Question #59694, Chemistry / General Chemistry

Elements A and Z combine to form two different compounds: A2Z3 and AZ2. If 0.15 mol of A2Z3 has a mass of 15.9 g and 0.15 mol of AZ2 has a mass of 9.3 g, what are the atomic masses of A and Z

Answer:

Let atomic mass of element A=**X** and atomic mass of element Z = **Y.**

Molar mass of compound A_2Z_3:

$$M_{A2Z3} = 2X + 3Y$$

Molar mass of compound AZ_2:

$$M_{AZ2} = X + 2Y$$

In the task, it is given that:

$$0.15(2X + 3Y) = 15.9 \quad (1)$$

AND

$$0.15(X + 2Y) = 9.3 \quad (2)$$

From the last equation:

$$X = \frac{9.3}{0.15} - 2Y = 62 - 2Y$$

Now we will substitute it into the (1) equation:

$$2(62 - 2Y) + 3Y = \frac{15.9}{0.15}$$

$$124 - 4Y + 3Y = \frac{15.9}{0.15}$$

$$124 - Y = 106$$

$$\boldsymbol{Y = 18}\ \text{[u]}$$

AND

$$\boldsymbol{X} = 62 - 2Y = 62 - 36 = \mathbf{26}\ \textbf{[u]}$$

Atomic mass of element **A** is **26** units and atomic mass of element **Z** is **18** units.