Fifth Guiding Model (Chemistry 2026

1-Element X, from the first transition series, is used in an acid-resistant alloy. Which Of the following represents the electronic configuration of the X^{3+} ion?

a) $[_{18}Ar]\ 3d^3$
b) $[_{18}Ar]\ 3d^6$
c) $[_{18}Ar]\ 3d^7$
d) $[_{18}Ar]\ 3d^4$

2- Element X, from the first transition series, has a completely filled (d) sublevel and no unpaired electrons in any oxidation state. Which of the following represents the element type and the electronic configuration of its ion in the compound XO?

a) Transition, $[Ar]\ 3d^{10}$
b) Transition, $[Ar]\ 3d^9$
c) Non-transition, $[Ar]\ 3d^{10}$
d) Non-transition, $[Ar]\ 3d^9$

3-Which of the following expresses one of the reasons for using nickel as a catalyst in Oil hydrogenation?

a) Increases the surface area of the reactants
b) Decreases the chance of collisions between the reactant molecules.
c) Electrons of 4s, 3d share in concentrating reactants on its surface.
d) Increases the activation energy of the reactant molecules.

4 - Two non-consecutive transition elements, X and Y, are from the first transition series.
Element X: One of its compounds is used as a catalyst in the contact method.
Element Y: It has the same number of unpaired electrons as element X.
- Which of the following is correct?

(a) The radius of element (X) is larger than that preceding it in the series
(b) The effective nuclear charge of element (Y) is less than that of element (X)
(c) The density of element (Y) is less than the density of element X
(d) The atomic mass of element (Y) is greater than that follow it in the series.

5- (A, B, and C) three consecutive elements from the first transition series.
Element (A) has an anomalous electronic configuration than that of other elements in the series.
-Which of the following represents the correct order of magnetic moments for ions of these elements in the oxidation state (3+)?

a) $A^{3+} > B^{3+} > C^{3+}$
b) $B^{3+} > C^{3+} > A^{3+}$
c) $B^{3+} > A^{3+} > C^{3+}$
d) $C^{3+} > B^{3+} > A^{3+}$

6- When a confirmatory reagent (X) is added to a salt solution (Y), the color of reagent (X) disappears and the salt (Y) oxidizes.

- **Which of the following represents reagent (X) and salt (Y)?**

	The reagent X	The salt Y
a)	Acidified potassium permanganate	sodium nitrite
b)	Magnesium sulphate	sodium carbonate
c)	Lead II acetate	sodium sulphide
d)	brown iodine solution	Sodium sulphate

7- From the following diagram:

black ppt. (Y) $\xleftarrow{(X)}$ $CuCl_{2(aq)}$ $\xrightarrow{K_2CO_{3(aq)}}$ **(Z) ppt.**

-Which of the following represents substance X, Y, and Z?

	X	Y	Z
a)	$AgNO_{3(aq)}$	$AgCl_{(s)}$	$KCl_{(s)}$
b)	$HCl_{(aq)} + H_2S_{(g)}$	$CuCl_{2(s)}$	$CuCO_{3(s)}$
c)	$HCl_{(aq)} + H_2S_{(g)}$	$CuS_{(s)}$	$CuCO_{3(s)}$
d)	$Na_2S_{(aq)}$	$NaCl_{(s)}$	$KCl_{(s)}$

8- 100 mL of 0.5 M calcium hydroxide is added to 200 mL of 0.6 M hydrochloric acid according to the following equation: $2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$

- Which of the following represents the concentration of excess reactant?

a) 0.2 M

b) 0.0667 M

c) 0.633 M

d) 0.316 M

9- 2.52 g of hydrated crystals of acid (A) [$A{\cdot}XH_2O$]. It was dissolved in distilled water to make a 250 mL of 0.08 M solution. 25 mL of this solution was titrated with a sodium hydroxide solution containing 0.16 g of the solute.

(Molar mass of the acid = 90 g/mol, NaOH = 40 g/mol)

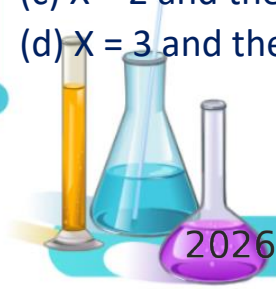
-Which of the following expresses the number of water molecules (X) and the type Of acid?

(a) X = 2 and the acid is diprotic

(b) X = 1 and the acid is monoprotic

(c) X = 2 and the acid is triprotic

(d) X = 3 and the acid is triprotic



10- All of the following reactions produce substances sparingly soluble in water <u>except</u>:

a) Magnesium sulphate solution with potassium bicarbonate solution

b) Dilute hydrochloric acid with potassium thiosulphate salt

c) Silver nitrate solution with potassium sulphite solution

d) Carbon dioxide with calcium hydroxide solution for a short time

11- Which of the following is true for reactions (A) and (B)? (When each is performed in a sealed container)?

Reaction (A)	Reaction (B)
$N_{2(g)} + 3H_{2(g)} = 2NH_{3(g)}$	$Mg_{(s)} + 2HCl_{(aq)} = MgCl_{2(aq)} + H_{2(g)}$

a) Both reactions reach equilibrium at the same time.

b) Neither reaction reaches equilibrium.

c) Reaction (A) reaches equilibrium, but reaction (B) does not.

d) Reaction (B) reaches equilibrium, but reaction (A) does not.

12- Two solutions of two weak acids (HA) and (HB) have a pH = 3 for each

- Acid HA has a concentration of 0.1 M.

- Acid HB has a concentration of 0.01 M.

Which of the following is correct for acids HA and HB?

a) Acids HA and HB have a different $[OH^-]$

b) Acids HA and HB have the same value of K_a.

c) The value of K_a for acid HB is greater.

d) The value of K_a for acid HA is greater.

13- Which of the following equilibrium reactions shifts to the forward reaction by increasing the volume of the container?

a) $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$

b) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

c) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

d) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

14- Two tubes (A, B) each contain equal masses of an active metal and the same acid. If the reaction in tube (B) is ended in a shorter time than in tube (A).

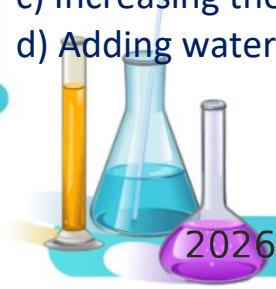
Which of the following is the reason of the different in reaction time of the two reactions?

a) Division of the metal in tube (A)

b) Adding a catalyst to tube (A)

c) Increasing the temperature of tube (B)

d) Adding water to tube (B)



15- Four solutions have the same concentration:

1- HCl solution **2- NaOH solution**

3- CH_3COOH acid solution **4- NH_4OH solution**

-The order of these solutions according to the hydronium ion concentration is:

a) 1 > 3 > 4 > 2 b) 2 > 4 > 3 > 1

c) 1 > 2 > 3 > 4 d) 1 > 3 > 2 > 4

16- A saturated lead (II) chloride ($PbCl_2$) solution is in equilibrium according to the Following equation: $PbCl_{2(s)} \rightleftharpoons Pb^{2+}_{(aq)} + 2Cl^-_{(aq)}$

-Which of the following is correct regarding the solubility of $PbCl_2$ when a small Amount of each of the following salts is added separately?

a) Solubility decreases with addition of sodium sulphate solution.

b) Solubility increases with addition of sodium nitrate solution.

c) Solubility decreases with addition of lead (II) acetate solution.

d) Solubility increases with addition of potassium nitrate solution.

17- A galvanic cell consists of:

An electrode (X) in XSO_4 solution

An electrode (Y) in YSO_4 solution

-If metal (X) is a stronger reducing agent than metal (Y), which of the following describes what happens in this cell?

a) Electrons move from (Y) to (X) through the external wire

b) The mass of electrode (X) increases by time

c) Negative ions move from the bridge to the half cell (X)

d) Reduction of (X^{2+}) ions occurs at the anode

18- An electrochemical cell undergoes the following reaction:

$$2Y_{(s)} + 3X^+_{(aq)} \rightarrow 2Y^+_{(aq)} + 3X_{(s)};\ emf = +1.6\ V$$

- Which of the following is correct for both electrode type (Y) and cell type?

	the Y-electrode type	type of cell
A	cathode	Galvanic
B	anode	Electrolytic
C	anode	Galvanic
d	cathode	Electrolytic

19- Four electrodes [X], [Y], [Z], [L], where:

(X^{2+}/X)	(Y^{2+}/Y)	(Z/Z^{2+})	(L/L^{2+})
-0.44 V	+1.5 V	-0.34 V	+1.18 V

Which of the following reactions represents a cell that produces the greatest electromotive force (emf)?

a) $Y + L^{2+} \rightarrow Y^{2+} + L$

b) $X + L^{2+} \rightarrow X^{2+} + L$

c) $L + Y^{2+} \rightarrow L^{2+} + Y$

d) $X + Y^{2+} \rightarrow X^{2+} + Y$

20- Which of the following examples illustrates cathodic protection of metals against corrosion?

(a) Coating iron with an inorganic substance such as red primer

(b) Galvanizing iron by dipping it in zinc

(c) Coating iron with a metal that has a lower reduction potential than iron

(d) Coating iron with a metal that has a lower oxidation potential than iron

21- Which of the following represents the anode half-reaction during the electrolysis of molten sodium hydride (NaH) between graphite electrodes?

a) $2Na^{+} + 2e^{-} \rightarrow 2Na$

b) $2Na \rightarrow 2Na^{+} + 2e^{-}$

c) $2H_2 \rightarrow 2H^{+} + 2e^{-}$

d) $2H^{-} \rightarrow H_2 + 2e^{-}$

22- Which of the following metals that deposits 18 g when 1.5 F passes through one of its molten salts? (Na = 23, Mg = 24, Ca = 40, K = 39)

a) Na b) Mg c) Ca d) K

23- <u>Two organic compounds, (X) and (Y):</u>

<u>X:</u> An aliphatic compound that, upon oxidation, produces a compound used in Polyester production.

<u>Y:</u> An aromatic compound whose sodium salt is used to prevent growth of fungi.

-Which of the following is correct?

a) Compound (X) obey to the formula $C_nH_{2n+2}O_2$ and does not contain a carboxyl group.

b) Compound (Y) does not obey the formula $C_nH_{2n}O_2$ and contains a carboxyl group.

c) Compound (X) obey to the formula $C_nH_{2n+2}O_2$ and contains a carboxyl group.

d) Compound(Y) obey to the formula $C_nH_{2n}O_2$ and contains a carboxyl group.

24- Which of the following hydroxyl compounds cannot be obtained by ammonolysis of an ethyl benzoate isomer?

a) C_6H_5OH

b) $C_6H_5CH_2CH_2OH$

c) $C_6H_5CH_2OH$

d) C_2H_5OH

25- The following equation illustrates one of the thermal catalytic cracking processes:

$$C_{20}H_{42(s)} \xrightarrow{\text{Heat/ Pressur / } cat.} X_{(l)} + Y_{(g)} + Z_{(l)}$$

X: An alkene containing 30 mol of atoms per mole.

Y: The heaviest gaseous alkene.

- Which of the following does not represent compound (Z)?

a) It is produced from the hydrogenation of hexyne.

b) It reacts with hydrogen halides (HBr) according to Markownikoff's rule.

c) Its catalytic reforming yields a compound used as organic solvent.

d) It has the general formula C_nH_{2n+2}.

26- X, Y, and Z are three hydrocarbon derivatives:

X: has the general formula $C_nH_{2n}O_2$ and reacts with active metals.

Y: has the general formula $C_nH_{2n}O_2$ and does not react with active metals.

Z: has the general formula $C_nH_{2n+2}O$ and reacts with active metals.

If the molar masses of (X, Y, and Z) are equal, which of the following is correct regarding their boiling points?

a) (Y) has a higher boiling point than (Z).

b) (Z) has a higher boiling point than (X).

c) (Y) has a higher boiling point than (X).

d) (X) has a higher boiling point than (Z).

27- An organic compound with the molecular formula $C_5H_{10}O_2$ has a complex Functional group of two functional groups.

- Which of the following could be the IUPAC name for this compound?

a) 2,2-Dimethyl butanoic acid

b) Methyl butanoate

c) Ethyl propanoate

d) 2,2-Dimethyl propanoic acid

28- Which of the following represents the correct order of some organic compounds according to the amount of oxygen required for the complete combustion of one mole?

a) Methane > Ethane > Ethyne

b) Ethane > Ethene > Ethyne

c) Ethyne > Ethene > Ethane

d) Ethyne > Ethene > Methane

29- Compound A, produced by the fractional distillation of coal tar, the following reactions, in order, under the standard conditions for each occurs for compound A: (Chlorination by substitution - Reaction with sodium hydroxide - Nitration)

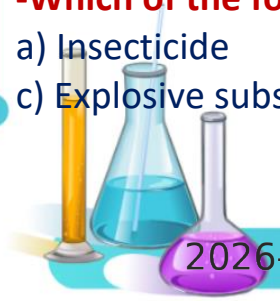
-Which of the following represents a use of the produced compound?

a) Insecticide

b) Widen arteries

c) Explosive substance

d) Bakelite polymer



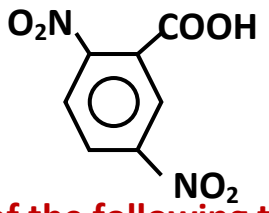
30- Which of the following is the IUPAC name of the compound shown?

a) 3,6-dinitro benzoic acid

b) 2,5-dinitro benzoic acid

c) Meta, para-dinitro benzoic acid

d) 3,5-dinitro benzoic acid



31- Which of the following describes the properties of each of the following types of alcohols?

a) Primary and secondary alcohols react with sodium metal, while tertiary do not.

b) Primary alcohols are oxidized only to form a mixture of aldehyde and ketone at the end of the reaction.

c) Primary alcohols have a continuous carbon chain, while secondary and tertiary alcohols have branched carbon chains.

d) Primary and secondary alcohols react with acidified potassium permanganate, while tertiary do not.

32- Three organic compounds are used in the manufacture of polymers:

- **(Reaction of compound (1) with compound (2)) gives polymer used to treat heart disease.**
- **(Reaction compound 3 with an aldehyde) gives polymer used in the manufacture Of cigarette ash trays.**

- Which of the following represents each of the three compounds?

	Compound 1	Compound 2	Compound 3
a)	Ethyne	Hydrogen fluoride	Teflon
b)	Ethylene glycol	Phthalic Acid	Carbolic acid
c)	Ethylene Glycol	Terphthalic Acid	Carbolic acid
d)	Phthalic Acid	Carbolic acid	Ethylene Glycol

33- Fe_2O_3 can be obtained by all of the following methods except:

a) Addition of (dil.) H_2SO_4 to the product of reduction Fe_3O_4/ Addition of alkali / Heating above 200℃

b) Passing hot air on red hot iron / Oxidation

c) Leaving iron (II) sulphate in air for a period of time / Addition of alkali / Heating above 200℃

d) Addition of iron to diluted oxalic acid / Heating in the absence of air / Oxidation

34- Which of the following processes is necessary to produce steel iron from a sample of siderite?

a) Roasting - Oxidation - Removing impurities - Addition of carbon.

b) Roasting - Reduction - Removing impurities - Addition of carbon.

c) Removing impurities - Roasting - Addition of carbon - Reduction.

d) Removing impurities - Reduction - Addition of carbon - Roasting.

35- 5 g of impure sample of aluminum sulphate $Al_2(SO_4)_3$ was dissolved in water. An excess amount of ammonia solution was added until aluminum hydroxide was completely precipitated. The precipitate was separated and dried, yielding a mass of 2.03 g. Which of the following represents the percentage of aluminum in the sample? [Al=27, S=32, N=14, O=16, H=1]

a) 85.95% b) 14.05% c) 52.5% d) 8.75%

36-A solution containing (Ag^+, K^+, Cu^{2+}) cations.

-Which of the following expresses the possible color of the precipitate formed when excess of HCl solution is added and then H_2S gas is passed through this solution?

(a) Black precipitate (b) White precipitate

(c) A mixture of white and black precipitates (d) No precipitate is formed

37- Lead (II) chloride is sparingly soluble in water, its solubility product [Ksp=1.2x 10^{-5}] at 25°C

-Which of the following represents the volume of a saturated solution containing 0.1 g of salt at the same temperature? ($PbCl_2$ = 278 g/mol)

(a) 25 mL (b) 50 mL (c) 100 mL (d) 150 mL

38-In the following equilibrium reaction: $A_{(g)} + B_{(g)} \rightleftharpoons 2C_{(g)}$

- The concentrations of reactants and products at 200°C in 1L container are:

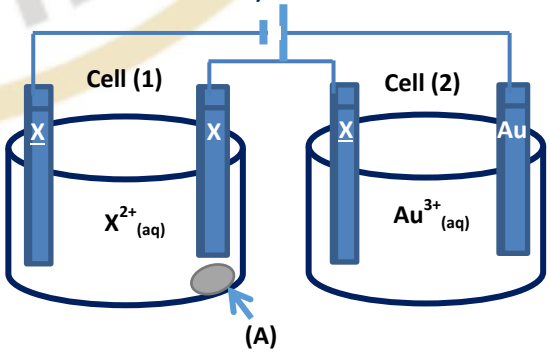
[A] = 0.200 M, [B] = 3.00 M, [C] = 0.500 M

- Which of the following represents the number of moles of (A) that must be added To make [C] = 0.700 M at the same temperature?

a) 0.225 mol b) 0.305 mol c) 0.417 mol d) 0.610 mol

39- From the opposite figure:

All of the following are correct for cells (1) and (2) except:



a) Cells (2) is used to plate metal (X)

b) Cell (1) is used to purify metal (X)

c) The potential of battery is slightly greater than That of metal (X)

d) The oxidation potential of substance (A) is higher than that of (X)

40- In Daniell cell, if the mass of consumed zinc is 6.5 g, then the mass of deposited copper is: (Zn = 65, Cu = 63.5)

a) 6.5 g, deposited at the positive electrode

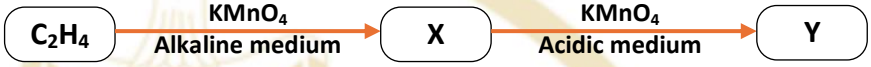
b) 6.35 g, deposited at the anode half-cell

c) 6.35 g, deposited at the positive electrode

d) 3.25 g , deposited at the cathode half-cell

41- From the following diagram:

-Which of the following is true?



a) (X): Used in the manufacture of insecticides, (Y): Dibasic acid

b) (X): Used in car radiators, (Y): Removes the color of acidified $KMnO_4$

c) (X): Used in the manufacture of polymers, (Y): Is $C_2H_2O_4$

d) (X): Used in the treatment of burns, (Y): Is $C_2H_2O_4$

42- By performing the following processes (in order) on Organic acid that has a pungent odor and freezes at 16℃):

(Neutralization - Dry distillation - Heating then rapid cooling - Trimerization).

- Which of the following represents the final product of these processes?

a) Branched aromatic hydrocarbon.

b) Unsaturated aliphatic hydrocarbon.

c) Unbranched aromatic hydrocarbon.

d) Saturated aliphatic hydrocarbon.

43- Which of the following represents the correct order of processes required to obtain the compound with the formula C_6H_5COOH from a compound with the formula $C_7H_{15}COOH$?

a) Catalytic reforming - Dry distillation - Oxidation - Neutralization

b) Neutralization - Dry distillation - Oxidation - Catalytic reforming

c) Thermal catalytic cracking - Catalytic reforming - Neutralization

d) Neutralization - Dry distillation - Catalytic reforming - Oxidation

44- Three organic compounds:

(A) : An aliphatic organic compound with the general formula $C_nH_{2n+2}O_z$

(B) : An aromatic acid containing two different functional groups

(C) : A liquid organic compound used in the manufacture of artificial fats and as a Base for manufacture of compound with a general formula $C_nH_{2n+2}O_3$

- Which of the following is true for compounds A, B, and C?

a) Compound (A) effervesces when sodium bicarbonate is added to it.

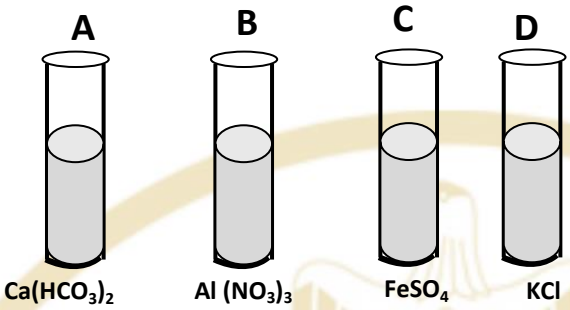
b) Compound (B) turns potassium dichromate from orange to green.

c) Compound (C) removes the color of alkaline potassium permanganate solution.

d) Compound (A) gives a purple color with Iron III chloride solution.

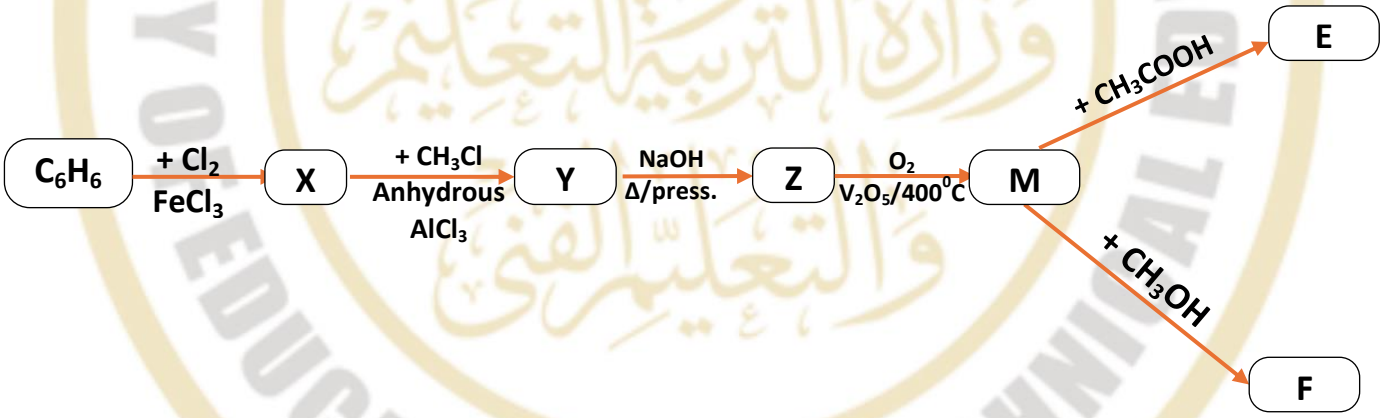
Essay questions:

45- You have four test tubes containing different salt solutions:



1- Write the chemical name of the reagent used to distinguish between the solid Salts of the four solutions by one experiment.
2- Which of the four solutions gives a precipitate with an excess of sodium Hydroxide solution?
3- Which of the above solutions gives a gas and a precipitate when dilute sulphuric Acid is added?
4- Which of the above salts cannot detects its cation by a normal chemical reagent?

46- From the following diagram:



If you know that compound (E) is used as a medicinal drug and is recommended to be taken with plenty of water to prevent stomach ulcers:
- Write the chemical formulas of compounds (Z) and (Y).
- Write the chemical formula of the acid produced by the acidic hydrolysis of Compound (F).
- Mention one use of compound (F).