Noteset 3F: Atomic Mass

Atomic Mass

Mass of a single atom (isotope) of an element in kilograms (kg), grams (g), or atomic mass unit (amu)

Atomic Mass is based on the mass of the p^+ and n^0 (Mass #)

Atomic Mass: Actual mass (g, kg, or amu)

Mass #: # of $p^+ + n^0$

Calculating the atomic mass

Subatomic Particle Mass	Ratio
$p^+ = 1.672 \times 10^{-24}$ g	x 1836.15
$n^0 = 1.675 \times 10^{-24}$ g	x 1838.15
$e^- = 9.109 \times 10^{-28}$ g	x 1

Mass e^- too small to actually make a difference to atomic mass

Because the mass of a p^+ or n^0 is so small we use amu

Mass $1p^+$ = Mass $1n^0$ = 1 amu (1.67×10^{-24} g) (atomic mass unit)

Comparing mass atom (g vs. amu)

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$1\ amu = 1.67 \times 10^{-24} g = 1.67 \times 10^{-27} kg$

$^{35}_{17}Cl \longrightarrow 17p^+ + 18n^0$ [Mass# = AtomicMass(amu)]

$17p^+ = 17 \cdot 1.67 \times 10^{-24} g = 2.84 \times 10^{-23} g$

$18n^0 = 18 \cdot 1.67 \times 10^{-24} g = 3.01 \times 10^{-23} g$

Atomic $= \underline{5.85 \times 10^{-23} g}$

$17 \cdot 1amu = 17amu$

$18 \cdot 1amu = 18amu$

Atomic $= \underline{35amu}$

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Calculating atomic mass

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1. Find # p^+ and # n^0
   [n^0 = Mass# − Atomic #
2. Mass of p^+ and n^0 (amu)
   [$1p^+$ or $1n^0$ = 1 amu]
3. Add p^+ and n^0 mass = Atomic Mass (amu)

Atomic Mass $^{35}_{17}Cl$

17
Cl
35.45

17 ← Atomic #

35.45 ← Avg. Atomic Mass

(Chlorine-35) ← Mass#

$P^+ = 17 \longrightarrow 17amu$

$n^0 = 35 - 17 = 18 \longrightarrow 18amu$

Mass# $= 35 \longrightarrow 35amu$ (Atomic Mass)

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Isotope Stability

Every isotope of an atom has a chance to exist based on the $p^+ : n^\circ$ ratio. Closer to Ideal = More common.

Ideal $p^+ : n^\circ$ ratio

Small Atoms – $1p^- : 1n$
Medium Atoms – $1p^+ : 1.2n^\circ$
Large Atoms – $1p^+ : 1.5n^\circ$

2 Isotopes of Chlorine

$^{35}_{17}Cl$ (75%)	$^{37}_{17}Cl$ (25%)
35 amu	37 amu
($17p^+ : 18n^\circ$)	($17p^+ : 20n^\circ$)

Average Atomic Mass

Atomic Mass based on all isotopes and their % abundance

% abundance

% of all isotopes a single isotope occupies (# isotope out of 100)

Ex: $^{35}_{17}Cl$: 75% (75 out of 100)

Single Iso. $^{37}_{17}Cl$: 25% (25 out of 100)

$^{35}_{17}Cl$: 35 amu $^{37}_{17}Cl$: 37 amu

atomic mass

Avg Atomic Mass = 35.45 amu

Based on % Abund

Finding Avg. Atomic Mass

A : $Amount_A \times (\% \div 100)$

B : $Amount_B \times (\% \div 100)$

C : $Amount_C \times (\% \div 100)$

Add A + B + C = Avg. Amount

	Item Price	% Sold	Frac.
A :	2.00 ×	8%/100 =	0.16
B :	4.00 ×	72%/100 =	2.88
C :	6.00 ×	20%/100 =	1.20

Avg : 0.16 + 2.88 + 1.20

= 4.24 (Avg. Cost)