statements is true about nonpolar covalent molecules?
   A. They share electron unequally
   B. They are always asymmetrical geometry
   C. They dissolve easily in water.
   D. They have equally sharing of electron.

45. A student needs to determine which compound has the highest boiling point from the given compounds: H_2S, CO_2, NH_3, or CH_4. Based on your understanding of intermolecular force, which option would you recommend and why?
   A. H_2S, because it has the weakest London dispersion forces.
   B. CO_2, because it has dipole-dipole interactions.
   C. NH_3, because it forms strong hydrogen bonds.
   D. CH_4, because it has stronger dipole-dipole forces.

46. What does the Law of Conservation of Mass state?

    A. Matter can be created and destroyed in a chemical reaction.

    B. The total mass of reactants and products are equal in balanced chemical reaction.

    C. The composition of a compound varies depending on how it is prepared.

    D. The ratio of elements in a compound changes based on reaction conditions.

47. A student performs a reaction with two reactants and finds that the actual yield is significantly lower than expected. Which approach would best help them determine whether a reactant was limiting or in excess?

    A. Calculate the theoretical yield based on stoichiometry and compare it with the actual yield.

    B. Measure the temperature change of the reaction to assess reactant consumption

    C. Weigh only one reactant before and after the reaction and assume the other is limiting.

    D. Estimate the product yield visually to determine whether the reaction reached completion.

48. What is meant by an amphiprotic species?

    A. A species that can donate a proton (acid) or accept a proton (base).

    B. A species that can only donate a proton

    C. A species that can only accept a proton

    D. A species that cannot donate or accept a proton.

49. In each of the reactions listed below, identify the correct Bronsted-Lowry acid base reaction.

    A. CH_3COOH (aq.) + H_2O (l) $\rightleftharpoons$ CH_3COOH_2 (aq) + H_3O^+ (aq.)

    B. HCN (aq) + SO_4^{2-} (aq.) $\rightleftharpoons$ CN^- (aq) + HSO_4^- (aq.)

    C. HF (aq) + NH_3 (g) $\rightleftharpoons$ F^- (aq) + NH_3 (aq.)

    D. $HClO_4$ (aq.) + F^-(aq) $\rightleftharpoons$ ClO_4^- (aq) + H_2F^+ (aq)

50. In the reaction: $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$, what is the acid-base conjugate pair involving in the reaction?

    A. $HCOOH$ and CH_3COO^- C. CH_3COO^- and H_2O

    B. CH_3COOH and H_3O^+ D. H_2O and H_3O^+

51. A solution has a hydroxide ion concentration of $[OH^-] = 2.5 \times 10^{-3}$ M. Using Kw = 1.0×10^{-14}, how would you determine the hydronium ion concentration $[H_3O^+]$ at $25^O{}_c$

    A. $[H_3O^+] = (1.0 \times 10^{-14}) / (2.5 \times 10^{-3})$ C. $[H_3O^+] = (1.0 \times 10^{-14}) + (2.5 \times 10^{-3})$

    B. $[H_3O^+] = (2.5 \times 10^{-3}) \times (1.0 \times 10^{-14})$ D. $[H_3O^+] = (1.0 \times 10^{-14}) - (2.5 \times 10^{-3})$

52. If a 0.05 M solution of $Ba(OH)_2$ completely dissociates in water, what is the $[OH^-]$ and pH?

    A. $[OH^-]=0.05M$, pH = 2   C. $[OH^-]=0.025M$, pH = 1.6

    B. $[OH^-]=0.10M$, pH = 13   D. $[OH^-]=0.01M$, pH = 2

53. Two students argue about the hydroxide ion concentration in a solution with a pH of 4. Student A suggested $[OH^-] =1.0\times10^{-10}$ M, while Student B suggested $[OH^-] =1.0\times10^{-4}$ M. Who is correct?

    A. Student A, because pOH =14−PH and $[OH^-]=10^{-pOH}$

    B. Student B, because in acidic solutions $[OH^-]$ is greater than $[H^+]$.

    C. Neither, because $[OH^-]$ can't be calculated from pH

    D. Both are correct because pH and pOH are independent values.

54. Which of the following is the Net Effect for addition of sodium acetate (CH_3COONa) to acetic acid (CH_3COOH) solution?

    A. $[H_3O^+]$ increase   C. pH decrease

    B. $[OH^-]$ increase   D. ionization level of CH_3COOH increase

55. Which of the following is an example of a common buffer system?

        A. NaCl and HCl   B. H_2CO_3 and HCO_3^- C. H_2SO_4 and SO_4^{2-} D. NaOH and H_2O

56. What is the primary function of a buffer solution?

     A. To speed up chemical reactions

     B. To completely neutralize acid and base

     C. To resist pH changes when acids or bases are added

     D. To prevent neutralization reaction

57. If you mix acetic acid (CH_3COOH) with sodium acetate (CH_3COONa), what will be the resulting solution?

     A. A strong acid solution   C. A neutral solution

     B. A strong base solution   D. A buffer solution

58. Which of the following is the correct difference between soap and detergent?

     A. Soap is better than detergent

     B. Soap is made from synthetic fats or oils, while detergents are natural.

     C. Soaps do not work well in hard water, but detergents work better in hard water.

     D. Both soap and detergent are equally dissolve in water

59. If a buffer solution has a pH of 7.4 and additional small amount of HCl is added, what will likely happen?

     A. The pH will decrease slightly   C. The buffer will break down immediately

     B. The pH will increase significantly   D. The pH will remain exactly the same

60. Why is the bicarbonate buffer system essential in human blood?

     A. It neutralizes strong acids only

     B. It maintains blood pH within a narrow pH range

     C. It increases oxygen levels in the blood

     D. It eliminates carbon dioxide

61. Consider potassium phosphate (K_3PO_4) dissolving in water. Why does the solution to be basic?

     A. The phosphate ion (from a weak acid) hydrolyzes to produce OH^- ions.

     B. The potassium ion hydrolyzes to produce OH^- ions.

     C. Both ions hydrolyze equally to raise the pH.

     D. Neither ion hydrolyzes.

62. A chemist is examining the titration curve of a reaction between an acid and a base. By analyzing the curve, the chemist notices that after a certain volume of titrant has been added, the neutralization reaction is nearly complete. Based on your analysis of the titration data, which statement best defines the equivalence point?

     A. Amount of titrant = Amount of analyte in a sample.

     B. Amount of titrant > Amount of analyte in a sample.

     C. Amount of titrant < Amount of analyte in a sample.

     D. Neither of titrant nor titrand consumed

63. Which of the following is TRUE about the titration of 50ml of 0.5M CH_3COOH
   ($Ka = 1.8 \times 10^{-5}$) with 0.25 M NaOH? (pKa = 4.74)
   - A. Equivalent point occurs when 50 ml of NaOH is added
   - B. pH of the solution after addition of 50 ml of NaOH is equal to pKa of CH_3COOH
   - C. pH at the equivalence point is greater than 7.00
   - D. The resulting solution is acidic when 50 ml of NaOH is added

64. Which of the following is correct about oxidation-reduction reaction?
   - A. Oxidation reaction is takes place by losing of electron
   - B. Electron is always transferred from oxidizing agent to reducing agent
   - C. Reduction is takes place by increasing its oxidation number
   - D. The reaction is takes place without transferring of electron.

65. Which of the following is TRUE about metallic conductors?
   - A. There is flow of electrical energy and transfer of matter
   - B. Electrical conduction through metals does bring about chemical transformations
   - C. Free and mobile electrons of the metallic atoms are responsible for electrical conductance
   - D. Conductivity of metal increases with increase in temperature

66. A For the electrolysis of aqueous copper (II) sulfate, which of the following statements is correct?
   - A. Cu and O_2 are produced in mol ratio of 1:1
   - B. H_2 and O_2 are produced in mol ratio of 1:1
   - C. H_2 and O_2 are produced in a mol ratio of 2:1
   - D. Cu and O_2 are produced in a mol ratio of 2:1

67. A silver electrode is placed in a solution of $AgNO_3$, and a current of 1.5 A is passed for 20
   minutes. Given that the molar mass of Ag is 108 g/mol, how much silver is deposited?
   - A. 0.42 g   B. 1.01 g   C. 2. g   D. 3.8

68. A copper and zinc strip are connected to a battery and placed in separate solutions of their sulfates.
   If equal currents pass through both solutions, which of the following metal will deposit is correct
   (Assume the molar mass of Cu and Zn is almost equal?
   - A. Zinc, because its atomic mass is higher
   - B. Zinc, because its sulfate is more soluble
   - C. Copper that requires fewer electrons per ion to deposit
   - D. They will deposit equally

69. What is Faraday's first law of electrolysis?
   - A. The amount of substance deposited is directly proportional to the voltage
   - B. The amount of substance deposited is inversely proportional to the time taken
   - C. The amount of substance deposited is inversely proportional to the charge
   - D. Amount of substance deposited is directly proportional to the charge passed through the cell

70. The process of electro refining of copper involves electrolysis. What is the primary purpose of this
   process in industry?
   - A. To add impurities to copper
   - B. To decrease the temperature of copper
   - C. To make copper a better conductor
   - D. To remove impurities from copper

71. Given the challenges of corrosion in metal products, evaluate the effectiveness of electroplating in
   preventing rust formation compared to other protective methods used in the manufacturing industry.
   - A. Electroplating is the most effective method that forms durable protective coating on metals.
   - B. Electroplating is less effective than galvanization because it requires more maintenance.
   - C. Electroplating is ineffective in preventing rust formation at extreme temperatures.
   - D. Electroplating is only effective when metals are combined with nonmetals.

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72. Which of the following statements correctly distinguishes between primary and secondary cells?
   A. Primary cells can be recharged, while secondary cells cannot
   B. Secondary cells convert chemical energy into electrical energy only once
   C. Primary cells are for single-use, while secondary cells can be recharged
   D. Both types of cells are rechargeable

73. In a galvanic cell, why does oxidation occur at the anode?
   A. Because the anode is always negatively charged in electrochemical cell
   B. Because electrons are sources from anode and enter to cathode
   C. Because reduction can only happen at the cathode
   D. Because the anode gains electrons

74. Which of the following is best describing the difference between electrolytic and galvanic cell?

option	Electrolytic cell	Galvanic cell
A	Requires an external power supply	Generates electrical energy
B	Spontaneous ($\Delta G < 0$)	Non-spontaneous ($\Delta G > 0$)
C	Electrons flow from cathode to anode through an external wire	Electrons flow from anode to cathode through salt bridge.
D	Oxidation is takes place at anode electrode	Oxidation is takes place at cathode electrode

75. Which of the following describes the net reaction that occurs in the cell,
   Cd/Cd^{2+} (1 M) // Cu^{2+} (1 M) /Cu
   A. $Cu + Cd^{2+} \rightarrow Cu^{2+} + Cd$
   B. $Cu^{2+} + Cd^{2+} \rightarrow Cu + Cd$
   C. $Cu^{2+} + Cd \rightarrow Cu + Cd^{2+}$
   D. $2Cu + Cd^{2+} \rightarrow 2Cu+ + Cd$

76. What is the primary contribution of industrial chemistry to society?
   A. Reducing the need for natural resources
   B. Producing materials essential for daily life
   C. Reducing extent to use resources
   D. Stopping all chemical reactions

77. Which of the following is a renewable resource?
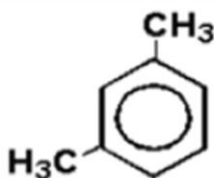   A. Coal   B. Petroleum   C. Solar energy   D. Natural gas

78. Which of the following would decrease ammonia production in the Haber process?
   A. Increasing nitrogen concentration
   B. Removing ammonia as it is formed
   C. Increasing temperature significantly
   D. Using an iron catalyst

79. Which of the following is NOT true about industrial production of sodium carbonate (Na_2CO_3)?
   A. The raw materials are Brine solution (NaCl),Limestone ($CaCO_3$), Ammonia and Water
   B. The byproduct of manufacturing of Na_2CO_3 in the Solvay process is $CaCl_2$
   C. Burning coke in the Solvay process is required to provides the heat energy
   D. The Solvay process involves industrial manufacturing process of Na_2SO_4

80. The following chemical structure represents a molecule of what molecular formula?

   A. C_8H_{10}
   B. C.C_8H_{12}
   C. C_6H_6
   D. C_8H1_6

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