

One mole: distinguish atoms from molecules

Check the chemical entity before converting moles to grams

• Mole, particles and molar mass

◆ A mole counts specified entities

- One mole contains exactly $6.02214076 \times 10^{23}$ specified elementary entities.
- The entity must be stated: atoms, molecules, ions, electrons or formula units.
- At school precision, molar mass in g mol^{-1} has the same numerical value as particle mass in u.

○ O, O₂ and O₃

- Using O $\approx$ 16 u, one mole of O atoms has mass $\approx$ 16 g.
- One mole of O₂ molecules has mass $\approx 2 \times 16 = 32$ g.
- One mole of O₃ molecules has mass $\approx 3 \times 16 = 48$ g.

◇ Mass → moles → particles

- Number of moles $n = \text{given mass (m)} \div \text{molar mass (M)}$.
- Number of specified entities $N = nN_a$, where $N_a = 6.02214076 \times 10^{23} \text{ mol}^{-1}$.
- Example: 16 g of O₂ gas is 0.5 mol of O₂ molecules, but contains 1.0 mol of O atoms.

□ Check the entity first

- Never use 32 g for '1 mole of oxygen atoms' or 16 g for '1 mole of oxygen gas (O₂)'.
- For X₂, molecular molar mass is twice the atomic molar mass of X.
- Equal moles of different substances have equal particle counts, not equal masses.

REMEMBER Specify the entity before converting mass to moles: O atoms and O₂ molecules are different counts.