

Stars

Introduction

Begin by asking the students what they know about stars. Accept all answers. Depending upon the grade level, they may list simple facts (e.g., we see them at night and they are up in the sky) or more sophisticated facts (e.g., they are in constellations or they are like distant "Suns."). It is unlikely that anyone will mention color or size, except maybe to say that stars are big. But, stars are different colors and different sizes.

Materials

Candles and candle holders (e.g., cupcakes)

Matches

White paper and crayons

Construction paper

Colored chalk

String

Spherical colored balloons

Ruler or meter stick

Activity 1

Distribute to each group of students: white paper, crayons, and one candle in a candleholder. Remember to reiterate your classroom's safety rules before beginning. Light the candles. Ask the students to draw what they see in the flame, and to pay special attention to the colors they use. When everyone is finished drawing, ask each group to describe what they saw. The answers will usually make the students want to look at their candle flame again, so don't extinguish the flames until all students have reported (unless it becomes a safety issue). Most will notice that the color of the flame is different close to the wick.

Ask the students which part of the flame is hottest. Many think that "red" is al-

ways the hotter color, so that's what they expect. Ask some to describe the colors of the flame on a gas stove. In stars, just as in Earth-bound fires, blue is hotter than yellow, and yellow is hotter than red. Explain that when we heat things that don't easily melt (like metal), they first look normal, then begin glowing "red-hot," and later become "white-hot." The sun is much hotter than a candle flame. Unlike a candle, the sun uses nuclear fusion as its energy source, not a chemical reaction like burning oil or wood.

Activity 2

Students who can read star maps can be sent home with instructions to look for colored stars. Don't tell them which colors to expect – just provide a star map. In the winter sky, Orion is a good choice since Betelgeuse is red and Rigel is blue. In the summer sky, look for Vega (white) or Deneb (blue) and Antares (red). Since stars are faint, some people can't distinguish their colors well at night.

Stars are different colors because they are different temperatures. They are all "hot" compared to most things on Earth; they range in surface temperature from less than 3000 K to over 50,000 K.

Activity 3

Because it is difficult to make three-dimensional models that preserve scale, some of the representations of stars in this activity will be flat. On a sidewalk or parking lot, try drawing colored circles in chalk for the larger stars. You can make the smaller ones out of colored construction paper. To begin, ask stu-

dents to choose two stars that they can represent with balloons. Allow them to choose the color of the balloon and to blow each up to the proper diameter. These two balloons set the scale for the rest of the exercise. For example, if you blew up a yellow balloon to represent the Sun, then a white one that is 2.4 times larger (in diameter) would represent Vega. Now, they compute how large the disks would be for the other stars.

Making a disk to represent a star is like using a flat picture to represent a person.

Stars are spheres of hot gas, round like balloons. For the smaller stars, students can cut disks of colored paper to the correct scale and for the larger stars, they draw the largest diameters using colored chalk or yarn to show the outline. (To make a circle, measure a piece of string equal to the required diameter. Fold the string in half and hold at the center. Place a piece of chalk where the ends of the string meet and trace a circle.) Use this table to relate star diameters. If you begin with a one-centimeter Sun, then Betelgeuse will be 8 meters! So, this activity can take a lot of space.

Star	Diameter (1 = Sun's Diameter)	Color
Sun	1	Yellow
Betelgeuse in Orion	800	Red
Antares in Scorpio	600	Red
Vega in Lyra	2.4	White
Rigel in Orion	58	Blue
Proxima Centauri C (closest star to the sun)	0.03	Red
Dubhe (brightest star in the Big Dipper)	14	Orange

Just like plants, the sizes of stars change as they age. Although stars range in mass from less than 1 percent the mass of the Sun to 10,000 solar masses, the largest diameter stars are not the most massive. Stars "puff up" as they age and become less dense.