

Grade: 9  
chemistry

**First exercise (8pts)**  
**Periodic table and chemical bonding**

The table below represents a part of the modern periodic table.

<b><sub>1</sub>H</b>																<b>He</b>	
<b>Li</b>	<b>Be</b>											<b>B</b>	<b>C</b>	<b>N</b>	<b>O</b>	<b>F</b>	<b>Ne</b>
<b>Na</b>	<b>Mg</b>											<b>Al</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cl</b>	<b>Ar</b>
<b>K</b>	<b>Ca</b>																

Referring to the given part of the periodic table, answer the following questions:

- 1- We consider the 2 atoms of the 2 elements: **hydrogen (H) and phosphorous (P)**.
  - a- Indicate the number of valence electrons and the valence level of each atom.
  - b- Write the Lewis representation of each atom.
  - c- Identify the valence of each one.
  - d- Explain the bond formation in the compound  $\text{PH}_3$ , then indicate its type and write Lewis structure of this compound.
- 2- An ion  $\text{X}^{2-}$  has the electron configuration :  $\text{K}^2\text{L}^8$ .
  - a- Deduce the atomic number of X.
  - b- Identify X by referring to the given periodic table.
  - c- Knowing that X has 9 neutrons, calculate its atomic mass.
- 3- Deduce the electron configuration of the third noble gas.

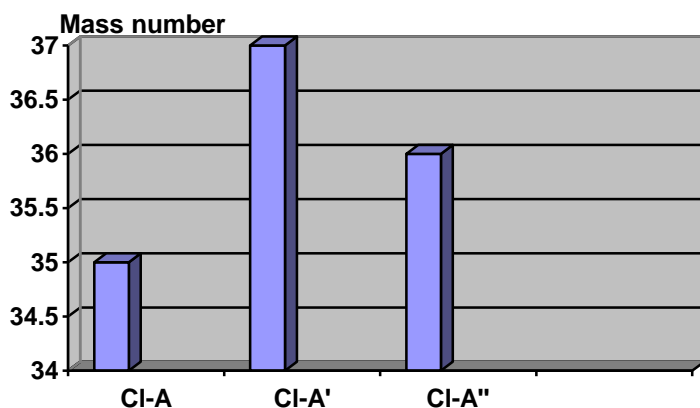
**Second exercise (6.5pts)**  
**Importance of Chemical Elements**  
**to the human body**

A- Chlorine and hydrogen are two necessary elements to the human body. They are important because they form hydrochloric acid molecules (HCl) which facilitate the digestion of proteins in stomach and kill the microbes that enter with food.

**Given:** **Chlorine atom** has 3 energy levels and 7 valence electrons.

- 1- Indicate the type of bond between these 2 atoms when they form HCl. Pick up from the text a word that justifies the answer.
- 2- Deduce the electron configuration of the chlorine atom.
- 3- Indicate, by referring to the text, the results of the absence of chlorine and its derivatives in food.

B- The given histogram represents the mass number of 3 isotopes of chlorine.



- 1- Transform the given histogram into a data table.
- 2- Indicate the atomic number of each isotope.
- 3- Indicate the family that chlorine belongs to.
- 4- Calculate the number of neutrons of each isotope.
- 5- Two moles of chlorine A are needed to prepare 72 g of HCl. Calculate the mass of these 2 moles of Cl-A.

**Third exercise (5.5 pts)**  
**Argon: An inert gas**

Argon is a noble gas discovered in 1894. It is colorless and odorless and chemically it is inert. Argon is the third element by its abundance in the atmosphere (approximately 1%). It is used to produce light through filling in the incandescent bulb lamps. The nucleus of argon atom  ${}^{40}_{18}\text{Ar}$  is represented by 2 values (18 and 40).

- 1- Determine the composition of the argon atom.
- 2- Calculate the charge of  ${}^{40}_{18}\text{Ar}$  atom. (Given: **relative charge of proton=1+**, **relative charge of electron=1-**).
- 3- We consider the atom X (20, 40).  
Are X and Ar atoms of the same element or different elements? Justify the answer.
- 4- The mass of a sample (S) of argon gas is equal 4 g. Calculate the number of moles that corresponds to (S).
- 5- Pick up from the text a use of argon gas.
- 6- "In the atmosphere argon reacts with another element to form a molecular compound". Justify whether this statement is true or not.

**Bareme(20points)**

Question	Reponse	Note	Commentaire
1 (8pts)	1- a- <b>H</b> : 1 valence e and shell K <b>P</b> : 5 valence e and shell M	0.25x4	0 without justification
	b- Lewis H P	0.25x2	
	c-The valence is the nb of single e in the outer energy level H: 1 p:3	0.25x3	
	d- P :needs 3e to have a saturated outer shell and to be stable (octet rule ).	0.25	
	H :needs 1e to have a saturated outer shell and to be stable (duet rule ).	0.25	
	Thus P shares 1 pair of e with each of 3 hydrogen atoms.	0.5	
	Single covalent bond	0.5	
	Lewis: .....	0.75	
	2- a- Since this ion has a charge -2, this means that x has gained 2 e.	0.25	
	X <sup>2-</sup> has 2+8=10 e	0.25	
	X has 10-2=8 e	0.25	
	In a neutral atom the nb of e is equal to that of p Z=8	0.25	
	b- X has 8 e: its .elec.conf: K <sup>2</sup> L <sup>6</sup> GVI et P=2 X is oxygen	0.25+0.25	
	c- A=Z+N =8+9=17 Atomic mass =17u	0.25	
	3- the third noble gas belongs to column 1 so it has 1 e on its outer shell and to the forth period so it has 4 shells. Thus its conf: : K <sup>2</sup> L <sup>8</sup> M <sup>8</sup> N <sup>1</sup> .	0.25	
	0.25		
	0.5		
Q-2 (6.5pts)	A- 1- covalent "molecule"	0.5+0.5	
	2- Cl has 3 energy levels and 7 valence e its conf : K <sup>2</sup> L <sup>8</sup> M <sup>7</sup> .	0.25x3	
	3- The digestion of proteins becomes difficult – the microbes will enter all the organs of the digestive track causing diseases.	0.25x2	

<b>Q-3</b> (5.5pts)	<p>B- 1- Table Title</p> <p>2- <math>Z=17</math></p> <p>3- halogenes</p> <p>4- Cl-A <math>N=A-Z=35-17=18</math>  Cl-A' <math>N=A-Z=37-17=20</math>  Cl-A" <math>N=A"-Z=36-17=19</math></p> <p>5-- <math>M(\text{Cl-A}) = 35 \text{ g. mol}^{-1}</math>  <math>m = n \times M = 2 \times 35 = 70 \text{ g.}</math></p>	<p>0.5+ 0.5</p> <p>1</p> <p>0.5</p> <p>0.25x3</p> <p>1</p>	<p>One mistake ---zero</p> <p>-0.25 unite</p>
	<p>1- Nb of P =18 since atom is neutral nb of e=18  nb of N= <math>A-Z= 40-18=22</math></p> <p>2- Atomic charge = ch of P +ch of N +ch of e  <math>=18(1+) + 22(0) +18(1-)</math>  <math>= 0</math></p> <p>3- Differents , their nb of protons are differents</p>	<p>0.25x5</p> <p>0.5</p> <p>0.5</p> <p>0.25+0.5</p>	
	<p>4- <math>n=m/M =4/40=0.1 \text{ mol}</math></p>	<p>1</p>	
	<p>5- light (To fill incandescent bulb lamp )</p>	<p>0.5</p>	
	<p>6- Incorrect because argon is an inert gas that is chemically inert so it can not combine to any element. It is always monoatomic.</p>	<p>1</p>	