**OEB on 01/15/2024**

**L1 material sciences**

**Chemistry 1 exam**

**Exercise 1 (4pts) :**

* At 25°C, the specific heat capacity of liquid water is 1cal/g. K, convert it to BTU/ lb.R

Data: 1 lb=454g, 1 BTU = 252 cal, ΔT(R) = ΔT(K) x 1.8

* What is the number of protons, neutrons and electrons that participate in the composition of the following structures:



* Give the Lewis representation of the following molecules and ions:

**Exercise 2 (4pts) :** Nitrogen is an element that naturally has two isotopes: and

The average mass of natural nitrogen is 14.01 amu.

I.Calculate relative abundance of these two isotopes.

II. The majority isotope is bombarded by an α particle to form oxygen ( )

1. Write the nuclear reaction.

2. Calculate in Joules, in eV then in MeV, the energy released by a nitrogen nucleus.

Deduce the energy released by a mole of nitrogen in MeV

**data** : 



**Exercise 3 (4pts) :**

The hydrogen atom in its ground state is excited by an electric discharge. The electron of this atom then undergoes a transition at the energy level nj = 9.

1- Calculate the energy absorbed by this atom in eV and the corresponding frequency.

2- The excited electron stabilizes by undergoing a transition from level nj to a lower level ni. This transition is accompanied by an emission of energy, equals to 1.34 eV, in the form of a light line.

1. Determine the value of ni;

2. Which series does this line belong to?

**data**: RH = 1,097.10+7 m-1; h = 6.62 x 10-34 J.s; C = 3 x 10+8 m/s; 1 eV = 1.6 x 10-19 J

**Exercise 4 (4pts):**

The decay constant of radioactive sodium Na\* is: λ= 0.046 h-1.

**1**. Give the expression for the radioactive nuclei at time t (Nt) as a function of time, the radioactivity constant λ and the number of initial nuclei N0 .

**2**. Calculate the period T in hours.

**3**. Calculate the time required for the decay of: a) 1% of the initial nuclei, b) 99% of the initial nuclei.

**Exercise 5 (4pts):**

1. Give the position of the following elements in the periodic table: 7N, 17Cl, 21Sc, 24Cr, 26Fe, 29Cu, 30Zn, 47Ag

2. Antimony (Sb) belongs to the same family as nitrogen (7N) and to the same period as silver. Give its electronic configuration and its atomic number Z.