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Unit 7C
Nuclear Fusion
Practice Problems TEACHER

Work each of the following problems. SHOW ALL WORK.

1. **What happens to the mass that is lost when light nuclei fuse together to form heavier nuclei?**

This mass is converted into energy.

2. **Is the mass of protons and neutrons greater when they are alone or when they are bound together in the nucleus? Explain why.**

The protons and neutrons by themselves have more mass than when they are bound together. In the process of binding protons and neutrons together, this additional mass, called the mass defect, is released as energy.

3. **Explain how nuclear fusion is responsible for heating the Earth.**

The Earth receives energy from the sun in the form of electromagnetic radiation, which is produced by nuclear fusion in the sun.

4. **One kilogram of hydrogen is consumed in the proton-proton chain reaction, 993 grams of helium are formed, and 7 grams of mass are lost as energy. How much energy is created when those 7 grams of matter are lost?**

$$E = \Delta mc^2$$
$$E = (0.007\ kg)(3 \times 10^{8}\ {}^{m}/_{s})^2$$
$$E = (0.007\ kg)(9 \times 10^{16}\ {}^{m^2}/_{s^2})$$
$$E = 6.3 \times 10^{14}\ J$$

5. **A possible nuclear fusion reaction that could occur on Earth is the fusion of a hydrogen-2 nucleus called deuterium with a hydrogen-3 nucleus called tritium. Each fusion of these two nuclei releases 2.8 x 10^{-12} joules of energy. How much mass is this amount of energy equal to?**

$$E = \Delta mc^2$$
$$2.8 \times 10^{-12}\ J = m(3 \times 10^{8}\ {}^{m}/_{s})^2$$
$$2.8 \times 10^{-12}\ J = m(9 \times 10^{16}\ {}^{m^2}/_{s^2})$$
$$m = 3.1 \times 10^{-29}\ kg$$

questions continued on next page

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Work each of the following problems. SHOW ALL WORK.

6. **The sun produces 3.8 x 10^{26} joules of energy every second. How much mass is being converted to energy every second in the nuclear fusion reactions in the sun?**

$$E = \Delta mc^2$$
$$3.8 \times 10^{26}\ J = m(3 \times 10^{8}\ {}^{m}/_{s})^2$$
$$3.8 \times 10^{26}\ J = m(9 \times 10^{16}\ {}^{m^2}/_{s^2})$$
$$m = 4.2 \times 10^{9}\ kg$$