Second Guiding Model (Chemistry 2026)

Choose the correct answer:

1- Which of the following represents the correct order of ions of some elements according to their magnetic attraction?

a) $Fe^{2+} > Ti^{4+} > Mn^{2+}$

b) $Mn^{2+} > Fe^{2+} > Ti^{4+}$

c) $Mn^{2+} > Ti^{4+} > Fe^{2+}$

d) $Ti^{4+} > Mn^{2+} > Fe^{2+}$

2- Which of the following represents the product of the chemical processes to dress iron ore before reduction?

a) A decrease in the mass of the ore and a decrease in iron percentage.

b) A decrease in the mass of the ore and increase volume of ore.

c) A decrease in the percentage of impurities and a decrease in the percentage of iron.

d) A decrease in the percentage of impurities and an increase in the percentage of iron.

3- Which of the following expresses the reaction for preparing the reducing agent for iron ore in one of the furnaces?

a) Water vapor with coke

b) Hydrogen gas with coke

c) Carbon dioxide with methane

d) Water vapor and carbon dioxide with methane

4- Which of the following represents the correct order of the processes required to obtain black oxide of iron from $FeCl_3$?

a) Addition of alkaline solution - thermal decomposition - reduction

b) Thermal decomposition - oxidation - addition of alkaline solution

c) Addition of alkaline solution - reduction - thermal decomposition

d) Thermal decomposition - reduction - addition of alkaline solution

5- Which of the following represents the correct order of the processes performed on limonite ore to obtain steel?

a) Roasting - addition of carbon - reduction

b) Reduction - addition of manganese - roasting

c) Roasting - reduction - addition of carbon

d) Purification of the ore - sintering - reduction

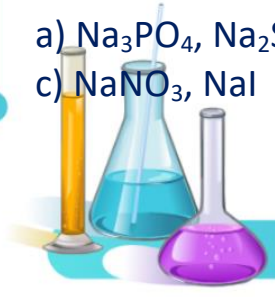
6 -Which of the following pairs of salts can be distinguished by using hydrochloric acid?

a) Na_3PO_4, Na_2SO_3

b) NaBr, NaCl

c) $NaNO_3$, NaI

d) Na_2CO_3, $NaHCO_3$



7- Which of the following cannot be used to distinguish between a calcium carbonate precipitate and a silver phosphate precipitate?

a) The difference in the color of each precipitate

b) Addition of water with dissolved carbon dioxide

c) Addition of ammonium hydroxide solution (NH_4OH)

d) Addition of acidified $KMnO_4$ solution to each of them

8- A mixture of hydrogen sulphide and sulphur dioxide gases is released from a factory.

-Which of the following solutions can be used, to get rid of these gases separately?

a) Sodium chloride solution followed by lead (II) acetate

b) Hydrochloric acid followed by acidified potassium permanganate

c) Lead (II) nitrate solution followed by copper sulphate solution

d) Lead (II) acetate solution followed by acidified potassium

9- Salt solution (X) reacted with both:

Silver nitrate solution, forming a white precipitate

Ammonium carbonate solution, forming a white precipitate

-Which of the following represents salt (X)?

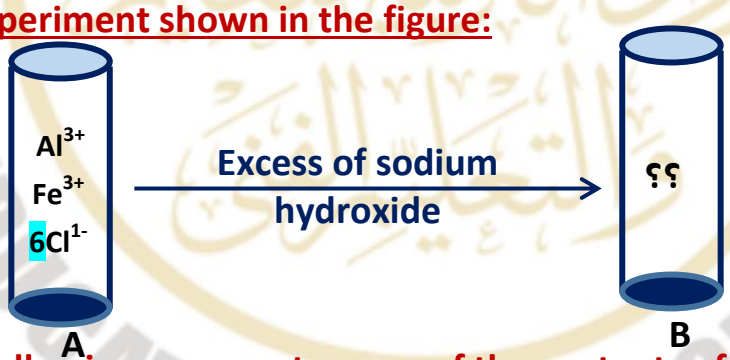
a) Calcium chloride

b) Calcium phosphate

c) Sodium chloride

d) Lead (II) nitrate

10- From the experiment shown in the figure:



- Which of the following represents some of the contents of test tube (B)?

a) $Al^{3+}_{(aq)}$, $Na^{+}_{(aq)}$, $AlO_2^{-}{}_{(aq)}$, $Cl^{-}_{(aq)}$

b) $Al(OH)_{3(s)}$, $Fe^{3+}_{(aq)}$, $AlO_2^{-}{}_{(aq)}$, $Cl^{-}_{(aq)}$

c) $Fe(OH)_{3(s)}$, $Fe^{3+}_{(aq)}$, $Al^{3+}_{(aq)}$, $AlO_2^{-}{}_{(aq)}$

d) $Fe(OH)_{3(s)}$, $Na^{+}_{(aq)}$, $AlO_2^{-}{}_{(aq)}$, $Cl^{-}_{(aq)}$

11- Which of the following equations represents a process where the rate of the forward reaction is equal to the rate of the backward reaction?

a) $AgNO_{3(aq)} + NaCl_{(aq)} = AgCl_{(s)} + NaNO_{3(aq)}$.

b) $HCl_{(aq)} + H_2O_{(l)} = H_3O^{+}_{(aq)} + Cl^{-}_{(aq)}$

c) $N_{2(g)} + 3H_{2(g)} = 2NH_{3(g)}$ (open vessel).

d) $CH_3COOH_{(aq)} + H_2O_{(l)} = CH_3COO^{-}_{(aq)} + H_3O^{+}_{(aq)}$

12- Hydrocyanic acid solution is in equilibrium according to the following equation:

$$HCN_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + CN^-_{(aq)}$$

-Which of the following occurs when a few drops of HCl are added to this solution?

a) The degree of acid dissociation increases.
b) The concentration of the CN^- ion increases.
c) The degree of acid dissociation decreases.
d) The equilibrium state is unaffected.

13- From the following equilibrium reaction: $2X_{2\,(g)} + Y_{2\,(g)} \rightleftharpoons 2X_2Y_{\,(g)}$ - heat

- Which of the following is correct regarding its effect on this reaction?

a) Adding (X_2) increases the concentration of the products and increases the Amount of energy released.
b) Adding (Y_2) increases the concentration of the products and increases the Amount of energy absorbed.
c) Withdrawing heat from the reaction increases the value of the equilibrium constant
d) Increasing the heat in the reaction decreases the value of the equilibrium constant

14- Which of the following reactions is the fastest?

a) A 10 g magnesium ribbon with 25 mL of 0.2 M H_2SO_4 at room temperature.
b) A 5 g magnesium ribbon with 50 mL of 0.1 M H_2SO_4 at 35°C.
c) A 10 g magnesium powder with 50 mL of 0.1 M H_2SO_4 at room temperature.
d) A 5 g magnesium powder with 25 mL of 0.2 M H_2SO_4 at 35°C.

15- Solution (X) has a hydrogen ion concentration [H^+] of 1.0×10^{-9} M at 25°C.

-Which of the following represents solution X?

(a) A solution of a base, pOH has a value of 9.
(b) A solution of an acid, pOH has a value of 5.
(c) A solution of a base, pH has a value of 9.
(d) A solution of an acid, pH has a value of 5.

16- In the following equilibrium reaction: $2NO_{2\,(g)} \rightleftharpoons N_{2\,(g)} + 2O_{2\,(g)}$

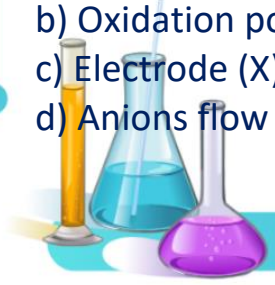
The total pressure at equilibrium is 3.2 atm, the partial pressure of NO_2 is 2 atm, and the partial pressure of O_2 is 1 atm.

-Which of the following represents the value of K_p for the reaction?

a) 0.1 b) 0.2 c) 0.05 d) 5

17- A galvanic cell is formed from electrodes (X) and (Y), Electrons were transferring toward electrode Y during operating, Which of the following is correct?

a) Reduction potential of (X) is less than the reduction potential of (Y)
b) Oxidation potential of (X) is less than the oxidation potential of (Y)
c) Electrode (X) is the positive electrode of the cell.
d) Anions flow across the bridge towards electrode (Y)



18- The standard potentials of electrodes (X) and (Y) are as follows:

$X_{(s)} + 2H^+_{(1M)} \rightarrow X^{2}_{(aq)} + H_{2(g)}$, $E^\circ = +0.76$ V

$Y_{(s)} + 3H^+_{(1M)} \rightarrow Y^{3+}_{(aq)} + 3/2H_{2(g)}$, $E^\circ = +1.66$ V

-Which of the following is correct for an electrochemical cell formed from (X) and (Y)?

a) The anode is X and the emf value is +0.9 V

b) The anode is Y and the emf value is +0.9 V

c) The anode is X and the emf value is +2.42 V

d) The anode is Y and the emf value is +2.42 V

19- When an electric current is passed through a copper (II) nitrate solution using a pure copper electrode connected to the positive pole of battery and an iron electrode connected to the negative pole of the battery.

-Which of the following is true when the electric current is passed?

a) The concentration of nitrate ions in the solution increases while the concentration of copper ions remains constant.

b) Copper ions are reduced at the cathode, and the solution remains electrically neutral.

c) The concentration of copper ions increases while the concentration of nitrate ions in the solution decreases.

d) The copper at the anode is oxidized, and the total charge of the solution becomes positive.

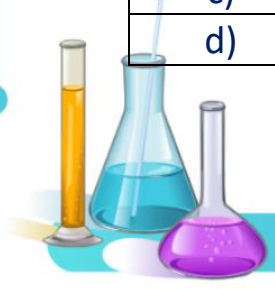
20- Three electrolytic cells are connected in series, each containing inert electrodes and the following electrolytes: molten Al_2O_3, molten Mg_3N_2, and molten NaCl. Which of the following represents the ratio between the volumes of gases emitted from these cells?

	Oxygen gas	Nitrogen gas	Chlorine gas
a)	2	3	1
b)	0.166	0.250	0.330
c)	1	2	3
d)	0.250	0.166	0.500

21- The following reaction occurs in a galvanic half-cell: $X^{n+} + ne^- \rightarrow X$

Which of the following represents element (X) and the use of this cell?

	Element (X)	Use of the cell
a)	Hg	Ear phones
b)	Pb	medical devices
c)	H_2	drinking water for astronauts
d)	O_2	spacecraft



22- Which of the following is correct during the discharge of a lithium ion cell?

a) Lithium ions move from positive electrode to negative electrode.

b) Electrons move from positive electrode to negative electrode.

c) Lithium ions move to the negative electrode.

d) Lithium ions move to the positive electrode.

23- The following are general formulas for halogenated derivatives of some hydrocarbons and the uses of one of their isomers.

All of the following are true regarding the type of halogenated derivative and the use of one of its isomers except:

	formula of derivative	Type of derivative and use of one of its isomers
a)	$C_nH_nCl_{2n+1}$	Saturated: was used as an anesthetic
b)	$C_nH_{n+1}Cl_{n+1}$	Saturated: Used in dry cleaning
c)	$C_nH_{n+1}Cl_{n-1}$	Unsaturated: Used in carpet manufacturing
d)	$C_nH_{n-1}Cl$	Unsaturated: Used in the preparation of phenol

24- All of the following are true regarding the chemical formula and name according to the IUPAC system except:

	Chemical formula	name according to the IUPAC system
a)	$(CH_3)_3CC(CH_3)_3$	2,2,3,3-tetramethyl butane
b)	$(CH_3)_2CC(CH_3)_2$	3,2-dimethyl-2-butene
c)	$(CH_3)_3CC(C_2H_5)_3$	3,3-diethyl-2,2-dimethyl pentane
d)	$(CH_3)_3CCH_2C_2H$	4,4-dimethyl-2-butene

25- Which of the following represents the number of alkene isomers containing an ethyl group and with the molecular formula C_5H_{10}?

a) 6

b) 5

c) 4

d) 3

26- Which of the following is the IUPAC name of the alcohol produced by the alkaline hydrolysis of 2-bromo-3-methyl butane?

a) 2-Methyl-1-butanol

b) 3-Methyl-1-butanol

c) 2-Methyl-2-butanol

d) 3-Methyl-2-butanol

27- Two compounds (X, Y) have the following formulas:

X: $C_2H_5C_2H(CH_3)_2$ **Y: $CH_3CHC(CH_3)_2$**

Which of the following is the IUPAC name for the compounds formed by the addition of hydrogen bromide to compounds X and Y?

	Product of hydrogen bromide addition to compound (X)	Product of hydrogen bromide addition to compound (Y)
a)	2-Bromo-2-methyl pentane	2-Bromo-2-methyl butane
b)	2-Bromo-2-methyl pentane	2-Bromo-3-methyl pentane
c)	2-Bromo-4-methyl butane	1-Bromo-3-methyl butane
d)	2-Bromo-3-methyl butane	2-Bromo-2-methyl butane

28- Which of the following represents the correct order of the processes required to obtain the simplest aromatic carboxylic acid from the simplest aliphatic hydrocarbon?

a) Halogenation – Alkaline hydrolysis – Complete oxidation.
b) Strong heating and rapid cooling – Polymerization – Alkylation – Nitration.
c) Strong heating and rapid cooling – Polymerization – Alkylation – Oxidation.
d) Halogenation – Alkaline hydrolysis – Complete oxidation.

29- Which of the following processes is correct for obtaining a compound with the formula C_nH_nO from the compound $C_7H_6O_2$?

a) Basic hydrolysis b) Dehydration c) Acid hydrolysis d) Neutralization

30- Which of the following is the correct order of processes required to obtain 1,2-dimethyl cyclohexane from a compound with the molecular formula C_6H_6O?

a) Neutralization - Fractional distillation - Catalytic reforming - Reduction
b) Heating with zinc - Alkylation – Fridle Crafts reaction - Oxidation
c) Neutralization - Alkylation - Dehydration – Fridle Crafts reaction
d) Heating with zinc - Alkylation – Fridle Crafts reaction - Hydrogenation

31- Which of the following pairs of compounds can be used to produce a polymer (in only three chemical processes) used in the manufacture of arteries and heart valves?

a) Ethylene and para methyl toluene
b) Ethylene glycol and Terphthalic acid
c) Ethanol and para methyl toluene
d) Acetylene and ethanol

32- Given that:

Compound (A): **An organic acid that reacts with oxygenated mineral acids and Does not react with halogenated acids.**

Compound (B): **An organic compound $C_nH_{2n}O$ and is oxidized to an acid used in The manufacture of insecticides and perfumes.**

-Which of the following describes the use of the compound resulting from the reaction of (A) and (B) in an acidic or basic medium?

a) Explosives manufacturing
b) Electrical equipment
c) Disinfectant manufacturing
d) Heart valve manufacturing

33- All of the following are intermetallic alloys except:

a) Cementite b) Brass c) Duralumin d) Lead and gold

34- Coke plays a role in extracting zinc from its ores according to the following equation: $2ZnO + C \rightarrow 2Zn + CO$

- Which of the following materials plays the same role as coke in extracting iron?

a) A mixture of ($CO + H_2$)
b) Methane gas
c) Coke
d) A mixture of ($CO_2 + H_2O$)

35- 44.8 g of potassium hydroxide was dissolved in water to make 500 mL of solution. 10 mL of this solution was titrated using 0.2 M sulphuric acid. Which of the following represents the volume of the consumed acid? [K=39, H=1, O=16]

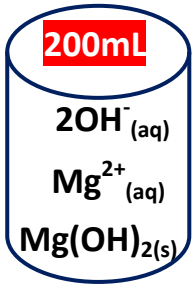
a) 8 mL b) 40 mL c) 180 mL d) 160 mL

36- 1.437 g of $ZnSO_4.XH_2O$ was dissolved in water, and then barium chloride solution was added, 1.165 g of barium sulphate precipitated.

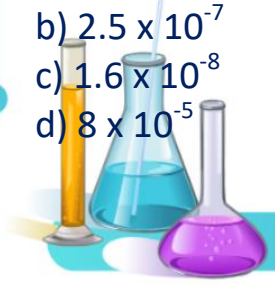
-Which of the following represents the molecular formula of hydrated zinc sulphate? [Zn=65.4, Ba=137.3, S=32, O=16]

a) $ZnSO_4.5H_2O$ b) $ZnSO_4.6H_2O$
c) $ZnSO_4.7H_2O$ d) $ZnSO_4.8H_2O$

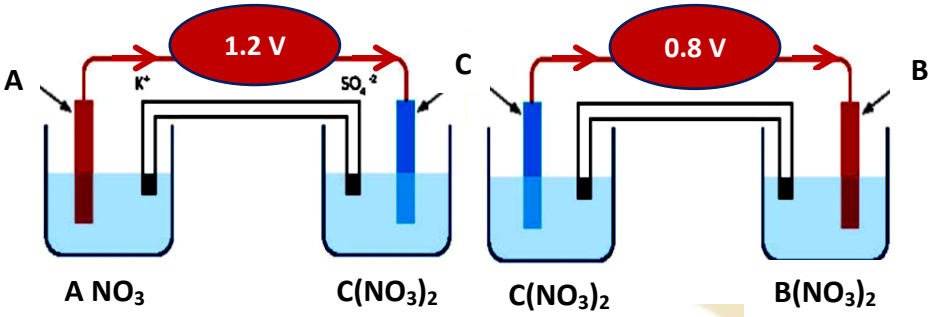
37- From the opposite figure, every 50 mL of solution contains 2×10^{-4} mol of solute. Which of the following represents the value of K_{sp} for $Mg(OH)_2$ salt?



a) 4×10^{-6}
b) 2.5×10^{-7}
c) 1.6×10^{-8}
d) 8×10^{-5}



38- From the electrolytic cells shown:



-Which of the following represents a cell consisting of two electrodes: (B) as anode and (A) as cathode?

a) A spontaneous reaction occurs, emf = +2 V
b) A non-spontaneous reaction occurs, emf = -1.2 V
c) A non-spontaneous reaction occurs, emf = -2 V
d) A spontaneous reaction occurs, emf = +1.2 V

39- In the following spontaneous reaction: $Ni_{(s)} + CuCl_{2\,(aq)} \rightarrow Cu_{(s)} + NiCl_{2\,(aq)}$

-Which of the following is correct?

a) Copper ion is a strong reducing agent.
b) Solutions of copper salts can be stored in nickel containers.
c) Solutions of nickel salts can be stored in a copper container.
d) Chloride ion is a strong oxidizing agent.

40- All of the following can be used to distinguish between ethyl alcohol and phenol except:

a) Bromine water
b) Sodium
c) $FeCl_3$ solution
d) Acidified potassium permanganate

41- Three hydrocarbon derivatives:

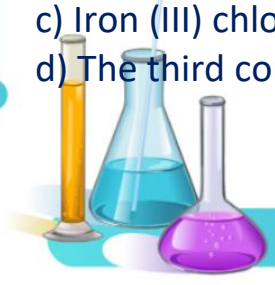
Compound (1): reacts with dilute hydrochloric acid and does not react with Sodium hydroxide solution.

Compound (2): reacts with both compound (1) and sodium hydroxide solution Under suitable conditions.

Compound (3): reacts with sodium hydroxide solution and does not react with Hydrochloric acid.

All of the following are true except:

a) The general formula of compound (1) is $C_nH_{2n+2}O$
b) The general formula of compound (2) is $C_nH_{2n}O_2$
c) Iron (III) chloride is used for detect the third compound
d) The third compound is prepared by oxidizing the first compound.



42- Which of the following represents the correct order of processes required to obtain a saturated hydrocarbon from an alcohol that is not oxidized by normal oxidizing agents?

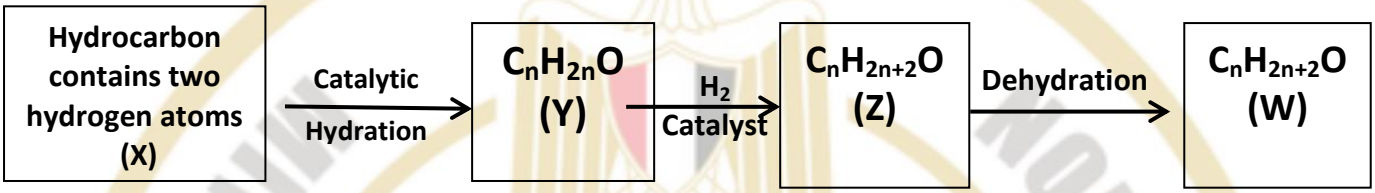
a) Dehydration of ethanol at 180°C followed by hydrogenation

b) Dehydration of 1-propanol with sulphuric acid at 180°C

c) Dehydration of 2-methyl-2-propanol followed by hydrogenation

d) Dehydration of 2-propanol with sulphuric acid at 180°C

43- From the following diagram:



Which of the following is true for compounds (W, Z, Y, X)?

a) Compound (X) reacts by addition in one step.

b) Compound (Y) is propanal.

c) Compound (Z) is a primary alcohol.

d) Compound (W) reacts with sodium metal.

44- A carboxylic acid with the formula $C_3H_6O_3$ undergoes the following reactions:

- Reaction (1): React as an acid with methanol

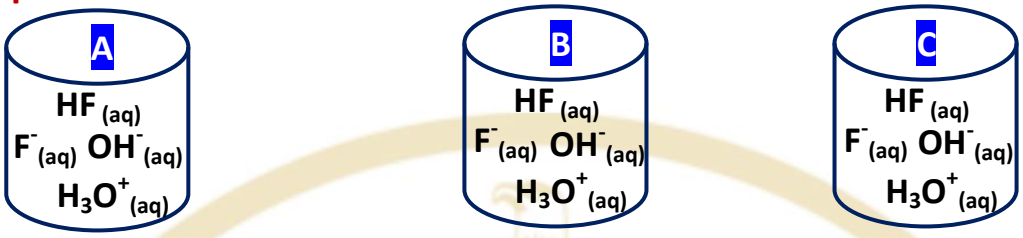
- Reaction (2): reacts as an alcohol with acetic acid

-Which of the following represents the product of reactions (1) and (2)?

	product of Reaction (1)	product of Reaction (2)
a)	$CH_3CH(OCOCH_3)COOH$	$CH_3CH(OH)COOCH_3$
b)	$CH_3CH(OH)COOCH_3$	$CH_3CH(OCOCH_3)COOH$
c)	CH_3COOCH_3	$CH_3CH(OH)COOH$
d)	$CH_3CH(OH)COOCH_3$	CH_3COOCH_3

Essay Questions:

45- The following figure shows three solutions (A, B, and C) of hydrofluoric acid at room temperature:



M = 0.4M

M = 0.28M

M = 0. 02M

$Ka = 6.7 \times 10^{-4}$

-Study the figure and then answer:

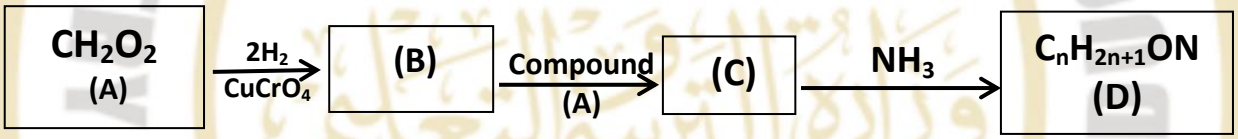
(1) Which solution has the highest pH value?

(2) Which solution has the highest fluoride ions concentration?

(3) What is the Ka value of the solution (B)?

(4) Which acid solution has a dissociation percentage= 4.9%?

46- Study the following diagram:



Answer the following questions:

1- What is the common name for compound (A)?

2- Write the structural formula of the compound formed from the reaction of Compound (B) with $C_7H_6O_3$?

3- What is the IUPAC name for compound (C)?

4- Write the structural formula of compound (D).