

Seventh Guiding Model (Chemistry 2026)

1-Three consecutive elements (A, B and C) from the first transition series. Element (C) has twice the number of unpaired electrons as element (B) and three times the number of unpaired electrons as element (A).

- Which of the following represents the uses of elements (A, B and C)?

Choices	A	B	C
a)	Dry cell	metal plating	Fehling's solution composition
b)	Hydrogenation of oils	heating coils	luminescent paints
c)	Oxidizing agent and disinfecting	galvanization	magnet manufacturing
d)	artificial joints	car spring manufacturing	metal plating

2- Element (X) is an element of the second transition series, and its electronic configuration ends with $ns^{(n-3)}, (n-1)d^{2n}$

-Which of the following represents the type of element (X) and its use?

- (a) Transition element used in coinage metals
- (b) Transition element used with a non-transition element in the manufacture of Rechargeable batteries
- (c) Non-transition element used with a transition element in the manufacture of Rechargeable batteries
- (d) Non-transition element whose oxide is used in the manufacture of rubber and paints

3- A main transition element (X), whose (d) sublevel contains two unpaired Electrons in its oxidation state (3+).

-Which of the following oxidation states produced from break down a completely Filled principal energy Level with electrons

- a) X^{7+}
- b) X^{6+}
- c) X^{5+}
- d) X^{4+}

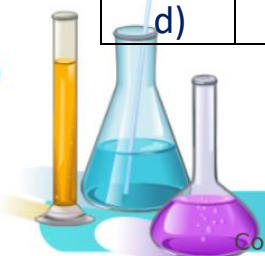
4- (X, Y) represent processes that take place during an iron ore dressing:

(X) : reduces the size of iron ore particles while its mass remains constant.

(Y) : increases the number of unpaired electrons in the iron ion.

Which of the following represents processes (X, Y)?

	X	Y
a)	crushing	Siderite roasting
b)	sintering	Surface tension
c)	crushing	Hematite roasting
d)	sintering	Magnetic separation



5- Element (X) from the first transition series, its X^{2+} ion contains (11) filled orbitals and (3) half-filled orbitals.

-Which of the following does not describe element (X)?

- Its atomic mass is less than the element that follows it
- Its density is less than the element that follows it
- All its compounds are paramagnetic
- Its effective nuclear charge is greater than the element that precedes it

6- Two salts (X & Y) both contain the same cation:

X: dissolves in water and dilute acids

Y: does not dissolve in water but dissolves in dilute acids

When dilute hydrochloric acid is added to each salt separately, gas (Z) is released.

- Which of the following represents gas (Z)?

- A white precipitate is formed when passed through potassium hydroxide solution For a short time.
- Produces by heating salt (X) , and salt(Y) is formed
- When passed through water containing salt (Y), the salt dissolves as sodium Bicarbonate.
- When passed through clear limewater for a long time, it becomes milky.

7- Dilute hydrochloric acid is added to Three salts (X, Y, and Z), separately, and the results were as follows:

- In the case of salt (X), a colorless gas was released that is easily oxidized.
- In the case of salt (Y), a white precipitate was formed.
- In the case of salt (Z), a gas was released that turns a paper wetted with lead (II) acetate to black.

-Which of the following represents salts (X, Y, and Z)?

	X	Y	Z
a)	NaNO_2	AgNO_3	Na_2S
b)	KNO_2	$\text{Pb}(\text{NO}_3)_2$	Na_2SO_3
c)	NH_4Cl	Ag_2SO_4	Na_2SO_3
d)	NaNO_3	$\text{Ba}(\text{NO}_3)_2$	Na_2S



8- Concentrated sulfuric acid was added to three solid salts (A, B, C).

In the case of salt (A): a colorless gas was released that was difficult to oxidize.

In the case of salt (B): colored vapors were released, and their solution could be used to detect one of the anions of the first group.

In the case of salt (C): no gas was released.

Which of the following represents salts (A, B, C)?

	Salt (A)	Salt (B)	Salt (C)
a)	CaCl_2	MgBr_2	PbSO_4
b)	CaCl_2	MgI_2	Ag_3PO_4
c)	MgBr_2	NaNO_3	Ag_3PO_4
d)	CaI_2	MgBr_2	PbSO_4

9- Four solutions are obtained by dissolving equal masses of four different substances in distilled water, all of which have the same volume.

- Which of these solutions has the lowest concentration?

(Ca=40, K=39, O=16, H=1, Li=7, Na=23, Cl=35.5)

a) LiCl

b) KOH

c) NaCl

d) $\text{Ca}(\text{OH})_2$

10- A solution contains the cations of (Cu^{2+} , Pb^{2+} , and Ca^{2+}). Which of the following can be added to the previous solution to obtain a solution containing only copper cation?

(a) Dilute sulfuric acid

(b) Sodium carbonate solution

(c) Sodium nitrate solution

(d) Dilute hydrochloric acid

11- Which of the following reactions obeys the law of mass action?

a) $\text{HCl}_{(\text{aq})} + \text{KOH}_{(\text{aq})} = \text{KCl}_{(\text{aq})} + \text{H}_2\text{O}_{(\text{l})}$ in an open container

b) $2\text{NaNO}_{3(\text{s})} = 2\text{NaNO}_{2(\text{s})} + \text{O}_{2(\text{g})}$ in an open container

c) $\text{CaCl}_{2(\text{aq})} + (\text{NH}_4)_2\text{CO}_{3(\text{aq})} = 2\text{NH}_4\text{Cl}_{(\text{aq})} + \text{CaCO}_{3(\text{s})}$ in a closed container

d) $\text{CaCO}_{3(\text{s})} = \text{CaO}_{(\text{s})} + \text{CO}_{2(\text{g})}$ in a closed container

12- The following equation represents a hypothetical reaction in a closed vessel at Equilibrium:



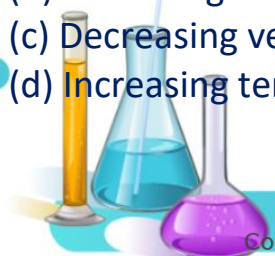
- Which of the following factors reduces the number of moles of substance (C)?

(a) Adding a small amount of substance (A) to the reaction medium

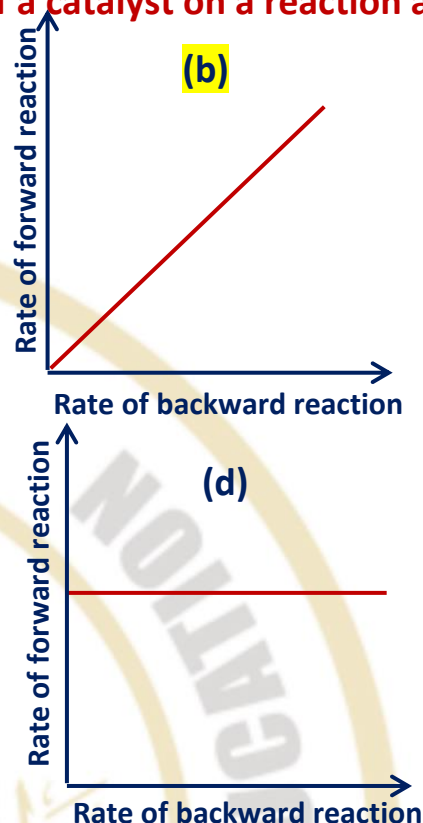
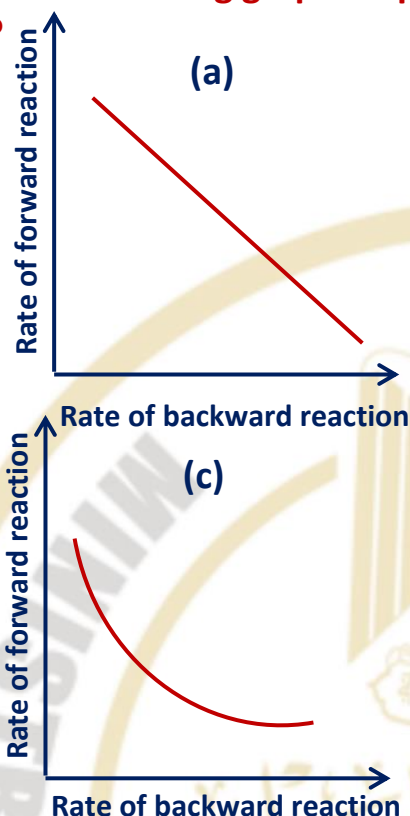
(b) Removing a small amount of substance (D) from the reaction medium

(c) Decreasing vessel volume

(d) Increasing temperature



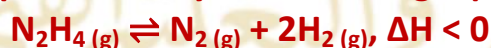
13- Which of the following graphs represents the effect of a catalyst on a reaction at equilibrium?



14- Hydrocyanic acid (HCN) solution has a pH = 4.7 and ionization constant ($K_a = 6.2 \times 10^{-10}$). The number of moles of acid dissolved in 300 mL of the solution is:

- a) 0.19 b) 0.47 c) 0.64 d) 0.14

15- When 0.2 mol of hydrazine gas is placed in a closed container of a volume (1L), equilibrium is established, that represented by the following equation:



At equilibrium, the hydrogen gas concentration $[\text{H}_2] = 0.2 \text{ M}$. Upon raising the temperature of the system and reaching equilibrium again, the nitrogen gas $[\text{N}_2]$ is:

- a) 0.08 M b) 0.20 M c) 0.30 M d) 0.10 M

16- The ionic product of water (K_w) increases with increasing temperature.

-Which of the following occurs when the temperature of water is raised?

- (a) The concentration of hydrogen ions increases, the pH of the water increases, and It becomes acidic on litmus solution.
- (b) The concentration of hydroxyl ions increases, the pOH value of the water Decreases and it becomes alkaline on litmus solution.
- (c) The concentration of hydroxyl ions increases, the pOH value of the water Decreases and it remains neutral on litmus solution.
- (d) The concentration of hydrogen ions increases, the pH of the water increases, and It remains neutral on litmus solution.

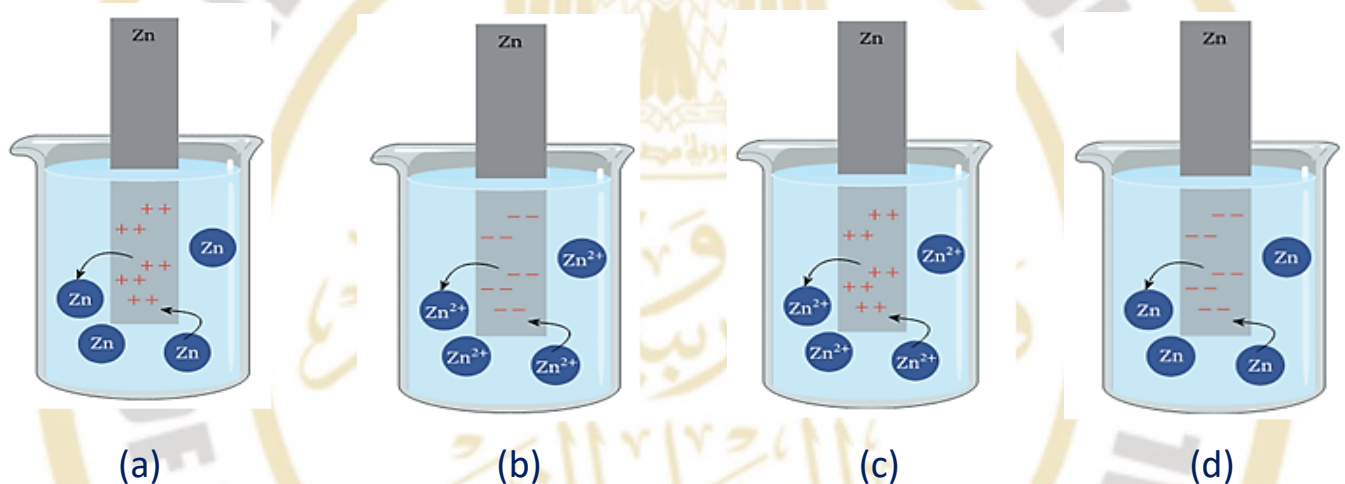


17- Which of the following represents the reactions at the electrodes of an Electrolytic cell for a copper chloride solution using platinum electrodes?

	Reaction at the anode	Reaction at the cathode
a)	$\text{Cu} \rightarrow \text{Cu}^{+2} + 2\text{e}^-$	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
b)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	$\text{Cu}^{+2} + 2\text{e}^- \rightarrow \text{Cu}$
c)	$\text{Cu}^{+2} + 2\text{e}^- \rightarrow \text{Cu}$	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
d)	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$	$\text{Cu} \rightarrow \text{Cu}^{+2} + 2\text{e}^-$

18- A zinc rod is placed in a container containing a molar solution of its ions at a temperature of 25°C.

-Which of the following diagrams represents the equilibrium state between the oxidation reactions of zinc atoms and the reduction reactions of zinc ions in the container?



19- When a car battery (X) with an acid density of 1.19 g/cm³ is connected in series With another car battery (Y) with an acid density of 1.29 g/cm³ which of the Following occurs?

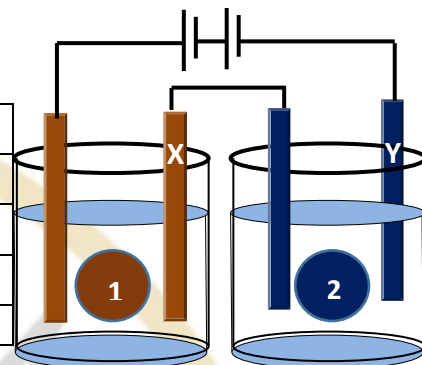
- a) Pb^{2+} ions are oxidized to Pb^{4+} ions at the positive electrode of the battery (X), and lead atoms are oxidized to Pb^{2+} ions at the positive electrode of the battery (Y).
- b) Pb^{2+} ions are reduced to Pb atoms at the positive electrode of the battery (X), and Pb^{2+} ions are reduced to Pb atoms at the positive electrode of the battery (Y).
- c) Pb^{2+} ions are oxidized to Pb^{4+} ions at the negative electrode of the battery (X), and lead atoms are oxidized to Pb^{2+} ions at the positive electrode of the battery (Y).
- d) Pb^{2+} ions are reduced to Pb atoms at the negative electrode of the battery (X), and Pb^{4+} ions are reduced to Pb^{2+} ions at the positive electrode of the battery (Y).



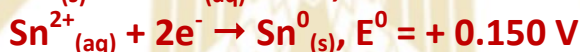
20- The following figure shows two cells containing molten of different salts. After an electric current was passed through the cells for a period of time, the increase in cathode mass of cell 1 is twice that of the cathode of cell 2. Which of the following represents the molten salts in the two cells? And the substance formed at (X, Y) electrodes?

(Cu = 63.5, Al = 27, Au = 195, Mg = 24, Zn = 65, Cr = 52)

	Cell (1)-formed substance at (X)	Cell (2)- formed substance at (Y)
a)	AuCl ₃ - gold is precipitated	ZnCl ₂ -Chlorine gas is evolved
b)	AuCl ₃ - gold is precipitated	ZnCl ₂ - zinc is precipitated
c)	CrCl ₃ -Chlorine gas is evolved	AlCl ₃ -Chlorine gas is evolved
d)	CrCl ₃ -Chromium is precipitated	MgCl ₂ -Chlorine gas is evolved



21- A galvanic cell consists iron and tin electrodes:



Which of the following represents the anode or the cathode, and what is the emf value of the cell?

- a) Iron electrode is anode and emf = +0.559 V
- b) Iron electrode is cathode and emf = -0.559 V
- c) Tin electrode is anode and emf = +0.259 V
- d) Tin electrode is cathode and emf = -0.259 V

22- The following reaction represents an electrochemical cell:



Given that: $\text{X}^0_{(s)} \rightarrow \text{X}^{2+}_{(aq)} + 2e^-, E^0 = + 0.23 \text{ V}$



Which of the following represents the type of this cell and the value of emf?

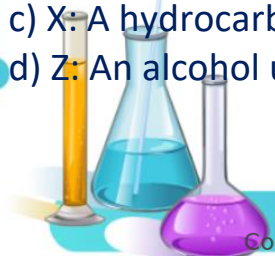
- (a) Electrolytic and emf = -1.03 V
- (b) Galvanic and emf = -0.564 V
- (c) Electrolytic and emf = +0.564 V
- (d) Galvanic and emf = +1.03 V

23- From the following reactions:



Which of the following represents compounds (X, Z)?

- a) X: A hydrocarbon used as a safe anesthetic.
- b) Z: An acid used in preserving fruits and vegetables.
- c) X: A hydrocarbon derivative used as a safe anesthetic.
- d) Z: An alcohol used in pesticides.



24- Alkylation of toluene produces two isomers (X, Y). Complete oxidation of isomer (X) produces a compound used in the manufacture of artificial heart valves.

- Which of the following represents (X, Y)?

- a) (X): 1,2-Dimethyl benzene.
- b) (Y): 4-Methyl toluene.
- c) (Y): Its oxidation produces phthalic acid.
- d) (X): Its oxidation produces phthalic acid.

25- A branched gaseous alkane can be obtained by the dry distillation of:

- a) 2-Methyl sodium pentanoate.
- b) 2-Methyl sodium hexanoate.
- c) 3-Methyl sodium butanoate.
- d) 3-Methyl sodium pentanoate.

26- Upon catalytic hydration of 3-methyl-1-butyne, compound (X) is produced. Which of the following expresses the general formula of compound (X)?

- a) $C_nH_{2n}O$, decolorizes permanganate.
- b) $C_nH_{2n}O$, does not decolorize permanganate.
- c) $C_nH_{2n+2}O$, decolorizes permanganate.
- d) $C_nH_{2n+2}O$, does not decolorize permanganate.

27- From the diagram opposite:



- Which of the following represents the product of chlorination of compound (X) in the presence of $FeCl_3$?

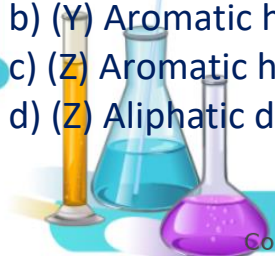
- a) Meta chloro ethyl benzene only
- b) Para chloro ethyl benzene only
- c) A mixture of ortho and para chloro ethyl benzene
- d) A mixture of ortho and para chloro methyl benzene

28- An aromatic liquid (X) with a boiling point of $80^\circ C$ undergoes the following reactions:

The reaction	Reaction conditions	Reaction product
X + chlorine	UV	Y
X + chlorine	UV/ $FeCl_3$	Z

- Which of the following is true?

- a) (Y) Aliphatic derivative
- b) (Y) Aromatic hydrocarbon
- c) (Z) Aromatic hydrocarbon
- d) (Z) Aliphatic derivative



29- When an excess of NaOH solution is added to dicarboxylic acids (X & Y):

In case of acid (X), a salt with the formula $\text{NaOOC}-\text{COONa}$ is formed

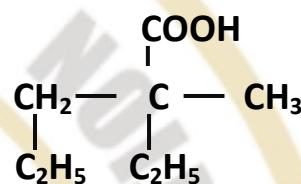
In case of acid (Y), a salt with the formula $\text{C}_6\text{H}_4(\text{COONa})_2$ is formed

- Which of the following represents the two acids? (X & Y)?

- a) X: Oxalic acid , Y: Phthalic acid
- b) X: Oxalic acid , Y: Benzoic acid
- c) X: Phthalic acid , Y: Ethanoic acid
- d) X: Oxalic acid , Y: Salicylic acid

30- Which of the following is the correct IUPAC name for the compound shown in The figure?

- a) 2,3-Diethyl-2-methyl propanoic acid
- b) 2-Methyl-2-ethyl pentanoic acid
- c) 2-Methyl-2-propyl propanoic acid
- d) 2-Ethyl-2-methyl pentanoic acid



31- By alkaline hydrolysis of compound (X), we obtain the simplest alcohol containing an ethyl group as branch.

- Which of the following is the name of compound (X)?

- a) 3-Chloro-2-ethyl pentane
- b) 1-Chloro-2-ethyl butane
- c) 2-Chloro-2-ethyl propane
- d) 2-Chloro-2-ethyl pentane

32-When 1-propanol is dehydrated then water is added to the resulting compound In the presence of a catalyst, compound (X) is produced.

- Which of the following represents compound (X)?

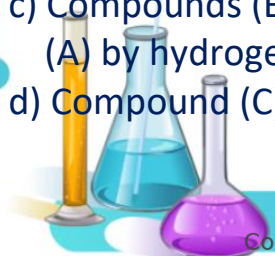
- a) It decolorizes bromine dissolved in carbon tetrachloride and 1,2-dibromopropane is formed
- b) It oxidizes by acidified potassium permanganate and propanoic acid is formed
- c) It decolorizes acidified potassium permanganate and propanone is formed
- d) It oxidizes by hydrogen peroxide to a dihydric alcohol

33- The following diagram illustrates some reactions of iron and its compounds:



- From the previous diagram, which of the following is correct?

- a) Replacing chlorine with dilute hydrochloric acid gives the same product as (B).
- b) Both (A) and (D) react with concentrated sulfuric acid to give a mixture of iron (II) and iron (III) sulphate.
- c) Compounds (B) and (C) have the same magnetic moment and (C) can be reduced to (A) by hydrogen at 500°C .
- d) Compound (C) reacts with dilute hydrochloric acid to give compound (B).



34- Each of the following represents a group of transition and non-transition elements That form different types of alloys.

(X): non-transition element from the third period, Group IIIA

(Y): non-transition element from the second period, Group IVA

(A): transition element used as a catalyst in the hydrogenation of oils

(B): transition element used as a catalyst in the Fischer-Tropsh process

- Which of the following represents the type of alloy formed from some of the Above elements?

	An alloy of (Y) and (B) whose components can be separated by dilute acid	An alloy of (Y) and (B) whose components cannot be separated by dilute acid	An alloy of (X & A)	an alloy of (Y, A & B)
a)	intermetallic	Interstitial	Substitutional	Interstitial & intermetallic
b)	Interstitial	Substitutional	intermetallic	Substitutional & Interstitial
c)	Interstitial	intermetallic	intermetallic	Substitutional & Interstitial
d)	Substitutional	intermetallic	Interstitial	Substitutional & Interstitial

35- When 45 g of a pure sample of hydrated barium chloride ($\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$) is dissolved in 500 mL of distilled water, 84.2 mL of the resulting solution is required to precipitate all the sulphate anions produced from dissolving 10 g of hydrated sodium sulphate ($\text{Na}_2\text{SO}_4 \cdot \text{XH}_2\text{O}$) in water.

($\text{BaCl}_2 \cdot 2\text{H}_2\text{O} = 244 \text{ g/mol}$ - $\text{BaCl}_2 = 208 \text{ g/mol}$ - $\text{Na}_2\text{SO}_4 = 142 \text{ g/mol}$)

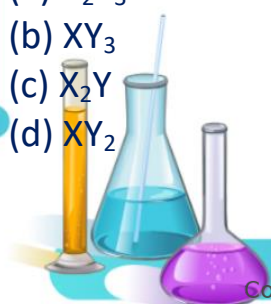
Which of the following expresses the chemical formula of hydrated sodium sulphate?

- a) $\text{Na}_2\text{SO}_4 \cdot 5\text{H}_2\text{O}$
- b) $\text{Na}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$
- c) $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$
- d) $\text{Na}_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$

36- Saturated solution of a sparingly soluble salt (A) is in water. Its saturated solution with a concentration of ($1 \times 10^{-4} \text{ mol/L}$). Given that K_{sp} of this salt is (1.08×10^{-18})

-Which of the following represents the chemical formula of salt (A)?

- (a) X_2Y_3
- (b) XY_3
- (c) X_2Y
- (d) XY_2



37- Two solutions of two different acids (X) and (Y), each monoprotic:

(X): Concentration 0.1 M and ionization constant $K_a = 1.8 \times 10^{-5}$

(Y): Concentration 0.1 M and ionization constant $K_a = 5.1 \times 10^{-4}$

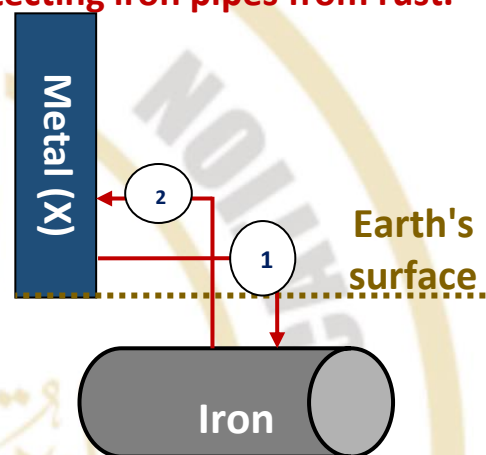
- Which of the following describes the properties of each of the two acids (X) and (Y)?

- a) (X) conducts electricity more efficiently and has a lower pH value than (Y).
- b) (Y) conducts electricity more efficiently and has a higher pH value than (X).
- c) (X) conducts electricity less efficiently and has a lower pH value than (Y).
- d) (Y) conducts electricity more efficiently and has a lower pH value than (X).

38- The opposite figure illustrates one method of protecting iron pipes from rust.

- Which of the following represents metal (X)?

- a) It does not replace hydrogen ions in acids, so the electron direction is (2).
- b) It reduces iron ions in its solution, so the electron direction is (1).
- c) Its ions are reduced by iron atoms, so the electron direction is (1).
- d) Its oxidation potential is higher than iron, so the electron direction is (2).



39- When a spoon is coated with gold using a cell containing an electrolyte solution of AuCl_3 , 0.5 mol of electrons pass into the solution. ($\text{Au}=197\text{g/mol}$)

Which of the following represents the changes that occur during this electrolysis?

	Increase in the mass of the spoon	the concentration of gold ions in the solution
a)	10.94g	decreases
b)	32.8g	increases
c)	32.8g	remains constant
d)	10.94g	remains constant

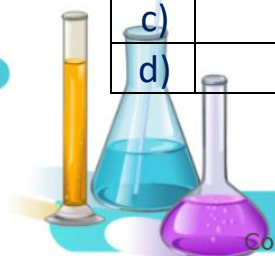
40- Glycolic acid (hydroxy ethanoic acid), with the formula $\text{HO}-\text{CH}_2\text{COOH}$, the following experiments were performed on it:

Experiment (A): Reaction with methanol

Experiment (B): Reaction with acetic acid

Which of the following represents the chemical formula of the product of experiments (A) and (B)?

	The result of experiment (A)	The result of experiment (B)
a)	$\text{HO}-\text{CH}_2-\text{COOCH}_3$	$\text{CH}_3\text{COO}-\text{CH}_2-\text{COOH}$
b)	$\text{CH}_3-\text{COO}-\text{CH}_2\text{COOH}$	$\text{HO}-\text{CH}_2-\text{COOCH}_3$
c)	$\text{HO}-\text{CH}_2\text{COOH}$	$\text{CH}_3-\text{COO}-\text{CH}_2-\text{COO}-\text{CH}_3$
d)	$\text{CH}_3\text{O}-\text{CH}_2\text{COOH}$	$\text{HO}-\text{CH}_2\text{COO}-\text{CH}_3$



41- (A, B and C) Three organic compounds have the following molecular formulas:

(A): $C_3H_6O_3$

(B): $C_2H_4O_2$

(C): $C_4H_8O_2$

The ammonolysis of compound (C) gives the amide of compound (B).

Each of the following represents the reactions of compounds (A, B and C) except:

- a) (A) and (B) react with metal carbonates, while (C) does not.
- b) (A) does not react with (B) but react with alcohols.
- c) (A) and (B) react with active metals, while (C) reacts with metal hydroxides upon heating.
- d) One of the isomers of (C) reacts with active metals, their hydroxides, carbonates, and bicarbonates.

42- (M) is an organic compound that can be obtained by the following steps in order:

(1) Neutralizing acid (X) with caustic soda, then heating the product strongly in the Presence of soda lime to prepare gas (Y)

(2) Chlorination of gas (Y) at $400^\circ C$ to obtain (Z)

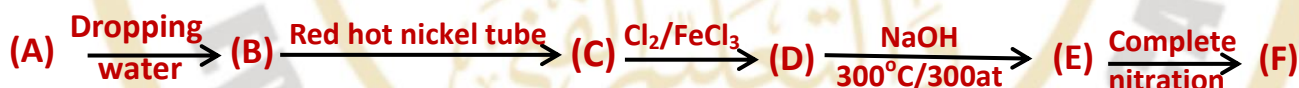
(3) Reacting (Z) with the simplest aromatic hydrocarbon to obtain (W)

(4) Oxidizing (W) in the presence of V_2O_5 to obtain (M)

Which of the following represents organic compounds (X, Y, Z, W, M)?

	Acid (X)	Gas (Y)	Compound (Z)	Compound (W)	Product (M)
a)	Propanoic acid	Ethane	Chloro ethane	Ethyl benzene	Benzoic acid
b)	Acetic acid	Methane	Chloro methane	Toluene	Benzaldehyde
c)	Acetic acid	Methane	Chloro methane	Toluene	Benzoic acid
d)	Acetic acid	Methane	dichloro methane	Phenol	Salicylic acid

43- From the following diagram:

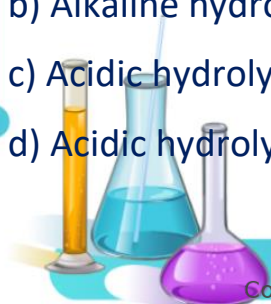


Which of the following represents each of (C, E and F)?

	(C)	(E)	(F)
a)	Aromatic Benzene	Phenol	Picric Acid
b)	Aromatic Benzene	Chlorobenzene	TNT
c)	Toluene	Phenol	Picric Acid
d)	Acetylene	Aromatic Benzene	Phenol

44- Which of the following represents the correct order of chemical reactions required to obtain propane from a compound with the chemical formula $CH_3CH_2COOCH_2CH_2CH_3$?

- a) Alkaline hydrolysis $\rightarrow$ Dry distillation $\rightarrow$ Catalytic hydrogenation
- b) Alkaline hydrolysis $\rightarrow$ Dehydration $\rightarrow$ Catalytic hydrogenation
- c) Acidic hydrolysis $\rightarrow$ Oxidation $\rightarrow$ Dehydration
- d) Acidic hydrolysis $\rightarrow$ Reduction $\rightarrow$ Dehydration



Essay Questions:

45- The opposite figure shows an experiment to detect the anion of salt (X) and the cation (Z). Study the figure well and then answer the following questions:

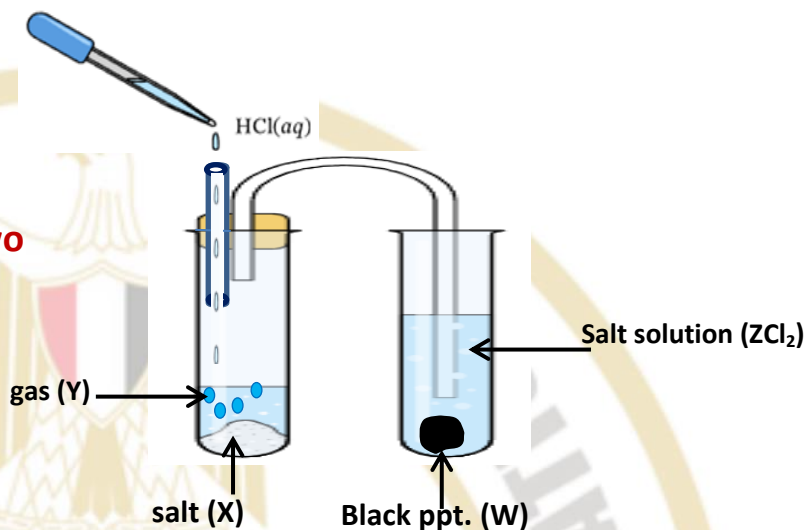
(1) Write the chemical formula for each of:

(a) Salt (ZCl_2)

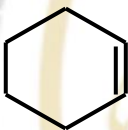
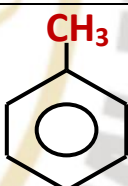
(b) Black precipitate (W)

(2) Write the chemical formula for two other salts instead of salt (ZCl_2) that exhibit the same observations.

The anion of either must be nitrate.



46- The following table shows the chemical formulas of organic compounds:

(A)		(B)	$CH_2=CH_2$	(C)	$CH_3-CH=CH_2$
(D)	$CH\equiv CH$	(E)		(F)	

Write the IUPAC name for each of the following:

- The compound formed by reacting 1 mol of one of the above compounds with 2 mol of bromine to produce a saturated compound
- The compound formed by reacting HBr with one of the above compounds according to Markownikoff's rule in the first step.
- The two compounds formed by reacting 2 mol of one of the above compounds with 2 Mol of chlorine under suitable conditions to give two mono chloro isomers

