

Grade: 9

chemistry

### First Exercise (7 pts)

Phosgene  $\text{COCl}_2$  is a poisonous gas heavier than air. With cooling and pressure, it can be converted into liquid; so that it can be stored. When liquid phosgene is released, it quickly turns into gas that stays close to the ground and spreads quickly. At high concentration, its odor may be strong causing difficulties in breathing, heart failure, low blood pressure and pulmonary edema.

Given:  ${}^{12}_6\text{C}$  ;  ${}^{16}_8\text{O}$  ;  ${}^{35}_{17}\text{Cl}$

- 1- Write the electron configuration of each element constituting phosgene.
- 2- Determine the group and the row of C, O, and Cl.
- 3- Write the Lewis electron dot symbol of C, O and Cl.
- 4- Identify the valence of each of the above elements.
- 5- Write the Lewis dot structure of  $\text{COCl}_2$ , and indicate the type of bonds between the atoms.
- 6- Prove that the nuclear charge of carbon is 6+.

Given the relative charge of a proton is 1+

- 7- Phosgene was widely used during the World War II causing majority deaths.

Pick up from the text the characteristics of phosgene that justify this use.

### Second Exercise (6.5 pts)

A galvanic cell or voltaic cell is a cell where a chemical reaction is used to produce electricity.

A galvanic cell is constructed using the following materials: lead (Pb) strip, copper (Cu) strip, lead nitrate solution ( $\text{Pb}^{2+}$ ,  $2\text{NO}_3^-$ ), copper (II) sulfate solution ( $\text{Cu}^{2+}$ ,  $\text{SO}_4^{2-}$ ), salt bridge containing ( $\text{K}^+$ ,  $\text{NO}_3^-$ ) solution, connecting wires and a lamp.

The blue color (due to the presence of  $\text{Cu}^{+2}$  ions) of the copper sulfate solution fades after a while of the galvanic cell functioning.

- 1- a- Write the half chemical equation that explains the change in color of the copper sulfate solution.  
b- Specify whether it occurs in the cathodic or anodic half compartment of the cell.

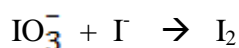
- 2- Sketch and label the above galvanic cell.
  - 3- Indicate, on the schema, the flow of electrons and the direction of the electric current.
  - 4- Write the other half equation and the overall one.
  - 5- Give the symbolic representation of the galvanic cell.
  - 6- Indicate the direction of cations of the salt bridge. Justify.
  - 7- After a certain time, the mass of lead strip decreases by 0.5g and becomes 5 g.
- Calculate the number of mole founding the lead strip used at the beginning of the experiment.

Given: Pb (A = 207)

### Third Exercise (7 pts)

- A)** A mediamutation is a redox reaction where the same element in two different chemical species undergoes oxidation and reduction at the same time and form one product.

Given the following unbalanced equation:



- 1- Determine the oxidation number of iodine in:  $\text{IO}_3^-$ ,  $\text{I}^-$ , and  $\text{I}_2$ .
- 2- Determine the oxidizing and the reducing agents in the above reaction.
- 3- Prove that the above reaction is a mediamutation reaction.

- B)** Potassium iodide KI is a component in some disinfectants and hair treatment and it's the most common additive used to iodize the table salt.

- 1- Identify the nature of potassium  ${}_{19}\text{K}$ . (metal or non-metal)
- 2- Assuming that iodine ( I ) has 7 valence electrons, give the Lewis dot structure of  $\text{I}_2$ .
- 3- Write the Lewis dot structure of  $\text{I}^-$ .
- 4- Explain how potassium K reaches its stability in KI.
- 5- Knowing that a potassium atom contains 20 neutrons in its nucleus, determine its atomic mass.
- 6- Match each of the following to its melting point, justifying the answer.

$\text{KI}$  • • 681 °C

$\text{I}_2$  • • 113.7 °C

- 7- Between the two chemicals KI and  $\text{I}_2$ , which one might be an electrolyte? Justify the answer.