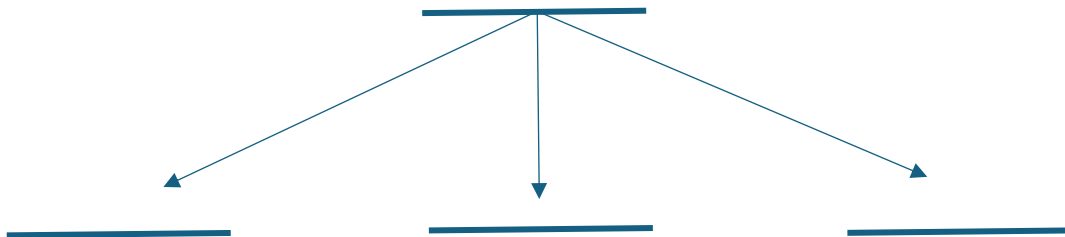


ABR 16-Month NM Pathway – Problem Set 1: Atoms, Radiation, & Radioactivity

Required Readings:

- RSNA Physics Module: Atoms, Radiation, & Radioactivity
- Essentials of NM Physics, Instrumentation, and Radiation Biology (Powsner)
 - Chapter 1 - Basic Nuclear Medicine Physics
 - Chapter 2 - Interaction of Radiation with Matter

1. What is the principal quantum number and how is it calculated?
2. What is the difference between *ionization* and *excitation* of an orbital electron?
3. Define isotope, isotone, isomer, and isobar.
4. Fill in the decay scheme with the corresponding decay type(s) (alpha, β^+ , β^- , isomeric transition, and electron capture). How is the atomic number affected in each decay scheme? What is a 'dogleg' and what does it denote (not shown here)?



5. Fill in the blank. With regard to B⁺ decay: positrons are identical to electrons except that they have a net charge of ____ (antiparticle). At rest, a positron combines with a negative electron and undergoes an _____ reaction. The mass of the electron and mass of the positron are converted to their energy equivalents and thus two _____ of _____ keV are emitted in opposite directions.
6. Fluorine-18 gains nuclear stability via which two decay mechanisms?
7. What (and how much) is a Curie? What is the relationship between the Curie and the Becquerel?
8. Recall that Gray (or rad) is a unit of *dose* where 1 Gy = 1J/kg. If 100J of energy were absorbed uniformly in 20kg of tissue, what is the dose?
9. What is equivalent dose? Effective dose? Units for each?
10. What are the radiation weighting factors of gamma, x-ray, alpha, B⁺, and B⁻ ?