

One mole is a quantity of N_0 atoms or molecules. Therefore, the atomic weight is the weight of one mole of atoms, and the molecular weight is the weight of one mole of molecules. The N_0 is Avogadro's number, and it's equal to the following:

$$N_0 = 6.022 \cdot 10^{23}$$

The molecular weight M_w of a molecule, multiplied by the number of moles n , is equal to the total weight W of the molecules:

$$W = n \cdot M_w$$

So one mole includes $6.022 \cdot 10^{23}$ particles.

For O_2 , one mole has weight of 32 g (from molecular weight)

$$\text{mass of one molecule} = 6.022 \cdot 10^{23} / 32 \text{ g} = \mathbf{5.314 * 10^{-23} \text{ g}}$$

$$\text{mass of one atom is } 5.314 * 10^{-23} \text{ g} / 2 = \mathbf{2,657 * 10^{-23} \text{ g}}$$