

CONCEPT: ATOMIC MASS

- **Atomic Mass** is the mass of an element that includes the masses of all 3 subatomic particles.
 - Atomic masses of elements can be found by simply looking at the Periodic Table.
 - The atomic mass of an element is an average of all its isotopes that uses the units of _____, _____ or _____.
 - Recall that 1 amu = _____ kg.

1A (1)										2A (2)												3A (13)		4A (14)		5A (15)		6A (16)		7A (17)		8A (18)																					
1	H	1.008			3	Li	6.941	4	Be	9.012	3B		4B		5B		6B		7B		8B			1B		2B		5	B	10.81	6	C	12.011	7	N	14.007	8	O	15.999	9	F	18.998	10	Ne	20.180								
11	Na	22.99			12	Mg	24.31				(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	13	Al	26.982	14	Si	28.085	15	P	30.974	16	S	32.06	17	Cl	35.45	18	Ar	39.948															
19	K	39.10	20	Ca	40.08	21	Sc	44.956	22	Ti	47.867	23	V	50.942	24	Cr	51.996	25	Mn	54.938	26	Fe	55.845	27	Co	58.933	28	Ni	58.693	29	Cu	63.546	30	Zn	65.38	31	Ga	69.723	32	Ge	72.630	33	As	74.922	34	Se	78.971	35	Br	79.904	36	Kr	83.798
37	Rb	85.47	38	Sr	87.62	39	Y	88.906	40	Zr	91.224	41	Nb	92.906	42	Mo	95.95	43	Tc	98	44	Ru	101.07	45	Rh	102.91	46	Pd	106.42	47	Ag	107.87	48	Cd	112.41	49	In	114.82	50	Sn	118.71	51	Sb	121.76	52	Te	127.60	53	I	126.90	54	Xe	131.29
55	Cs	132.91	56	Ba	137.33	57	La	138.91	72	Hf	178.49	73	Ta	180.95	74	W	183.84	75	Re	186.21	76	Os	190.23	77	Ir	192.22	78	Pt	195.08	79	Au	196.97	80	Hg	200.59	81	Tl	204.38	82	Pb	207.2	83	Bi	208.98	84	Po	(209)	85	At	(210)	86	Rn	(222)
87	Fr	(223)	88	Ra	(226)	89	Ac	(227)	104	Rf	(267)	105	Db	(268)	106	Sg	(269)	107	Bh	(270)	108	Hs	(270)	109	Mt	(278)	110	Ds	(281)	111	Rg	(282)	112	Cn	(285)	113	Nh	(286)	114	Fl	(289)	115	Mc	(290)	116	Lv	(293)	117	Ts	(294)	118	Og	(294)

58	Ce	140.12	59	Pr	140.91	60	Nd	144.24	61	Pm	(145)	62	Sm	150.36	63	Eu	151.96	64	Gd	157.25	65	Tb	158.93	66	Dy	162.50	67	Ho	164.93	68	Er	167.26	69	Tm	168.93	70	Yb	173.05	71	Lu	174.97
90	Th	232.04	91	Pa	231.04	92	U	238.03	93	Np	(237)	94	Pu	(244)	95	Am	(243)	96	Cm	(247)	97	Bk	(247)	98	Cf	(251)	99	Es	(252)	100	Fm	(257)	101	Md	(258)	102	No	(259)	103	Lr	(266)

EXAMPLE: Which of the following represents an element from the first column with the greatest atomic mass?

- a) Ba b) Al c) Cs d) Li e) Na

PRACTICE: Which of the following choices has the greatest atomic mass?

- a) Element A (0.283 kg)
- b) Element B (3.20×10^{24} amu)
- c) Element C (0.350 kg)
- d) Element D (4.14×10^{26} Da)

CONCEPT: ATOMIC MASS

Calculating Atomic Mass

- The **Atomic Mass** of an element can be calculated if you know the **Isotopic Masses** and **Percent Abundances**.
 - **Isotopic Masses**: The masses for all the isotopes of a given element.
 - **Percent Abundances**: The percentages available for each of the isotopes of a given element.
 - Sometimes referred to as _____ abundances.
 - **Fractional Abundance**: Represents the **percent abundance** of an isotope divided by _____.

Atomic Mass Formula

$$\text{Atomic Mass} = [(\text{Isotope Mass } _) \cdot (\text{Fractional Abundance})] + [(\text{Isotope Mass } _) \cdot (\text{Fractional Abundance})]$$

EXAMPLE: Calculate the atomic mass of lithium if the isotopic masses and percent abundances are given for its 2 naturally occurring isotopes.

Li-6	6.015122 amu	7.59%
Li-7	7.016004 amu	92.41%

- a) 6.091 amu b) 6.941 amu c) 100.00 amu d) 5.993 amu e) 7.529 amu

STEP 1: If you are given **percent abundances** then divide them by 100 in order to isolate the **fractional abundances**.

STEP 2: Plug your given variables into the atomic mass formula in order to isolate the missing variable.

CONCEPT: ATOMIC MASS

Calculating Atomic Mass (No Fractional Abundances)

- Adding up the **fractional abundances** of all isotopes for an element gives you a total of _____.
 - Important for atomic mass questions where there are _____ isotopes with unknown fractional abundances.

EXAMPLE: Iron possesses two naturally occurring isotopic forms. Iron-54 has an isotopic mass of 53.939615 amu and Iron-56 has an isotopic mass of 55.934942 amu. What is the percent abundance of Iron-56?

STEP 1: Make the first isotope's fractional abundance _____ and the second isotope's _____.

STEP 2: Plug your given variables into the atomic mass formula in order to isolate the missing variable.

CONCEPT: ATOMIC MASS

PRACTICE: Neon possesses three naturally occurring isotopes. ^{20}Ne has a percent abundance of 90.48% and an isotopic mass of 19.99244 amu, ^{21}Ne has a percent abundance of 0.27% and an isotopic mass of 20.99384 amu, and ^{22}Ne has a percent abundance of 9.25%. What is the isotopic mass of the ^{22}Ne isotope?

- a) 20.9182 amu b) 15.119 amu c) 23.001 amu d) 21.98768 amu

PRACTICE: Three isotopic forms of potassium exist: ^{39}K , ^{40}K and ^{41}K . Potassium has an atomic mass of 39.0983 amu. Potassium-40 has an isotopic mass of 39.9640 amu and natural abundance of 0.0117%. Potassium-41 has an isotopic mass of 40.9618 amu and natural abundance of 6.7302%. What is the isotopic mass of Potassium-39?

- a) 106.905 amu b) 38.9637 amu c) 106.903 amu d) 106.911 amu