TWO-MINUTE PROBLEMS

Q13T.1 How many neutrons are in a $^{197}_{79}$Au nucleus?
A. 79
B. 179
C. 118
D. Some other number (specify)

Q13T.2 About how many times larger in diameter is a $^{64}_{29}$Cu nucleus than an $^{27}_{13}$Al nucleus?
A. 2.37
B. 1.54
C. 1.33
D. They are about the same size.
E. Some other factor (specify)

Q13T.3 The mass of the earth–moon system is somewhat less than the sum of the mass of the earth and the mass of the moon. T or F?

Q13T.4 The ground-state energy of an electron in a hydrogen atom is −13.6 eV. This means that the binding energy of that electron is
A. −13.6 eV.
B. +13.6 eV.
C. Some other value (specify).

Q13T.5 If energy is released when the parts of a system are allowed to disperse to infinity, its binding energy is
A. Positive.
B. Negative.
C. Zero.
D. Not defined in such a case.

Q13T.6 The earth's rotation (A) increases, (B) decreases, or (C) does not affect its gravitational binding energy.

Q13T.7 According to the chart shown in figure Q13.6, how many stable isotopes of $_{30}$Zn exist?
A. One
B. Two
C. Three
D. Five
E. There is no way to determine this from the chart.

Q13T.8 A charged particle moving in the magnetic field created by an external magnet experiences a force that is perpendicular to both the particle's velocity $\vec{v}$ and the direction of the magnetic field $\vec{B}$ in the sense indicated by your right thumb if your right index finger points in the direction of $\vec{v}$ and your adjacent finger points in the direction of $\vec{B}$. (The magnetic field $\vec{B}$, in turn, points away from the external magnet's north pole and toward its south pole.) A certain radioactive substance emits quantons that, when placed in a magnetic field directed away from the observer, bend to the right side of their direction of travel. These nuclei are decaying via which kind of process?
A. An alpha decay process
B. A beta decay process
C. A gamma decay process
D. There is not enough information to specify.

Q13T.9 The type of radiation that fogged Becquerel's photographic plates was probably
A. Alpha radiation.
B. Beta radiation.
C. Gamma radiation.
D. Either alpha or beta radiation.
E. Either beta or gamma radiation.

Q13T.10 If the activity of a radioactive sample has decreased by a factor of 4 in time T, then $T = 2t_{1/2}$. T or F?

HOMEWORK PROBLEMS

Basic Skills

Q13B.1 How many protons are in each of the following nuclei? How many neutrons?
(a) $^{9}_{4}$Be **(b)** $^{13}_{6}$C **(c)** $^{197}_{79}$Au **(d)** $^{40}_{20}$Ca **(e)** $^{43}_{20}$Ca

Q13B.2 How many protons are in each of the following nuclei? How many neutrons?
(a) $^{64}_{29}$Cu **(b)** $^{23}_{12}$Mg **(c)** $^{54}_{26}$Fe **(d)** $^{56}_{26}$Fe **(e)** $^{57}_{26}$Fe

Q13B.3 Compute the radii of the $^{4}_{2}$He and the $^{197}_{79}$Au nuclei. How many times larger is the gold nucleus's radius than the helium nucleus's radius?

Q13B.4 Compute the radii of the $^{12}_{6}$C and the $^{238}_{92}$U nuclei. How many times larger is the uranium nucleus's radius than the carbon nucleus's radius?

Q13B.5 The experimentally measured mass of a sodium $^{23}_{11}$Na atom is 22.989770 u. Compute its mass deficit in unified mass units (u) and its binding energy in MeV.

Q13B.6 The measured mass of an iron $^{56}_{26}$Fe atom is 55.934937 u. Compute its mass deficit in unified mass units (u) and its binding energy in MeV.

Q13B.7 The measured mass of a lead $^{208}_{82}$Pb atom is 207.976652 u. Compute its mass deficit in unified mass units (u) and its binding energy in MeV.

Q13B.8 Using figure Q13.6, list the stable isotopes of $_{80}$Hg.

Q13B.9 Using figure Q13.6, list the stable isotopes of $_{20}$Ca.

Q13B.10 $^{28}_{13}$Al has a half-life of 2.24 min. By what factor will the activity of a sample have decreased after 1.0 h?