

Grade: 9

chemistry

First Exercise (8 points)
Hydrocarbons, Fuels and index of octane

A- In general hydrocarbons having highly branched structures, burn slowly in the car motor, in order to push the pistons of the motors forward. While hydrocarbons having non branched chains (linear), tend to detonate in the motor and push violently the pistons forward. These detonations produce undesirable explosions.

The index of octane is a scale used to evaluate the quality of fuel, based on the way the fuel burns. The more the index of octane, the better the quality of the fuel.

An isomer of octane, the 2,2,4-trimethylpentane as well as heptane are used as fuels.

- 1- What is the index of octane?
- 2- In Lebanon we use two types of car fuel: "95 octane" and "98 octane", having each respectively 95 and 98 as index of octane. Which of them is better for the car? Justify the answer.
- 3- Write the condensed structural formula of heptane and 2,2,4-trimethylpentane.
- 4- Indicate which of these two hydrocarbons is better as a car fuel. Justify the answer.

B- Octane is an alkane extracted from petroleum by fractional distillation. It can undergo cracking to give propene (C_3H_6) which is an alkene, and an alkane C_xH_y having shorter chain than that of octane as shown in the following equation:



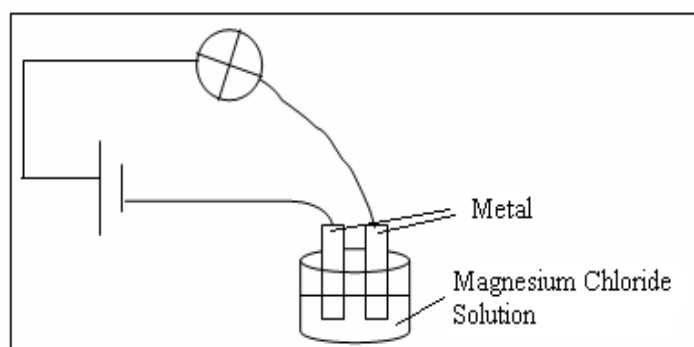
- 1- Distinguish between fractional distillation and cracking.
- 2- Determine x and y.
- 3- Propene polymerizes to form a polymer: the polypropene. This polymer can be remolded when heated.
 - a- Write the equation of this reaction using the condensed structural formulas.
 - b- "Polypropene is thermoset." Justify whether this statement is true or no.

Second Exercise (6.5 points)
Chemical Bonds and Electrochemistry

A- Given the adjacent set up made up of a lamp, a generator and connecting wires. Two metallic strips are dipped in a beaker containing a magnesium chloride solution. The lamp glows.

Given: Mg (Z=12) Cl (Z=17)

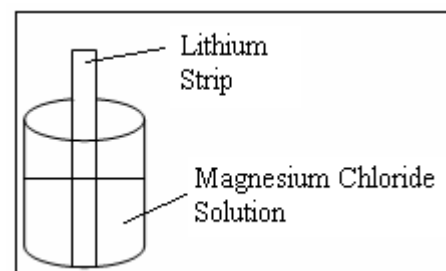
- 1- Write the electron configuration of the two atoms Mg and Cl.
- 2- Write their Lewis dot symbols.



- 3- Explain the formation of the compound MgCl_2 indicating the nature of the chemical bond involved.
- 4- " MgCl_2 is an electrolyte." Justify this statement referring to the text.

B- In the beaker containing the MgCl_2 solution, we dip a strip of lithium (Li) (suppose that lithium is inactive in water), which is an alkali metal as shown in the adjacent figure.

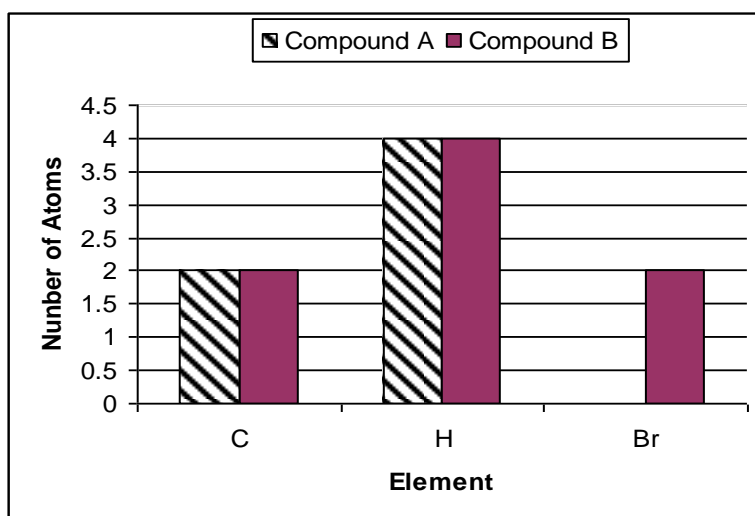
A redox reaction takes place in the beaker and after a while we notice that the mass of the lithium strip decreases and some metallic magnesium deposits.



- 1- The ion corresponding to lithium is " Li^+ ". Justify why this ion has a charge equal to +1.
- 2- Write the half ionic equations taking place and precise the type of each.
- 3- Deduce the over all equation.
- 4- Indicate the oxidizing agent and the reducing one.

Third Exercise (5.25 pts) Organic Compounds

The following histogram shows the number of atoms of each element constituting two organic compounds: A and B.



- 1- Determine, by referring to the above histogram the molecular formula of each of the compounds A and B.
- 2- Compound B has two structural isomers. Write the structural formula of each isomer and give its systematic name.
- 3- a- Compound A reacts with Br_2 to give compound B. Write using condensed structural formulas the equation of the reaction involved.
b- Indicate if this reaction (3-a) is an addition or substitution one.
- 4- Compound A reacts with water (H_2O) to give compound C.
 - a- Write using condensed structural formulas the equation of the reaction that allows obtaining compound C from A.
 - b- Give the name of compound C and indicate its functional group and give its name.