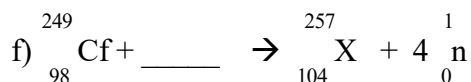
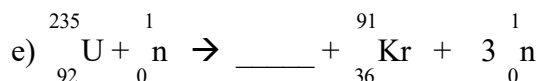
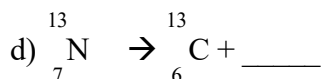
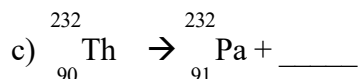
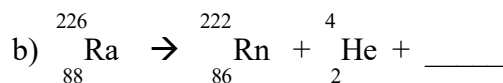
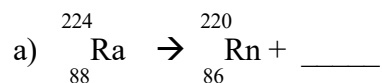


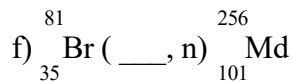
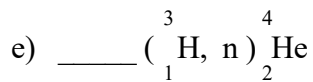
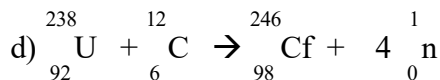
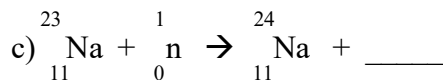
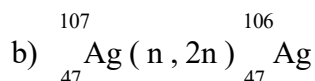
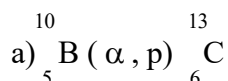
# Nuclear Chemistry

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**Problem #1.** Complete and *balance* the following equations by supplying the missing particles or energy ray. *Identify the type* of radioactive decay for each reaction.



**Problem #2.** Write complete and balance equations for each of the following processes, or write the shorthand notation for the given reaction:



**Problem #3.** Write nuclear equations for the following process:

a) krypton-81 undergoes beta decay

b) alpha decay of uranium-238

c) electron capture of lead-206

d) thorium-230 undergoes alpha emission

e) positron emission of radium-226

f) neutron bombardment of zirconium-99

g) thorium-230 decays a radium isotope

h) nitrogen-13 undergoes beta decay

i) iodine-131 undergoes beta decay

j) gold-195 undergoes electron decay

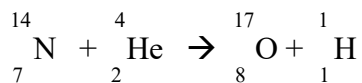
**Problem #4.** A piece of wood from an ancient artifact has a carbon-14 activity of 11.7 disintegrations per min. per gram of carbon. Current carbon-14 activity in fresh samples is 15.3 disintegrations per min. per grams of carbon. The half-life of carbon is 5730 yrs. calculate the age of the wood sample.

**Problem #5.** The half-life of nucleus Rn-222 is 3.88 days. How many mg of a 5000 mg sample of Rn-222 remains after sixty days?

**Problem #6.** What is the original mass of C-14 in a sample if 10.00 mg of it remains after 20,000 years? The half-life of C-14 is 5730 years.

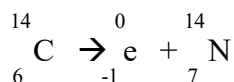
**Problem #7.** Calculate the energy of 1.0 amu in joules using the Einstein's relationship.  
(1 J= 1 kg.m<sup>2</sup>/s<sup>2</sup> , 1g =6.02x10<sup>23</sup> amu)  $E = C^2 (\Delta m)$

**Problem #8.** For the nuclear reaction



calculate the energy in joules associated with the reaction of one atom of nitrogen-14 with one atom of He-4 , given that isotopic masses(amu) are N-14 (14.00307); He-4 (4.00260 ); O-17 (16.99991); and H-1(1.007825).

**Problem #9.** Carbon-14 decays as follows:



isotopic masses are 14.00307 for nitrogen-14 and 14.00324 for carbon-14. What energy change occurs in the beta decay of C-14?

**Problem #10.** Calculate the nuclear binding energy of Li-7 and Cl-35 if this nucleous has a mass of 7.01435 amu. (  $m_p = 1.00728$  amu ,  $m_n = 1.00867$  amu)

**Problem #11.**  ${}_{26}^{56}\text{Fe}$  has a mass defect of 0.58872 amu. What is its binding energy per nucleon?

**Problem #12.** Predict which of the following nuclides are likely to be radioactive (Briefly justify your choice) and determine the mode of decay.

- |               |              |                  |
|---------------|--------------|------------------|
| a) Carbon-14  | b) Xenon-118 | c) Plutonium-239 |
| d) Indium-120 | e) He-4      | f) Ca-40         |
| g) Tc-98      | h) Zn-64     | i) Br-90         |
| j) Ag-103     |              |                  |