

The Life Cycles of Stars

Aim: Can you produce a model of the life cycle of stars?

Introduction: At first glance, stars appear to be single pinpoints of white light, but more careful observation reveals what astronomers have known for years—that stars come in a range of colors: red/orange, yellow, white and blue. With the naked eye we can see that some stars are brighter than others. Differences in brightness arise from a combination of factors: stars come in a wide variety of sizes, some shine more brightly than others, and some are more distant than others. What turns out to be the case is that stars change size and color because of internal changes as they are born, age and finally die.

Stars form in giant clouds of gas and dust. Gravity pulls the materials together until the pressure and temperature inside the ball of material is high enough (15 million degrees or so) so that nuclear fusion starts creating new elements and producing a tremendous amount of energy. Stars range in size from WAY smaller than the Sun (Von Maanen's Star is only 0.007 sun diameters, though 47000 times as dense!) and WAY more than 20X as big! (Betelgeuse is 1000 sun diameters (1000³ times the sun in volume, and Antares is 776 sun diameters - though both are way less dense than the sun) depending upon the amount of dust and gas which had gathered during the star's formation.

The processes of star formation are fascinating. Stars are under contradictory forces the force of gravity pulling the gases in, while the force of nuclear fusion pushes materials out. And, after billions of years the hydrogen which is the fuel of the star's reactions runs out. So, then what happens? Depending on the initial size of the star, conversion of mass to energy can result in expansion and cooling first, as the gravitational force decreases due to the loss of mass. That cooling can then allow the star to collapse back on itself, becoming a rapidly spinning dwarf star. There is no longer the outward force of the reactions to counteract gravity and the star begins to collapse inward. The first step in the death of a star is the formation of a red giant, explained above but what happens next depends upon the size of the star.

In this lab you will model the life cycle of stars of various sizes.

Materials: tissue paper, crepe paper, black construction paper, labels, glue, star stickers, charts of star life cycles

Procedure:

- Using the materials available to you, and the charts of star life cycles as guides, create the stages of the stars' life cycle.
- Glue them into place on the black construction paper, leaving space for labels with which to explain or identify the stages.

Analysis:

- What materials did you use for each stage? List the stage and the material you chose for that stage, and describe the shape or structure of the materials.

Stage	Material	Description

Please turn over

2. Why did you choose the materials and shapes that you did?