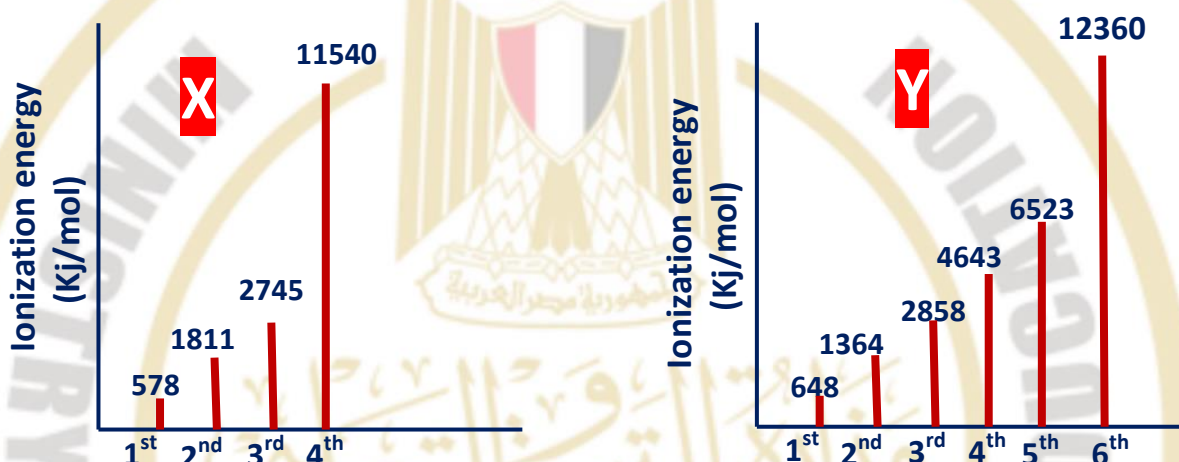


Third Guiding Model (Chemistry 2026)

1- Which of the following expresses the electronic structure of a transition metal ion and the use of one of the compounds of this ion?

- (a) $[_{18}\text{Ar}] 3d^3$ - Used in dry car batteries
- (b) $[_{18}\text{Ar}]$ - Used as a catalyst in the contact method
- (c) $[_{18}\text{Ar}]$ - in artificial joints
- (d) $[_{18}\text{Ar}] 3d^6$ - oil hydrogenation

2- The following graphs represent the ionization energies of two elements (X) and (Y):



-Which of the following expresses the type of element (X) and (Y) and the use of One of their alloys?

	Type of element	Use of one of its alloys
A	(X) Transition	Used in aircraft structures
B	(X) Non-transition	Used in Mig fighter jets
C	(Y) Transition	Used in railway tracks
d	(Y) Non-transition	used in drink cans

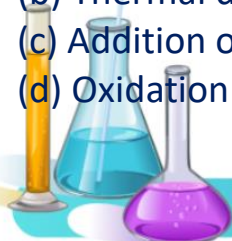
3- A transition element (X) from the first transition series has similar properties of the element that precedes and follows it in the same group.

-Which of the following easily occurs for its ions?

- (a) $X^{3+} \rightarrow X^{2+}$
- (b) $X^{4+} \rightarrow X^{3+}$
- (c) $X^{3+} \rightarrow X^{4+}$
- (d) $X^{2+} \rightarrow X^{3+}$

4- Which of the following is necessary to prepare iron (III) sulphate from iron (II) sulphate?

- (a) Thermal decomposition followed by the addition of dilute sulphuric acid
- (b) Thermal decomposition followed by the addition of concentrated sulphuric acid
- (c) Addition of sodium hydroxide followed by the addition of dilute sulphuric acid
- (d) Oxidation followed by the addition of sodium hydroxide



5. Study the following table:

	Properties of the ore before dressing	Properties of the ore after dressing
Mass of ore	4 Kg	3.85Kg
% of iron	45%	69%

- What process was used to dress the ore?

- (a) Crushing (b) Roasting
(c) Sintering (d) Reduction

6- Hydrochloric acid solution was added to three solid salts (X, Y, Z) separately, and the results were as follows:

(X): A gas rises that does not change the color of the acidified potassium Permanganate solution.

(Y): A suspension forms in the solution and a gas affects the acidified potassium Permanganate solution.

(Z): The color of the solution does not change and no gas is evolved.

- Which of the following is true for salts (X, Y, Z)?

	Salt X	Salt Y	Salt Z
A	Silver bicarbonate	Sodium thiosulphate	Sodium nitrate
B	Sodium sulphite	Sodium nitrate	Sodium nitrite
C	Sodium carbonate	Sodium thiosulphate	Sodium sulphide
d	Sodium nitrate	Sodium nitrite	Sodium chloride

7- The following experiments were conducted on four salt solutions X, Y, Z, and W:

Solution X: A precipitate formed when calcium hydroxide solution was added.

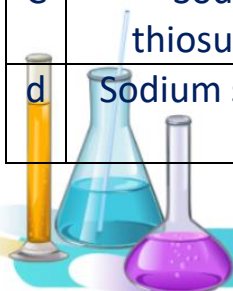
Solution Y: No precipitate formed when calcium hydroxide solution was added.

Solution Z: Decolorizes color of the iodine solution.

Solution W: A black precipitate formed when lead nitrate II was added.

Which of the following is correct for salts (X, Y, Z, W)?

	Salt (X)	Salt (Y)	Salt (Z)	Salt (W)
A	Potassium bicarbonate	Ammonium carbonate	Sodium sulphide	Sodium thiosulphate
B	Ammonium carbonate	Potassium bicarbonate	Sodium thiosulphate	Sodium sulphide
C	Sodium thiosulphate	Sodium sulphide	Ammonium bicarbonate	Sodium sulphide
d	Sodium sulphide	Sodium thiosulphate	Ammonium carbonate	Sodium bicarbonate



8- Which of the following is not used to distinguish between nitric oxide gas and hydrogen chloride gas?

- (a) Sodium chloride solution
- (b) Exposing each separately to air
- (c) Glass rod wet ammonia
- (d) Acidified potassium permanganate solution

9- The experiments shown in the following table were conducted to identify three acids:

Experiment	Observation
Passing hydrogen bromide gas in hot concentrated acid (1)	Orange vapors evolves
Exposing to glass rod wet with ammonia solution to vapors of acid (2)	White cloud is formed
Adding barium nitrate solution to diluted acid solution (3)	White precipitate is formed

- Which of the following represents acids (1), (2), and (3)?

	Acid (1)	Acid (2)	Acid (3)
A	Sulphuric acid	Hydrochloric acid	Phosphoric acid
B	Hydrochloric acid	Phosphoric acid	Nitric acid
C	Nitric acid	Sulphuric acid	Phosphoric acid
d	Sulphuric acid	Hydrochloric acid	Nitric acid

10- Which of the following salts can be detected using the reagent of the confirmatory test for one of the cations in the fifth analytical group?

- (a) $MgCl_2$
- (b) $Fe_2(SO_3)_3$
- (C) $Pb(NO_2)_2$
- (d) $Ba_3(PO_4)_2$

11- Which of the following does not represent a reversible reaction?

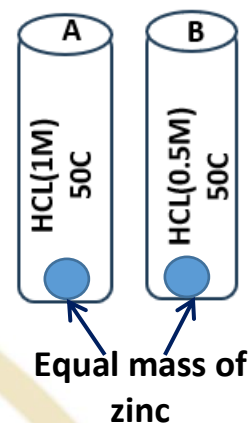
- (a) Preparing ammonia gas from its elements in a closed container.
- (b) Adding acetic acid to ethyl alcohol.
- (c) Addition of magnesium sulfate solution to sodium carbonate solution.
- (d) Adding iron (III) chloride solution to ammonium thiocyanate solution



12- Study the tubes (A) and (B) in the illustrated figure:

-Which of the following describes the result of the reaction
In each tube?

- (a) The rate of disappearing the piece of zinc in tube (A) is Greater than that in tube (B).
- (b) The rate of disappearing the piece of zinc in tube (B) is Greater than that in tube (A).
- (c) The amount of hydrogen gas produced in tube (B) is greater Than that in tube (A) upon complete dissolution of the zinc
- (d) The amount of hydrogen gas produced in tube (B) is less than that in tube (A) Upon complete dissolution of the zinc



13- Which of the following expresses the effect of heat on a system in equilibrium?

- (a) Lowering the temperature reduces the value of K_c in exothermic reactions.
- (b) Raising the temperature increases the value of K_c in exothermic reactions.
- (c) Lowering the temperature reduces the value of K_c in endothermic reactions.
- (d) Raising the temperature reduces the value of K_c in endothermic reactions.

14- All of the following solutions have a degree of dissociation ($\alpha \approx 1$) except:

- (a) Hydrochloric acid (1M)
- (b) Sodium hydroxide (1M)
- (c) Nitric acid (1M)
- (d) Boric acid (1M)

15- Acetic acid ionizes in its solution according the following equation:



Which of the following occurs when drops of sodium hydroxide are added to this solution?

- (a) Acid dissociation increases and pH value of the solution decreases.
- (b) Acid dissociation increases and pH value of the solution increases.
- (c) The rate of acid formation increases and pH value of the solution decreases.
- (d) The rate of acid formation increases and pH value of the solution increases.

16- The following table shows the number of moles of reactants and products at a given temperature in the following equilibrium reaction: $2\text{NOCl}_{(g)} \rightleftharpoons 2\text{NO}_{(g)} + \text{Cl}_{2(g)}$

Substance	Cl_2	NO	NOCl
Number of moles at equilibrium	3	1.5	3

-If the value of K_c for the reaction at the same temperature = 0.25, then the volume of the reaction vessel in liters is:

- a) 1
- b) 2
- c) 3
- d) 4



17- When a galvanic cell is formed from electrodes (Y) and (X), an increase in the concentration of (Y^{2+}) ions is observed.

-Which of the following statements is correct?

- (a) The oxidation potential of (X) is greater than that of (Y).
- (b) (Y^{2+}) is a reducing agent during cell operation
- (c) Electrons flow in the wire from (X) to (Y)
- (d) (X^{2+}) is an oxidizing agent during cell operation

18- By using the following table:

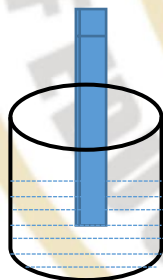
Type of reaction	Reaction equation
Non-spontaneous	$Cd + Zn^{2+} \rightarrow Cd^{2+} + Zn$
Spontaneous	$Cd + Cu^{2+} \rightarrow Cd^{2+} + Cu$

- Which of the following expresses the correct order of the above metal ions according to their strength as oxidizing agents?

- (a) $Cd^{2+} > Cu^{2+} > Zn^{2+}$
- (b) $Zn^{2+} > Cu^{2+} > Cd^{2+}$
- (c) $Cd^{2+} > Zn^{2+} > Cu^{2+}$
- (d) $Cu^{2+} > Cd^{2+} > Zn^{2+}$

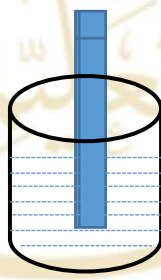
19-From the following figure:

Rod of metal (X)



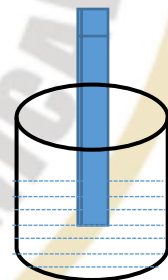
HCl acid solution

Rod of metal (Y)



Aqueous solution of (Z) metal salt

Rod of metal (Z)



HCl acid solution

[Metal (X) doesn't dissolve]

[Metal (Z) precipitate]

[Metal (Z) dissolves]

-Which of the following expresses the poles that form a galvanic cell with the greatest electromotive force?

- (A) X,Z
- (B) Y, H_2
- (C) X,Y
- (D) Z,Y



20- The following table shows four galvanic cells made of hypothetical metals with an iron electrode under standard conditions:

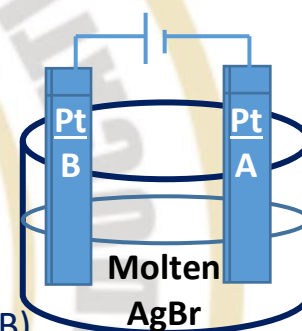
Electrodes	Cell potential	Direction of flow of electrons
A - Fe	+ 1.4 V	A → Fe
B - Fe	+ 1.05 V	Fe → B
C - Fe	+ 0.5 V	C → Fe
D - Fe	+ 1.7 V	Fe → D

-Which of the following metals is preferred to be used as a sacrificial electrode for iron to protect it from rust?

- (a) A
- (b) B
- (c) C
- (d) D

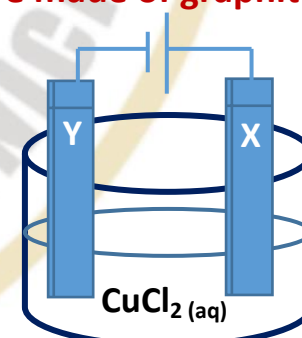
21- Which of the following occurs in the electrolytic cell In the corresponding figure?

- (a) Reduction of bromide ions ($\text{Br}^-_{(\text{aq})}$) at electrode (A)
- (b) Oxidation of bromide ions ($\text{Br}^-_{(\text{aq})}$) at electrode (B)
- (c) Reduction of silver ions ($\text{Ag}^+_{(\text{aq})}$) and precipitated at electrode (B)
- (d) Oxidation of silver ions ($\text{Ag}^+_{(\text{aq})}$) and precipitated at electrode (A)



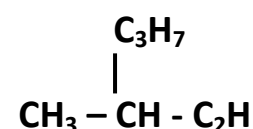
22- In the cell shown in the figure, if the electrodes (Y) and (X) are made of graphite. - Which of the following describes what happens in this cell?

- (a) Electrode (Y) is coated with a layer of (X)
- (b) The concentration of Cu^{2+} ions remains constant.
- (c) The concentration of Cl^- ions remains constant.
- (d) Cl_2 gas evolves at electrode (X)



23- The correct name for the corresponding compound According to IUPAC system is:

- (a) 3,4-dimethyl-1-pentyne
- (b) 3-propyl-1-butene
- (c) 2-ethyl-1-butene
- (d) 3-methyl-1-hexyne



24- The following table describes some isomers of the compound C_4H_8 :

X	Y	Z	W
Isomers obey Markownikoff's rule	Isomers decolorizes alkaline potassium permanganate	isomers that give by catalytic hydration alcohol difficult to be oxidized	Closed chain isomers

- Which of the following represents the number of each type of these isomers?

	X	Y	Z	W
A	1	2	3	1
B	2	3	1	2
C	2	1	2	3
d	2	2	1	1

25- Which of the following describes the processes necessary to obtain the simplest hydrocarbon from the simplest alkyne?

- (a) Catalytic hydration – incomplete oxidation – reduction – dry distillation.
- (b) Catalytic hydration – complete oxidation – reduction – dry distillation.
- (c) Oxidation (Bayer) – complete oxidation – neutralization – dry distillation.
- (d) Catalytic hydration – complete oxidation – neutralization – dry distillation.

26-The following table shows the observations or the role of iron (III) chloride when it added to organic compounds (X) and (Y):

Organic substance	Observation or role
(X)	Give violet color
(Y)	Catalyst during preparation

-Which of the following is true for these compounds?

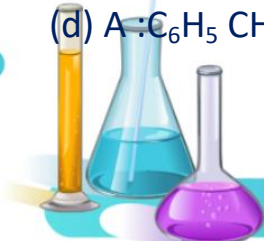
- (A) (X) : salicylic acid , (Y): carbolic acid
- (b) (X) : Carbolic acid, (Y) : Halo benzene
- (C) (X) : Marookh oil , (Y) : Sulphuric acid
- (d) (X) : Halo benzene, (Y) : Marookh oil

27- From the following reaction:

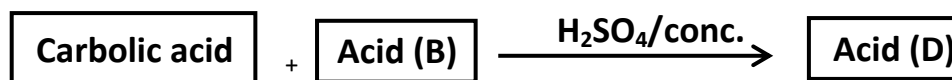


Which of the following represents the compounds (A) and (B)?

- (a) A : $C_6H_5CHClC_6H_5$, B : H_2
- (b) A : $C_6H_5CH_2C_6H_4$, B : H_2
- (C) A : $C_6H_5CH_2C_6H_5$, B : HCl
- (d) A : $C_6H_5CH_2C_6H_5$, B : Cl_2



28- The following diagram shows how to prepare an organic compound: -



- Which of the following represents the resulting compound (D)?

- (a) Trinitrotoluene
- (b) Trinitroglycerol
- (c) Picric acid
- (d) Dacron fiber

29- Upon acidic hydrolysis of propyl formate ester, compound (X) is produced, which reacts with sodium hydroxide.

- All of the following are properties of compound (X) except:

- (a) It has no isomers
- (b) Its molecular formula is CH_2O_2
- (c) It reacts with halogenated acids
- (d) It is secreted by some insects

30- An alcohol that cannot be prepared by catalytic hydration, All of the following applies on this alcohol except?

- (a) It can be prepared by the general method for preparing alcohols.
- (b) It has structural isomers.
- (c) It has harmful effects on human health.
- (d) It is used in the preparation of esters.

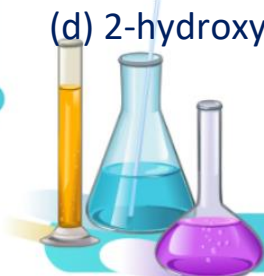
31- (A) and (B) are organic compounds. The molecular formula of alcohol (A) is $\text{C}_2\text{H}_6\text{O}$ and that of compound (B) is $\text{C}_7\text{H}_6\text{O}_3$.

- Compounds (A) and (B) are similar in that they both:

- (a) are used in medical fields.
- (b) react with sodium hydroxide.
- (c) Used in the manufacture of Dacron fibers.
- (d) React with hydrochloric acid.

32-All of the following substances decolorize a potassium permanganate solution in an acidic medium except:

- (a) Hydroxy cyclohexane
- (b) Isobutyl alcohol
- (c) 2-bromo-2-propanol
- (d) 2-hydroxy propanoic acid



33- Two consecutive transition elements (X) and (Y) from the first transition series contain the same number of electrons in (3d) subshell, element (X) is resisting effect of air.

- Which of the following describes the properties of elements (X) and (Y)?

- (a) Element (Y) has a lower density than element (X)
- (b) The atomic mass of element (X) is greater than that of element (Y)
- (c) The radius of element (X) is greater than the radius of element (Y)
- (d) The effective nuclear charge of element (Y) is greater than that of element (X)

34- The representative element (X) is forming the following alloys:

- Intermetallic alloy with element (Y)
- An alloy used in the manufacture of Mig aircraft with element (Z)
- An alloy used in the manufacture of spacecraft with element (L)

Which of the following expresses elements X, Y, Z and L?

	(X)	(Y)	(Z)	(L)
A	Al	Ni	Sc	Ti
B	C	Fe	Ni	Cr
C	Pb	Au	Ni	Ti
d	Al	Ni	Fe	Sc

35- 14.3 g of sodium carbonate hydrate $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ dissolved in water to form a 500 mL solution. Then 25 mL of this solution is titrated with 25 mL of hydrochloric acid, which of the following expresses the concentration of hydrochloric acid?

[Na=23, C=12, O=16, H=1]

- (a) 0.1M
- (b) 0.2M
- (c) 0.3M
- (d) 0.4M

36- 200 mL of 0.01 M sodium hydroxide solution, which of the following expresses the mass of sodium hydroxide that must be added to make the concentration of the solution 0.7 M?

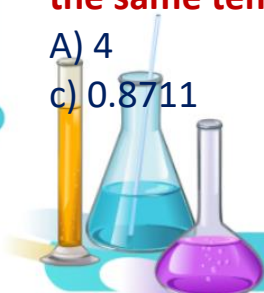
[NaOH=40g/mol]

- (a) 0.138 g
- (b) 0.381 g
- (c) 5.52 g
- (d) 52.5 g

37- One mole each of hydrogen gas and iodine was mixed at a certain temperature in a 2L container. At equilibrium, the remaining amount of each was 0.3 mol.

-Which of the following expresses the equilibrium constant for this reaction at the same temperature?

- A) 4
- b) 16
- c) 0.8711
- d) 21.78



38- 0.1 M Ammonium hydroxide (NH_4OH) solution at 25°C

- Which of the following is correct? ($K_b = 1.8 \times 10^{-5}$)

	PH	POH	α
A	2.87	11.13	0.0134
B	11.13	2.87	0.0134
C	13	1	1
d	9.26	4.74	1.8×10^{-5}

39- The following diagram shows the steps that organic compound (A) undergoes to obtain organic compound (E):



-Which of the following represents (A, C, E)?

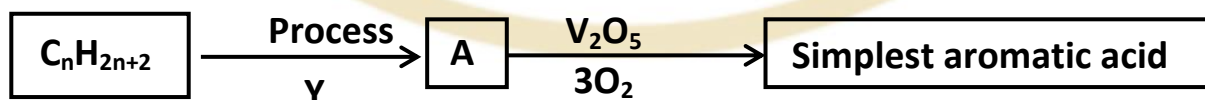
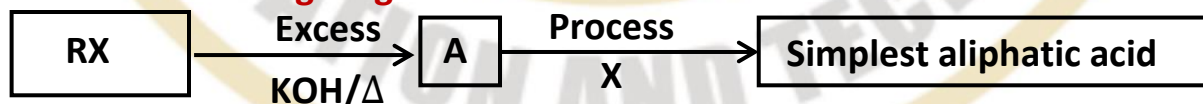
choices	A	C	E
A	Sodium butanoate	2-chloropropane	propanal
B	Sodium pentanoate	1-chlorobutane	Butanoic acid
C	Sodium butanoate	1-chloro propane	propane
d	Sodium pentanoate	2-chloro butane	Butanoic acid

40- An electric current of 10 amperes was passed through a sodium chloride melt for 10 hours.

- Which of the following expresses the mass of produced sodium metal? [$\text{Na} = 23$]

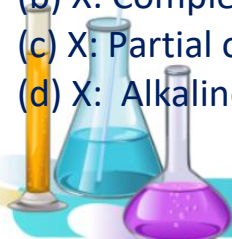
- (a) 42.1 g
- (b) 423.2 g
- (c) 85.8 g
- (d) 21.1 g

41- From the following diagrams:



-Which of the following expresses chemical processes (X) and Y?

- (a) X: Acidic hydrolysis , Y: Alkaline hydrolysis
- (b) X: Complete oxidation , Y: catalytic reforming
- (c) X: Partial oxidation , Y: Ester formation
- (d) X: Alkaline hydrolysis , Y: Acid hydrolysis



42- Three organic acids:

- (A) Contains an oxidizable alcoholic group.
- (B) Contains a non-oxidizable alcohol group.
- (C) Does not contain any alcohol groups.

Which of the following expresses compounds (C, B, A)?

- (a) A : $C_3H_6O_3$, B: $C_6H_8O_7$, C: C_6H_6O
- (b) A : $C_6H_8O_7$, B: C_6H_6O , C: $C_6H_3O_7N_3$
- (c) A : C_6H_6O , B: $C_6H_8O_7$, C: $C_3H_6O_3$
- (d) A : $C_3H_6O_3$, B: $C_7H_6O_3$, C: C_6H_6O

43- If you know that compounds (A) and (B) are hydrocarbons with the following formulas:



-Which of the following applies to compounds (A) and (B)?

- (a) A: is produced by the catalytic reforming method of heptane
B: is produced by the hydrogenation of hexane
- (b) A: has the molecular formula C_nH_{2n}
B: has the molecular formula C_nH_n
- (c) A: Produced by the reduction of carboxylic acid
B: Produced by the hydrogenation of compound (A)
- (d) A: An open-chain alkane
B: Produced by cyclic polymerization

44- From the following diagram:



-If you know that (C) is an unsaturated aliphatic hydrocarbon

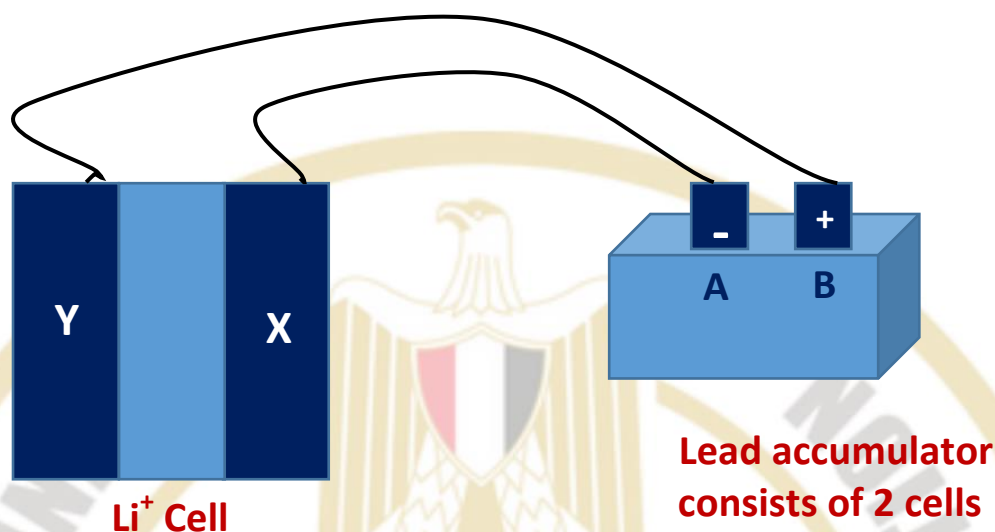
- Which of the following statements is correct for compounds (A, B, C, D)?

- a) (A) : Propanoic acid , (B) : Propanol , (C) : Propene
- b) (A) : Ethyl alcohol , (B) : Acetaldehyde , (D) : Acetic acid
- c) (A): Propanoic acid , (C) : Propane , (D) : Propanol
- d) (A) : Ethyl alcohol , (B) Acetic acid , (D) : Acetaldehyde



Essay questions:

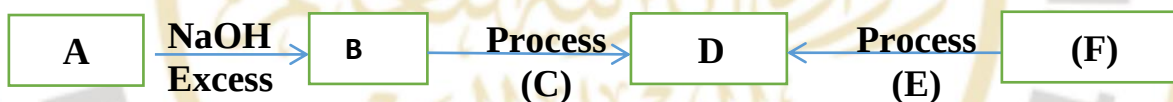
45- Study the following figure:



Answer the following questions

- Identify the anode and cathode in a lithium battery.
- Identify (lead battery or lithium cell) where spontaneous reactions occur.

46- From the following diagram:



-If you know that organic compound (A) is used as a preservative for frozen fruit, and organic compound (F) is produced by the catalytic hydration of propyne.

- Write the structural formulas for compounds (B) and (D).
- Write the names of chemical processes (C) and (E).

