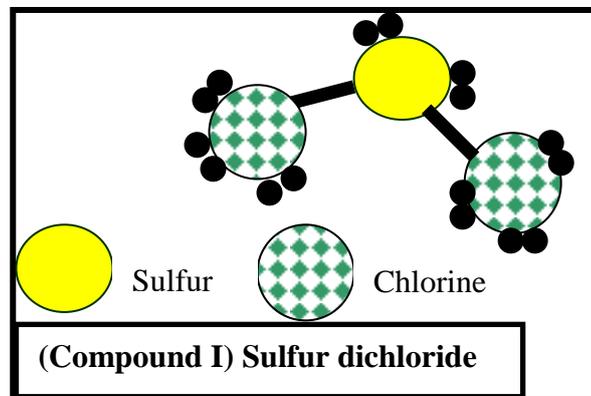Grade: 9
chemistry

First Exercise (8 points)
Sulfur Dichloride and Magnesium Sulfide

A. Sulfur is used in the gunpowder industry, in rubber and in colorants. One of its product is sulfur dichloride (compound I) that is shown by the adjacent molecular model.

1. Write the molecular formula of sulfur dichloride.

Sulfur   Chlorine

(Compound I) Sulfur dichloride

2. Copy then complete the following table.

	Number of energy levels	Number of valence electrons	Valence	Group	Period
Chlorine	3			VII	
Sulfur	3				

3. a- Write the electron configuration of sulfur.

   b- Give Lewis representation of chlorine, sulfur and sulfur dichloride.

4. Explain how sulfur has achieved its octet **(in compound I)** and indicate the type of the involved bond.

B. Another product of sulfur, is magnesium sulfide (compound II), that is formed between sulfide and magnesium ions. Magnesium atom, Mg (Z=12, N=12) loses 2 electrons to have a stable electron configuration forming thus magnesium ion.
1- Translate the latter given in an equation.
2- Justify, by calculus, that magnesium ion has a charge equal to 2+.

**Given: Relative charge of a proton= 1+ ; Relative charge of an electron= 1- ; Relative charge of a neutron = 0 .**

3- a- Identify magnesium atom in the adjacent figure.
   b- Classify the two atoms (magnesium and sulfur) into metal and non metal.
   c-Explain how sulfur has achieved its octet **(in compound II)** and indicate the type of the involved bond.

Magnesium sulfide
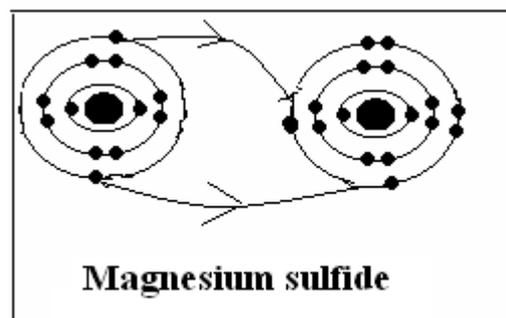
Second Exercise (4.5points)
Electrolysis With Soluble or Insoluble Anode

A- Compact discs (CD), CD-ROM and others are carriers of various information. These discs are fabricated using molds. Some steps of their fabrication involve the deposit of thin layers of nickel metal by "galvanoplasty".

1- What is the aim behind galvanoplasty?

B- We intend to perform the galvanoplasty in a simplified way using the setup schematized to the right.
Given: Ni atom loses 2 electrons to form Ni^{2+} ion and Ni has 31 neutrons and 28 protons in its nucleus.
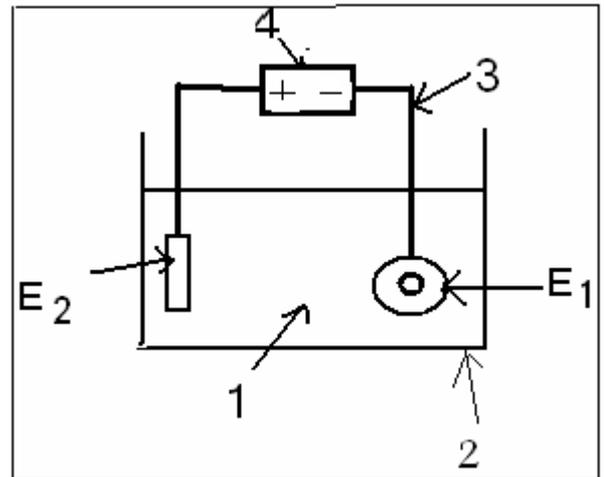
1- Label the parts of the set up (1,2,3,4, E_1 et E_2) while indicating the nature of the electrodes E_1 and E_2 .
2- Draw the setup after a certain time of fuctioning.

3- Based on the above given:
      a- Determine the mass number of nickel atom.
      b- Write its atomic symbol.

C- Knowing that water electrolysis is another application of electrolysis, choose the best answer to complete the following: (Give your answers in your answer sheet)

1- Water electrolysis is an electrolysis with……………..
 a- soluble anode.
 b- insoluble anode.

2- The addition of a small amount of sulfuric acid to distelled water………………….
 a- decreases the speed of its electrolysis.
 b- increases the speed of its electrolysis.

3- Hydrogen gas is collected at the……………………….
 a- cathode.
 b- anode.

4- The overall equation of water decomposition is…………………………….
 a- $2H_2O \longrightarrow 2H_2 + O_2$
 b- $2H_2O \longrightarrow O_2 + 4H^+$

Third Exercise (7.5points)
Galvanic Cell and Variation of the Electrodes Mass

A. The adjacent figure (Document 1) represents a galvanic cell that contains three solutions S_1, S_2 and S_3. Knowing that solution S_1 is tin sulfate (Sn^{2+}, SO_4^{2-}) and the overall equation of the reaction that takes place in the cell is:

$$Sn + 2Ag^+ \rightarrow Sn^{2+} + 2Ag$$
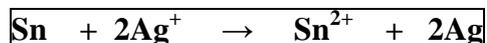
Answer the following questions:

1 – The other two solutions are potassium nitrate (K^+, NO_3^-) and silver nitrate (Ag^+, NO_3^-). Indicate solution S_2. Justify the answer.

2- a – Verify, using oxidizing numbers, that the equation above represents a redox reaction.

 b- Write the half equations of the half reactions taking place at each electrode, and indicate the oxidizing and reducing agent.

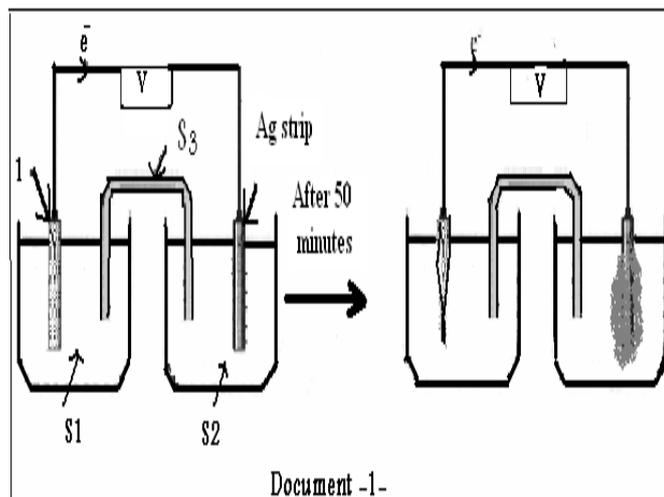**3-** Describe, while justifying, the variation in the concentrations of the following ions: Sn^{2+}, SO_4^{2-} et Ag^+.

Document -1-

4- Choose the answer that represents the symbol of the cell above:
 a- Sn^{2+} / Sn -salt bridge- Ag / Ag^+
 c - Sn^{2+} / Sn -salt bridge- Ag^+/Ag
 b- Sn / Sn^{2+} -salt bridge- Ag^+ / Ag
 d -Ag / Ag^+ -salt bridge- Sn^{2+} / Sn

B. The document below represents the variation of the mass of the Ag strip and that of Sn strip as a function of time.
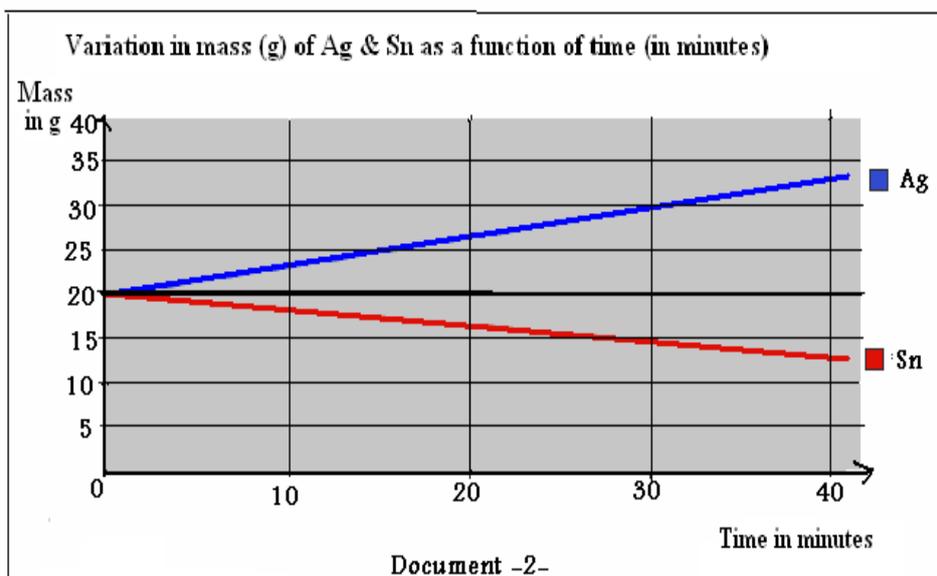
 • *Refering to Document – 2- answer the following questions:*

1- Indicate the mass of each of the two strips at time t = 0 minute.
2- Calculate the decrease in mass of Sn strip between time 0 and 30 minutes.
3- Determine the number of moles that corresponds to the mass of the Ag strip at time t = 40 minutes.
Given: M (Ag =108 g.mol^{-1})

Document –2–

Good work