In-class activity 14

Assemble Your Group

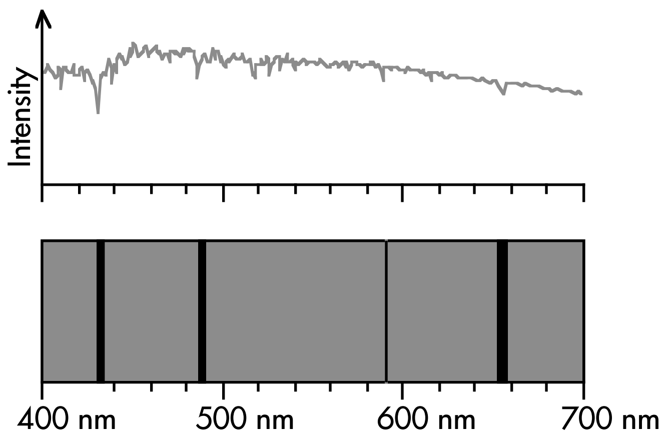
1. Find your assigned group members, and sign in below.

Team member: ___________________ Team member: ___________________

Team member: ___________________ Team member: ___________________

Absorption Spectra

2. (Cf. Seeds and Backman, *ASTRO3,* Brooks/Cole Cengage Learning (2018), pp. 92-93.) The intensity versus wavelength graph[1] and the (simplified) absorption lines of the sun, as detected by an observatory on a high mountain are shown at right.



(a) (Clearly circle your answer.) According to Kirchhoff's laws, this spectrum is produced by

- a hot, dense object
- hot, diffuse gas atoms
- blackbody radiation passing through cool, diffuse gas atoms

.

(b) Briefly explain your answer to (a).

Explanation:

[1] Spectrum adapted from *SpectrumExplorer 2.1,* lite.bu.edu/spex/.

(c) Rank the following spectra from having the least to the most number of absorption lines[2]; clearly indicate ties, if any. Then briefly explain the reasoning for your ranking.

(A) The sun, observed from a spacecraft in orbit around Earth.
(B) The sun, observed from a telescope at sea level.
(C) Light from an incandescent light bulb, across the room.

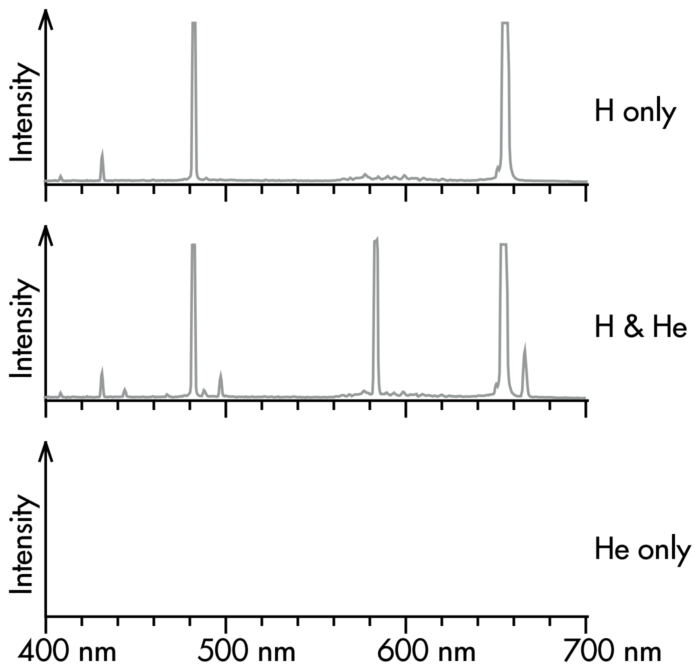
________ ________ ________
(least lines) (most lines)

Explanation:

Emission Spectra

3. The (simplified) intensity versus wavelength graph of a sample that contains only hydrogen (H) atoms is shown with the graph of a sample that contains both hydrogen and helium (He) atoms. Carefully note the wavelength values of the peaks in these graphs.

(a) Sketch in the peaks of a sample that contains *only* He atoms.



(b) (Clearly circle your answer.) According to Kirchhoff's laws, these spectra are produced by
- a hot, dense object
- hot, diffuse gas atoms
- blackbody radiation passing through cool, diffuse gas atoms

.

(c) Briefly explain your answer to (b).

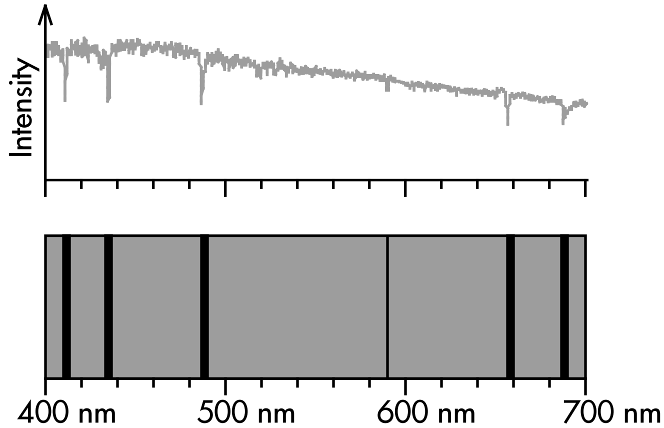
Explanation:

[2] Adapted from Adams, Prather, and Slater, *Lecture-Tutorials for Introductory Astronomy, 1/e*, Addison-Wesley (2005), pp. 43-44.

The Doppler Effect

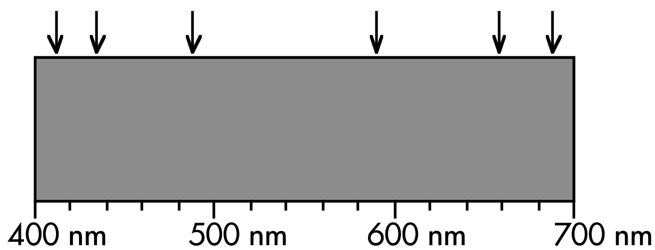
4. (Cf. Seeds and Backman, *ASTRO3*, Brooks/Cole Cengage Learning (2018), pp. 88-89.) The intensity versus wavelength graph[1] and the (simplified) absorption lines of a stationary F5 main sequence star are shown at right.

Carefully note the wavelength values of the absorption lines in this spectrum.

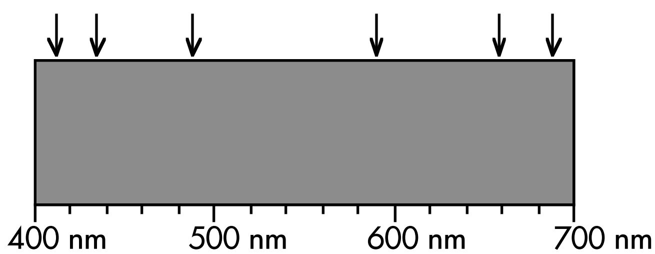


If a star has a radial velocity that moves it *towards* Earth, all absorption lines experience a *blueshift*, shifting towards slightly *shorter* wavelength values. If a star has a radial velocity that moves it *away* from Earth, all absorption lines experience a *redshift*, shifting towards slightly *longer* wavelength values.

(a) Sketch in the absorption lines of an F5 star that is moving *slowly towards* Earth. (The arrows indicate the expected wavelength values for a stationary F5 star.)



(b) Sketch in the absorption lines of an F5 star that is moving *quickly away* from Earth. (The arrows indicate the expected wavelength values for a stationary F5 star.)



(c) Briefly explain in words how the amount of shift of absorption lines in your two sketches is related to how fast or slow the radial velocity of a star is. (Make sure the amount of shifts in your sketches for 4(a)-(b) are consistent with your explanation.)

Explanation: