This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School
for Boys and Girls Loueizeh - Baabda

Stage Exam 03

26JAN2024

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

Subject :	Chemistry
Class :	10B and 10C
Teacher :	Mrs. Mirella Freige
Duration :	1 hour

Graph paper is needed.

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, includlng 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: (5 points)

Answer by true or false then, correct the statements that are false by writing a full sentence:

a) The mass of a proton is close to that of a neutron.

b) In an atom, electrons are the less dense particles.

c) The mass of an atom is concentrated in its cloud.

d) Isotopes are atoms of the same element with the same number of neutrons.

e) Isotopes occupy the same box in the periodic table.

f) A cation is a negatively charged ion.

g) The color of the solution containing sulfate ions is purple.

h) The solution containing iron III ions is blue.

i) The magnesium chloride dissociation equation is: $Mg^{2+} + 2Cl^- \rightarrow MgCl_2$

j) The ionic compound K_2S is called potassium sulfate.

Exercise 2: (8 points) **Zinc**

The element zinc is essential for the proper functioning of the body. It plays an important role in growth, immune response, neurological and reproductive functions.

It is mainly present in the form of zinc ions Zn^{2+} and rarely in atomic form.

In nature, there are 5 types of zinc nuclei:

Nucleus	$^{64}_{30}Zn$	$^{66}_{30}Zn$	$^{67}_{30}Zn$	$^{68}_{30}Zn$	$^{70}_{30}Zn$
Abundance	48.3%	**a**	4.1%	19.0%	0.6%

1. Calculate the value of **a,** then draw the histogram which shows the relative abundance of each isotope of zinc.

2. Indicate the common point between all forms of the element zinc.

3. Explain the difference between an atomic form and an ionic form of the same chemical element.

4. What differentiates the nuclei of the same chemical element?

5. Determine the composition of the least abundant zinc nucleus.

6. Specify whether there is a zinc nucleus containing 36 neutrons.

7. The nuclear charge of a zinc atom is 4.8×10^{-18} C.

Calculate the value of its atomic number Z knowing that the elementary charge e of a proton is equal to $+ 1.6 \times 10^{-19}$ C.

8. Consider the zinc(II) ion

8.1- Give the composition of the $^{66}_{30}Zn^{2+}$ ion.

8.2- Write the equation for the formation of the Zinc II ion.

8.3- Name the following ionic compounds $ZnCl_2$, ZnO and $ZnSO_4$.

Exercise 3 (3 points) **The vital mineral**

Iron Fe is a vital mineral necessary for red blood cell production, oxygen transport to body organs, and the synthesis of certain hormones.

It is recommended for an adult to consume 2 mg of iron per kilo of weight per day.

a- What daily mass of iron is recommended for an adult weighing 58 kg?

b- Calculate the number of moles corresponding to this recommended mass.

c- Deduce the number of Fe atoms in this mass.

Given M(Fe) = 56 g/mol; $N_A = 6.02 \times 10^{23}$.

Exercise 4 (4 points) **Ferric chloride**

The formula unit of ferric chloride (iron III chloride) is $FeCl_3$. Its molar mass is 162.5g/mol.

The primary use of ferric chloride is to remove impurities in water and for wastewater treatment.

In order to prepare an aqueous solution of ($Fe^{3+} + 3Cl^-$) a mass (m) of ferric chloride is dissolved in distilled water.

a- Write the equation of dissociation of ferric chloride in distilled water.

b- Calculate the number of ferric ions N_{Fe3+} if the number of chloride ions N_{Cl^-} in the resulting solution is equal to 36.12×10^{21}.

c- Deduce the number of moles of ferric ions Fe^{3+}.
Given: $N_A = 6.02 \times 10^{23}$

d- Calculate (m).

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I - a) True (1/2 each)
b) True
c) False, the mass of an atom is concentrated in its nucleus.
d) False, isotopes are atoms of the same element with the same number of p^+ and $\bar{e}$.
e) True
f) False, a cation is a positively charged ion.
g) False, the color of the solution containing permanganate ions is purple
h) False, the color of the solution containing copper II ions is blue.
i) False, $MgCl_2 \longrightarrow Mg^{2+}_{(aq)} + 2\,Cl^-_{(aq)}$
j) False, K_2S is called: potassium sulfide.

II - 1. $a = 100 - (48.3 + 4.1 + 19 + 0.6)$
$a = 28\,\%$. (1/4)
2. All forms of the element zinc have the same number of protons. (1/2)
3. The atom is electrically neutral: number of p^+ = nbr. of $\bar{e}$ (1/2)
The ion is a charged entity: number of $\bar{e}$ ≠ nbr. of p^+ (1/2)
4. The nuclei of the same chemical element have different number of neutrons. (1/2)
5. The least abundant zinc is: $^{70}_{30}Zn$ (0.6%)
Nucleus Composition: nbr. $p^+ = Z = 30$
nbr. $n^\circ = A - Z = 40$. (1/2)
6. $N = 36$; $A = Z + N = 30 + 36 = 66$.
Yes, there is a zinc nucleus containing 36 neutrons since, $^{66}_{30}Zn$ exists in nature. (1/2)

7. Nucleus charge $= +4.8 \times 10^{-18}$ C.

$e = +1.6 \times 10^{-19}$ C.

Atomic number $Z = \frac{Q}{e} = \frac{4.8 \times 10^{-18}}{+1.6 \times 10^{-19}} = 30$ (1)

8. $^{66}_{30}Zn^{2+}$ 8.1. number of $p^+ = Z = 30$.

number of $\bar{e} = (30 - 2) = 28\ \bar{e}$.

number of n° : $A - Z = 66 - 30 = 36$. (3/4)

8.2. $Zn \longrightarrow 2\bar{e} + Zn^{2+}$ (1/2)

8.3. $ZnCl_2$: zinc chloride. (1/2)

ZnO : zinc oxide. (1/2)

$ZnSO_4$: zinc sulfate. (1/2)

Exercise 3 :

a - Daily mass of Fe : $58 \times 2 = 116$ mg $= 0.116$ g. (1)

b - $n_{(mol)} = \frac{m\,(g)}{M_{(Fe)}} = \frac{0.116}{56} = 2.07 \times 10^{-3}$ mol. (1)

c - Number of Fe atoms : $N = n \times N_A = 2.07 \times 10^{-3} \times 6.023 \times 10^{23}$

$= 12.46 \times 10^{20}$ atoms (1)

Exercise 4 :

$M(FeCl_3) = 162.5$ g/mol.

a - $FeCl_{3(s)} \xrightarrow{water} Fe^{3+}_{(aq)} + 3Cl^-_{(aq)}$ (1)

b - According to the Law of proportionality : $\frac{N_{Fe^{3+}}}{1} = \frac{N_{Cl^-}}{3}$

$N_{Fe^{3+}} = \frac{36.12 \times 10^{21}}{3} = 12.04 \times 10^{21}$ ions. (1)

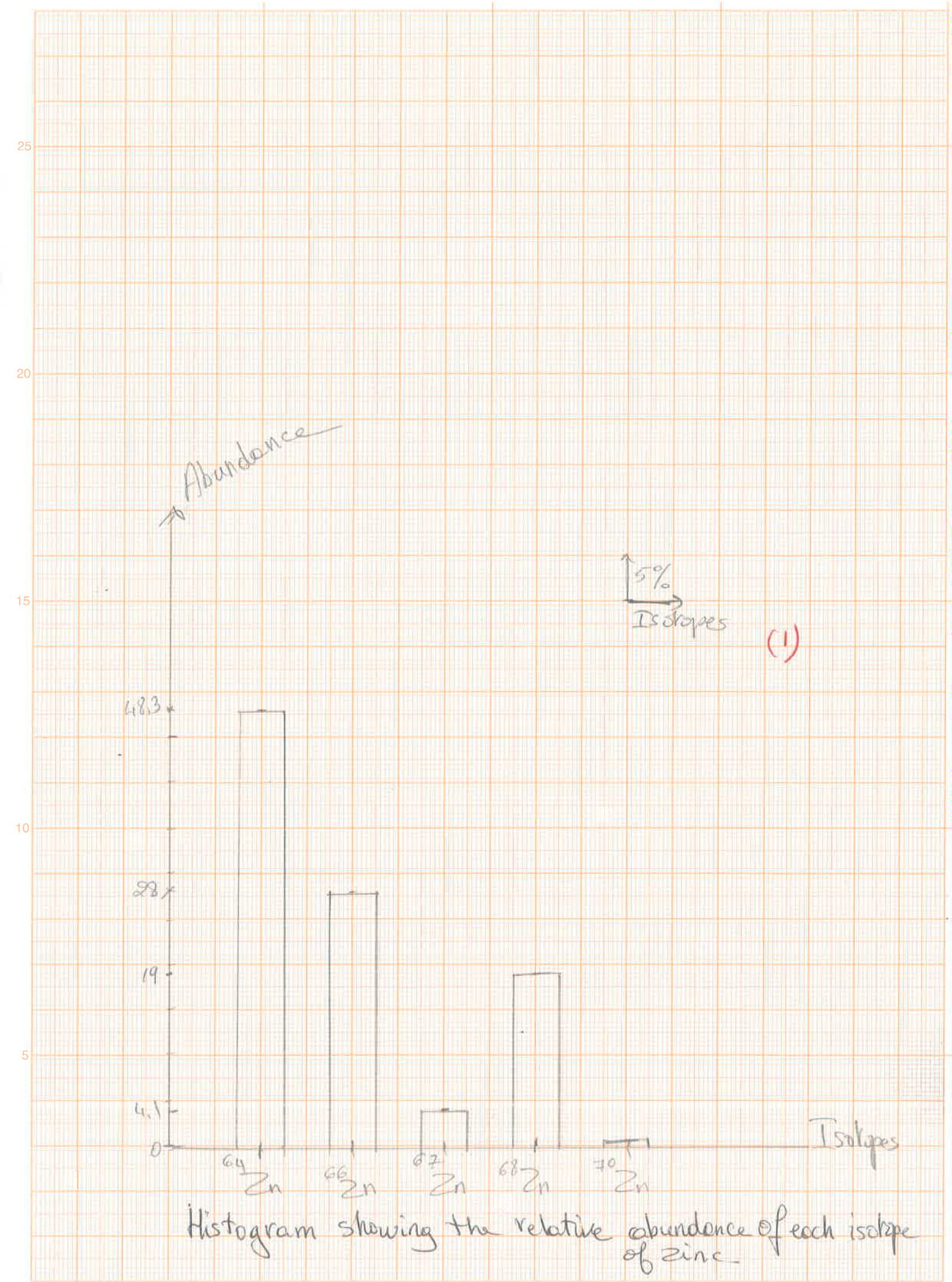
c - $n_{Fe^{3+}} = \frac{N}{N_A} = \frac{12.04 \times 10^{21}}{6.02 \times 10^{23}} = 2 \times 10^{-2}$ mol. (1)

d- $n_{FeCl_3} = n_{Fe^{3+}} = 0.02\ mol$.

(m) : mass of $FeCl_3$: $m = n \times M(FeCl_3)$

$= 0.02 \times 162.5$

$= 3.25\ g$. (1)



Histogram showing the relative abundance of each isotope of zinc