The tutorial answers

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March 2024

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1. Exercise 1

1. Constitution of atomic entities :

Symbol	Mass number	Protons	Neutrons	Electrons
K	40	19	21	19
H	3	1	2	1
O	16	8	8	8
Fe	58	26	32	26
Mg	24	12	12	12
Se	76	34	42	34
O²-	18	8	10	10
Mg²+	25	12	13	10
Fe²+	56	26	30	24

2 . The different isotope families are :

$$({}^{3}_{1}H, {}^{2}_{1}H), ({}^{16}_{8}O, {}^{18}_{8}O^{-2}) ({}^{58}_{26}Fe^{+2}, {}^{56}_{26}Fe^{+2}) ({}^{24}_{12}Mg, {}^{25}_{12}Mg^{+2})$$
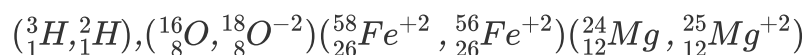
2. Exercise 2

1 . the nucleus mass of a phosphorus atom :

$$m_{nucleus} = Z.m_p + N.m_N = 15.m_P + 16.mN$$

$$m_{nucleus} = 15.(1{,}673.10^{-27}) + 16.(1{,}675.10^{-27})$$

$$m_{nucleus} = 51{,}895.10^{-27}\ Kg$$

2 . The electron cloud massof a phosphorus atom :

$$m = \acute{e}.m_{\acute{e}} = 15.(9{,}109.10^{-27})$$

$$m_{electron} = 136{,}635.10^{-31}\ Kg$$

3 . The mass of a phosphorus atom :

$$m_p = m_{nucleus} + m_{electroncloud}$$

$$m_P = 51{,}895.10^{-27} + 136{,}635.10^{-31}$$

$$m_P = 51{,}908^{-27}\ Kg$$

Conclusion

the mass of the atom is therfore substantially the same as the mass of its nucleus so the mass of the electron cloud is negligible

3. Exercise 3

1. Number of electron in the Iron atom

-the mass of all the electron is $2{,}366.10^{-29}$ kg and the mas of a single electron is $9.31.10^{-31}$ Kg
so :

$$number\ of\ electon\ of\ the\ iron = \frac{2{,}366{,}10^{-29}}{9{,}31{,}10^{-31}} = 26$$

Iron has 26 electrons

2. The number of positive charges carried by the nucleus of the iron atom :

Iron is a natural atom so its number of proton is equal to its number of electron, therefore iron has 26 positive charges.

3. The atomic number of the iron atom :

In an atom, the number of electrons is equal to the number of charges in the nucleus, so iron has 26 positive charges and its atomic number is Z=26.

4. The number of iron atoms in an iron nail of 2,5 g :

knowing that :

$$1\ atom\ of\ iron \rightarrow 9{,}3.10^{23}g$$
$$2{,}5g \rightarrow X$$
$$X = 2{,}69.10^{22}\ atoms$$

So there are $2{,}69.10^{22}$ atoms in an iron nail of 2.5g.

4. Exercise 4

1. Isotopes composition :

Isotope	N°1	N°2	N°3	N°4
A	54	56	57	58
N	28	30	31	32

2. Natural average mass of Fe

$$A(Fe) = 0{,}0584.53{,}9399 + 0{,}9175.55{,}9349 + 0{,}0212.56{,}9350 + 0{,}0028.57{,}9330$$

$$A(Fe_{nat}) = 55{,}8396g.\,mol^{-1.}$$

3. Calculation of mass defect (Δm)

$$\Delta_m = P.m_p + N.m_n - A$$
$$\Delta_m = 26.1{,}0073 + 30.1{,}0087 - 55{,}9349$$
$$\Delta_m = 0{,}5129\ amu$$