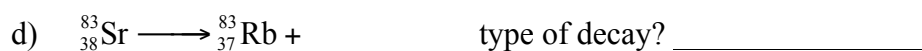
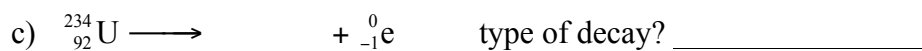
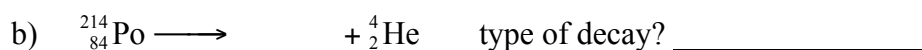
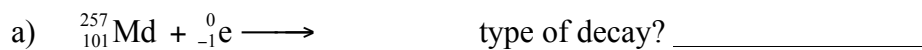
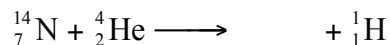


4) Iron-56 is the lightest stable isotope of iron. Iron-55 is unstable because of the composition of its nucleus. What two possible decay mechanisms would create a more stable nucleus? Explain. Write the complete decay equation for the mechanism that is NOT an emission.

5) Complete these nuclear decay equations and determine if they are alpha, beta, positron or electron capture.



6) Elements can be created artificially when they are bombarded with particles such as alpha particles. Complete this reaction. This was the earliest artificial transmutation reaction-- performed by Rutherford in 1911. Just balance the mass numbers and atomic numbers.



7) Strontium-90 decays through beta decay. If it has a half-life of 29 years, how long does it take to have only 25% left ($\frac{1}{4}$ of it left)? (*You could begin with any amount. How about starting with 1 g?*)

8) Why is the equation $E = mc^2$ significant in a nuclear reaction, but not in a chemical reaction?

9) How is energy released during nuclear fusion? During fission? How does Mass Defect relate to the stability of a nucleus?

10) a) How much energy (in J) is released when this alpha decay takes place? ${}^{226}_{88}\text{Ra} \longrightarrow {}^{222}_{86}\text{Rn} + {}^4_2\text{He}$
mass of ${}^{226}\text{Ra} = 226.025360$ amu mass of ${}^{222}\text{Rn} = 222.017530$ amu mass of ${}^4\text{He} = 4.00260361$ amu
(See reference charts for formulas and more constants.)

b) Convert this to MJ/mol

11) Why are alpha particles fairly harmless outside the human body, but quite dangerous inside it?

12) Why does the fission of U-235 produce a nuclear chain reaction?

13) Why do atomic bombs explode and nuclear power plants produce a steady amount of heat? Explain.

14) What is the purpose of control rods in a nuclear power plant?

15) What is the purpose of a moderator in a nuclear power plant?

16) Why is it safer to use water as a moderator instead of graphite?

17) Why is fusion not currently used in nuclear power plants?

- 18) Why do stars contract after the supply of hydrogen starts to run low?
- 19) Why is it more difficult to fuse two helium nuclei together than to fuse two hydrogen nuclei together?
- 20) When will a supernova occur? What happens when a supernova does occur?
- 21) Why do C-14 levels stay constant when an organism is alive, but C-14 levels decrease when a organism dies? (*You don't need to know the specific reactions involved, just know the basic concepts.*)
- 22) _____ T or F? The majority of radiation that a typical human receives is man-made.
- 23) _____ T or F? Eating potassium should be avoided because all potassium atoms are radioactive.
- 24) _____ T or F? Radiation can be beneficial and harmful. Give examples. _____
- 25) A piece of an unknown metal with a mass of 23.8 g is heated to 100.0°C and dropped into 50.0 g of water at 24.0°C. The final temperature of the system is 32.5°C. What is the specific heat of the metal? (*See reference charts for specific heat of water and formulas.*)