

1) The nucleus of a radium-226 atom is unstable, which causes the nucleus to spontaneously

- 1) absorb electrons      3) decay  
2) absorb protons      4) oxidize

2) Which isotope will spontaneously decay and emit particles with a charge of +2?

- 1)  $^{53}\text{Fe}$     2)  $^{137}\text{Cs}$     3)  $^{198}\text{Au}$     4)  $^{220}\text{Fr}$

3) Which reaction is an example of natural transmutation?

- 1)  $^{239}\text{Pu} \rightarrow ^{235}\text{U} + ^4_2\text{He}$   
2)  $^{27}\text{Al} + ^4_2\text{He} \rightarrow ^{30}\text{P} + ^1_0\text{n}$   
3)  $^{238}\text{U} + ^1_0\text{n} \rightarrow ^{239}\text{Pu} + 2\ ^0_{-1}\text{e}$   
4)  $^{239}\text{Pu} + ^1_0\text{n} \rightarrow ^{147}\text{Ba} + ^{90}\text{Sr} + 3\ ^1_0\text{n}$

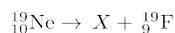
4) Which list of particles is in order of increasing mass?

- 1) proton  $\rightarrow$  electron  $\rightarrow$  alpha particle  
2) proton  $\rightarrow$  alpha particle  $\rightarrow$  electron  
3) electron  $\rightarrow$  proton  $\rightarrow$  alpha particle  
4) alpha particle  $\rightarrow$  electron  $\rightarrow$  proton

5) Which type of radiation would be attracted to the positive electrode in an electric field?

- 1)  $^0_{-1}\text{e}$     2)  $^1_1\text{H}$     3)  $^4_2\text{He}$     4)  $^1_0\text{n}$

6) Given the nuclear equation:



What particle is represented by X?

- 1) alpha                      3) neutron  
2) beta                      4) positron

7) After decaying for 48 hours,  $\frac{1}{16}$  of the original mass of a radioisotope sample remains unchanged. What is the half-life of this radioisotope?

- 1) 3.0 h    2) 9.6 h    3) 12 h    4) 24 h

8) Which radioisotopes have the same decay mode and have half-lives greater than 1 hour?

- 1) Au-198 and N-16      3) I-131 and P-32  
2) Ca-37 and Fe-53      4) Tc-99 and U-233

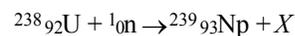
9) What was the original mass of a radioactive sample that decayed to 25 grams in four half-life periods?

- 1) 50 g    2) 100 g    3) 200 g    4) 400 g

10) Which equation is an example of artificial transmutation?

- 1)  $^9_4\text{Be} + ^4_2\text{He} \rightarrow ^{12}_6\text{C} + ^1_0\text{n}$   
2)  $\text{U} + 3\text{F}_2 \rightarrow \text{UF}_6$   
3)  $\text{Mg}(\text{OH})_2 + 2\text{HCl} \rightarrow 2\text{H}_2\text{O} + \text{MgCl}_2$   
4)  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$

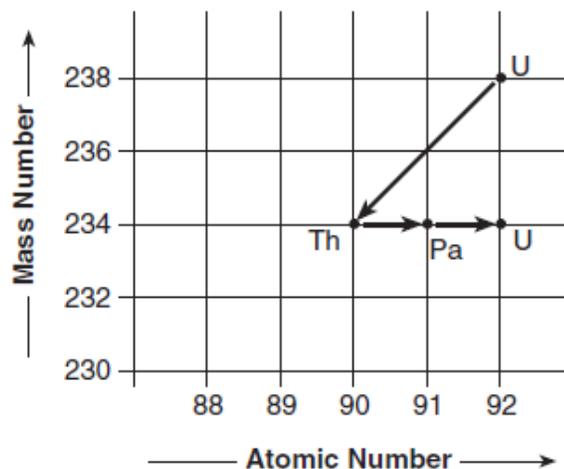
11) In the reaction:



The species represented by X is

- 1)  $^1_1\text{H}$     2)  $^1_0\text{n}$     3)  $^4_2\text{He}$     4)  $^0_{-1}\text{e}$

12) The chart below shows the spontaneous nuclear decay of U-238 to Th-234 to Pa-234 to U-234.



What is the correct order of nuclear decay modes for the change from U-238 to U-234?

- 1)  $\beta^-$  decay,  $\gamma$  decay,  $\beta^-$  decay  
2)  $\beta^-$  decay,  $\beta^-$  decay,  $\alpha$  decay  
3)  $\alpha$  decay,  $\alpha$  decay,  $\beta^-$  decay  
4)  $\alpha$  decay,  $\beta^-$  decay,  $\beta^-$  decay

13) Which radioactive isotope is used in geological dating?

- 1) uranium-238              3) cobalt-60  
2) iodine-131              4) technetium-99

14) Which radioisotope is used in medicine to treat thyroid disorders?

- 1) cobalt-60                      3) phosphorus-32  
2) iodine-131                    4) uranium-238

15) A radioisotope which is sometimes used by doctors to pinpoint a brain tumor is

- 1) carbon-12                    3) technetium-99  
2) lead-206                    4) uranium-238

16) Which isotope is used to treat cancer?

- 1) C-14                            3) Co-60  
2) U-238                        4) Pb-206