Name: **Nuclear Practice Test** **Ms. DeSerio**

____ 1. Which nuclear emission has the greatest mass and the *least* penetrating power?

1) an alpha particle
2) a beta particle
3) a neutron
4) a positron

____ 2. The nucleus of a radium-226 atom is unstable, which causes the nucleus to spontaneously

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

____ 3. Which list of particles is in order of increasing mass?

1) proton → electron → alpha particle
2) proton →alpha particle → electron
3) electron → proton → alpha particle
4) alpha particle → electron → proton

____ 4. Which radioisotope has an atom that emits a particle with a mass number of 0 and a charge of +1?

1) ^{3}H **3) ^{19}Ne**
2) ^{16}N 4) ^{239}Pu

____ 5. Which nuclear emission has no charge and no mass?

1) alpha particle **3) gamma ray**
2) beta particle 4) positron

____ 6. What is the total number of years that must pass before only 25.00 grams of an original 100.0-gram sample of C-14 remains unchanged?

1) 2865 y **3) 11 460 y**
2) 5730 y 4) 17 190 y

____ 7. What is the half-life of a radioisotope if 25.0 grams of an original 200.-gram sample of the isotope remains unchanged after 11.46 days?

1) 2.87 d 3) 11.46 d
2) 3.82 d 4) 34.38 d

____ 8. Which equation represents natural transmutation?

1) ${}^{10}_{5}B + {}^{4}_{2}He \rightarrow {}^{13}_{7}N + {}^{1}_{0}n$
2) ${}^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$
3) $S + 2e^{-} \rightarrow S^{2-}$
4) $Na \rightarrow Na^{+} + e^{-}$

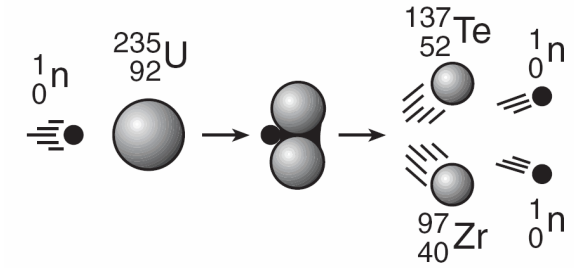
____ 9. In which type of reaction is an atom of one element converted to an atom of a different element?

1) decomposition 3) saponification
2) neutralization **4) transmutation**

____ 10. What is one benefit associated with a nuclear fission reaction?

1) The products are not radioactive.
2) Stable isotopes are used as reactants.
3) There is no chance of biological exposure.
4) A large amount of energy is produced.

____ 11. Base your answer to the following question on Given the diagram representing a reaction:



Which phrase best describes this type of reaction and the overall energy change that occurs?

1) nuclear, and energy is released
2) nuclear, and energy is absorbed
3) chemical, and energy is released
4) chemical, and energy is absorbed

____ 12. Given the balanced equation representing a nuclear reaction:

$$^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + ^{1}_{0}n$$

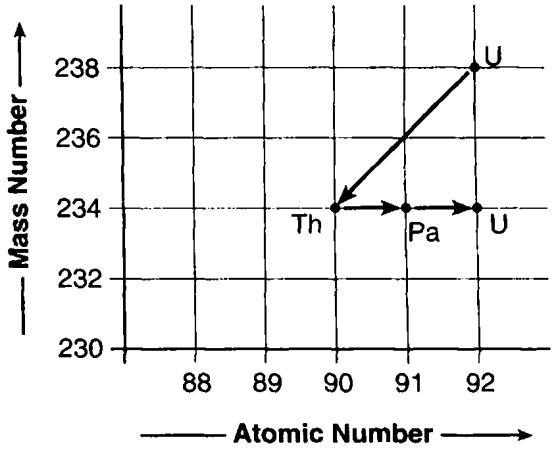
Which phrase identifies and describes this reaction?

1) fission, mass converted to energy
2) fission, energy converted to mass
3) fusion, mass converted to energy
4) fusion, energy converted to mass

____ 13. Which equation represents the radioactive decay of $^{226}_{88}Ra$?

1) $^{226}_{88}Ra \rightarrow ^{222}_{86}Rn + ^{4}_{2}He$
2) $^{226}_{88}Ra \rightarrow ^{226}_{89}Ac + ^{0}_{-1}e$
3) $^{226}_{88}Ra \rightarrow ^{226}_{87}Fr + ^{0}_{+1}e$
4) $^{226}_{88}Ra \rightarrow ^{225}_{88}Ra + ^{1}_{0}n$

____ 14. Base your answer to the following question on 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) β^- decay, γ decay, β^- decay
2) β^- decay, β^- decay, α decay
3) α decay, α decay, β^- decay
4) α decay, β^- decay, β^- decay

____ 15. Given the equation:

$$^{14}_{7}N + ^{4}_{2}He \rightarrow X + ^{17}_{8}O$$

When the equation is balanced correctly, which particle is represented by *X*?

1) $^{0}_{-1}e$ **2) $^{1}_{1}H$** 3) $^{2}_{1}H$ 4) $^{1}_{0}n$

____ 16. During a nuclear reaction, mass is converted into

1) charge
2) energy
3) isomers
4) volume

____ 17. The decay of which radioisotope can be used to estimate the age of the fossilized remains of an insect?

1) Rn-222
2) I-131
3) Co-60
4) C-14

____ 18. Which radioisotope is used for diagnosing thyroid disorders?

1) U-238
2) Pb-206
3) I-131
4) Co-60

____ 19. Which risk is associated with using nuclear fission to produce energy in a power plant?

1) depletion of hydrocarbons
2) depletion of atmospheric oxygen
3) exposure of workers to radiation
4) exposure of workers to sulfur dioxide

____ 20. What is a problem commonly associated with nuclear power facilities?

1) A small quantity of energy is produced.
2) Reaction products contribute to acid rain.
3) It is impossible to control nuclear fission.
4) It is difficult to dispose of wastes.

Base your answers to questions **21** and **22** on the information below

In living organisms, the ratio of the naturally occurring isotopes of carbon, C-12 to C-13 to C-14, is fairly consistent. When an organism such as a woolly mammoth died, it stopped taking in carbon, and the amount of C-14 present in the mammoth began to decrease. For example, one fossil of a woolly mammoth is found to have 1/32 of the amount of C-14 found in a living organism.

____ 21. Determine the total time that has elapsed since this woolly mammoth died.

____ 22. Identify the type of nuclear reaction that caused the amount of C-14 in the woolly mammoth to *decrease* after the organism died.

Base your answers to questions **23** and **24** on the information below.

Nuclear fission has been used to produce electricity. However, nuclear fusion for electricity production is still under development. The notations of some nuclides used in nuclear reactions are shown in the table below.

Some Nuclides Used in Nuclear Reactions

Reaction	Nuclides
nuclear fission	$^{233}_{92}U$, $^{235}_{92}U$
nuclear fusion	$^{1}_{1}H$, $^{3}_{1}H$

____ 23. Complete the table below that compares the total number of protons and the total number of neutrons for the hydrogen nuclides used for fusion.

Nuclide	Total Number of Protons	Total Number of Neutrons
$^{1}_{1}H$		
$^{3}_{1}H$		

____ 24. Compare the atomic masses of nuclides used in fusion to the atomic masses of nuclides used in fission.

Base your answers to questions **25** through **28** on the information below.

Nuclear radiation is harmful to living cells, particularly to fast-growing cells, such as cancer cells and blood cells. An external beam of the radiation emitted from a radioisotope can be directed on a small area of a person to destroy cancer cells within the body.

Cobalt-60 is an artificially produced radioisotope that emits gamma rays and beta particles. One hospital keeps a l00.0-gram sample of cobalt-60 in an appropriate, secure storage container for future cancer treatment.

____ 25. Determine the total time that will have elapsed when 12.5 grams of the original Co-60 sample at the hospital remains unchanged.

____ 26. Complete the nuclear equation below for the beta decay of the Co-60 by writing an isotopic notation for the missing product.

$$^{60}_{27}Co \leftrightarrow {}^{0}_{-1}\beta + \_\_\_\_\_$$

____ 27. Compare the penetrating power of the two emissions from the Co-60.

____ 28. State *one* risk to human tissue associated with the use of radioisotopes to treat cancer.

Answer Key
Nuclear Practice Exam

1. **1**
2. **3**
3. **3**
4. **3**
5. **3**
6. **3**
7. **2**
8. **2**
9. **4**
10. **4**
11. **1**
12. **3**
13. **1**
14. **4**
15. **2**
16. **2**
17. **4**
18. **3**
19. **3**
20. **4**
21. 28 650 y
22. *Examples:* – natural transmutation – transmutation – beta decay – radioactive decay
23.

Nuclide	Total Number of Protons	Total Number of Neutrons
$^{1}_{1}H$	1	0
$^{3}_{1}H$	1	2

24. —The nuclides used for fusion have smaller atomic masses than nuclides used for fission. —The nuclides used in fission are many times more massive. —Fusion particles are lighter.
25. 15.813 y / 15.8 y
26. $^{60}_{28}Ni$/ ^{60}Ni/ nickel-60
27. —Gamma radiation has greater penetrating power. —Beta particles have weaker penetrating power.
28. —Nuclear radiation is harmful to all living cells. — Radioisotopes can cause gene mutations. — Treatments can cause stomach problems, such as nausea.