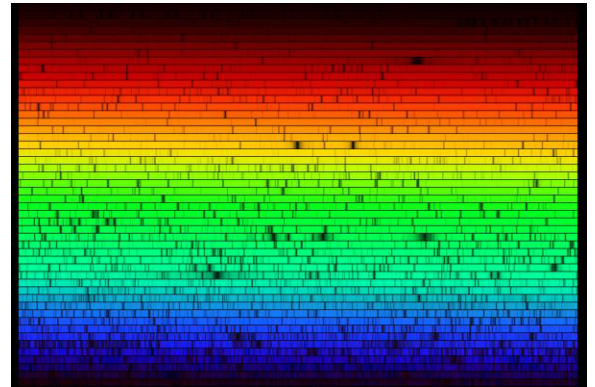


ASTR 311 Tutorial 2: Decoding Starlight

The colour of a glowing gas, like a candle flame, the burner on a gas stove or a star, reveals its temperature: hotter gases glow blue, colder gases glow red. On more careful inspection, though, the light we receive from each gas contains an enormous amount of information: not just its temperature but also its chemical composition, motion and more. This information is found by decoding the spectrum of the gas.

In this tutorial, you'll learn how to “crack the code” and reveal what the glowing objects are made of.

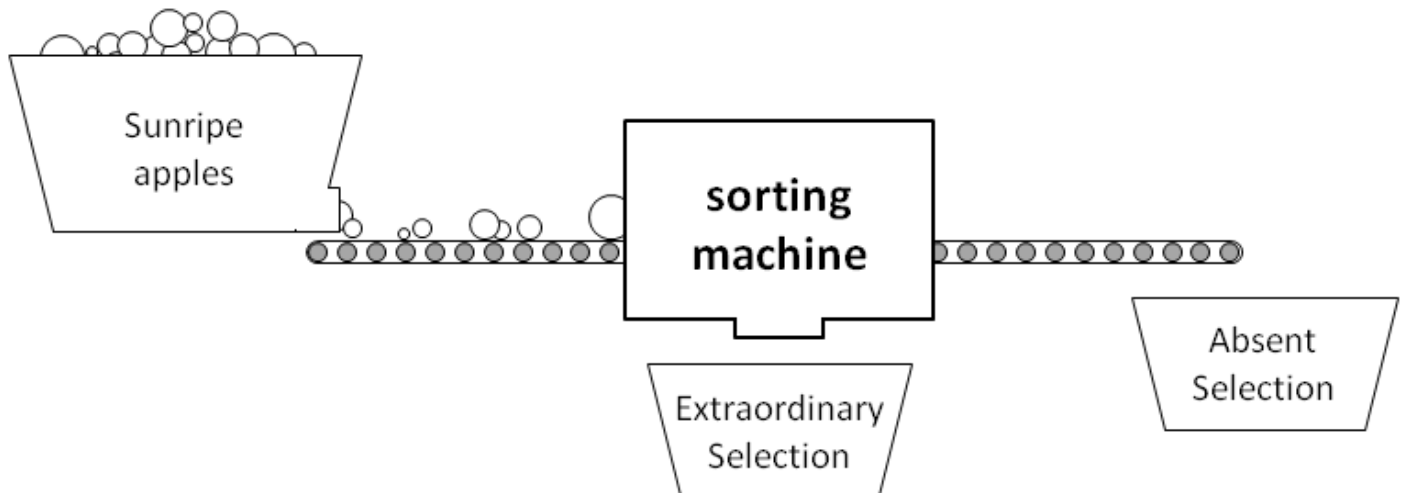


The Sun's spectrum

Part 1: The Sunripe Apple Sorting Machine

In the Fall, apple orchards sell their apples to the Sunripe Company. One of Sunripe's products, *Extraordinary Selection*[®] apple pie, is made only from certain apples: those with diameters between 60 – 65 mm and 80 – 85 mm.

Your job is to **design the sorting machine** that selects the *Extraordinary Selection*[®] apples out of all the apples processed in the factory. Sketch your design on the whiteboard and be prepared to share your design.



Part 2: A Catalogue of Spectra

Visit each of the 4 stations. At each one, use the diffraction grating slide to see what the spectrum of the gas looks like. Draw the emission spectrum in the space below – the positions of the lines is important, so use the reference spectrum as a guide for where to draw the lines.

Reference spectrum



Gas: _____

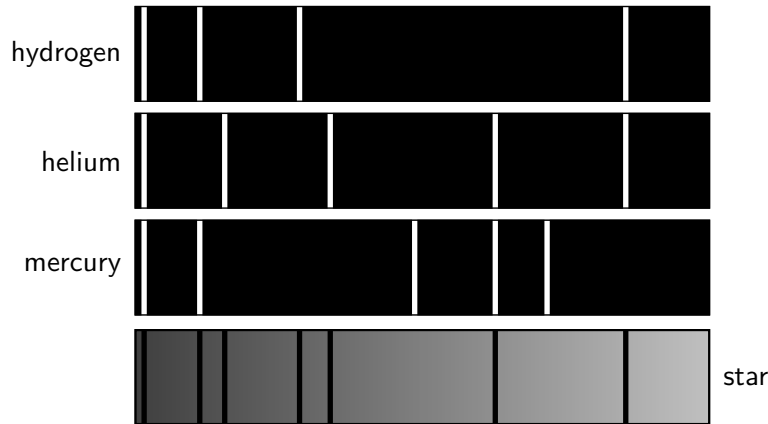
Gas: _____

Gas: _____

Gas: _____

Part 3: Questions Please hand in this worksheet when you are finished.

1. These are the emission spectra of several elements and the absorption spectrum of a star. How many elements are present in the star's atmosphere?



- 2 element 3 elements 7 elements 9 elements

2. The absorption spectra from 2 mystery stars are hanging on the walls in the room. Compare those spectra to your catalogue of emission spectra to figure out the chemical composition of the two stars. **Each star contains 2 elements.** (*Psst! Don't write on the mystery spectra or else the next group of students will get the answers!*)

Mystery Star 1 contains _____ and _____

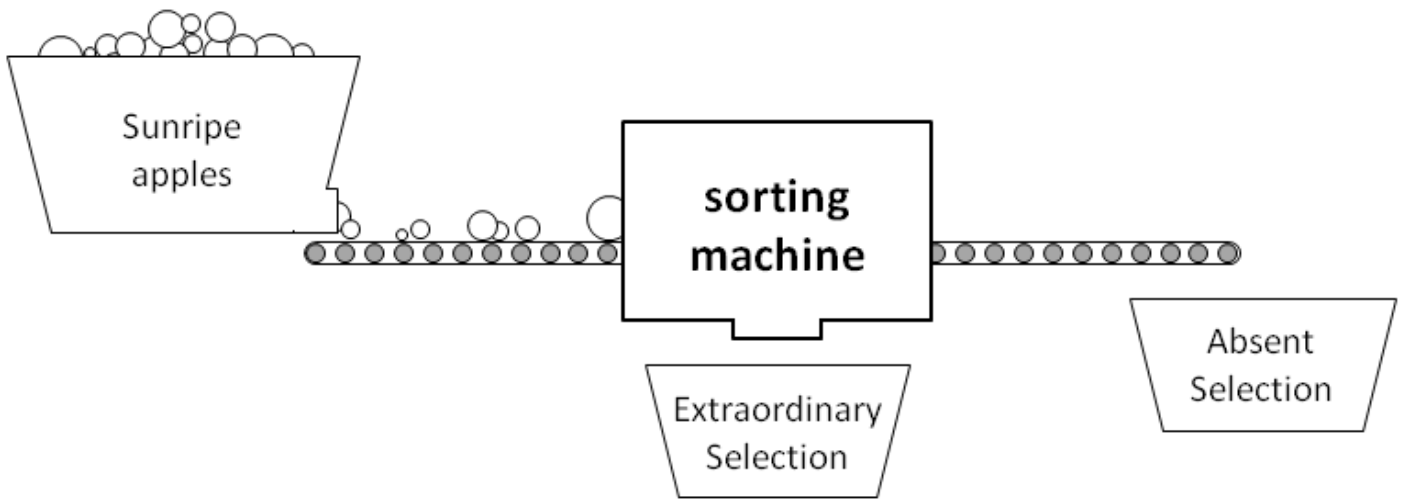
Mystery Star 2 contains _____ and _____

3. Look up at the spectrum of the fluorescent lights in this room. Is it a continuous, absorption or emission spectrum?

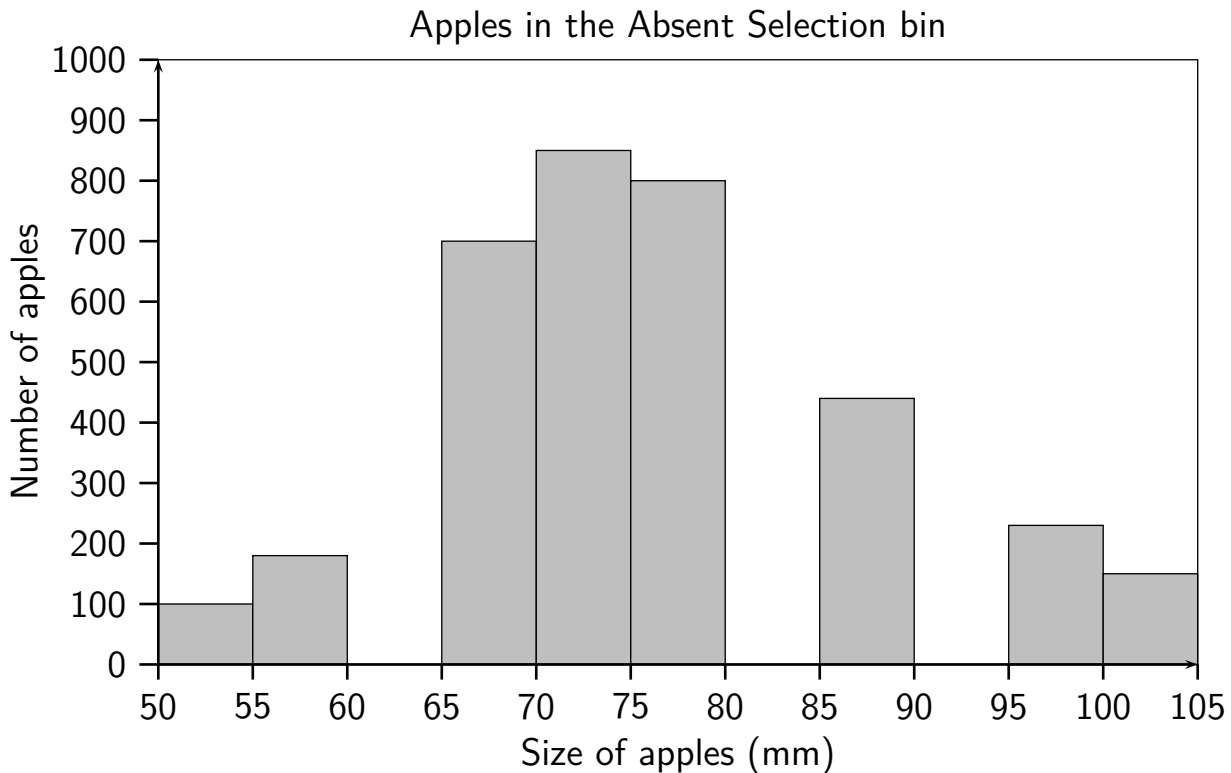
The atoms in the fluorescent lights **are not** helium, mercury, krypton or neon. Describe how you could use spectroscopy (the method of identifying emission lines and matching them to a catalogue) to find out what kinds of atoms are responsible for the light.

4. Using the symbols A (Absorption), C (Continuous) and E (Emission), which one of the following "spectrum arithmetic" equations is true?

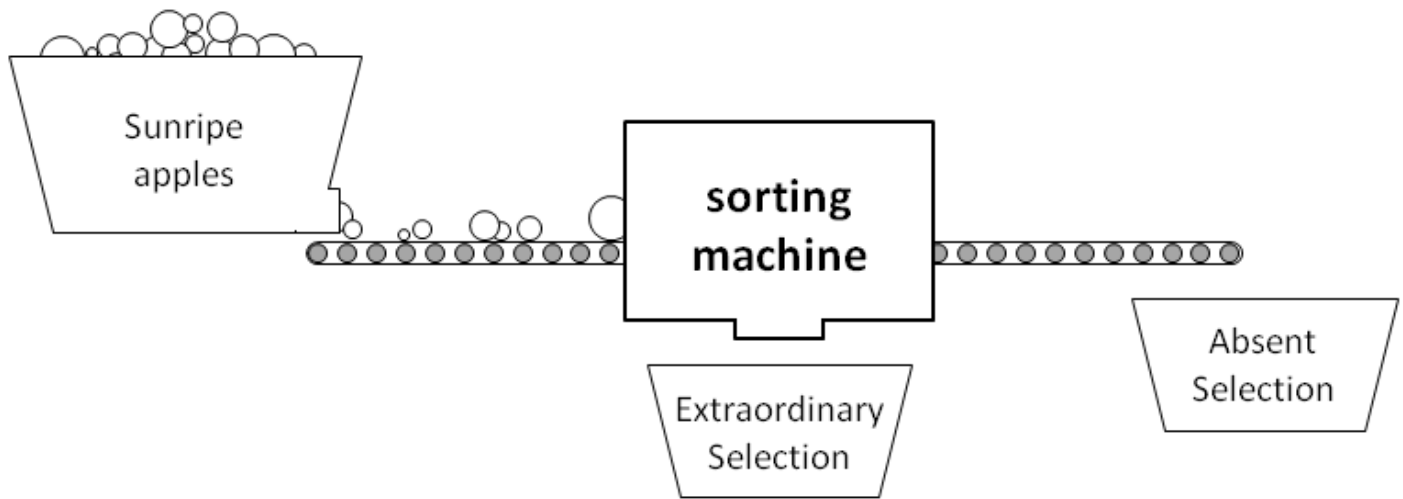
- $2A - E = C$ $E + C = A$ $C - E = A$ $C + A = 2E$



What sizes of apples do you find in the...



Product	Apple Sizes Used
pie	60–65, 80–85
juice	70–75, 80–85
sauce	80–85, 90–95
eating	65–75

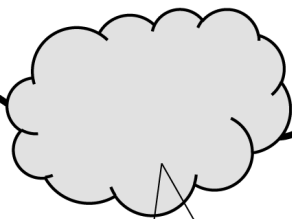
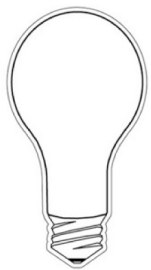


What sizes of apples do you find in the...

continuous spectrum



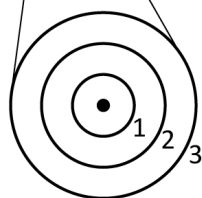
hot light source



absorption spectrum



absorption lines



emission spectrum



emission lines

What kind of light do you find in the...

Catalogue entry for fluorescent lights

reference spectrum



Mystery Star 1



Mystery Star 2

