Gather your findings in the table below. As a class, we will use the distance and speed to confirm the expansion of the universe.

Part A: Determine the luminosity of a cepheid using their pulsation period



| Group | Pulsation Period, P (days) | Luminosity, L (QW) |
| --- | --- | --- |
| A | 4.3 |  |
| B | 4.4 |  |
| C | 4.5 |  |
| D | 4.6 |  |
| E | 4.7 |  |

Part B: Calculating the cepheid’s distance using luminosity

Use the following equation to calculate the distance from Earth to the Cepheid. Y*ou will need your Luminosity from Part A!*



| Group | Luminosity, L (QW) | Distance, d (Mpc) |
| --- | --- | --- |
| A |  |  |
| B |  |  |
| C |  |  |
| D |  |  |
| E |  |  |

Part C: Calculating redshift

Use the images provided for each cepheid and determine its redshift.



You will need to find its moving wavelength ($λ\_{m}$) and then subtract its stationary wavelength ($λ\_{s}$). Use the relationship:

$Δλ=λ\_{m}-λ\_{s}$

Once you find the shift ($Δλ$), find the speed in the chart below (use the value *closest* to what you found). Record this in the table provided.

| Group | Stationary Wavelength, $λ\_{s}$(nm) | Moving Wavelength, $λ\_{m}$(nm) | Shift, $Δλ$ (nm) | Speed, v (m/s) |
| --- | --- | --- | --- | --- |
| A |  |  |  |  |
| B |  |  |  |  |
| C |  |  |  |  |
| D |  |  |  |  |
| E |  |  |  |  |

Part D: Expansion of the universe

Use your speed, v (from Part C) and distance, d (from Part B) to graph the relationship of the speed of the universe as it relates to the distance from the Earth.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

The graph shows that the farther away you are the faster it is moving away from you. What is your conclusion?