

COVENANT UNIVERSITY
NIGERIA

TUTORIAL KIT
OMEGA SEMESTER

PROGRAMME: PHYSICS

COURSE: PHY 422

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PHY 422: Nuclear and Particle Physics

CONTRIBUTORS: Dr. Usikalu M.R.

1. What is the primary difference between ^{13}C and ^{12}C ?
2. How many neutrons and how many protons are in ^{22}Ne ?
3. What is the difference between an *element* and an *isotope*?
4. What is the difference between the atomic number and the atomic mass number?
5. Consider the following three forces: gravity, electromagnetic, and strong nuclear. What is responsible for holding nuclei together and which is responsible for holding electrons in their orbits?
6. Which one of the following processes is considered radioactive decay?
7. When bismuth $^{211}_{83}\text{Bi}$ undergoes alpha decay, what daughter nucleus is produced?
8. When osmium $^{191}_{76}\text{Os}$ undergoes beta decay, what daughter nucleus is produced?
9. By what method can a nucleus decay to a daughter nucleus with a larger atomic number?
10. Ionizing radiation can be harmful to living things because of what reasons?
11. Consider the following nuclear reaction: $^{122}_{52}\text{Te}(X,d)^{124}_{53}\text{I}$. The symbol "d" indicates a deuterium nucleus ^2_1H . What is particle X in this reaction?
12. Consider the following nuclear reaction: $^4_2\text{He} + ^{10}_5\text{B} \rightarrow ^{13}_6\text{C} + X$. What is true concerning particle X in this reaction?
13. What occurs in the process known as nuclear fission?
14. Consider the following nuclear reaction: $^{235}_{92}\text{U} + \gamma \rightarrow X + ^{90}_{36}\text{Kr} + 3^1_0\text{n}$. What is X in this reaction?
15. How many neutrons are released in the following reaction: $^{235}_{92}\text{U} + ^1_0\text{n} \rightarrow ^{88}_{38}\text{Sr} + ^{136}_{54}\text{Xe} + ^1_0\text{n}$?
16. What is the purpose of the moderator in a fission reactor?
17. What is the energy released by 1kg of uranium when fissioned according to the given equation? $^{235}_{92}\text{U} + ^1_0\text{n} \rightarrow ^{148}_{57}\text{La} + ^{85}_{35}\text{Br} + 3^1_0\text{n}$
18. In the fusion reaction $^2_1\text{H} + ^3_1\text{H} = ^4_2\text{He} + ^1_0\text{n}$, how much energy, in joules is released?
19. What is the binding energy of the last neutron in ^4He ?
20. Iron isotopes ^{49}Fe and ^{51}Fe are both known short-lived radioactive positron emitters, but ^{50}Fe has not yet been discovered. Compute the expected value for the nuclear mass of ^{50}Fe .

Answers

1. The number of neutrons is different.
3. A. An *element* has a particular number of protons and neutrons, while an *isotope* has a particular number of protons and a varying number of neutrons.
5. Gravity holds electrons, while the strong nuclear force holds nuclei together.
7. $^{207}_{81}\text{Tl}$

9. beta decay
11. X must be an alpha particle
13. A nucleus with an atomic number greater than that of iron is split.
15. 12

17. $8 \times 10^{13} J$

19. 20.58 MeV