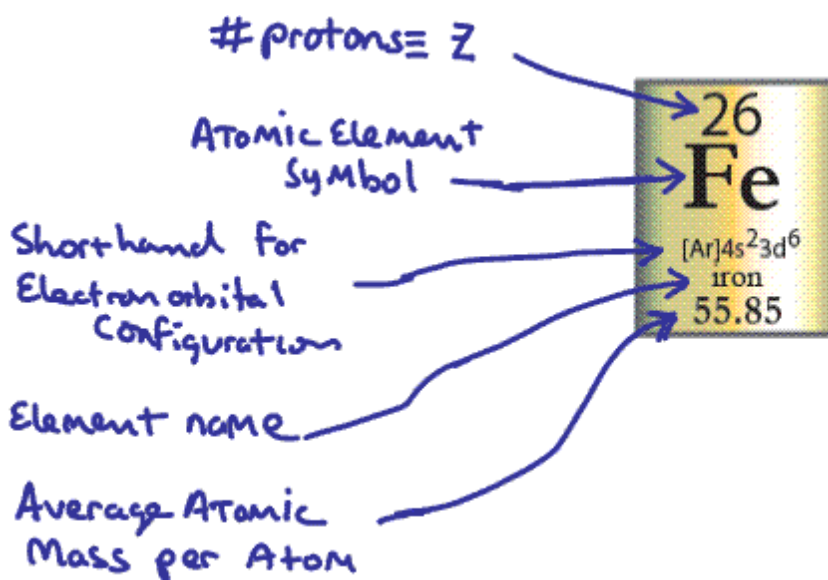


Physics 102 – Spring 2014 – Recitation module 9

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	4 Be beryllium 9.012	3B	21 Sc scandium 44.96	4B	22 Ti titanium 47.88	5B	23 V vanadium 50.94	6B	24 Cr chromium 52.00	7B	25 Mn manganese 54.94	8B	26 Fe iron 55.85	27 Co cobalt 58.93	28 Ni nickel 58.69	11B	29 Cu copper 63.55	12B	30 Zn zinc 65.39	3A	5 B boron 10.81	4A	6 C carbon 12.01	5A	7 N nitrogen 14.01	6A	8 O oxygen 16.00	7A	9 F fluorine 18.99	8A	2 He helium 4.003																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	3 Li lithium 6.941		11 Na sodium 22.99		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 101.9		46 Pd palladium 106.4		47 Ag silver 107.9		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		31 Ga gallium 69.72		32 Ge germanium 72.64		33 As arsenic 74.92		34 Se selenium 78.96		35 Br bromine 79.90		36 Kr krypton 83.80																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
	19 K potassium 39.10		20 Ca calcium 40.08		37 Rb rubidium 85.47		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 101.9		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		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)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
	37 Rb rubidium 85.47		38 Sr strontium 87.62		56 Ba barium 137.3		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		114 Uuq unbinilium (289)		115 Uup ununpentium (288)		116 Uuh ununhexium (289)		117 Uuq ununseptium (289)		118 Uuo ununoctium (289)		119 Uuq ununnonium (289)		120 Uuq unundecium (289)		121 Uuq unundecium (289)		122 Uuq unundecium (289)		123 Uuq unundecium (289)		124 Uuq unundecium (289)		125 Uuq unundecium (289)		126 Uuq unundecium (289)		127 Uuq unundecium (289)		128 Uuq unundecium (289)		129 Uuq unundecium (289)		130 Uuq unundecium (289)		131 Uuq unundecium (289)		132 Uuq unundecium (289)		133 Uuq unundecium (289)		134 Uuq unundecium (289)		135 Uuq unundecium (289)		136 Uuq unundecium (289)		137 Uuq unundecium (289)		138 Uuq unundecium (289)		139 Uuq unundecium (289)		140 Uuq unundecium (289)		141 Uuq unundecium (289)		142 Uuq unundecium (289)		143 Uuq unundecium (289)		144 Uuq unundecium (289)		145 Uuq unundecium (289)		146 Uuq unundecium (289)		147 Uuq unundecium (289)		148 Uuq unundecium (289)		149 Uuq unundecium (289)		150 Uuq unundecium (289)		151 Uuq unundecium (289)		152 Uuq unundecium (289)		153 Uuq unundecium (289)		154 Uuq unundecium (289)		155 Uuq unundecium (289)		156 Uuq unundecium (289)		157 Uuq unundecium (289)		158 Uuq unundecium (289)		159 Uuq unundecium (289)		160 Uuq unundecium (289)		161 Uuq unundecium (289)		162 Uuq unundecium (289)		163 Uuq unundecium (289)		164 Uuq unundecium (289)		165 Uuq unundecium (289)		166 Uuq unundecium (289)		167 Uuq unundecium (289)		168 Uuq unundecium (289)		169 Uuq unundecium (289)		170 Uuq unundecium (289)		171 Uuq unundecium (289)		172 Uuq unundecium (289)		173 Uuq unundecium (289)		174 Uuq unundecium (289)		175 Uuq unundecium (289)		176 Uuq unundecium (289)		177 Uuq unundecium (289)		178 Uuq unundecium (289)		179 Uuq unundecium (289)		180 Uuq unundecium (289)		181 Uuq unundecium (289)		182 Uuq unundecium (289)		183 Uuq unundecium (289)		184 Uuq unundecium (289)		185 Uuq unundecium (289)		186 Uuq unundecium (289)		187 Uuq unundecium (289)		188 Uuq unundecium (289)		189 Uuq unundecium (289)		190 Uuq unundecium (289)		191 Uuq unundecium (289)		192 Uuq unundecium (289)		193 Uuq unundecium (289)		194 Uuq unundecium (289)		195 Uuq unundecium (289)		196 Uuq unundecium (289)		197 Uuq unundecium (289)		198 Uuq unundecium (289)		199 Uuq unundecium (289)		200 Uuq unundecium (289)		201 Uuq unundecium (289)		202 Uuq unundecium (289)		203 Uuq unundecium (289)		204 Uuq unundecium (289)		205 Uuq unundecium (289)		206 Uuq unundecium (289)		207 Uuq unundecium (289)		208 Uuq unundecium (289)		209 Uuq unundecium (289)		210 Uuq unundecium (289)		211 Uuq unundecium (289)		212 Uuq unundecium (289)		213 Uuq unundecium (289)		214 Uuq unundecium (289)		215 Uuq unundecium (289)		216 Uuq unundecium (289)		217 Uuq unundecium (289)		218 Uuq unundecium (289)		219 Uuq unundecium (289)		220 Uuq unundecium (289)		221 Uuq unundecium (289)		222 Uuq unundecium (289)		223 Uuq unundecium (289)		224 Uuq unundecium (289)		225 Uuq unundecium (289)		226 Uuq unundecium (289)		227 Uuq unundecium (289)		228 Uuq unundecium (289)		229 Uuq unundecium (289)		230 Uuq unundecium (289)		231 Uuq unundecium (289)		232 Uuq unundecium (289)		233 Uuq unundecium (289)		234 Uuq unundecium (289)		235 Uuq unundecium (289)		236 Uuq unundecium (289)		237 Uuq unundecium (289)		238 Uuq unundecium (289)		239 Uuq unundecium (289)		240 Uuq unundecium (289)		241 Uuq unundecium (289)		242 Uuq unundecium (289)		243 Uuq unundecium (289)		244 Uuq unundecium (289)		245 Uuq unundecium (289)		246 Uuq unundecium (289)		247 Uuq unundecium (289)		248 Uuq unundecium (289)		249 Uuq unundecium (289)		250 Uuq unundecium (289)		251 Uuq unundecium (289)		252 Uuq unundecium (289)		253 Uuq unundecium (289)		254 Uuq unundecium (289)		255 Uuq unundecium (289)		256 Uuq unundecium (289)		257 Uuq 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Uuq unundecium (289)		335 Uuq unundecium (289)		336 Uuq unundecium (289)		337 Uuq unundecium (289)		338 Uuq unundecium (289)		339 Uuq unundecium (289)		340 Uuq unundecium (289)		341 Uuq unundecium (289)		342 Uuq unundecium (289)		343 Uuq unundecium (289)		344 Uuq unundecium (289)		345 Uuq unundecium (289)		346 Uuq unundecium (289)		347 Uuq unundecium (289)		348 Uuq unundecium (289)		349 Uuq unundecium (289)		350 Uuq unundecium (289)		351 Uuq unundecium (289)		352 Uuq unundecium (289)		353 Uuq unundecium (289)		354 Uuq unundecium (289)		355 Uuq unundecium (289)		356 Uuq unundecium (289)		357 Uuq unundecium (289)		358 Uuq unundecium (289)		359 Uuq unundecium (289)		360 Uuq unundecium (289)		361 Uuq unundecium (289)		362 Uuq unundecium (289)		363 Uuq unundecium (289)		364 Uuq unundecium (289)		365 Uuq unundecium (289)		366 Uuq unundecium (289)		367 Uuq unundecium (289)		368 Uuq unundecium (289)		369 Uuq unundecium (289)		370 Uuq unundecium (289)		371 Uuq unundecium (289)		372 Uuq 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Congratulations! You have just become emperor. Your country needs a boost in power. You need to launch a new power generating project. You have two choices – a coal power plant or a nuclear power plant. Which will you choose to build? What is your reasoning?

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)?

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

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? For the latter, would it be “effective” as a tool for terrorism?