Work Sheet 13
Some question to ponder about nuclear chemistry

1.
A person goes to get radiation treatment for cancer utilizing "brachytherapy" in which a small radioactive source is placed directly into the body.

The radiation center has some newly created radioactive sources of ^{192}Ir. They start out as 10 Curie sources. Under computer control and robot inserts the source using a long needle into the patients body and holds it there for the treatment. When the source is new, the treat can be as short as say 30 minutes.

Given that the half-life of ^{192}Ir is 74 days, what would be the intensity of the source that was originally 10 Curies after 3 months? How much longer would a radiation treatment take to achieve the same exposure of radiation for the patient?

To understand the complexity of computing the exposure to a particular source, look at the typical decay of ^{192}Ir which is chosen in part for its simplicity.
http://ozradonc.wikidot.com/iridium-192

2. Why are many forms of nuclear decay also accompanied by the gamma radiation?

3. You are standing 10 feet away from three different radioactive sources.

All three happen to be 1 Curie sources. The first is primarily an alpha emitter, the second a beta, and the third both a beta and gamma source. Will your exposure be the same or different for these three. If different from which will your you exposure yield the highest exposure as measured in Sieverts?

4. Which will give you a higher exposure in Sieverts: holding a 10 microCurie alpha emitter in your hand, or breathing in a 10 microCurie alpha emitter into your lungs? Or will they both be the same since you are essentially absorbing all the radiation that is emitted?

More practice with balancing and decay products

Balance the following

$^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + \_\_\_\_\_$

$^{3}_{2}He + {}^{3}_{2}He \rightarrow 2\ {}^{1}_{1}H + \_\_\_\_\_$

$^{239}_{93}Np \rightarrow {}^{239}_{94}Pu + \_\_\_\_\_$

$\_\_\_\_\_ \rightarrow {}^{4}_{2}He + {}^{208}_{81}Tl$

The following nuclei decay via electron capture predict their decay product

^{57}Co

^{68}Ge

^{49}V

The following undergo alpha emission, predict their decay product

^{226}Ra

^{238}U

^{218}Rn

the following undergo beta decay, predit their decay product

^{218}P

^{90}Sr

^{63}Ni

When we speak of dangerous radiation exposure, are we customarily speaking of alpha radiation, beta radiation or gamma radiation? Discuss.

People who work around radioactivity wear film badges to monitor the amount of radiation that reaches their bodies. These badges consist of small pieces of photographic film enclosed in a light-proof wrapper. What kind of radiation do these devices monitor?

A sample of a particular radioisotope is placed near a Geiger counter, which is observed to register 260 counts per minute. Six hour later, the detector counts at a rate of 20 counts per minute. What is the half-life of the material?

In what way is the emission of gamma radiation from a nucleus similar to the emission of light from an atom?

Can it be truthfully said that, whenever a nucleus emits an alpha or beta particle, it actually becomes the nucleus of a different element?