AIM: HOW TO CALCULATE THE AVERAGE ATOMIC MASS?

DO NOW: 1. WHAT ARE THE 3 SUBATOMIC PARTICLES OF AN ATOM? LIST THE THREE SUBATOMIC PARTICLES AND THEIR CHARGE.

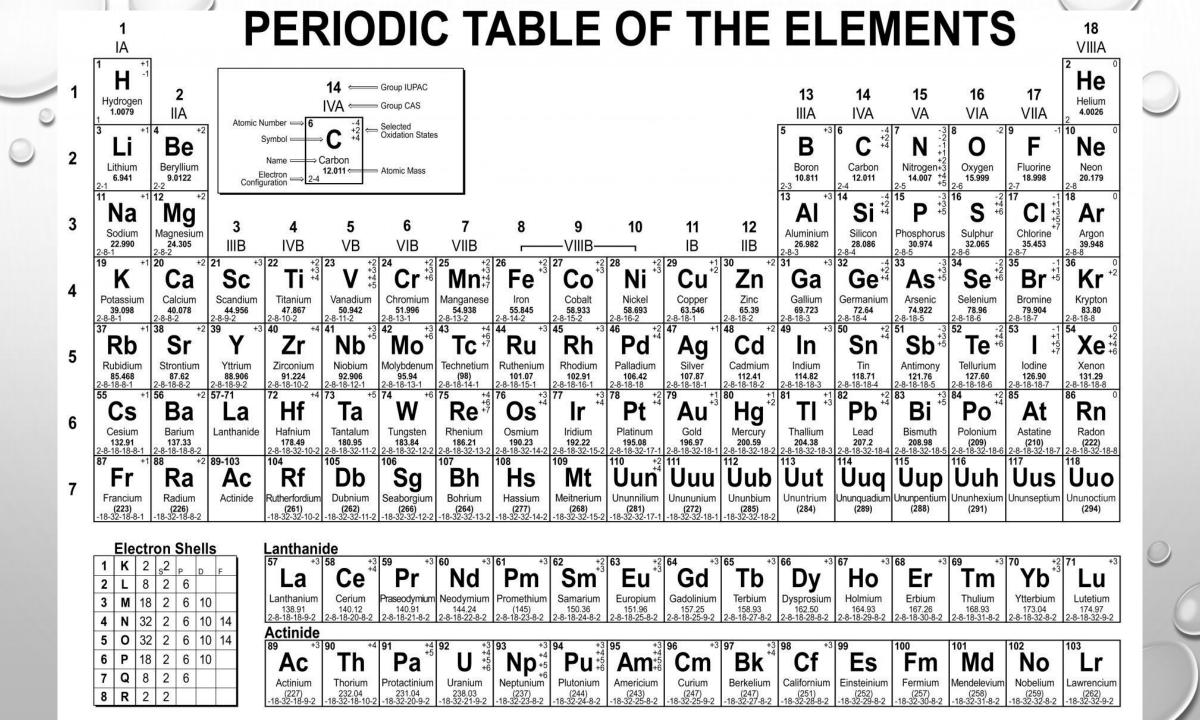
2. IF AN ATOM HAS AN ATOMIC MASS OF 34 AND THE ATOM HAS 16 NEUTRONS, HOW MANY PROTONS DOES THE ATOM HAVE?

ISOTOPES

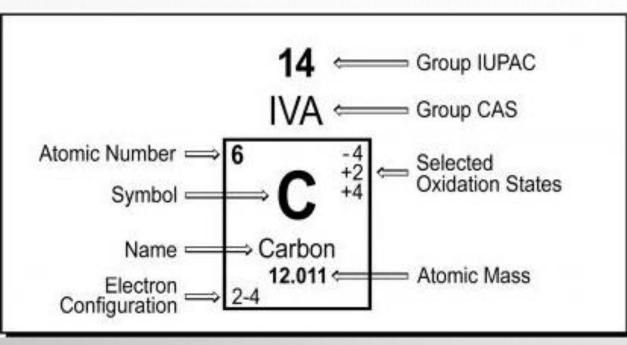
- ISOTOPES-ATOMS THAT HAVE THE SAME NUMBER OF PROTONS BUT DIFFERENT NUMBERS OF NEUTRONS ARE CALLED ISOTOPES.
- BECAUSE ISOTOPES OF AN ELEMENT HAVE DIFFERENT NUMBERS OF NEUTRONS, THEY ALSO HAVE DIFFERENT MASS NUMBERS.

AVERAGE ATOMIC MASS

- MOST ELEMENTS OCCUR NATURALLY AS MIXTURES OF ISOTOPES.
- THE MASS NUMBERS ON THE PERIODIC TABLE ARE THE WEIGHTED AVERAGE OF THE MOST ABUNDANT ISOTOPES' MASS NUMBERS.
- THE ATOMIC MASS OF AN ELEMENT IS A WEIGHTED AVERAGE MASS OF THE ATOMS IN A NATURALLY OCCURRING SAMPLE OF THE ELEMENT.







Name	Symbol	Natural Percent Abundance	Mass (amu)	"Average" Atomic Mass
Carbon	12 C 13 C	98.89 1.11	12.000 13.003	12.011



Natural Percent Abundance of Stable Isotopes of Some Elements	
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Name	Symbol	Natural Percent Abundance	Mass (amu)	"Average" Atomic Mass
Hydrogen	¹₁H	99.985	1.0078	
.,	2 H	0.015	2.0141	1.0079
	² ₁ H ³ ₁ H	negligible	3.0160	1.0010
Helium	³ ₂ He	0.0001	3.0160	4.0026
	⁴ ₂ He	99.9999	4.0026	
Carbon	¹² ₆ C ¹³ ₆ C	98.89	12.000	12.011
	13 ₆ C	1.11	13.003	
Vitrogen	¹⁴ ₇ N	99.63	14.003	14.007
	15 N	0.37	15.000	
Oxygen	16 O 17 O 18 O	99.759	15.995	
	17 ₈ O	0.037	16.995	15.999
	¹⁸ ₈ O	0.204	17.999	
Sulfur	³² 16 S	95.002	31.972	
	33 6 S 16 S	0.76	32.971	32.06
		4.22	33.967	
	³⁶ 16 S	0.014	35.967	
Chlorine	35 ₁₇ Cl	75.77	34.969	35.453
	³⁷ 17CI	24.23	36.966	
Zinc	⁶⁴ 30 Zn	48.89	63.929	
	⁶⁶ ⊸7n	27.81	65.926	200.000.000
	30	4.11	66.927	65.38
		18.57	67.925	
	⁷⁰ ₃₀Zn	0.62	69.925	

HOW TO CALCULATE AVG. ATOMIC MASS

• TO CALCULATE THE ATOMIC MASS OF AN ELEMENT, MULTIPLY THE MASS OF EACH ISOTOPE BY ITS NATURAL ABUNDANCE, EXPRESSED AS A DECIMAL, AND THEN ADD THE PRODUCTS.

SAMPLE PROBLEM 1

• RUBIDIUM HAS TWO COMMON ISOTOPES, 85–RB AND 87–RB. IF THE ABUNDANCE OF 85–RB IS 72.2% AND THE ABUNDANCE OF 87RB IS 27.8%, WHAT IS THE AVERAGE ATOMIC MASS OF RUBIDIUM?



Isotope	% abundance	Fraction of abundance	mass	
85-Rb	72.2%	0.722	85 amu <	= 61.37
87-Rb	27.8%	0.278	_{<} 87 amu =	24.186
				+

*_____85.556 amu

SAMPLE PROBLEM 2

• GIVEN THE AVERAGE ATOMIC MASS OF AN ELEMENT ON THE PERIODIC TABLE AND THE PERCENT NATURAL ABUNDANCE OF EACH ISOTOPE, CALCULATE THE IDENTITY OF THE UNKNOWN ISOTOPE?(ATOMIC MASS OF CHROMIUM IS 51.996 AMU)

- CHROMIUM- ?? 4.345%
- CHROMIUM-52 83.79%
- CHROMIUM-53 9.50%
- CHROMIUM-54 2.365%



• X= UNKNOWN CHROMIUM

$$[(X)(0.04345)] + [(52)(0.8379)] + [(53)(0.0950)] + [(54)(0.02365)] = 51.996$$
AMU

SAMPLE PROBLEM 3

 CHLORINE HAS TWO NATURALLY OCCURRING ISOTOPES. THE MASS OF CHLORINE-35 IS 34.696 AMU AND THE MASS OF CHLORINE-37 IS 36.966 AMU. USING THE AVERAGE MASS FROM THE PERIODIC TABLE (AVERAGE ATOMIC MASS OF CHLORINE IS 35.453), FIND THE ABUNDANCE OF EACH ISOTOPE. (REMEMBER THAT THE SUM OF THE TWO ABUNDANCES MUST BE 100)

- X= FRACTION OF ABUNDANCE FOR CHLORINE-35
- 100 X= FRACTION OF ABUNDANCE FOR CHLORINE-37

[(34.696)(X)] + [(36.966)(100 - X)] = 35.453 AMU