Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Due Date: \_\_\_\_\_\_\_\_\_\_\_\_

***Hertzsprung-Russell Diagram Activity***

**Purpose:** To study the difference between different types of stars.

**Important Definitions:**

**LUMINOSITY:**

**TEMPERATURE:**

**Background Info:** This diagram was developed by two astronomers named Hertzsprung and Russell. Both studied the relationship between temperature and luminosity for big groups of stars. By plotting this information on a graph, these scientists discovered that there are actually only a few types of stars that exist, rather than a range of all possible combinations of temperature and luminosity. The graph is known as the H-R diagram and modern astronomy (ex. star classification, star life cycle) is often based on these findings.

**Procedures:** On the grid below, plot the temperature and luminosity of the stars listed. **DO NOT** join the points with a line.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1,000,000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100,000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10,000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10  **Luminosity (Sun = 1)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.01 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.001 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0001 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.00001 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.000001 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1500

3000

5000

6000

7500

11000

25000

45000



**Temperature (°K)**



**Discussion Questions:**

1. Examine the axes of the graph.
   1. How are they numbered?
   2. Is this the normal method of numbering graphs?
   3. Why is this method used here?
2. Where is the Sun located on this graph? Label the sun on the graph. What sized star is the Sun and which stage of its life cycle is it in?
3. The plotted points seem to be broken into three distinct groups. Describe each.
4. Where do most of the points fit on the graph? (what life cycle stage?)
5. Where is the smallest group of stars located on the graph?
6. What is the significance of the H-R diagram to modern astronomy?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Star** | **Visual Magnitude** | **Distance (l.y.)** | **Temperature (K)** | **Luminosity** |
| **Brightest Stars** | | | | |
| **Canopus** | -0.72 | 100.0 | 7,400 | 1500.0 |
| **Alpha Centauri** | -0.01 | 4.3 | 5,800 | 1.5 |
| **Arcturus** | -0.06 | 36 | 4,500 | 110.0 |
| **Vega** | +0.04 | 26.0 | 10,700 | 55.0 |
| **Rigel** | +0.14 | 800.0 | 11,800 | 40,000.0 |
| **Procyon A** | +0.38 | 11.3 | 6,500 | 7.3 |
| **Betelgeuse** | +0.41 | 500.0 | 3,200 | 17,000.0 |
| **Achernar** | +0.51 | 65.0 | 14,000 | 200.0 |
| **Beta Centauri** | +0.63 | 300.0 | 21,000 | 5,000.0 |
| **Altair** | +0.77 | 16.5 | 8,000 | 11.0 |
| **Aldebaran** | +0.86 | 53.0 | 4,200 | 100.0 |
| **Spica** | +0.91 | 260.0 | 3,400 | 2,800.0 |
| **Antares** | +0.92 | 400.0 | 3,400 | 5,000.0 |
| **Deneb** | +1.26 | 1,400.0 | 9,900 | 60,000.0 |
| **Nearest Stars** | | | | |
| **Sun** | -26.7 | 0.00002 | 5,800 | 1.0 |
| **Alpha Centauri A** | -0.01 | 4.3 | 5,800 | 1.5 |
| **Alpha Centauri B** | +1.4 | 4.3 | 4,200 | 0.33 |
| **Alpha Centauri C** | +11.0 | 4.3 | 2,800 | 0.0001 |
| **Wolf 359** | +13.66 | 7.7 | 2,700 | 0.00003 |
| **Lalande 21185** | +7.47 | 8.1 | 3,200 | 0.0055 |
| **Sirius A** | -1.43 | 8.7 | 10,400 | 23.0 |
| **Luyten 726-8 A** | +12.5 | 8.7 | 2,700 | 0.00006 |
| **Ross 154** | +10.6 | 9.6 | 2,800 | 0.00041 |
| **Epsilon Eridani** | +3.73 | 10.8 | 4,500 | 0.30 |
| **Ross 128** | +11.13 | 11.0 | 2,800 | 0.00054 |
| **Luyten 789-6** | +12.58 | 11.0 | 2,700 | 0.00009 |
| **61 Cygni A** | +5.19 | 11.1 | 4,200 | 0.084 |
| **61 Cygni B** | +6.02 | 11.1 | 3,900 | 0.039 |
| **Procyon A** | +0.38 | 11.3 | 6,500 | 7.3 |
| **Procyon B** | +10.7 | 11.3 | 7,400 | 0.00055 |
| **Epsilon Indi** | +4.73 | 11.4 | 4,200 | 0.14 |
| **Other Stars** | | | | |
| **Delta Aquari** | +3.28 | 84 | 9,400 | 24.0 |
| **Beta Cassopeiae** | +2.26 | 45 | 6,700 | 8.2 |
| **02 Eridani B** | +9.5 | 16 | 11,000 | 0.0028 |
| **L879-14** | +14.10 | 63 | 6,300 | 0.00068 |
| **70 Ophiuchi A** | +4.3 | 17 | 5,100 | 0.6 |
| **Delta Persei** | +3.03 | 590 | 17,000 | 1,300.0 |
| **Zeta Persei** | +2.83 | 465 | 24,000 | 16,000.0 |
| **Tau Scorpii** | +2.82 | 233 | 25,000 | 2,500.0 |
| **Van Maanen’s Star** | +12.36 | 14 | 7,500 | 0.00016 |

