

23. (a) The energy yield of the bomb is $E = (66 \times 10^{-3} \text{ megaton})(2.6 \times 10^{28} \text{ MeV/megaton}) = 1.72 \times 10^{27} \text{ MeV}$. At 200 MeV per fission event, $(1.72 \times 10^{27} \text{ MeV})/(200 \text{ MeV}) = 8.58 \times 10^{24}$ fission events take place. Since only 4.0% of the ^{235}U nuclei originally present undergo fission, there must have been $(8.58 \times 10^{24})/(0.040) = 2.14 \times 10^{26}$ nuclei originally present. The mass of ^{235}U originally present was $(2.14 \times 10^{26})(235 \text{ u})(1.661 \times 10^{-27} \text{ kg/u}) = 83.7 \text{ kg}$.
- (b) Two fragments are produced in each fission event, so the total number of fragments is $2(8.58 \times 10^{24}) = 1.72 \times 10^{25}$.
- (c) One neutron produced in a fission event is used to trigger the next fission event, so the average number of neutrons released to the environment in each event is 1.5. The total number released is $(8.58 \times 10^{24})(1.5) = 1.29 \times 10^{25}$.