

Star Property Sort

Classify stars by temperature, size, luminosity, and apparent brightness

Name: _____ Date: _____

Part 1 - Read the Star Model

Important: This is fictional classroom model data, created for this worksheet. It is not a catalog of real named stars. Use the numbers provided; do not decide a star's size from its color alone.

Reference bands

Property	Classify as
Temperature and color	Hot: 10,000 K or more; medium: 5,000-9,999 K; cool: below 5,000 K. In grayscale print: blue = dark gray, white = white, yellow = light gray, red = medium gray.
Size (solar radii)	Compact: below 0.1; small: 0.1-2; large: above 2
Luminosity (Sun = 1)	Faint: below 0.1; moderate: 0.1-10; high: above 10
Apparent magnitude, m	Bright: m at or below 3; middle: m above 3 through 8; dim: m above 8. Lower m means brighter as seen from Earth.

Model-star table

In this simplified model, apparent magnitude is based on luminosity and distance only. More luminosity increases received light; greater distance decreases it.

Star	Color	Temp. (K)	Radius (Sun = 1)	Luminosity (Sun = 1)	Distance (ly)	m
A	Blue	18,000	1.3	160	1,000	5.0
B	Yellow	5,800	1.0	1	20	2.0
C	Red	3,500	80	900	10,000	8.1
D	White	10,000	0.021	0.004	50	10.0
E	Red	3,200	0.35	0.015	8	4.6

Direction: On the next page, sort each star using the four reference bands. Color helps classify temperature, but radius is the evidence for size.

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Part 2 - Classify and Explain

1. Complete the comparison matrix. Write one class in every cell. Use the model-star table and the reference bands.

Star	Temperature	Size	Luminosity	Apparent brightness
A				
B				
C				
D				
E				

2. Brightness mismatch: Star C has much higher luminosity than Star B, yet C has a higher apparent magnitude and looks dimmer from Earth. Explain this mismatch. Include (a) one luminosity value, (b) both distances, and (c) what apparent magnitude tells an observer.

3. Evidence check: Which table column is the best evidence for a star's size? Why is color alone not enough?

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Teacher Notes and Answer Key - Setup

Materials and setup

Supplied: both student pages, fictional model-star table, grayscale-readable temperature/color legend, and comparison matrix. Additionally needed: one pencil per student and, if desired, a document camera. Print Part 1 and Part 2 double-sided or distribute in order. Students should have Part 1 visible while completing Part 2. Do not provide calculators; the student task is classification and evidence-based explanation.

Teaching script

Say: “Today, separate what a star is like from how bright it looks to us. Temperature is connected to color. Radius is the evidence for size. Luminosity is the energy a star gives off compared with the Sun. Apparent magnitude describes brightness as seen from Earth, and lower magnitude means brighter. In this fictional model, the apparent magnitude values are based on luminosity and distance. Read the numbers in the table rather than guessing from color.” Say: “A red star is not automatically large. Find size in the radius column.”

Observation method

As students work, use this four-point checklist for each student: (1) uses the stated temperature band, (2) uses radius rather than color for size, (3) keeps luminosity separate from apparent brightness, and (4) cites C's and B's distances in the explanation. Prompt only: “Which column measures that property?” Do not tell a student a classification. Collect Part 2 or conference using the numbered answers on the next page.

Answer 1 - Comparison matrix

Star	Temperature	Size	Luminosity	Apparent brightness
A	hot	small	high	middle
B	medium	small	moderate	bright
C	cool	large	high	dim
D	hot	compact	faint	dim
E	cool	small	faint	middle

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Answer Key - Explain the Evidence

Answer 2 - Brightness mismatch

Sample response: “Star C has luminosity 900, while B has luminosity 1, so C gives off more light. However, C is 10,000 light-years away and B is 20 light-years away. C has apparent magnitude 8.1 and B has 2.0; because lower apparent magnitude means brighter, B looks brighter from Earth. Distance can make a luminous star appear dim.”

Scoring for Item 2

Accept equivalent wording that states both distances, at least one correct luminosity value, and the rule that a lower apparent magnitude means a brighter appearance. The response must connect C's much greater distance to its dimmer appearance. Do not require students to calculate a brightness ratio.

Answer 3 - Evidence check

Sample response: “The radius column is the best evidence for size because it directly compares each star's radius with the Sun's radius. Color alone is not enough: C and E are both red, but C has radius 80 and E has radius 0.35. D is white but compact.”

Concept source credit

NASA, “Types of Stars” and “Stars in an Exoplanet World,” accessed for the concepts that color relates to temperature and that color alone does not determine size: <https://science.nasa.gov/universe/stars/types/> and <https://science.nasa.gov/exoplanets/stars/>. All numerical star entries on the student page are clearly labeled fictional classroom model data.