Radioactivity Worksheet

1) A positively charged particle made up of two protons and two neutrons and released by a radioactive nucleus is the _____.

2) An electron released by a radioactive nucleus that causes a neutron to change into a proton is called a _____.

3) The amount of time for half the atoms in a radioactive sample to decay is called _____.

4) The process in which the nuclei of unstable atoms can become more stable by emitting particles and/or electromagnetic radiation is called _____.

5) High-energy electromagnetic radiation released by a radioactive nucleus is called _____.

6) _____ decay is the breaking up of a radioactive element, more often than not resulting in the formation of a new nucleus.

7) _____ is the changing of an atom into another kind of atom that takes place during radioactive decay.

8) In the year _____, Henri Becquerel of _____ discovered radioactivity.

9) Alpha radiation is actually a stream of (positively, negatively) charged particles.

10) Beta radiation is actually a stream of (positively, negatively) charged particles.

11) Whenever an element undergoes (alpha, beta, gamma) decay, it turns into another element with an atomic number two less than before and a mass number four less than before.

12) During (alpha, beta, gamma) decay, a neutron in the nucleus decays into a proton, an electron, and a neutrino.

13) The more stable a nucleus is, the (longer, shorter) its half-life.

14) (Alpha particles, Beta particles, Gamma rays) can be stopped with a piece of paper.

15) (Alpha particles, Beta particles, Gamma rays) can be stopped with a thin metal sheet.

16) It takes a thick metal sheet to stop (alpha particles, beta particles, gamma rays).

17) (Alpha particles, Beta particles, Gamma rays) travel at the speed of light.

18) The term radioactivity was coined by _____.

19) (Alpha particles, Beta particles, Gamma rays) are not affected by a magnetic field because they carry no _____ charge.

20) An alpha particle is actually a nucleus of _____.

21) Beta particles originate in the _____ of the atom.

22) Radioactive decay processes occur until a _____ element is formed.

23) The half-life of a given isotope can be altered by heat, pressure, or some other physical means. True or False.

24) The half-life of Zn-71 is 2.4 minutes. If one had 100.0 g at the beginning, how many grams would be left after 7.2 minutes has elapsed?

25) Pd-100 has a half-life of 3.6 days. If one had 6.02×10^{23} atoms at the start, how many atoms would be present after 20.0 days?

26) Os-182 has a half-life of 21.5 hours. How many grams of a 10.0 gram sample would have decayed after exactly three half-lives?

27) After 24.0 days, 2.00 milligrams of an original 128.0 milligram sample remain. What is the half-life of the sample?

28) U-238 has a half-life of 4.46×10^9 years. How much U-238 should be present in a sample 2.5×10^9 years old, if 2.00 grams was present initially?

29) How long will it take the 40.0 grams sample of I-131 (half-life = 8.040 days) to decay to 1/100 its original mass?

30) Fermium-253 has a half-life of 0.334 seconds. A radioactive sample is considered to be completely decayed after 10 half-lives. How much time will elapse for this sample to be considered gone?

31) At time zero, there are 10.0 grams of W-187. If the half-life is 23.9 hours, how much will be present at the end of one day? Two days? Seven days?

32) 100.0 grams of an isotope with a half-life of 36.0 hours is present at time zero. How much time will elapse before 50.0 grams remains? Before 5.00 grams remains?

33) How much time will be required for a sample of H-3 to lose 75% of its radioactivity? The half-life of tritium is 12.26 years.

34) Rn-222 has a half-life of 3.82 days. How long before only 1/16 of the original sample remains?

35) U-238 has a half-life of 4.46×10^9 years. Estimates of the age of the universe range from 9×10^9 years to 23×10^9 years (Cauldrons in the Cosmos: Nuclear Astrophysics, C.E. Rolfs and W.S. Rodney, Univ. of Chicago, 1988, p) 477). What fraction of this isotope present at the start of the universe remains today? Calulate for both minimum and maximum values, as well as a median value of 16×10^9 years.

36) A sample of Se-83 registers 10^{12} disintegrations per second when first tested. What rate would you predict for this sample 3.5 hours later, if the half-life is 22.3 minutes?

37) Iodine-131 has a half-life of 8.040 days. If we start with a 40.0 gram sample, how much will remain after 24.0 days? How much remains after 20 days?

38) If you start with 2.97 x 1022 atoms of molybdenum-99 (half-life = 65.94 hours), how many atoms will remain after one week? one (non-leap) year?

How to Solve

$$(\text{starting amount}) \times (1/2)^{\text{number of half-lives}} = \text{ending amount}$$

number of half-lives can be expressed as (total time elasped ÷ length of half-life)

For example, here is the solution to #24: $100 \times (1/2)^{(7.2 \div 2.4)} = x$