Star colour and surface temperature

Student activity • observation and reasoning

YEAR 11 / LESSON 108 / PHYSICS + SCIENCE (DOUBLE AWARD)

The question

What does a star's colour tell us, and what can it not tell us alone?

Order labelled model stars by surface temperature and distinguish colour from apparent brightness.

Equipment

- Booklet, text-labelled star cards and calculator

Paper or screen analysis only. No hot filament lamp, flame, laser or direct solar observation. Never look directly at the Sun.

Course coverage: Shared Physics / Double Award: 5.17, 8.7–8.8. Kelvin scale and stellar colour-temperature classification.

Plan, model or apparatus sketch

Draw clearly labelled astronomical axes, spectra or orbital/pathway diagrams as appropriate.

Method and reasoning

Read the whole sequence before starting

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1. Use labelled model-star cards: red 3000 K, orange 4500 K, yellow-white 6000 K and blue-white 12000 K. Treat these as rounded teaching examples rather than measurements of named stars.

2. Order the cards from coolest to hottest using the numerical temperatures. Check that the blue-white example is hotter than the red example.

3. Convert the 6000 K example to degrees Celsius using $\theta = T - 273$. Explain why temperature in kelvin has no degree sign.

4. Draw a qualitative spectrum model showing that hotter thermal emitters have their peak at shorter wavelength. Explain that a star emits a broad range, not only one colour.

5. Compare two stars with the same surface temperature but different sizes, and two identical stars at different distances. Explain why colour alone cannot determine luminosity or apparent brightness.

6. State limits when interpreting photographs: filters, colour processing and intervening dust can affect apparent colours. Use the supplied labels rather than screen colour alone.

Cleanup

- Collect cards and retain the temperature ordering.

Record your evidence

Blank spaces are for your own work

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Reference and task data

The rounded colour labels are approximate. The 6000 K example is about 5727 °C using the specified 273 offset. Surface temperature is not the much higher core temperature.

Model colour	Temperature / K	Relative order / reasoning
Red	3000	
Orange	4500	
Yellow-white	6000	
Blue-white	12000	

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Which model star is hottest?

2. Which is coolest?

3. Convert 6000 K to °C using 273.

4. Does a star emit only its named colour?

5. Can colour alone give apparent brightness?

6. Why are labels needed alongside coloured cards?