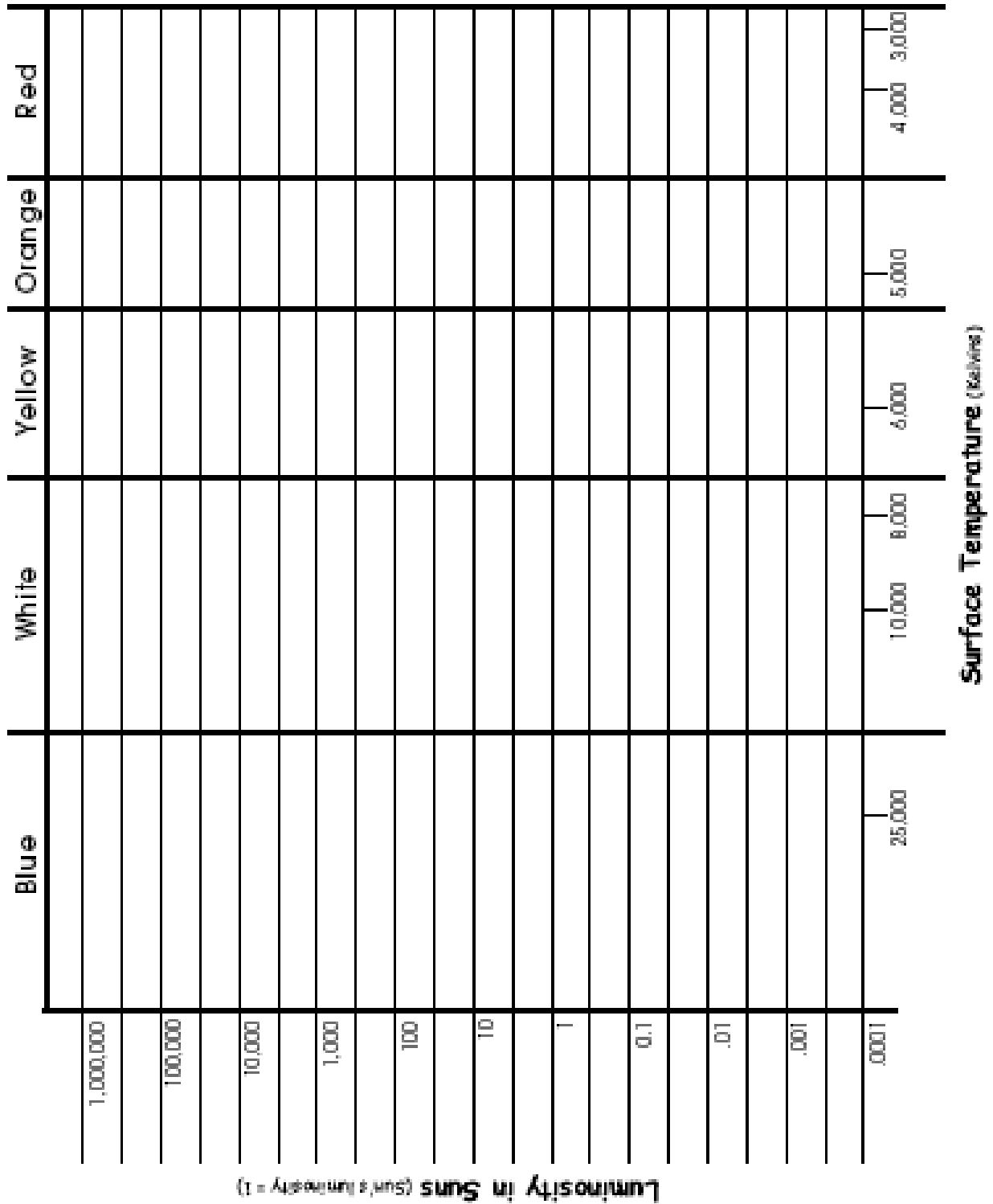


Name:

Date:

Period:

Hertzprung-Russell (HR) Diagram



Part A: Star Groupings-

Done on binder paper

Part B: HR DIAGRAM ACTIVITY

- Group stars that have similar temperature and luminosity.
- Draw the stars where they would go on the blank HR diagram. Use the color that fits the section of the HR diagram where the star is located. If the star is a giant, draw it a little larger. White stars can be drawn as unfilled circles. Label the star with its name.

Note to STUDENT: Some of the stars are factual, and some are fabricated for this lesson.

Discussion Questions: answer in space provided

1. What pattern or groups of stars do you observe on the diagram?
2. What is the relationship between temperature and luminosity? (In particular, look at the Main Sequence stars)
3. Is there a relationship between the number of stars and their temperature and luminosity? If so, what is it?
4. Why do you think this might be?
5. What other patterns do you notice?

Part C:

Read the Star Type Reading with your group.

Answer the comprehension questions:

1. What are the stages in a low-mass star's life?
2. What are the stages in a high-mass star's life?
3. What determines a star's type?
4. What makes the Sun an ideal star for life?
5. Is the Sun a low-mass or high-mass star?
6. Looking at the H-R diagram, what are the:
 - hottest, dimmest stars?
 - coolest, dimmest stars?
 - brightest, hottest stars?
 - brightest, coolest stars?

#11: Grouping Stars Activity

PART A: STAR TYPE ACTIVITY

1. Introduce star type.

- Question: In the Astronomy Training Module, what kind of star was needed to support human life?
 - Answer: A yellow star was needed to support human life.
- Question: How are stars different from planets?
 - Answer: A star is a large, hot ball of gases, which gives off its own light. A planet is a large body that does not give off its own light and is orbiting a star. A planet is generally much smaller than a star and can be made of solid, liquid and/or gas.

2. Discuss star categorizing.

- Say: Often times we put things into categories based on certain characteristics. For example, we can categorize cars by type (car, truck, SUV), by color, by size (sub-compact, compact, mid-size, luxury) or any number of other characteristics.

3. Engage students in star categorizing activity.

- Each group gets a copy of Grouping Stars Cards. **DOWNLOAD A COPY ON MY WEB PAGE**
- Cut out the cards and put them in categories. As an example, use distance from Earth to sort the stars. Sample categories might be: less than 10 light years, 10 to 100 light years and more than 100 light years. Have students list the star names that fit in each category.
- Have groups come up with as many different categories as they can and then have them list the categories and the stars that fit in each category.
- Have students share their categories. List the different categories on the board/chart/overhead.
- Possible categories might include Main Sequence stars and giants; temperature ranges of 0-3500 Kelvins, 3501- 6,000 Kelvins, 6,001-10,000 Kelvins and over 10,000 Kelvins; star diameter ranges of 1 to 3 Suns, 4 to 12 Suns and more than 100 Suns.

4. Discuss categories.

- Have students share their categories and list them on the board. Discuss which categories students think are best and why.
- Tell students that scientists classify stars by their temperature and brightness or luminosity. By graphing stars according to luminosity over temperature, they have observed groups of stars. Students will observe this in the following activity.

Part B: HR DIAGRAM ACTIVITY

1. Engage students in the HR Diagram activity.

- Hand out a blank HR diagram to each student (**DOWNLOAD A COPY AT MY WEB PAGE**)
- Place Are You My Type? Cards on lab tables. (**DOWNLOAD A COPY AT MY WEB PAGE**)
- Have students group stars that have similar temperature and luminosity.
- Project the Blank HR diagram on an overhead projector. Explain how to fill it out.
- Have students draw the stars where they would go on the HR diagram. Encourage students to use the color pen that fits the section of the HR diagram where the star is located. If their star is a giant, encourage them to draw a larger star. White stars can be drawn as unfilled circles. Have them label the star with its name.

• Stars should be grouped as follows:

Yellow stars	Red/orange stars	Blue/white stars	Supergiants
Sol Cen A Christinaurus Rex Donaldix Doserb Geofferan	Ross 154 Ross 248 UV Cet B Grb 34 A 2398 A Lac 9352 Samuelsonian Mattrix Sundownus Alisan	Hoedus II Furud Castar	Aludra Rigel
Yellow/orange giants	Red giants	White dwarfs	
Pallux Nihal Ain	Hassaleh Propus Aldebaran	V. maanen' s star Luyten	

2. Discuss with students the patterns they observe on the HR Diagram.

- Question: What groups of stars do you observe on the diagram?
- Answer: There is a band of stars that stretches from the top left corner to the bottom right.
- There are two clusters of stars in the top right.
- There is another cluster of stars in the bottom left.

Note to Teacher: Some of the above stars are factual, and some are fabricated for this lesson.

- Post a transparency of the Completed HR Diagram.
- Say: We call the band of stars that stretches at a diagonal, Main Sequence stars. The two clusters in the top right are called giants and supergiants. The bottom left cluster of stars is called the white dwarfs.
- Question: Is there a relationship between temperature and luminosity? (In particular, look at the Main Sequence stars) If so, how do you know?
 - Answer: Yes, there is a relationship between temperature and luminosity. The stars show a definite pattern instead of being scattered all over the diagram.
- Question: What is the relationship between temperature and luminosity?
 - Answer: The hotter a star is, the greater its luminosity.
- Question: Is there a relationship between the number of stars and their temperature and luminosity? If so, what is it?
 - Answer: There are more stars that are cool and dim than there are stars that are hot and bright.

Question: Why do you think this might be?

- Answer: Cooler, dimmer red stars live longer (hundreds of billions of years) compared to hotter, brighter blue stars that live only tens of millions of years.
- Note: When we look up in the sky, we mostly see brighter stars, because the dimmer red stars cannot be easily seen. However, there are actually far more red stars than brighter stars.
- Question: What else do you notice about the number of stars in each group?
 - Answer: Most of the stars are on the Main Sequence.

Part C:

Read with students the Star Type Reading.

- Discuss the different kinds of stars and how scientists categorize them.
- Have students answer the comprehension questions.

4. Discuss conclusions about star type and bridge to Habitable Zone Activity.

- Question: What kind of star is ideal for human life? Why?
 - Answer: A moderate, yellow star in the middle of the Main Sequence is ideal for human life, because it has a moderate temperature that remains pretty stable.
- Question: Would it be possible to have a different star type and just move my planet to a different distance?
 - Answer: That scenario may be possible in some cases.