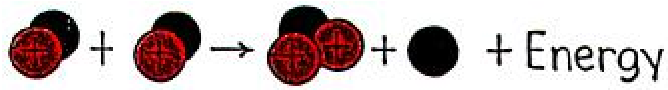
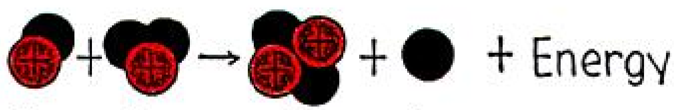
NEXT-TIME QUESTION

CONCEPTUAL Physics

Both nuclear fission and nuclear fusion release enormous energy. When a uranium nucleus fissions, the released energy is mainly kinetic energy of the repelling fragments. When a pair of hydrogen isotopes fuse, the energy initially released is in the form of



$$^{2}_{1}H + ^{2}_{1}H \rightarrow ^{3}_{2}He + ^{1}_{0}n + 3.26\ \text{MeV}$$



$$^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + ^{1}_{0}n + 17.6\ \text{MeV}$$

a) gamma radiation.
b) kinetic energy of recoiling particles.
c) potential energy of the helium nucleus that is formed.
d) heat.
e) a combination of all of the above.

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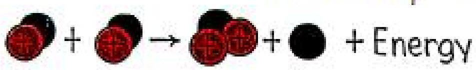

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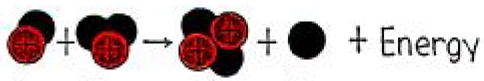

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Answer: b, kinetic energy of recoiling particles

The energy initially and typically released in the fusion of hydrogen isotopes is divided between the kinetic energy of the 2 particles produced—a helium nucleus and a neutron. Interestingly, a pair of hydrogen isotopes can't fuse to produce a lone helium nucleus—even though the numbers of protons and neutrons add up correctly. Why? Momentum and energy conservation: If a lone helium nucleus flies away after the reaction, it adds momentum that wasn't there before. Or if it remains motionless, there's no mechanism for energy release. So it can't move and it can't sit still! A fusion reaction requires the creation of at least 2 particles to share the released energy—or, in some cases, like in the dense core of the Sun, a neighboring nucleus to absorb some of the energy.

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