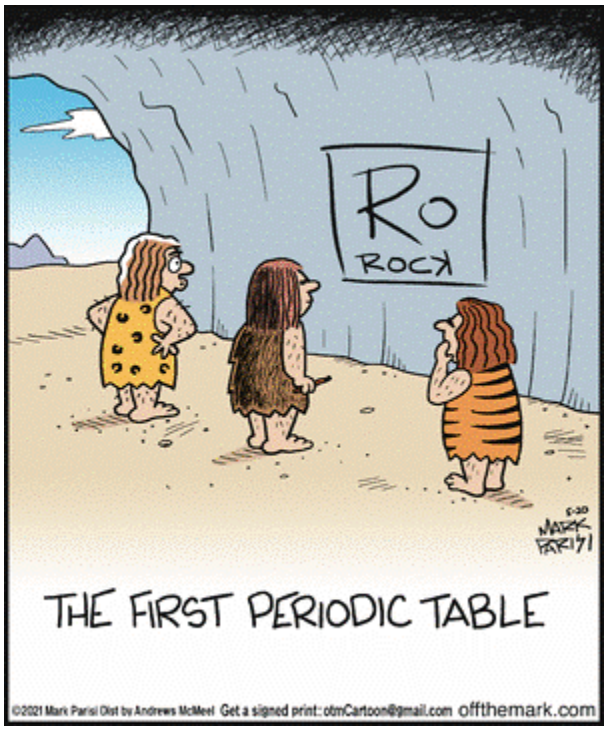
HOMEWORK SET 13: IPA ENERGY LEVELS
Due Monday, March 3, 2025

Problems adapted from TZDII[1]

10.3) a) Estimate the energy of the innermost electron of lead.
b) What is its most probable radius?

10.5) The ground state of sodium (Z = 11) has two electrons in the 1s level, two in the 2s, six in the 2p and one in the 3s. Consider an excited state in which the outermost electron has been raised to a 3d state (but all the inner electrons are in their ground states). Because the 3d wave function is not very penetrating, you can treat the outer electron as if it were completely outside all the other electrons.
a) In this approximation, what is the potential energy function U(r) felt by the outer electron?
WRITE OUT AN EQUATION FOR THIS … USE THE HYDROGEN & HYDROGENIC ATOMS REVIEW SHEET.
b) In the same approximation, what should be the energy of an electron in a 3d state? Compare your answer with the observed value of -1.52 eV. Why is the observed value lower than your estimate?



[1] Taylor, Zafiratos, & Dubson, *Modern Physics for Scientists and Engineers*, 2nd Editon, Pearson, Prentice Hall, 2004