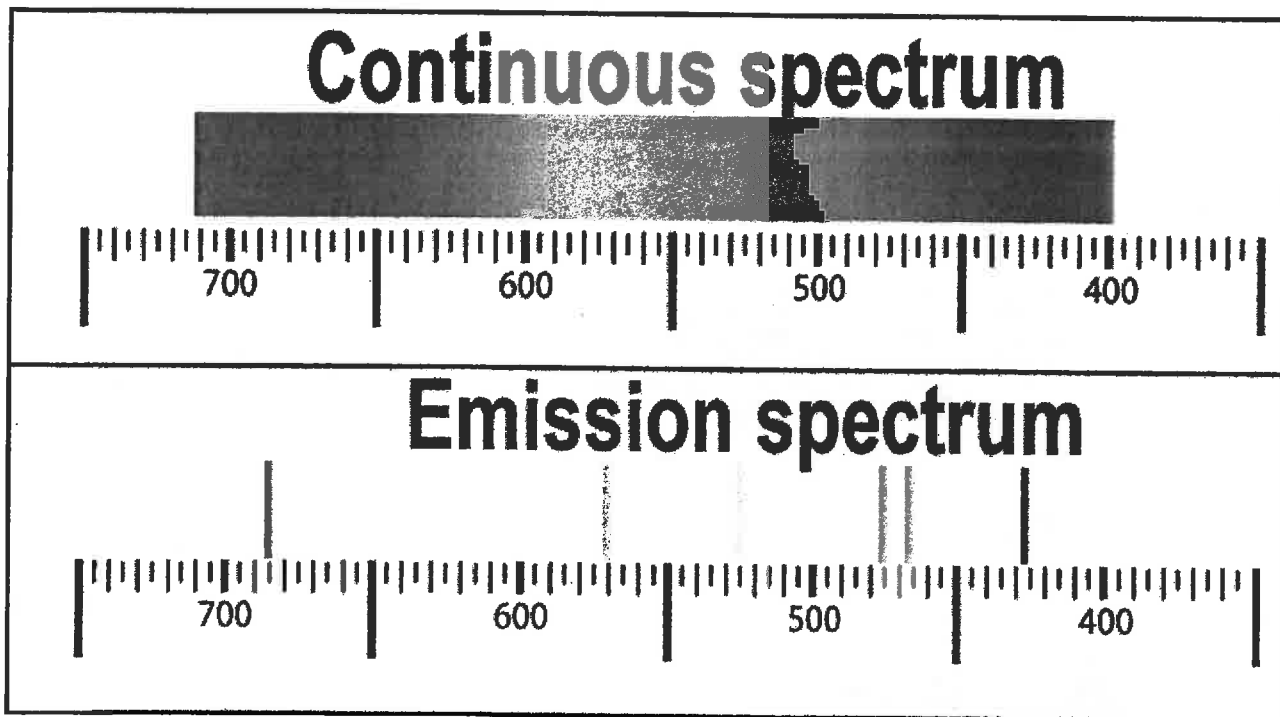


Name _____

Introduction to spectroscopy

How do we know what the stars or the Sun are made of?

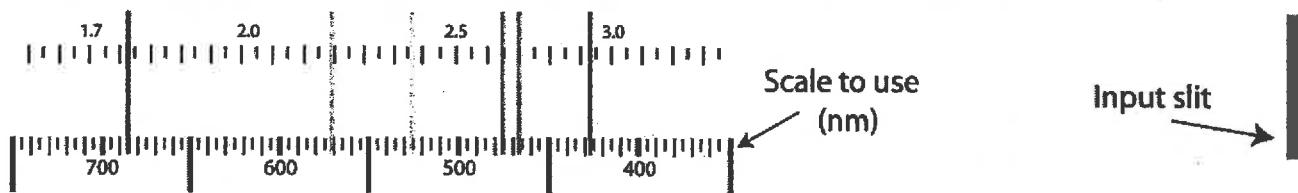
The light of celestial objects contains much information hidden in its detailed color structure. In this lab we will separate the light from some sources into constituent colors and use spectroscopy to find out the chemical constitution of known and unknown gases. The same procedure is used for starlight, telling us what its source is composed of. The baseline is a laboratory experiment with known materials, and later we can compare the unknown to what we already know.



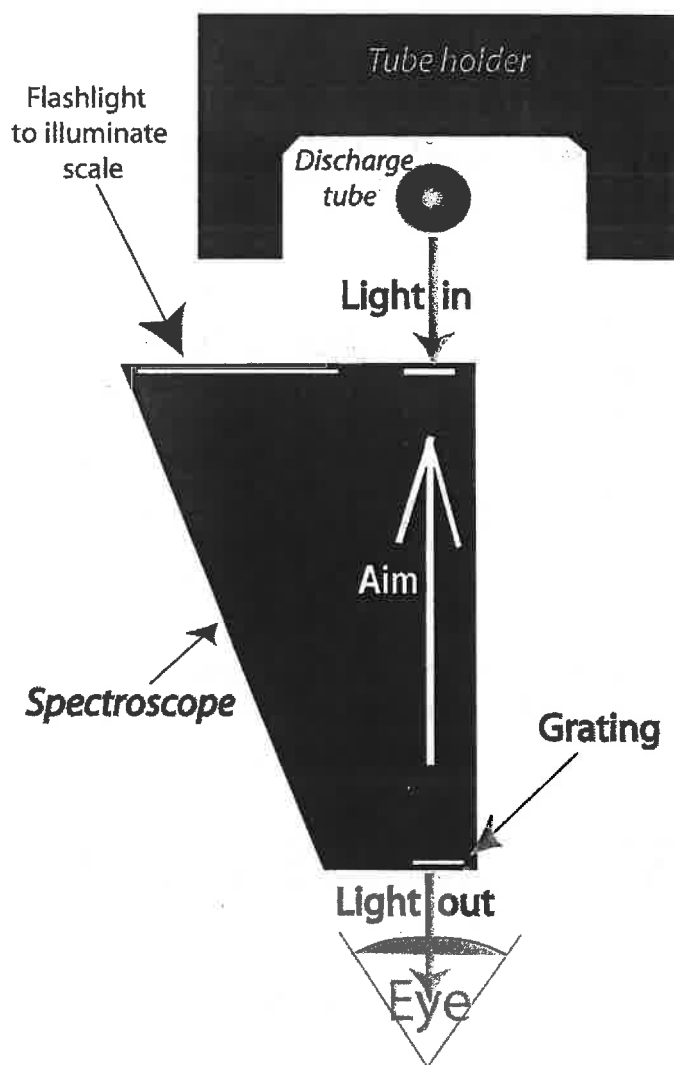
Hot, glowing bodies like a light bulb, or the Sun, glow in all the colors of the spectrum. All these colors together appear as white light. When such white light hits a prism, or a raindrop, or a diffraction grating, colors get separated according to their wavelength. Red, with its wavelength of 600 nm to 700 nm, is deflected least and ends up on one edge of the spectrum – or the rainbow when sunlight hits a raindrop after a storm. Blue, wavelength around 400 nm, is the other end of the visible spectrum. An infinite number of elementary colors are located between these two edges, each corresponding to its own wavelength.

An incandescent light bulb radiates a continuous spectrum. All colors are present in this “thermal glow”, and it is impossible to tell what the chemical composition of the source is. However, other physical processes produce different spectra. A fluorescent light tube works, crudely speaking, on the principle of lightening. Electrons rush from the negative pole to the positive pole inside, and hit gas atoms in the tube, making them emit light. This sort of light contains only a few colors, and is called “emission spectrum”. When we separate the colors of such light, only a few bright “emission” lines appear, each in its own color (and wavelength). Each sort of an atom will emit light at its own particular set of wavelengths.

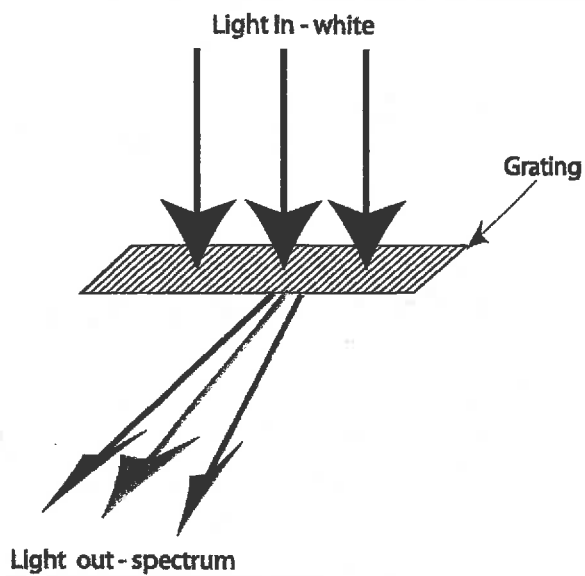
The view in the spectroscope



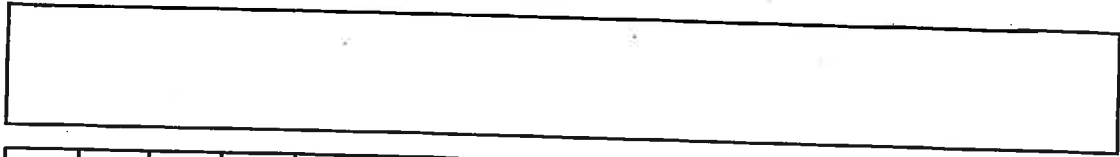
Top view of the setup



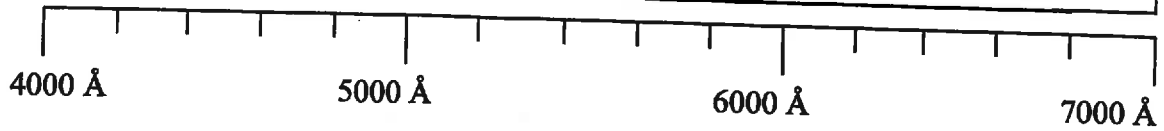
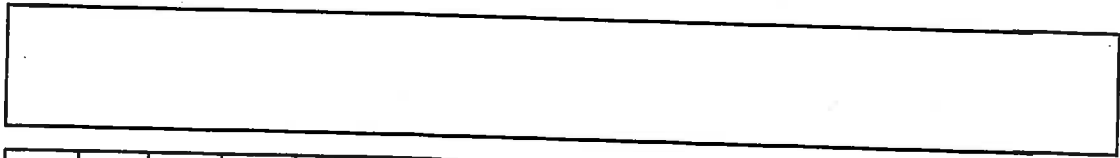
A diffraction grating breaks up mixed colors into constituents



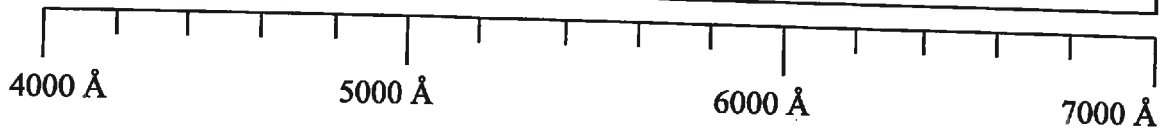
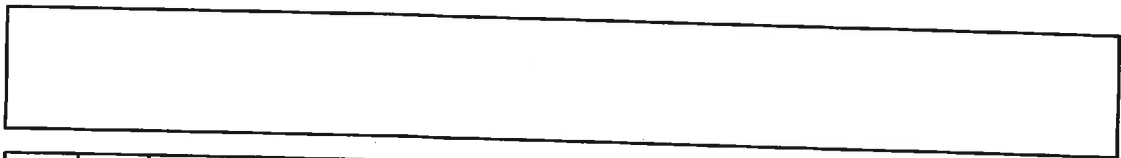
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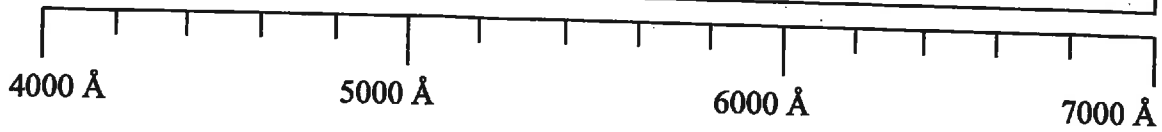
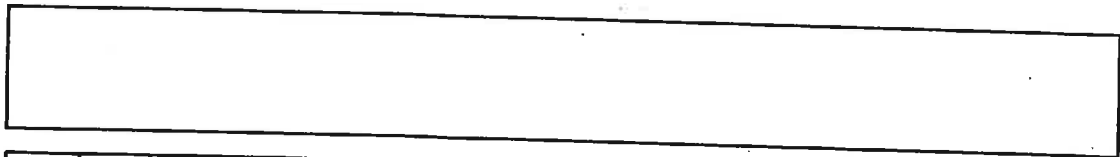
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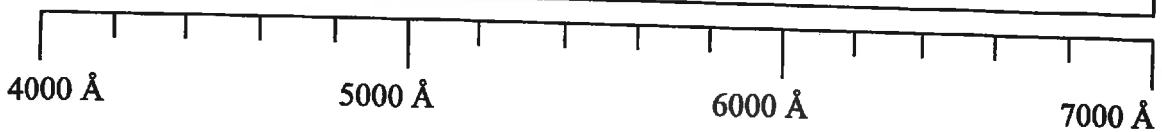
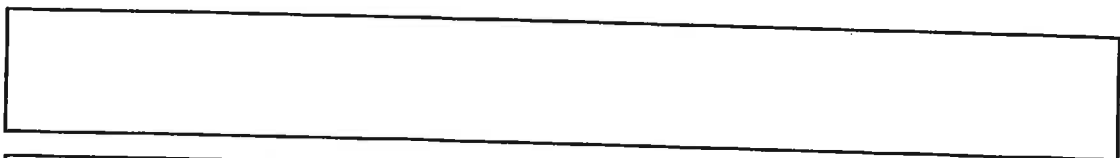
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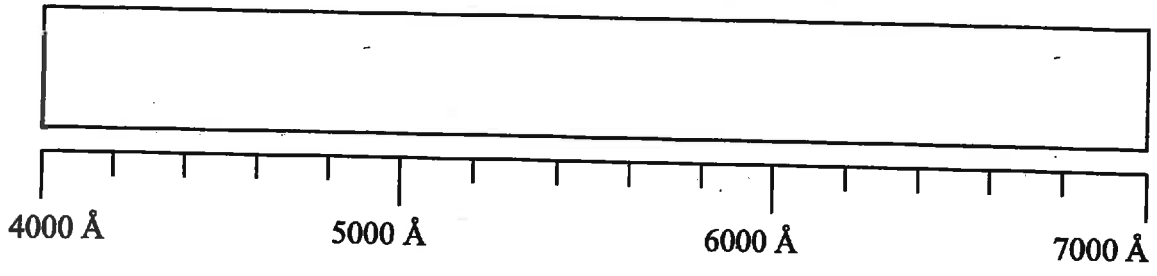
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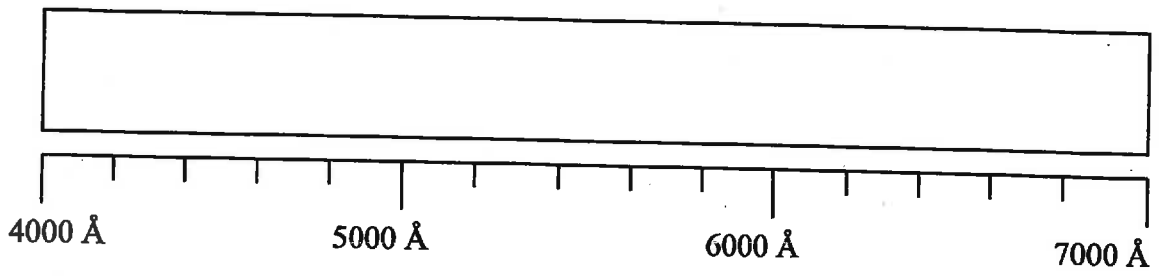
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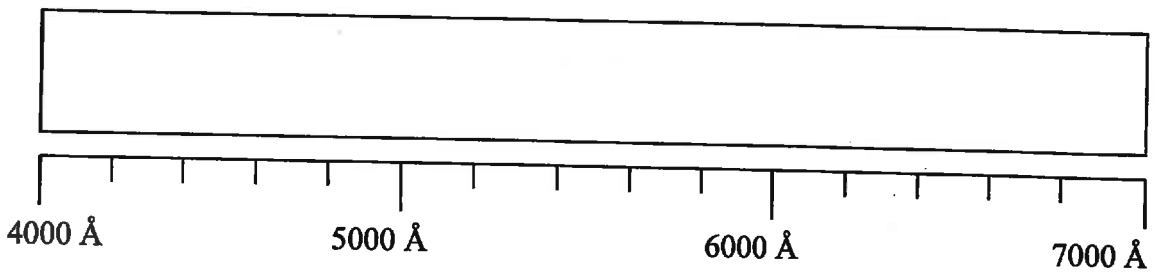
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