Ministry of Higher Education and Scientific Research

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Faculty of Mathematics & Matter Sciences

Department of Chemistry

Chemistry 1

Solution of exam (first semester SM 2023/2024)

Exercise 1: 6 points

1-The molar mass of sulfur is: MS = 32.065 $g.mol^{-1}$. M ≈ 32==>Isotope 32 is the most abundant.

2. Let us call x the abundance of isotope 33 and y that of isotope 34**.** **2Pts**

$32\times0.9493 + 33x + 34y = 32.065 \longrightarrow 33x + 34y=1.6874$…….(1)

$X + y + 0.9493= 1 \longrightarrow y= 0.0507-x$ …….(2)

We replace (2) in (1) $33x + 34(0.0507-x) =1.6874$

$33x + 1.7238 -34x =1.6874$ $x= 0.0364$ $y= 0.0143$ **4Pts**

Exercise 2: 6 points

1-

a-A disintegration of 30%

100 -30 = 70

$N_t=N_0 e^{-\lambda t}$, N_t: remaining number of nuclei, N_0: initial number of nuclei

$N_0–N_t$: number of disintegrated nuclei = 30%

$Ln N_t / N_0 = -\lambda t$, $\lambda = 1/t Ln N_0 / N_t = 1/1000 Ln 100/70 = 0.356.10^{-3} year^{-1}$

The période $T= Ln2/\lambda = Ln2/ 1.0162\times 10^4 = 1947$ years. **3Pts**

2-

$\lambda = Ln2/T = Ln2/2.10^{10} = 3.465\times 10^{-11} s^{-1}$

$N'= m/M \times N = 1/75 \times 6{,}023 \times 10^{23} = 8.030 \times 10^{21}$ nuclei.

$A_0 = \lambda N_0 = 8.031 \times 10^{21} \times 3.465\times 10^{-11} = 27.82\times 10^{10}$ dps.

$A= 27.82 \times 10^{10} / 3{,}7.10^{10}$ dps = 7.52 Ci **3Pts**

Exercise3: **8 points**

1- **5Pts**

elements	electronic configuration	period	group	valence electron
$_{23}V$	$1S^2 2S^2 2P^6 3S^2 3P^6 3d^3 4S^2$	4	V B	$3d^3 4S^2$
$_{24}Cr$	$1S^2 2S^2 2P^6 3S^2 3P^6 3d^5 4S^1$	4	VI B	$3d^5 4S^1$
$_{27}Co$	$1S^2 2S^2 2P^6 3S^2 3P^6 3d^7 4S^2$	4	VIII B	$3d^7 4S^2$
$_{30}Zn$	$1S^2 2S^2 2P^6 3S^2 3P^6 3d^{10} 4S^2$	4	II B	$3d^{10} 4S^2$
$_{32}Ge$	$1S^2 2S^2 2P^6 3S^2 3P^6 4S^2 3d^{10} 4P^2$	4	IVA	$4S^2 3d^{10} 4P^2$

2-In a column: (from top to bottom) When Z increases: the atomic radius (ra) increases Ionization energy and electronegativity decrease.

V(23), Cr(24), Co(27) and Zn(30).

In a period: (from left to right) When Z increases: the atomic radius (ra) decreases Ionization energy (EI) and electronegativity increase.

a) Ionization energy: EI (V23) < EI (Cr24) < EI (Co27) < EI (Zn30) < EI (Ge)32 (compared to the same period) **1Pts**

b) atomic radius: ra (Ge)32 < ra (Zn30) < ra (Co27) < ra (Cr24) < ra (V23) (compared to the same period) **1Pts**

c) Electronegativity: V23 < Cr24 < Co27 < Zn30 < Ge32 (compared to the same period) **1Pts**