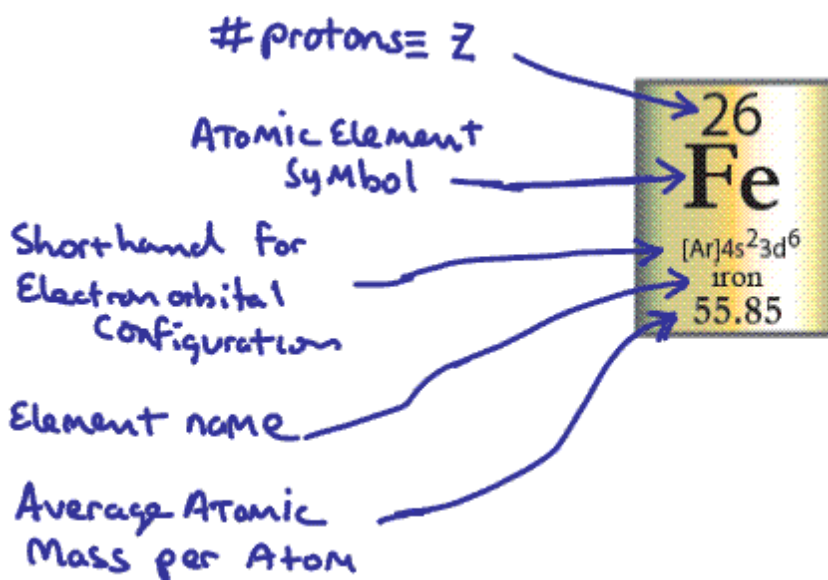


Physics 102 – Spring 2011 – Recitation module 7

Consider the periodic chart on the next page. This chart provides information about each of the known atomic elements. Below is a guide for the iron entry in the periodic chart. The other element entries are similar.



^{56}Fe has how many protons and how many neutrons?

^{57}Fe has how many protons and how many neutrons?

Why is the mass listed on the iron entry in the periodic chart 55.85 instead of a whole number like 56 or 57?

Using the periodic chart on the next page, determine the nuclear product remaining after

- 1) β^- decay of ^{211}Pb (lead-211)
- 2) α decay of ^{247}Cm (californium-247)
- 3) γ decay of ^{131}I (iodine-131)

Los Alamos National Laboratory Chemistry Division

Periodic Table of the Elements

1A	1 H hydrogen 1.008	2A	3B	4B	5B	6B	7B	8B	11B	12B	3A	4A	5A	6A	7A	8A																			
2	He helium 4.003	3	Li lithium 6.941	4	Be beryllium 9.012	5	B boron 10.81	6	C carbon 12.01	7	N nitrogen 14.01	8	O oxygen 16.00	9	F fluorine 18.998	10	Ne neon 20.18																		
11	Na sodium 22.99	12	Mg magnesium 24.31	13	Al aluminum 26.98	14	Si silicon 28.09	15	P phosphorus 30.97	16	S sulfur 32.07	17	Cl chlorine 35.45	18	Ar argon 39.95																				
19	K potassium 39.10	20	Ca calcium 40.08	21	Sc scandium 44.96	22	Ti titanium 47.88	23	V vanadium 50.94	24	Cr chromium 52.00	25	Mn manganese 54.94	26	Fe iron 55.85	27	Co cobalt 58.93	28	Ni nickel 58.69	29	Cu copper 63.55	30	Zn zinc 65.39												
37	Rb rubidium 85.47	38	Sr strontium 87.62	39	Y yttrium 88.91	40	Zr zirconium 91.22	41	Nb niobium 92.91	42	Mo molybdenum 95.94	43	Tc technetium (98)	44	Ru ruthenium 101.1	45	Rh rhodium 102.9	46	Pd palladium 106.4	47	Ag silver 107.9	48	Cd cadmium 112.4	49	In indium 114.8	50	Sn tin 118.7	51	Sb antimony 121.8	52	Te tellurium 127.6	53	I iodine 126.9	54	Xe xenon 131.3
55	Cs cesium 132.9	56	Ba barium 137.3	57	La* lanthanum 138.9	72	Hf hafnium 178.5	73	Ta tantalum 180.9	74	W tungsten 183.8	75	Re rhenium 186.2	76	Os osmium 190.2	77	Ir iridium 192.2	78	Pt platinum 195.1	79	Au gold 197.0	80	Hg mercury 200.6	81	Tl thallium 204.4	82	Pb lead 207.2	83	Bi bismuth 208.9	84	Po polonium (209)	85	At astatine (210)	86	Rn radon 222.0
87	Fr francium (223)	88	Ra radium (226)	89	Ac~ actinium (227)	104	Rf rutherfordium (261)	105	Db dubnium (262)	106	Sg seaborgium (263)	107	Bh bohrium (264)	108	Hs hassium (265)	109	Mt meitnerium (266)	110	Ds darmstadtium (271)	111	Uuu ununium (272)	112	Uub ununium (277)	113	Nh nihonium (284)	114	Uuq ununium (289)	115	Uup ununium (288)	116	Uuh ununium (289)	117	Uuq ununium (289)	118	Uuo ununium (289)

58	Ce cerium 140.1	59	Pr praseodymium 140.9	60	Nd neodymium 144.2	61	Pm promethium (145)	62	Sm samarium 150.4	63	Eu europium 152.0	64	Gd gadolinium 157.3	65	Tb terbium 158.9	66	Dy dysprosium 162.5	67	Ho holmium 164.9	68	Er erbium 167.3	69	Tm thulium 168.9	70	Yb ytterbium 173.0	71	Lu lutetium 175.0
90	Th thorium 232.0	91	Pa protactinium 231.0	92	U uranium 238.0	93	Np neptunium (237)	94	Pu plutonium (244)	95	Am americium (243)	96	Cm curium (247)	97	Bk berkelium (247)	98	Cf californium (251)	99	Es einsteinium (252)	100	Fm fermium (257)	101	Md mendelevium (258)	102	No nobelium (259)	103	Lr lawrencium (260)

Lanthanide Series*

Actinide Series~

element names in **blue** are liquids at room temperature
 element names in **red** are gases at room temperature
 element names in **black** are solids at room temperature

Which do you think is safer overall for the public – a coal power plant or a nuclear power plant?

What are all the factors you should consider in evaluating this?

When the atomic (fission) bomb was being developed, one of the scientists on the Manhattan project suggested that the detonation of the bomb might trigger fusion reactions in the atmosphere, causing a fusion chain reaction that could burn up the entire atmosphere of the Earth. Other scientist calculated that under worst-case scenario assumptions the temperature needed to ignite fusion reactions in the atmosphere was a factor of 100 higher than that expected to occur in the midst of the fission explosion. So, these scientists were confident that the atmosphere would not be destroyed. This issue and the potential risk was not made public at the time.

Discuss fission and fusion and make sure you understand the difference between the two processes.

What do you think about this story?

Was the risk justified in this instance?

How certain should the science be to make you comfortable with such a risk?

What would you have done if you were the President at the time (considering only this question)?

Sadly, it is possible that you might see one or more instances of “nuclear terrorism” in your lifetime. What kinds of events of this nature might happen?

What type of nuclear terrorism event is the most likely to happen?

What type of nuclear terrorism event would cause the most damage? Which would cause the least damage?

You measure the carbon radioactivity (number of decays observed per second) of an old wooden axe is only 20% of its original value. Estimate the age of the ax handle.

Can scientists carbon date an ordinary rock? Why or why not?

What are the two characteristics that make uranium a good substance to use for fueling a nuclear reactor? Why?