

Problem 8 **Three elements**

Three elements – **A**, **B**, and **C** form three binary compounds. Each element has the same valence in these compounds. The mass fraction of **A** in the compound with **B** is 75%, and the mass fraction of **B** in the compound with **C** is 7,8%. Determine the mass fraction of **C** in the compound with **A** and find all the elements.

Solution

Let's have these three compounds noted with $AbBa$, $BcCb$ and $AcCa$.

In this case the molecular mass for $AbBa$ is : $M = b M(A) + a M(B)$ and $b m(A):a M(B) = 3:1$ or $b M(A) = 3 a M(B)$.

For the compound made between B and C we have the compound noted $BcCb$ with molecular mass:

$M = c M(B) + b M(C)$ and the ratio $c M(B) : b M(C) = 7.8 : 92.2$ where $b M(C) = 11.82 c M(B)$

Now, $M(A) : M(C) = 3 a M(B) : 11.82 c M(B)$ and $M(A) : M(C) = a : 3.94 c$ and $a M(C) = 3.94 c M(A)$.

For the third compound $AcCa$ the molecular mass is $M = c M(A) + a M(C) = 4.94 c M(A)$

Then the percentage of A in compound with C is : $c M(A) 100 : 4.94 c M(A) = 20,24\%$ and the percentage of C is : $3.94 \cdot 100 : 4.94 = 79,76\%$

If we work with equivalents then $E(A):E(B) = 3:1$, and $E(B):E(C) = 1: 11,82$ and more $E(A) : E(C) = 1 : 3.94$.

We see very easily that if we multiply with 3 the equivalents of C, then we get 35.46, the atomic mass of chlorine. Taking this into consideration we find that A is Aluminium Al (with equivalents equal to 9 and valence 3) and B is carbon C with atomic mass 12 (equivalents 3).

The compounds are Al_4C_3 , CCl_4 and $AlCl_3$.

Solution proposed by

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