## **Periodic Table of the Elements**

									Francium	[223]	Ţ	87	Cesium	132.9054519	Cs	55	Rubidium	85.4678	Rb	37	Potassium	39.0983	_	19	Sodium	22.989769	Na	11	Lithium	6 941	Ξ.	သ	1.00/94 Hydrogen	I	1	1A	
Actinides					Lanthanides			[226]	Ra	88	Barium	137.327	Ba	56 <b>3</b>	Strontium	87.62	Sr	38	Calcium	40.078	Ca	20	Magnesium	24.3050	Mg	12	Beryllium	9012182	Be	4	2A						
				iides			Actinides			89-103	Lanthanides			57-71	Yttrium	88.90585	~	39	Scandium	44.955912	Sc	21	3B														
Actinium	[227]	Ac	89	Lanthanum	138.90547	La	57		Rutherfordium	[267]	<sub></sub>	104	Hafnium	178.49	H	72	Zirconium	91.224	Zr	40	Titanium	47.867	<b>=</b> !	22	4B												
Thorium	232.03806	Th	90	Cerium	140.116	Ce	58		Dubnium	[268]	DЬ	105	Tantalum	180.94788	Ta	73	Niobium	92.90638	Z V	41	Vanadium	50.9415	<	23	5B						_		0		<b>Q</b>		
Protactinium	231.03588	Pa	91	Praseodymium	140.90765	Ρŗ	59		Seaborgium	[271]	Sg	106	Tungsten	183.84	\$	74	Molybdenum	95.96	Mo	42	Chromium	51.9961	CIT	24	6B						medicinal roks		associated wy to yout		essential metals		
Uranium	238.02891	<b>C</b>		m	144.242	Z	60		Bohrium	[272]	Bh	107	Rhenium	186.207	Re	75	Technetium	[88]	Tc	43	Manganese	54.938045	Mn	25	7B						2		2 P		tal r		
Neptunium	[237]	N p	93	Promethium	[145]	Pm	61		Hassium	[270]	Нs	108	Osmium	190.23	S	76	Ruthenium	101.07	Ru	44	Iron	55.845	Fe	26							るるで	-	TOX	•	refer	•	
Plutonium	[244]	Pu	94	Samarium	150.36	Sm	62		Meitnerium	[276]	<b>M</b>	109	Iridium	192.217	7	77	Rhodium	102.90550	Rh	45	Cobalt	58.933195	င္ပ	27	— 8В —						S		ref Pi	:	<b>6</b>		
Americium	[243]	Am	95	Europium	151.964	Ш	63		Darmstadtium	[281]	Ds	110	Platinum	195.084	Pt	78 <b>3</b>	Palladium	106.42	Pd	46	Nickel	58.6934	Z	28													
Curium	[247]	Cm	96	Gadolinium	157.25	Gd	64		Roentgenium		Rg	111	Gold	196.966569	Au	79 <b>3</b>	Silver	107.8682	Ag	47	Copper	63.546	Cu	29	1B												
Berkelium	[247]	Ŗ	97	Terbium	158.92535	Б	65		Copernicium	[285]	Cn	112	Mercury	200.59	Hg	80	Cadmium	112.411	Cd	48	Zinc	65.38	Zn	30	2B								1		_		
Californium	[251]	ਪੂ	98	Dysprosium	162.500	Ų	66		Ununtrium	[284]	Uut	113	Thallium	204.3833	=	81	Indium	114.818	<u> </u>	49	Gallium	69.723	Ga	31	Aluminum	26.9815386	≥	13	Boron	10.811	w	Sī	3A	About Chemistry	©2010 Todd Helmenstine	http://che	
Einsteinium	[252]	Es	99	Holmium	164.93032	ᆼ	67		Ununquadium	[289]	Uuq	114	Lead	207.2	Pb	82	Tin	118.710	Sn	50	Germanium	72.64	Ge	32	Silicon	28.0855	<u>s</u>	14	Carbon	12.0107	ဂ	6	4A	nemistry	odd Heln	mistry.a	
Fermium	[257]	Fm	100	Erbium	167.259	Ψ̈́	89		Ununpentium	[288]	duU	115	Bismuth	208.98040	<u>Β</u>	83	Antimony	121.760	Sb	51	Arsenic	74.92160	As	33	Phosphorus	30.973762	ס	15	Nitrogen	14.0067	z	7	5A		nenstine	http://chemistry.about.com	s n
Mendelevium	[258]	Md	101	Thulium	168.93421	Τm	69		Ununhexium	[293]	Uuh	116	Polonium	[209]	Ро	84	Tellurium	127.60	Te	52	Selenium	78.96	Se	34	Sulfur	32.065	S	16	Oxygen	15.9994	0	00	6A			ב	
Nobelium	[259]	<b>N</b>	102	Ytterbium	173.054	ծ	70		Ununseptium	[294]	Uus	117	Astatine	[210]	Ą	85	lodine	126.90447	_	53	Bromine	79.904	Ψ	35	Chlorine	35.453	Ω	17	Fluorine	18.9984032	П	9	7A				
Lawrencium	[262]	Ę	103	Lutetium	174.9668	L	71		Ununoctium	[294]	Ouo	118	Radon	[222]	Rn	86	Xenon	131.293	×e	54	Krypton	83.798	ᅐ	36	Argon	39.948	₽	18	Neon	20.1797	N P	10	4.002602 Helium	He	2	8A	

\* this is not complete. This is my take of the top of my head.

Teaching notes: Just a few... I'd love for people to add teaching notes to this as they go through the exercise

Students often cite sources such as  $Zicam^{TM}$  or multivitamins, or personal knowledge from an MRI or CT scan. I try to encourage this as much as possible because the students are

- 1. Note that Iron has all three classifications. Many essentials are toxic when the concentration is too high. The concentration of these metals must be tightly regulated in an often small window.
- 2. Toxicity of a metal may depend on oxidation state as well. Cr(III) is essential but hexavalent chromium is highly toxic.
- 3. In spite of the toxicity of some metals we have found medicinal uses for them. For example, Pt is used in anticancer treatments, and gold is used in treatments for rheumatoid arthritis. This has been especially true in imaging where the decay properties of species like Tc have led to huge advances.