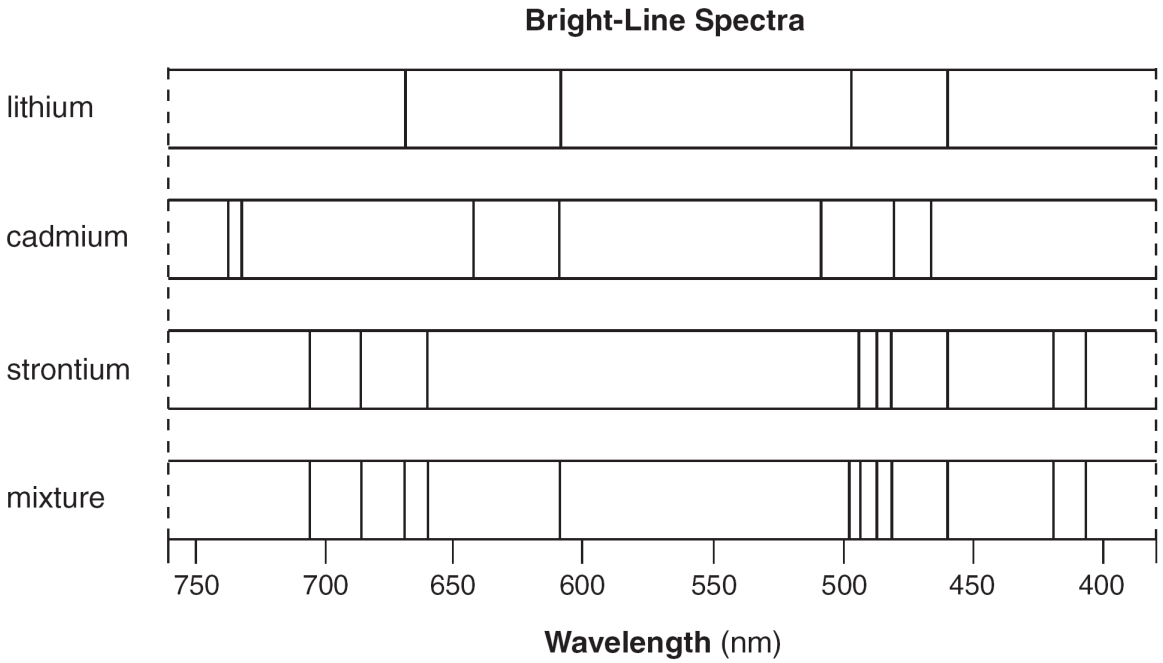
Name_____

Bright Lined Spectrum

Base your answers to questions **1** through **3** on the information below.
The bright-line spectra for three elements and a mixture of elements are shown below.



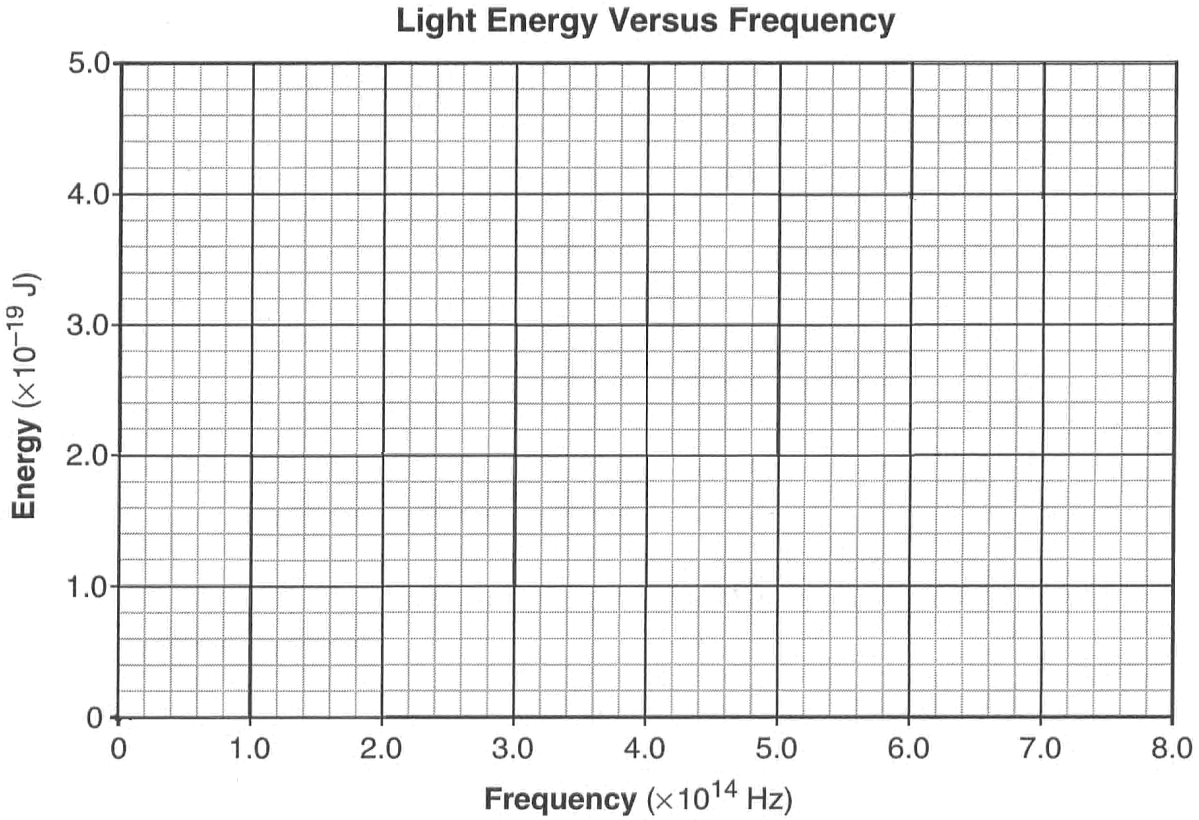
1. State the total number of valence electrons in a cadmium atom in the ground state.

2. Identify *all the elements in the mixture.*

3. Explain, in terms of *both electrons and energy, how the bright-line spectrum of an element is produced.*

4. Base your answer to the following question on the following information.

In a laboratory, a glass tube is filled with hydrogen gas at a very low pressure. When a scientist applies a high voltage between metal electrodes in the tube, light is emitted. The scientist analyzes the light with a spectroscope and observes four distinct spectral lines. The table below gives the color, frequency, and energy for each of the four spectral lines. The unit for frequency is hertz, Hz.



Visible Spectrum of Hydrogen

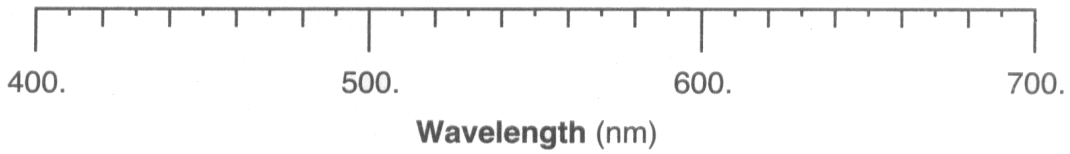
Color	Frequency ($\times 10^{14}$ Hz)	Energy ($\times 10^{-19}$ J)
red	4.6	3.0
blue green	6.2	4.1
blue	6.9	4.6
violet	7.3	4.8

On the grid, plot the data from the data table for frequency and energy. Circle and connect the points, including the point (0,0) that has already been plotted and circled for you.

Base your answers to questions **5** and **6** on the information below

The Balmer series refers to the visible bright lines in the spectrum produced by hydrogen atoms. The color and wavelength of each line in this series are given in the table below.

Color	Wavelength (nm)
red	656.3
blue green	486.1
blue	434.1
violet	410.2



5. Explain, in terms of both subatomic particles and energy states, how the Balmer series is produced.

6. On the diagram above draw four vertical lines to represent the Balmer series.

Base your answers to questions **7** through **9** on the information below.

A glass tube is filled with hydrogen gas at low pressure. An electric current is passed through the gas, causing it to emit light. This light is passed through a prism to separate the light into the bright, colored lines of hydrogen's visible spectrum. Each colored line corresponds to a particular wavelength of light. One of hydrogen's spectral lines is red light with a wavelength of 656 nanometers.

Tubes filled with other gases produce different bright-line spectra that are characteristic of each kind of gas. These spectra have been observed and recorded.

7. A student measured the wavelength of a hydrogen's visible red spectral line to be 647 nanometers. Show a correct, numerical setup for calculating the student's percent error.

8. Explain how the elements present on the surface of a star can be identified using bright-line spectra.

9. Explain, in terms of electron energy states and energy changes, how hydrogen's bright-line spectrum is produced.

Base your answers to questions **10** and **11** on the information below.

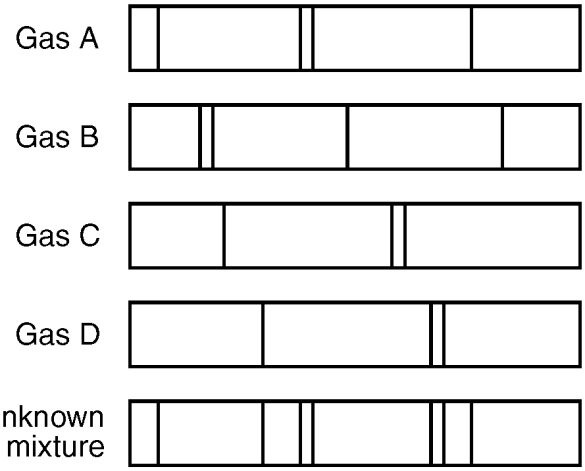
An atom has an atomic number of 9, a mass number of 19, and an electron configuration of 2–6–1.

10. Explain why the number of electrons in the second and third shells show that this atom is in an excited state.

11. What is the total number of neutrons in this atom?

Base your answers to questions **12** and **13** on the information and the bright-line spectra represented below.

Many advertising signs depend on the production of light emissions from gas-filled glass tubes that are subjected to a high-voltage source. When light emissions are passed through a spectroscope, bright-line spectra are produced.



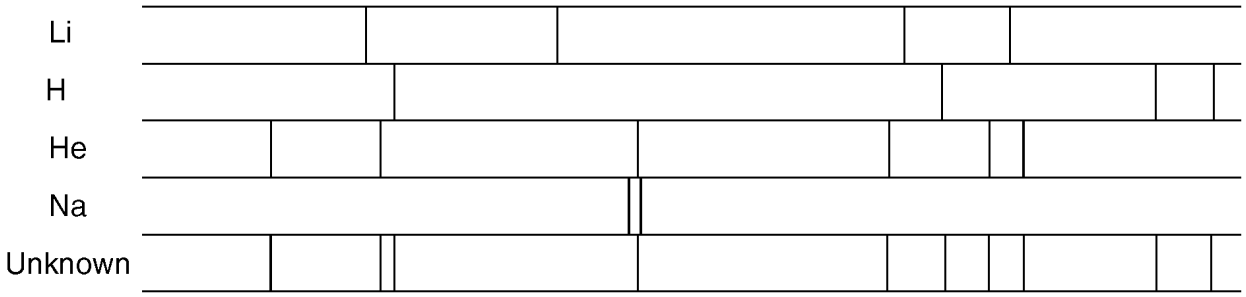
12. Explain the production of an emission spectrum in terms of the *energy states of an electron.*

13. Identify the *two* gases in the unknown mixture.

14. Draw a Lewis electron-dot structure for an atom of phosphorus.

Base your answers to questions **15** and **16** on the diagram below, which shows bright-line spectra of selected elements.

Bright-Line Spectra



15. Explain how a bright-line spectrum is produced, in terms of *excited state, energy transitions,* and *ground state.*

16. Identify the *two* elements in the unknown spectrum.