

Warm-up

First, project different pictures of the universe one at a time. Then, in small groups, tell students to express their thoughts, creating digital word clouds to record their words. For example, *a picture of a spiral-shaped galaxy* may inspire words such as *merry-go-round* or *pinwheel*. Finally, ask volunteers to share their word clouds with the rest of the class. Alternatively, have them create physical word clouds by writing the words on the board. Ask students to take turns.

Teaching Tip

For Exercise 3
First, write the words in bold from the text on slips of paper and post them around the classroom. Then, divide students into groups and have each group select a student who will participate first. Next, call out a definition and tell the first student from each group to run to the defined word. Repeat with the different words and their descriptions. Finally, the winning group will be the one that has the most points at the end.

Differentiation Strategy

For Exercise 2
Go to the Differentiation Strategies Bank and adapt this exercise using Strategy 6.

Flexi Exercises

(To adjust to students' needs, you can either use or not the activities below)

Exercise 1



What is the universe made of?

01 Write the name of an element from the periodic table. Then, research it and write a summary of what you learned. Compare descriptions with a classmate who researched a different element.

Answers will vary.

02 Read "The Universe Is a Live Wire." Write "T" if the statements are true, "F" if they are false, and "NM" if they are not mentioned.

- All kinds of matter have identical spectra.
- Spectroscopy can have applications in medicine to diagnose some illnesses.
- Photons are absorbed when electrons move up a level.
- The energy emitted when an electron moves down is inverse to the amount absorbed when an electron moves up.

F

NM

T

T

03 Read the text again. Match the definition to the words in bold from the text.

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|---------------|---|
| 1. spectrum | a. take in and utilize |
| 2. photons | b. the combination of light waves and particles |
| 3. absorbed | c. opposite |
| 4. wavelength | d. particles of energy |
| 5. emission | e. the release of energy |
| 6. inverse | f. the distance between two successive points on a wave |

The Universe Is a Live Wire

Astronomers use spectroscopy to help them understand the composition of the universe and everything it contains. They study the patterns of colors, studied as wavelengths of light, that they emit and absorb. This is possible because light interacts with different types of matter differently, producing a different **spectrum**, a collection of light waves or particles that occur in a particular order. Each element's spectrum is unique, in the same way that every human has unique fingerprints.

The electrons of an element can absorb energy in the form of photons, allowing them to jump to higher energy levels. The particular number and value of the **photons** determine what wavelength of light is **absorbed**, thus creating a specific absorption spectrum unique to each element. Conversely, when an electron drops from a higher to a lower energy level, it emits a photon, that is a particle of energy appearing as light. The specific value of the photons released determines the **wavelength** of light that is given off. Since different types of matter contain electrons in varying numbers and positions, an **emission** spectrum containing a unique combination of wavelengths can be determined for each element.

Interestingly, the energy required to move electrons up to a particular level is the same amount released when electrons return to the original level. This means that each element's emission spectra is directly **inverse** to its absorption spectra.

04 Research the spectrum of different elements. With a classmate, discuss the questions below.

- What differences do you notice?
- What similarities do the spectra have?
- What do you think the similarities mean for the elements?



Teaching Tip

For Exercise 5

First, in small groups, tell students to write the different word forms (emitted, emission, absorb, absorption) from the exercise. Then, ask students to organize the words according to their word forms (nouns, verbs, adjectives) and to match them up accordingly (absorption=noun, absorbed=verb).

Language Structures and Functions Tip

For Exercise 7

Before writing, tell students to choose at least three key words from Exercises 5 and 6 to use in their fact file. After writing, tell students to review their work, especially regarding the key words. Then, tell students to get feedback about the accuracy of the words and their part of speech. Finally, if time allows, review the grammar point in more detail.

Differentiation Strategy

For Exercise 8

Go to the Differentiation Strategies Bank and adapt this exercise using Strategy 8.

Wrap-up

First, tell students they will play a game similar to the popular game show “Family Feud.” Then, divide students into two groups (a.k.a. families), one on either side of a table. Next, place two objects (a board, a pen, and an eraser) on the table, naming one “emission spectra” and the other “absorption spectra.” Afterward, read aloud statements from the fact file (Exercise 7) or the presentation (Exercise 8). Tell groups to grab the object representing the correct spectra. Sample sentence: *This provides the inverse wavelength of the emission spectra. (absorption spectra).* Finally, the family with the most correct answers at the end of the game wins.

Flexi Exercises

(To adjust to students' needs, you can either use or not the activities below)

Exercise 6

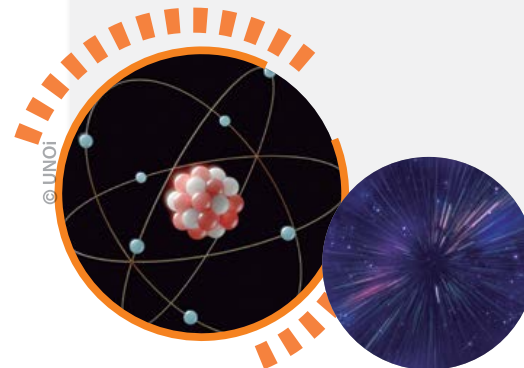
05 Match the sentence halves with the sentence pairs. With a classmate, discuss if the words in bold are nouns, adjectives, or verbs.

- | | |
|--|--|
| 1. Photons are emitted | a. occurs when electrons drop levels. |
| 2. The emission of photons | b. when electrons drop levels. |
| 3. The absorption of energy | c. allows electrons to jump. |
| 4. Energy is absorbed , | d. allowing electrons to jump. |
| 5. Differences in electron numbers | e. each element has a different spectrum. |
| 6. Due to the different electron numbers, | f. lead each element to have a different spectrum. |

07 Write a fact file about the emission and absorption spectrum. Answers will vary.

06 Write the correct form of the word in parentheses to complete the sentence.

- Scientists now have the ability to study wavelengths of light from the universe. (able)
- Alan's curiosity led him to learn more about astronomy. (curious)
- The generosity of an anonymous donor allowed the university to build a new science wing. (generous)
- The astronomy professor at a prominent university got security clearance to go to NASA to share her findings. (clear)
- The emergence of supposed findings on the internet about life on other planets has been amusing. (emerge)
- Electron's feel an attraction to other electrons due to their electric charges. (attract)



08 With a classmate, design and deliver a presentation on the difference between emission and absorption spectra.