SN EDUCATOR GUIDE

November 23, 2019

Strontium Found in Neutron Star Crash

Student Discussion Worksheet

Getting warmed up

Review the following questions as a class.

1. What subatomic particles exist in an atom? Where are these particles generally located, and what forces hold them together?

2. Why are some atoms unstable? What are two ways that the numbers of particles in an atom could make it unstable? What happens when an atom is not stable? How are ions produced, and what is nuclear decay?

3. How do we define an atom of a particular element? How do we distinguish between one element and another, and why is doing so useful? What techniques allow us to identify the presence of different elements?

4. What is nuclear fusion? How does a star form, live and die? How does nuclear fusion relate to a star's life cycle? How does a star's mass affect its life cycle, and how does our sun's size compare with that of other stars?

The star producer

If you have selected "We are stardust," read the article through the section "Death of a star" and discuss the following prompts in your group.

1. What types of stellar events can produce new elements?

2. What elements were created in the Big Bang? Describe the relative amounts of the elements in the very early universe's giant gas clouds.

3. What elements are created in a living star, and how are they created? What types of elements cannot be born from living stars?

4. How does a star's size and temperature affect the elements it can create while living? What types of elements are created by our sun?

5. How do relatively small stars die? How do relatively big stars die? Which process can produce more massive elements? Explain.

Artificial assembly time

If you have selected "Extreme elements push the boundaries of the periodic table," read the article through the section "Relativity rules" and discuss the following prompts in your group.

1. What types of elements must be created by scientists artificially?

2. What techniques are used by scientists to create these elements?

3. Where do scientists create superheavy elements? What equipment is needed?

4. How long do the heaviest labmade elements exist? What does their lifetime tell you about their stability? What happens to them when they no longer exist? What elements are left over and how are they relate to the original element.

5. In modern experiments, how much of a new element is generally created? How does the amount of the element and the time it exists affect the ability to study its properties?

Putting it all together

Answer the following questions as a class.

1. What are three ways that new elements are created? (Hint: Don't forget to think about what happens to the labmade elements shortly after they are created.)

2. How does the energy required to create an atom relate to the atom's size? What other factors might affect the type of element formed in a reaction?

3. Scientists in what fields are interested in how elements are created?

4. Why might we want to understand how elements are created?

5. What other questions do you have about the creation of elements?

Bonus: How does the size of an atom and particles within an atom compare with the size of the observable universe? Calculate the order of magnitude difference between their approximate diameters. Which do you think scientists know more about — atoms or the universe? Why? What are the limitations to studying each?