This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Mock Exams : Pt1

9, 10, 11 MAY022

Do NOT write in this box. Your MARK will be placed here.

Subject :	Chemistry	
Class :	9B and 9C	
Teacher :	Mrs. Jouluana El Khoury	
Duration :	1 hour	
Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

Exercise 1 **(6 points total)**

Document 1 shows some information about sodium sulfide.

Chemical formula	Na_2S	
Ions it contain	Sodium: Na^+	Sulfide: S^{2-}
Information about the atoms	The charge of the nucleus of the sodium atom (Na) is 11 +.	The electron configuration of the sulfur atom (S) is $K^2L^8M^6$.
Precautions	Sodium sulfide reacts with humidity to produce highly toxic gas hydrogen sulfide (H_2S), according to the following reaction: $Na_2S + 2\ H_2O \rightarrow H_2S + 2\ NaOH$.	

Document 1

1. **Verify that** the reaction, $Na_2S + 2\ H_2O \rightarrow H_2S + 2\ NaOH$, is not oxidation – reduction reaction.

   Given: In compounds, the oxidation number of the sodium atom is +1

2. **Determine**, by referring to **document 1,** the number of protons of the sodium atom knowing that the relative charge of one proton is 1 +.

3. **Justify** whether the following statements are true or false:
   - 3.1- The valence of the sulfur atom is 0.
   - 3.2- The electron configuration of the sulfide ion is $K^2L^8M^6$.
   - 3.3- Sulfur atom belongs to group VI and third period.

4. Sulfur atom gains 2 electrons to become a stable sulfide ion S^{2-}.
   - 4.1- **Calculate** the relative charge of the electron cloud of sulfide ion knowing that the charge of one electron = 1-
5. **Explain** the bond formation in sodium sulfide Na_2S.

Exercise 2: **(7 points total)** **Galvanic Cell**

Spontaneous redox reactions use chemical energy to produce electric energy in galvanic cells.

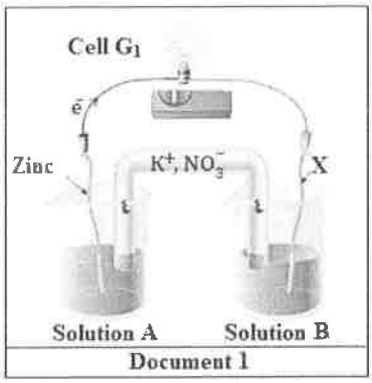
In a galvanic cell, the greater the difference in the tendencies of metals to lose electrons, the higher is the voltage.

Document 1 shows the schema of a typical galvanic cell G_1 which is set to function

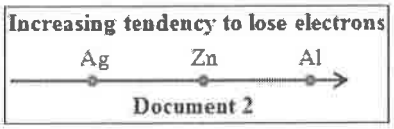
Document 2 shows an axis of increasing order of tendencies to lose electrons of three metals aluminum (Al), zinc (Zn) and silver (Ag).

1. **Justify**, by referring to **document 1,** that zinc metal is the anode in the galvanic cell G_1.
2. Refer to **document 2, identify** the metal of the strip X.
3. **Choose**, among the solutions given below, the one that corresponds to solution A and the one that corresponds to solution B. **Justify**.

   a- Aluminum nitrate solution (Al^{3+}, $3NO^-_3$).
   b- Zinc nitrate solution (Zn^{2+}, $2NO^-_3$).
   c- Silver nitrate solution (Ag^+, NO_3^-).



Document 1



Document 2

4. **4.1- Write** the half reactions that take place at the anode and at the cathode of the galvanic cell G_1.
   4.2- Deduce the equation of the overall reaction of galvanic cell G_1.

5. "Nitrate ions NO_3^- of the salt bridge move toward zinc solution". **Justify** this statement.

6. A galvanic cell G_2 is constructed from the metals *aluminum and silver*.
   Specify, by referring to the text and **document 2,** whether each of the following statements are correct or not.
   6.1 - The voltage of the galvanic cell G_2 is higher than that of the galvanic cell G_1.
   6.2 - Ag^+ is the reducing agent in the galvanic cell G_2

Exercise 3: (7 points total) **Fluorine**

Fluorine is a pale yellow, highly corrosive and flammable gas. It is the most reactive element. Compounds of fluorine such as sodium fluoride are used in tooth pastes to prevent tooth decay. There are other compounds made of fluorine like hydrogen fluoride and oxygen difluoride.

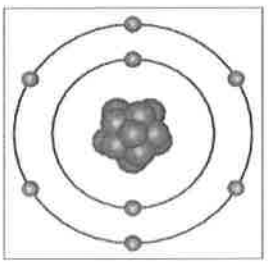
1. Fluorine element belongs to the period 2 and to the group VII in the periodic table.

   1.1- Show that the electron configuration of fluorine atom is K^2, L^7.

   1.2- Deduce the atomic number Z of fluorine element.

   1.3- Calculate the mass number A of fluorine if it contains 9 neutrons in its nucleus.

2. The adjacent document shows the representation of an oxygen atom.



   2.1- Choose among the following Lewis- electron dot symbols the one that corresponds to oxygen atom. **Justify**

   a) $|\overline{O}|$ **b)** $|\overline{O}\bullet$ **c)** $\bullet\overline{O}\bullet$ **d)** $\bullet O\bullet$

3. Fluorine reacts with oxygen to form oxygen difluoride (OF_2) molecule.

3.1- Write the Lewis dot structure of oxygen difluoride molecule and explain the bonds formation.

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Exercise 1 (6 points).

1. $Na_2S + 2H_2O \rightarrow H_2S + 2NaOH$

o.n. $+I\ -II \quad +I\ -II \quad +I\ -II \quad +I\ -II\ +I$ 0.5

in $\overset{+1}{Na_2}\overset{x}{S} \Rightarrow 2(+1)+x=0 \Rightarrow x=-2$ or $x=-II$ 0.25

for $\overset{+1}{H_2}\overset{x}{S} \Rightarrow 2(+1)+x=0 \Rightarrow x=-2$ or $x=-II$ 0.25

2. Relative charge of nucleus = Number of protons x charge of one proton. 0.5

$Q = Z \times 1+ \Rightarrow 11+ = Z \times 1+ \Rightarrow Z = \frac{11+}{1+} = 11 \quad Z = 11.$ 0.5

3.1. F 0.5

3.2 F 0.5

3.3 T 0.5

4.1. the relative charge of e^- cloud = number of electron x charge of one electron

$Q = 18 \times 1- = 18-$ 0.5

S has 16 electrons, it gains $2e^-$ to become ~~stable~~ sulfide ion S^{2-}

then S^{2-} has $16+2 = 18\ e^-$. 0.5

5. Sodium atom Na• loses $1e^-$ to become $[Na]^+$ 0.5

Sulfur atom $:\dot{\underset{\cdot\cdot}{S}}\cdot$ gains $2e^-$ to become sulfide ion $[:\underset{\cdot\cdot}{\overset{\cdot\cdot}{S}}:]^{2-}$ 0.5

$Na^\bullet \rightarrow :\underset{\cdot\cdot}{\overset{\cdot\cdot}{S}}:$

$Na^\bullet \rightarrow$

$2[Na]^+ [:\underset{\cdot\cdot}{\overset{\cdot\cdot}{S}}:]^{2-}$ 0.5

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Exercise 2. (7 points)

1- by referring to doc 1. the electrons flow from Zinc strip to X strip. and knowing that the electrons flow from the anode to the cathode, therefore the anode is the Zinc metal. 1

2- Zinc metal is the anode so it has more tendency to lose electrons than the cathode X strip.
by referring to doc 2., Zn has more tendency to lose e^- than Ag. therefore, X strip is silver strip Ag. 1

3- Solution A : Zinc nitrate solution. 0.5
Solution B : Silver nitrate solution. 0.5
since each metal is dipped in a solution containing its corresponding ions.

4.1 anode half-reaction : $Zn \rightarrow Zn^{2+} + 2e^-$ 0.5
cathode half reaction : $Ag^+ + 1e^- \rightarrow Ag$. 0.5

4.2.
we multiply the cathode half-reaction by 2.
$2 \times (Ag^+ + 1e^- \rightarrow Ag)$
$2Ag^+ + 2e^- \rightarrow 2Ag$. 0.5

overall reaction. $Zn + 2Ag^+ \rightarrow Zn^{2+} + 2Ag$. 0.5

5- In the anode half-cell the Zinc metal is oxidized into Zn^{2+} ions. to balance this increase in + charge, nitrate ions move toward Zinc solution 0.5

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6.1. T. Since the greater the difference in the tendencies of metals to lose $\bar{e}$, the higher the voltage. the difference in tendencies to lose electrons of Al and Ag is more than that of Zn and Ag. 0.75

6.2. F. Ag has less tendency to lose e^- so it is the cathode.
then Ag^+ undergoes reduction. So Ag^+ is the oxidant. 0.75

Exercise 3 (7 points)

1.1. Fluorine belongs to period 2, so it has 2 energy levels K and L, also it belongs to group III, so it has 7 valence e^- on the outer shell L, then the electron configuration of Fluorine atom is K^2, L^7 1

1.2. According to the e^- configuration, fluorine has
$2+7=9$ electrons
number of electrons = number of protons since atom is neutral $\Rightarrow$ atomic number $Z=9$. 1

1.3
Mass number = Atomic number + number of neutrons
$A = Z + N \Rightarrow A = 9+9 = 18$ 1

2.1. C. since oxygen has 6 valence electrons as shown in Doc1 1

3.1. oxygen needs to share 2 electrons to attain a stable octet
each fluorine needs 1 electron to attain a stable octet 1
So each fluorine shared 1 pair of electron with oxygen to form a single covalent bond. :F—O—F: 1