

*War & Peace Cluster, Summit Program, Physics section  
Assignment 2*

**ANotes:**

***Please write your answers on a separate sheet.  
There is not enough room between the questions.***

In all assignments you should keep in mind the GE goals, and in particular the goal referring to communication. It requires that a complete answer to a question requires not only the final result, but also the justification for that result. Mathematics is just another language, and showing the details of a calculation is nothing more than supporting your final conclusion.

**Questions:**

*Review questions*

1. What causes radioactivity ( $\alpha$  and  $\beta$ )? Why are some isotopes radioactive whilst others are stable? (You might be tempted to look up these answers on the Internet, but be wary of the responses. Some (most?) are of no real use in that you cannot use their reason to decide the answer to this question for any given isotope. Some are flat out wrong, for example, “an isotope is radioactive if it has too many neutrons”. Ask yourself how you would use their reasoning.)
2. What do you think makes radiation so dangerous? (Not what are the consequences, but what is about radioactive nuclei that causes them to be dangerous? The answer lies in the lecture material from this semester.)

*Parents and daughters* You should be able to answer these questions yourselves, but once you have done so by all means go ahead and check your answers on line.

3. For all of the isotopes below determine
  - i. the daughter nucleus
  - ii. the loss of mass
  - iii. the energy that is produced

You will need an online source such as [EnvironmentalChemistry.com](http://EnvironmentalChemistry.com) to find the data for this question and for the next two questions. Please see the web site for a link to their database. Also, remember that the destruction of 1 u (atomic mass unit) of mass creates 931.4 MeV of energy.

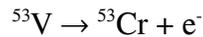
- a)  $^{90}\text{Sr}$  which is a  $\beta^-$  emitter.
- b)  $^{76}\text{As}$  which is a  $\beta^-$  emitter.
- c)  $^{182}\text{Hg}$  which is an  $\alpha$  emitter.

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4. You are told that the isotope  $^{53}\text{V}$  is radioactive, but you are not told what the daughter is. There are two possibilities. It could be an  $\alpha$  emitter

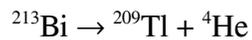


or it could be a  $\beta^-$  emitter.

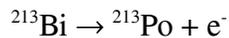


***Without looking up the answer***, but basing your answer on the masses of the different isotopes, which of the above possibilities is the correct one, if either?

5. You are told that the isotope  $^{213}\text{Bi}$  is radioactive, but you are not told what the daughter is. There are two possibilities. It could be an  $\alpha$  emitter



or it could be a  $\beta^-$  emitter



***Without looking up the answer***, but basing your answer on the masses of the different isotopes, which of the above possibilities is correct?