TeachEngineering

What's In Our Stars? Introduction

Warm-up questions:

Write/draw your ideas on your student handout.

"IDK" is not an acceptable answer right now – **you DO know something** – write it down! :)

How do you know what something is made of?

THINK & WRITE: How do you know what elements or molecules make up an item?

What if you don’t know…

What would you DO to find out?

THINK & WRITE: What tests, experiments, or data collection could you carry out to figure out the composition of something?

What if you can't observe/test it directly?

THINK & WRITE: What if the item is **too big** (the moon), **too small** (a molecule), or **too far** (a star)? How does this change your ideas?

What sort of tools would you require?

THINK & WRITE: What tools or equipment would you need to identify the composition of an item?

Why do we care?

THINK & WRITE: Why is it important to know what something is made of?

Introduction

As we hunt for Earth 2.0, a key aspect that needs to be considered is what star our new planet is going to be orbiting. There are trillions (or more!) of stars just in our Milky Way Galaxy. So how do we as scientists begin to determine what makes a star ideal for sustaining life?

Introduction

The first step is to discover how stars differ from one another. As you look into the night sky, you can see that they differ in size and brightness. But stars also differ in elemental composition (i.e., what elements are in them). The way scientists determine what elements are in materials that are too far (or deadly) to bring into an actual lab is through spectroscopy.

Introduction

Spectroscopy studies the pattern of wavelengths of light that an atom absorbs or emits when energized. Each element has a unique "fingerprint" of wavelengths that they will absorb/emit. This information is incredibly valuable, because different materials interact with light in different ways. By analyzing the patterns of wavelengths that interact with an object, scientists can identify the material, study its properties, and even detect substances that are otherwise invisible to the naked eye.

Introduction

However, to determine those wavelengths, we need specific tools—this is where **engineers** come in. Scientists can't detect those patterns of wavelengths just by looking at an object with the naked eye; they need a tool that can recognize each wavelength and determine the intensity (i.e., the amount of energy) of each wavelength. Engineers make this possible by designing and building devices called spectrometers. There are many different types of spectrometers, varying in price, sensitivity, and method of detection, but the end goal is the same: **to empower scientists to make new discoveries and form a deeper understanding of the world (and universe) around us.**

Introduction

In this lab, you will take on the role of an engineer and build a spectrometer! As a scientist, you will use the spectrometer to determine a unique spectral diagram for various lab materials and then use those diagrams to identify an unknown substance. Last, you'll apply the same concept and process to determine the composition of various stars in our galaxy!