

Fusion and stars · supported focus

International Baccalaureate · IB Diploma · Physics · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

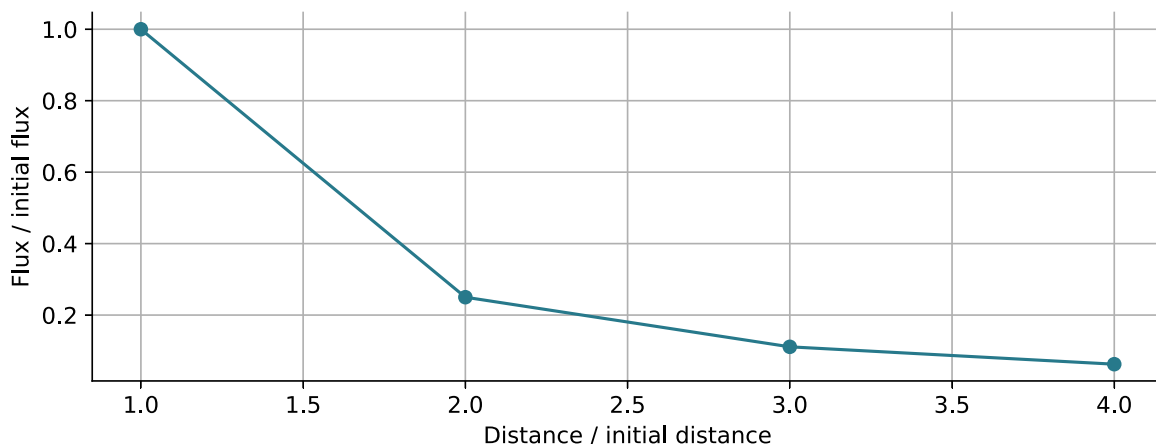
Stars, radiation and scale

■ What would explain this observation?

- Two stars can have the same apparent brightness while having different luminosities. Distance changes the **flux** reaching an observer.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- **Luminosity** is total power emitted; flux is power received per area. A stellar spectrum carries information about surface temperature and composition. Fusion transfers energy as light nuclei combine.
- luminosity: Total emitted power; flux: Power received per unit area.



■ Choose evidence that can test it

- For isotropic emission without absorption, flux follows an inverse-square relationship with distance. Observed brightness alone therefore cannot establish luminosity.
 - Keep distance units consistent, identify which quantities are intrinsic to the star, and distinguish observational evidence from a model of stellar evolution. Do not confuse a red giant stage with every possible final remnant.
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■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: distance doubles while luminosity remains fixed. Use F proportional to $1/d^2$. Flux ratio = $1/2^2 = 1/4$. A flux of 12 units becomes 3 units. This assumes no change in absorption or source output.

Example:

A source gives flux 18 units. Find flux at three times the distance. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- The Sun is not expected to become a supernova. Redshift can support cosmological expansion; it does not mean every nearby object must move away from every observer.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Apparent brightness alone always determines a star luminosity. This claim is false: The Sun is not expected to become a supernova. Redshift can support cosmological expansion; it does not mean every nearby object must move away from every observer.

Key:

Stars, radiation and scale: For isotropic emission without absorption, flux follows an inverse-square relationship with distance. Observed brightness alone therefore cannot establish luminosity.