

Atomic Structure and Nuclear Chemistry

Nuclear Equations and Radioactive Decay

Student Pages

Purpose

The purpose of this station is to reinforce your ability to balance nuclear equations; characterize alpha, beta, and gamma radiation; and compare the processes of fission and fusion.

Before You Begin...

Check to see that all the items are present and organized according to the Station Information Sheet. If you notice a problem, notify your teacher immediately.

Materials

Station Information Sheet
STAAR Chemistry Reference Materials*
Characteristics of Radiation Cards
Nuclear Equations Card
Nuclear Equations Strips
Fission–Fusion Venn diagram
Fission–Fusion Cards

*Reminder: Use the STAAR Chemistry Reference Materials as needed to help with the questions and activities.

Essential Questions

Nuclear reactions change the structure of nuclei and involve a tremendous amount of energy. The sun is fueled by nuclear reactions. Nuclear power plants are also fueled by nuclear reactions.

1. What changes occur in the nuclei of atoms involved in the reactions that fuel the sun?
2. What changes occur in the nuclei of atoms involved in the reactions that fuel nuclear power plants?

Activities

1. Locate the Characteristics of Radiation Cards. Sort the cards into categories according to which type of radiation each card describes. Record your answers in the table.

Alpha Radiation	Beta Radiation	Gamma Radiation

Which type of radiation presents the greatest risk? Why?

2. Locate the Nuclear Equations Card and the Nuclear Equations Strips. Examine the equations and strips and determine which strip contains the substance that will balance each equation. Insert the strip into the pocket behind the equation. Slide the strip until the substance that balances the equation shows in the window. Write your answers in the blank windows below.



slide \rightarrow

1	${}_{92}^{238}\text{U} \rightarrow$		$+ {}_2^4\text{He}$
2	\rightarrow		${}_{91}^{234}\text{Pa} + {}_{-1}^0\text{e}$
3	${}_{4}^9\text{Be} +$		$\rightarrow {}_6^{12}\text{C} + {}_0^1\text{n}$
4	${}_{92}^{238}\text{U} + {}_0^1\text{n} \rightarrow$	${}_{93}^{239}\text{Np} +$	

How do you know when a nuclear equation is balanced?

3. Write balanced nuclear equations for the following:
Carbon-14 undergoes beta decay.

Radium-236 undergoes alpha decay.

4. Locate the Fission–Fusion Venn Diagram and the Fission–Fusion Cards. Place the cards in the appropriate spaces on the diagram. Record the results from the Venn Diagram in the table below.

Fission	Both	Fusion

5. Now that you have completed these exercises, return to the Essential Question. Would you like to modify or change your answer? Write any modifications to your answer below.

NOTE: Because other students are going to do the activity after you, be sure to put all the materials at the station back as you found them. Sometimes there will be materials that need to be renewed or replaced. If you need assistance or have any questions, ask your teacher.

Question Card

1. Get the question card from your teacher.
2. With your teammates, discuss the question and decide how to answer it.
3. Note the answer your team came up with in your science journal, including justifications for the answer.

I Need to Remember . . .

Complete this part **after** class discussion of this station.

I need to remember . . .

Glossary for *Nuclear Equations and Radioactive Decay*

Alpha Particle

Alpha particles consist of two protons and two neutrons and are identical to helium-4 nuclei.

Beta Particle

Beta particles are energetic electrons emitted from the nucleus.

Fission

Fission is the splitting of a large nucleus into two or more smaller nuclei.

Fusion

Fusion is the joining of two lighter nuclei into a heavier nucleus.

Gamma Radiation

Gamma radiation is energetic electromagnetic radiation coming from the nucleus of a radioactive atom; it is also generated in stars when a positron and an electron collide during the fusion process.

Nucleus

The nucleus is the small, dense portion of an atom that consists of protons and neutrons.

Radioactive Decay

Radioactive decay is the disintegration of an unstable nucleus that causes one or more new nuclei to form and typically emits alpha particles, beta particles, or gamma rays.