# Estimating the Age of a Star Cluster

Turn in one copy of this lab with each group member's printed name and signature.  By signing, you certify that you have actively participated in the exercise and have put forth effort in equal share to your fellow group members.

| **Printed Name** | **Signature** |
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## **Part 1** - Relating color index to temperature

1. Examine Figure 1. What characteristics of the black body curve change as the temperature of the emitter changes?

2. Our telescope takes images through filters. The vertical bands in Figure 1 show the wavelength (color) of two of our filters, namely B and V. Color index is defined as the difference between the magnitude in the B filter and the magnitude in the V filter. Using this information and Figure 1, the fill out the table below. **Keep in mind that large magnitudes mean smaller intensity**:

| **Temperature** | **Sign (plus or minus) of the color index** |
|---|---|
| 12,000 K | |
| 8,000 K | |
| 3,000 K | |

3. Explain in two or three sentences why color index is a good indicator of temperature.

## <u>Part 2</u> – Estimating the main sequence lifetime of a star

1. Using the information in Table 1 and the fact that stars shine by converting mass into energy, explain in two or three sentences why high mass stars have short lifetimes compared to low mass stars.

2. Using the fact that the Sun has a main sequence lifetime of $1x10^{10}$ years, use a proportionality to estimate the lifetimes of the stars in the table below.

| **Mass ($M_{sun}$)** | **Luminosity ($L_{sun}$)** | **Estimated age (years)** |
|---|---|---|
| 18 | $5x10^5$ | |
| 6.5 | 800 | |
| 3.2 | 80 | |
| 2.1 | 20 | |
| 1.7 | 6.0 | |
| 1.3 | 2.5 | |
| 1.1 | 1.26 | |
| 1.0 | 1.0 | $1.0x10^{10}$ |
| 0.93 | 0.79 | |
| 0.78 | 0.40 | |
| .69 | 0.16 | |
| .47 | 0.063 | |
| .21 | 0.0079 | |

**<u>Part 3</u> – Estimating the age of a cluster**

1. Look at Figures 1 and 3. Assuming that all of the stars in a given cluster have the same birthday, which of the two clusters is older? How do you know?

2. Explain in two or three sentences why the **Main Sequence Turnoff** is an indicator of the age of a star cluster.

3. Find the Main Sequence Turnoff for the cluster that you have plotted and use it, Table 1, and your answers to **Part 2 Question 2** to estimate the age of your cluster.