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A map of the stars

Activity 2 answer sheet

Locate and label the Sun's position at key evolutionary stages on the H-R diagram (using reference materials or guided hints):

As the Sun evolves, its position on the H-R diagram shifts in ways that reflect changes in both luminosity and surface temperature:

Stage of the Sun	Brightness	Temperature	What processes cause these shifts?
Protostar → main Sequence	As the young Sun contracts and heats up, it becomes brighter until it settles into stable hydrogen fusion	Temperature rises sharply until hydrogen fusion ignites	Core contraction; ignition of hydrogen fusion
Main sequence (now)	Rises slowly over billions of years as the core becomes denser and hotter as hydrogen turns into helium	Temperature stays relatively stable with a slight gradual rise	Stable hydrogen fusion in the core
Red giant	When the core runs out of hydrogen, the Sun swells enormously and becomes hundreds to thousands of times brighter than it is now	Surface temperature decreases as the outer layers expand and cool; the Sun becomes redder	When the Sun's core contracts as hydrogen runs out, its outer layers expand, making it brighter but cooler on the surface
Helium-burning stage (horizontal branch)	After the first red-giant peak, the Sun becomes slightly less bright and stabilizes for a short time while it burns helium	Temperature increases again as the star contracts slightly and stabilizes	Helium fusion in the core (triple-alpha)

Asymptotic giant branch	It expands again and becomes very bright for a second time – another giant phase	Temperature drops again as the outer layers expand enormously	Helium shell burning; strong envelope expansion
White dwarf	Finally, the Sun shrinks into a small, dense white dwarf and its brightness drops sharply; it will slowly fade for trillions of years	Becomes very hot at first (exposed core), then cools slowly over time	After exhausting its fuel and shedding its outer layers, the hot remnant of a dying star is left behind – a white dwarf

Overall trends:

The Sun doesn't shine at the same brightness throughout its life. It grows brighter for most of its life, peaks as a giant, and then fades into a dim white dwarf while its temperature rises early, stays steady, cools as a giant, and ends as a hot leftover core. This reflects the gradual changes that occur as the fuel in the core is used up and the star changes shape.