Question 1 2 / 2 points

Assuming the radius of a hydrogen atom is given by the Bohr radius, $r_{Bohr} = 5.29 \times 10^{-11}$ m, what is the ratio of the nuclear density of a hydrogen atom to its atomic density? **Note**: Assume for this calculation that the mass of the atom is equal to the mass of the proton.

a) 1.2×10^{-14}
b) 4.4×10^{4}
c) 2.3×10^{-5}
d) 3.9×10^{17}
e) 8.6×10^{13}

Question 2 2 / 2 points

Determine the amount of energy released in the following alpha decay process:

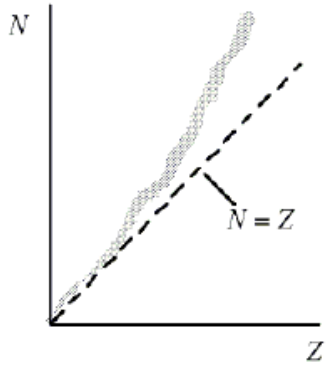
$$^{234}_{94}\text{Pu} \rightarrow {}^{230}_{92}\text{U} + {}^{4}_{2}\text{He}$$

The relevant atomic masses are $_{94}{}^{234}\text{Pu}$ = 234.043 299 u, $_{92}{}^{230}\text{U}$ =230.033 937 u, and $_{2}{}^{4}\text{He}$ = 4.002 603 u.

a) 927 keV
b) 6.30 MeV
c) 10.6 MeV
d) 3.73 keV
e) 8.04 MeV

Question 3 2 / 2 points

This question refers to the figure shown. Which one of the following concepts explains why heavy nuclei do not follow the $N = Z$ line (or trend) in the figure?



a) transmutation
b) Pauli exclusion principle
c) particle-wave duality
d) Heisenberg uncertainty principle
e) Coulomb repulsion

Question 4 2 / 2 points

The ratio of the abundance of carbon-14 to carbon-12 in a sample of dead wood is one quarter the ratio for living wood. If the half-life of carbon-14 is 5730 years, which one of the following expressions determines how many years ago the wood died?

a) 2×5730

b) 0.25×5730

c) 4×5730

d) 0.75×5730

e) 0.50×5730

Question 5 2 / 2 points

The proton has a mass of 1.007 28 u; and the neutron has a mass of 1.008 67. Use this information to determine the binding energy per nucleon of ${}_{90}^{232}\mathrm{Th}$ which has an atomic mass of 232.038 054 u.

a) 9.8 MeV

b) 8.7 MeV

c) 6.5 MeV

d) 10.2 MeV

e) 7.4 MeV

Question 6 2 / 2 points

The half-life of ${}_{79}^{200}\mathrm{Au}$ is 2.88×10^{3} s. What is the mass of a sample of ${}_{79}^{200}\mathrm{Au}$ that has an activity of 1.42×10^{12} Bq?

a) 2.41×10^{-3} g

b) 9.80×10^{-9} g

c) 5.89×10^{-12} g

d) 1.96×10^{-6} g

e) 2.78×10^{-15} g

Question 7 2 / 2 points

In a beta decay process, not all of the released energy is carried by the beta particle. Who proposed the existence of the neutrino in 1930 to account for the missing energy?

a) Wolfgang Pauli

b) Werner Heisenberg

c) Enrico Fermi

d) Erwin Schrödinger

e) Niels Bohr

Question 8 2 / 2 points

The binding energy of an isotope of chlorine is 298 MeV. What is the mass defect of this chlorine nucleus in atomic mass units?

a) 0.034 u

b) 0.320 u

c) 3.13 u

d) 0.882 u

e) 2.30 u

Question 9 2 / 2 points

Which one of the following thicknesses of lead would be least effective in stopping β rays?

a) 0.50 mm

b) 0.45 mm

c) 0.04 mm

d) 0.15 mm

e) 0.30 mm

Question 10 2 / 2 points

Which one of the following statements is true concerning the radioisotope carbon-14 that is used in carbon dating?

a) Carbon-14 is produced by the decay of carbon-12.

b) Carbon-14 is produced during β^- decay.

c) Carbon-14 is produced by cosmic rays striking the atmosphere.

d) Carbon-14 is produced by living cells.

e) Carbon-14 is produced by cells after they have died.
