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Unit 7C
Nuclear Fusion
Note-Taking Guide and Questions to Consider TEACHER

Main Ideas, Key Points, Questions:

After watching the video segment, write down key points, main ideas, and big questions.

Objective(s):

- *Describe the conditions under which nuclear fusion reactions occur.*
- *Understand and calculate the amount of energy that is released in a nuclear fusion reaction.*

Notes:

During the video segment, use words, phrases or drawings to take notes.

Summary:

After watching the video segment, write at least three sentences explaining what you learned. You can ask yourself: "If I was going to explain this to someone else, what would I say?"

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Answer the following.

1. **Define nuclear fusion in your own words.**

Two small, light nuclei come together to form a heavier nucleus.

2. **Why must nuclear fusion reactions take place at very high temperatures?**

Nuclei are positively charged and repel one another. Particles at very high temperatures are moving very quickly; fast enough that the repulsive force is overcome and the nuclei fuse together.

3. **What is the difference in mass between the smaller nuclei that fuse together and the newly formed heavier nucleus called?**

The difference in mass is called the mass defect.

4. **What equation relates the mass defect with the amount of energy that is released in a nuclear fusion reaction?**

$$E = \Delta m c^2$$

E is energy, Δm is the mass defect, and c is the speed of light.

5. **Write the total equation for the proton-proton chain reaction that takes place in stars.**

$$4\,{}^{1}_{1}H \longrightarrow {}^{4}_{2}He + 2\,{}^{0}_{1}\beta^{+} + 2\gamma + 2\nu$$

Four protons fuse to form a helium nucleus, two positrons, two gamma rays, and two neutrinos.

6. **In what part of a star does nuclear fusion take place?**

Nuclear fusion occurs in the core of a star.

questions continued on next page

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Answer the following.

7. **Why do stars emit mostly infrared and visible light and not gamma rays?**

Gamma rays are created in the proton-proton chain reaction in the core, but by the time they leave the sun, they have been reabsorbed and emitted over and over again in the layers of the sun outside of the core, causing them to lose energy.

8. **What does it mean that we are all "made of stardust"?**

The universe began with the two lightest nuclei elements, hydrogen and helium. All other elements were formed via nuclear fusion that occurred in stars, so everything is made of stardust.