NAME _____

CLASS _____ DATE _____

21

LAB INVESTIGATION

Properties of Stars

The Hertzsprung-Russell diagram, or H-R diagram, is a graph in which a star's temperature is plotted against its absolute magnitude. From such a diagram, other information about a star's properties and life cycle can be determined. A simplified H-R diagram appears in your textbook (~~Figure 21.6, page 382~~). In this laboratory, you will construct an H-R diagram using data on the 20 stars that are nearest to our sun (Figure 21.1) and the 20 stars that appear brightest in our sky (Figure 21.2). Then you will use the finished diagram to describe the properties and life cycles of stars.

Figure 22.5 pg 606

In the tables in Figures 21.1 and 21.2, the unit used for distance is the parsec. A parsec is equal to 3.26 light-years (LY). The Kelvin (K), or absolute temperature scale, is used in the tables and in the diagram (Figure 21.3).

- To **graph** a simplified Hertzsprung-Russell diagram
- To **identify** the characteristics of a star from data in the diagram
- To **classify** a star by its position in the diagram
- To **compare** the life cycle stages of stars based on their positions in the diagram

- data for nearest and brightest stars (Laboratory 21 Figures 21.1, 21.2)
- graph (Laboratory 21 Figure 21.3)
- sample Hertzsprung-Russell diagram (textbook Figure ~~21.6, page 382~~)
- pencil

22.5 pg 606

1. Study the lists in Figures 21.1 and 21.2 and answer Analysis and Conclusions questions 1 and 2.

In procedure steps 2 and 3, you will graph the stars onto the diagram. The following tips will be helpful to remember when graphing stars:

a. Temperature is on the horizontal axis; absolute magnitude is on the vertical axis.

b. Notice that the graph lines used to plot temperature are unevenly spaced, and that the number of Kelvins between each line is not constant. Carefully check a star's temperature and the value of a particular graph line before plotting each star.

c. Absolute magnitude decreases as the value becomes more positive. Thus, an absolute magnitude of +4.4 plots below the +4.0 line, not above.

2. Using a plus sign (+), graph each of the nearest stars (listed in Figure 21.1) on the diagram (Figure 21.3).

3. Using a circled dot (⊙), graph each of the brightest stars as seen from Earth (listed in Figure 21.2) on the diagram. Show stars that appear on both tables using a circled plus sign (⊕).

4. Answer Analysis and Conclusions questions 3–10.

The 20 Nearest Stars			
Name	Distance (parsecs)	Temperature (K)	Absolute Magnitude
Alpha Centauri	1.31	5800	+4.4
Barnard's Star	1.83	2800	+13.2
Wolf 359	2.35	2700	+16.8
Lalande 21185	2.49	3200	+10.5
Sirius	2.67	10 400	+1.4
Luyten 726-8	2.67	2700	+15.4
Ross 154	2.94	2800	+13.3
Ross 248	3.16	2700	+14.7
Epsilon Eridani	3.30	4500	+ 6.1
Ross 128	3.37	2800	+13.5
Luyten 789-6	3.37	2700	+14.9
61 Cygni	3.40	2800	+7.5
Procyon	3.47	6800	+2.7
Epsilon Indi	3.51	4200	+7.0
Sigma 2398	3.60	3000	+11.1
BD +43°44	3.60	3200	+10.3
Tau Ceti	3.64	5200	+5.7
CD –36°15693	3.66	3100	+9.6
BD +5°1668	3.76	3000	+11.9
CD –39°14192	3.92	3500	+8.7

Figure 21.1

The 20 Brightest Stars as Seen from Earth			
Name	Distance (parsecs)	Temperature (K)	Absolute Magnitude
Sirius	2.7	10 400	+1.4
Canopus	30.0	7400	–3.1
Alpha Centauri	1.3	5800	+4.4
Arcturus	11.0	4500	–0.3
Vega	8.0	10 700	+0.5
Capella	14.0	5900	–0.7
Rigel	250.0	11 800	–6.8
Procyon	3.5	6800	+2.7
Betelgeuse	150.0	3200	–5.5
Achernar	20.0	14 000	–1.0
Beta Centauri	90.0	21 000	–4.1
Altair	5.1	8000	+2.2
Alpha Crucis	120.0	21 000	–4.0
Aldebaran	16.0	4200	–0.2
Spica	80.0	21 000	–3.6
Antares	120.0	3400	–4.5
Pollux	12.0	4900	+0.8
Fomalhaut	7.0	9500	+2.0
Deneb	430.0	9900	–6.9
Beta Crucis	150.0	22 000	–4.6

Figure 21.2

1. Compare the two star lists, Figures 21.1 and 21.2. How many stars appear on both the Nearest Stars list and the Brightest Stars as Seen from Earth list? Name them.

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2. What does your answer to question 1 indicate about the nearest stars? Are the nearest stars also the brightest stars as seen from Earth?

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Earth Science 11 Properties of Stars Lab Name:

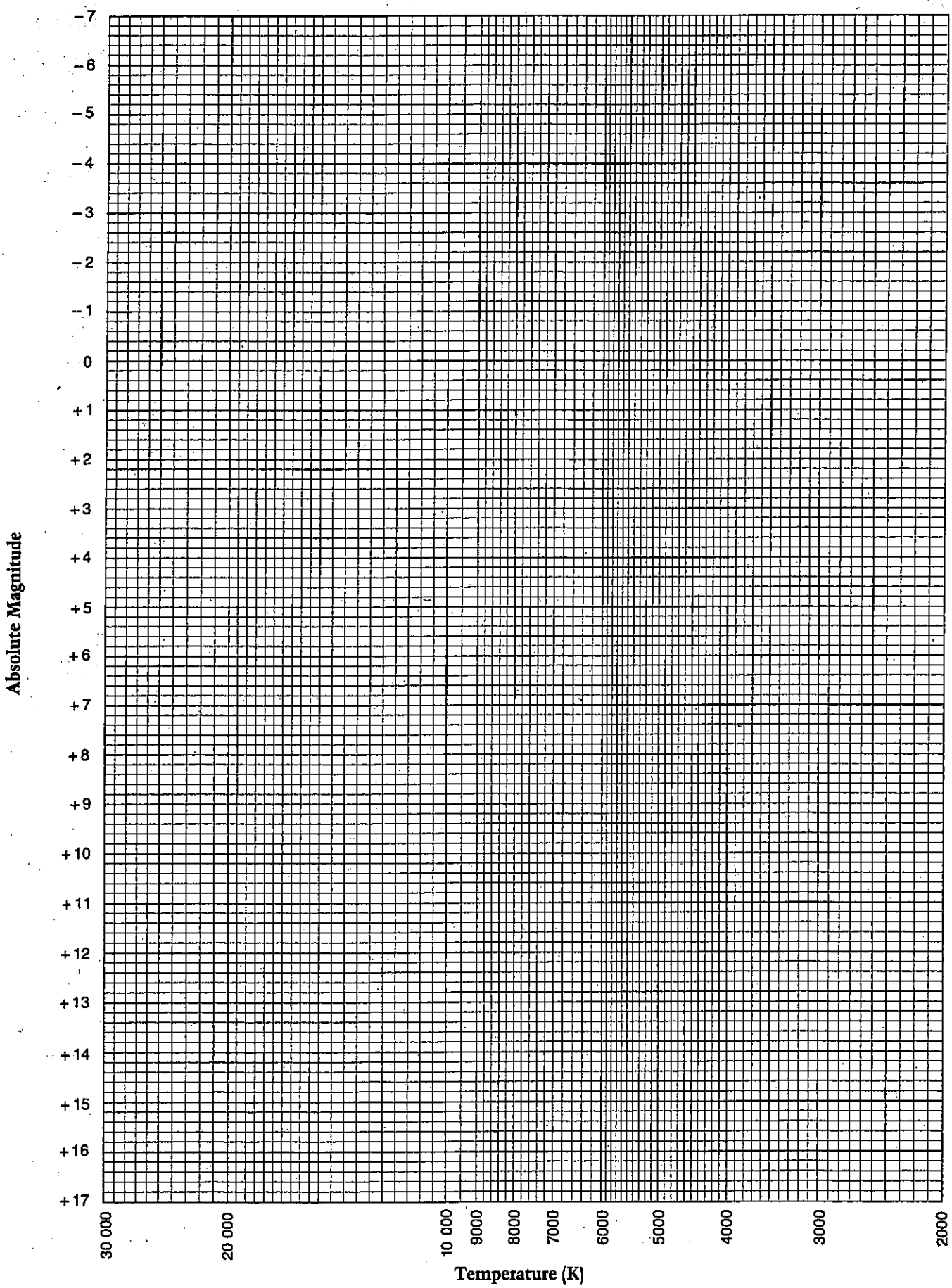

Figure 21.3

3. A star located in the lower right portion of Figure 21.3 is cool and dim. What are the characteristics of a star in the upper left of the diagram? In the upper right?

4. Refer to Figure ~~21.6~~ 22.5 on Page ~~382~~ 606 of your textbook. To which group do most of the stars on your diagram belong?

5. According to your diagram and Figure 21.6, are any of the 20 nearest or 20 brightest stars white dwarf stars? What is the evidence for your answer?

6. Our sun has a temperature of 6000 K and an absolute magnitude of +4.7. Use an asterisk (*) to show the location of the sun on your diagram. To what group does the sun belong?

7. Compare the absolute magnitude and temperature of the sun with those of the other stars in its group.

8. Betelgeuse is 150 parsecs away and has a surface temperature of only 3200 K. Yet Betelgeuse is one of the brightest stars as seen from Earth. What does this indicate about the size of Betelgeuse? Is your answer supported by the location of Betelgeuse on the diagram?

9. On your diagram, there is another star that is plotted near Betelgeuse. What is the name of the star? What kind of star is it?

10. Compare our sun with the red supergiant Antares. Which star is further along in its life cycle? How do you know?