Name: _____ Modern Astronomy

Date: _____ Period: _____ Earth Science

Lab Activity: The Universe

INTRODUCTION:

The Doppler effect [or the Doppler shift] is the change in frequency or wavelength of a wave in relation to an observer who is moving relative to the wave source. It is named after the Austrian physicist Christian Doppler, who described the phenomenon in 1842.

The Doppler effect for electromagnetic waves such as light is of great use in astronomy and results in either a so-called redshift or blueshift. It has been used to measure the speed at which stars and galaxies are approaching or receding from an observer.

OBJECTIVE:

You will be creating and analyzing spectral lines from a laboratory and five distant galaxies to determine their relative motions and speeds at which they are moving.

VOCABULARY:

Universe -

Big Bang -

Doppler Effect -

Red Shift -

Blue Shift -

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PROCEDURE:

1. Using Data Table A, color in each of the six blank spectra on the Report Sheet to show the colors of the visible spectrum.
2. Label each wavelength less than 390 nm “Ultraviolet” and each wavelength longer than 700 nm “Infrared”. Do not color this part of the spectra.
3. Using Data Table B, determine the location of each spectral line for the standard spectra and for several distant galaxies. Mark with a dark, black vertical line, the location of each of the spectral lines in each spectrum. Please note that some of the galaxies may have spectra that are shifted entirely off the portion we are studying. You do not draw any lines that are off the spectra provided on your handout.

DATA CHART A

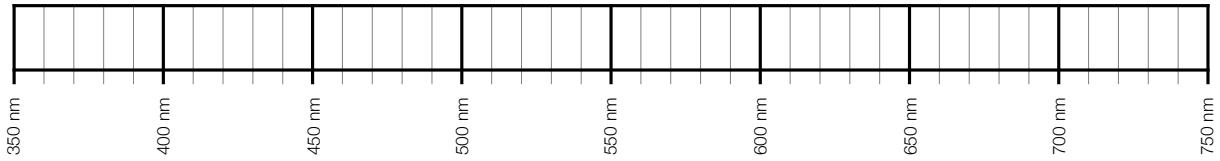
Violet	390 - 455 nm
Blue	455 - 492 nm
Green	492 - 577 nm
Yellow	577 - 597 nm
Orange	597 - 622 nm
Red	622 - 700 nm

DATA CHART B

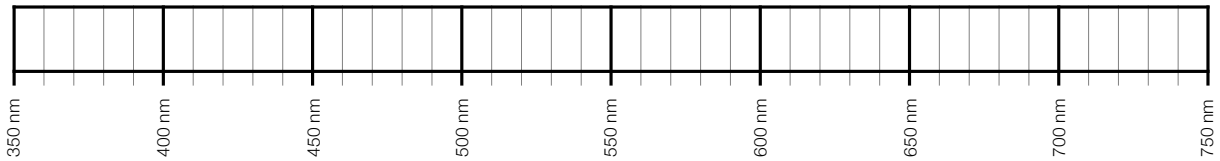
Standard Spectrum	420, 450, 530, 640, 656
Virgo A Galaxy	440, 470, 550, 660, 676
Coma Pinwheel Galaxy	470, 500, 580, 690, 706
Andromeda Galaxy	380, 410, 490, 600, 616
Cetus A Galaxy	430, 460, 540, 650, 666
M65 Spiral Galaxy in Leo	620, 650, 730, 840, 856

REPORT SHEET

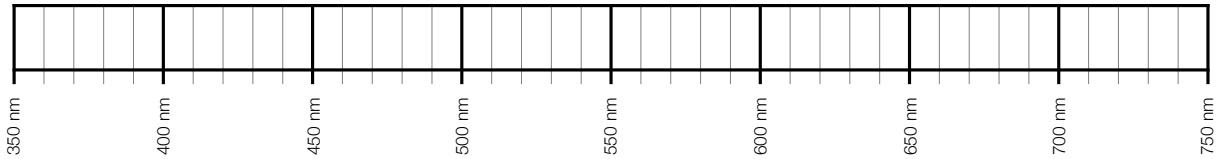
STANDARD SPECTRUM



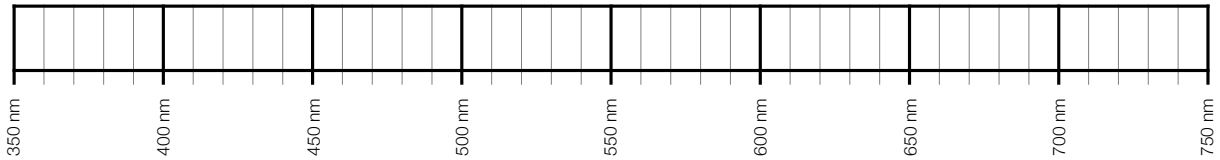
VIRGO A GALAXY



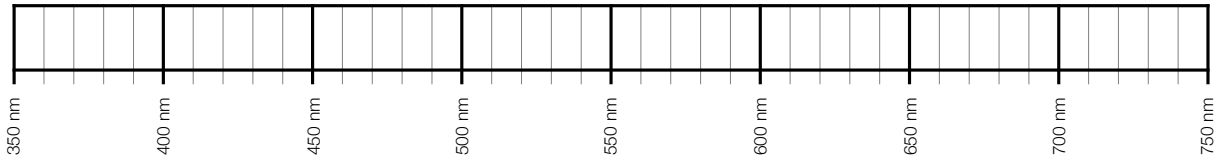
COMA PINWHEEL GALAXY



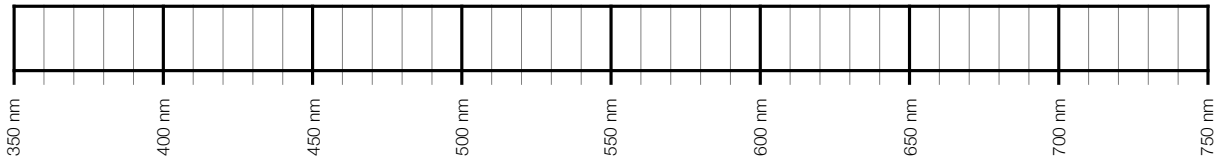
ANDROMEDA GALAXY



CETUS A GALAXY



M65 SPRIAL GALAXY IN LEO



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DISCUSSION QUESTIONS:

1. When the wavelength increases, what end of the visible light spectrum does it move toward?

2. When the wavelength increases, what is the object's motion relative to Earth?

3. What did the results of your analysis of the galaxies reveal about their motion relative to Earth?

4. How does the Andromeda galaxy differ from the other four galaxies you examined.

5. How is the amount of the red-shift related to how fast the object is moving away?

CONCLUSION: Explain how your data supports the expanding Universe?