Lect 6: Chapter 19: Section1: Stars 1 pt ec printing

Color, Composition, & Classification

What is a star?

A star is an enormous, hot ball of gas held together by _____. The gravity is so strong that it causes _____. within the star. Stars are the objects that heat and light the planets in a system. Everything revolves around stars. Thousands of stars cover our galaxy and when you look at our star, the Sun, you will see it is quite small. Throughout the universe, there are big ones, small ones, and different colored ones.

A star is a huge ball of _____, usually made of _____ (H) and _____ (He). That ball of fire also gives off light. All kinds of light. There are _____, _____, _____, and X-rays constantly emitted into space. You may find planets that are almost identical to the makeup of stars, like Jupiter, but something has not ignited their nuclear reaction.

Our Star: _____
As far as stars are concerned, the sun is rather small. The yellow color tells you it has a nice, medium temperature. The small radius also gives an indication that it not much of a powerhouse. Last is the luminosity. On Earth, the Sun may seem bright. Compared to other stars it is only a candle. Astronomers consider our Sun to be in the main sequence of its development.

The 3 Basics

Astronomers look at three main characteristics of stars. They study _____, _____, and _____ (size). Each of these three factors can tell you a lot about a star.

Think about this…  **← Blowtorch**  **← Candle**  **← Coal ember**

1. Which flame is hottest?
2. How are the colors different from each other?
3. There is a relationship between color and temperature. What do you think it is?

Color & Temperature

Stars are different colors too. A star's color depends on its _____.

Very hot: _____
Hot: _____ Cool: _____
Warm: _____ Very cool: _____

Bluer stars have a higher surface temperature. Lower temperature stars give off a lot of red light.

Luminosity

Remember, _____ is the total amount of light given off by a star. _____, or intensity, measures the amount of light reaching Earth. This is an important difference…the distance of a star makes a HUGE difference in its brightness. How bright a star seems to us is its _____ magnitude. The _____ magnitude refers to the actual brightness

Luminosity is caused by…

There are some specific factors that affect luminosity. As the _____ of a star increases, luminosity increases. If you think about it, a larger star has more surface area. That increased surface area allows more light and energy to be given off. _____ also affects a star's luminosity. You don't even need to look at a star for this idea. Just think about a stove, or a fire. When an electric stove is off, it is black. But when it is on high, the stove glows bright red. The same idea applies to stars. As a star gets hotter, the number of nuclear reactions increases. More reactions, more energy.

Classification of Stars

When scientists first started to study stars, certain differences became noticeable. They had different colors, different intensities, and even different movement. The time had come to develop with a system of classification for stars. Science has always used different forms of classification when it studies natural phenomena.

Astronomers classify stars by their temperature. Temperature determines much of the activity of a star. You can even figure out how old it is when you know the temperature.
Astronomers at Harvard College Observatory came up with the system and applied letters to each class. Some of the letters are O, B, A, F, G, K, & M. The "O"s are the hottest with temperatures over 25,000 Kelvin. The cooler stars are at the other end of the list with "M" stars at less that 3,500 Kelvin. As a reminder, water boils at 373 Kelvin.

Class	Color	Prominent Spectral Lines	Surface Temp. (K)
O	Blue	Ionized helium, hydrogen	> 25,000 K
B	Blue-white	Neutral helium, hydrogen	11,000 – 25,000 K
A	White	Hydrogen, ionized sodium and calcium	7,500 – 11,000 K
F	White	Hydrogen, ionized and neutral sodium and calcium	6,000 – 7,500 K
G	Yellow	Neutral sodium and calcium, ionized calcium, iron, magnesium	5,000 – 6,000 K
K	Orange	Neutral calcium, iron, magnesium	3,500 – 5,000 K
M	Red	Neutral iron, magnesium, and neutral titanium oxide	< 3,500 K

Special Stars: Not all stars have solar systems spinning around them. Some stars are just sitting out in the middle of nowhere. Some stars have a companion star nearby, kind of like a twin. When you have a twin, astronomers call you a Very cool: _____.

Special Stars: Giants

Really, really, really big stars. Some can be seen without a telescope.
There are 2 types:

1. _____ Giants: really hot & massive
2. _____ Giants: Cool & massive – these guys are big because they are cooling down and expanding

A _____ is a super massive star

Special Stars: Dwarfs

Smaller stars, There are 2 types:

1. _____:
   - about the size of a smaller planet
   - Sirius B, the largest known Dwarf star, is slightly smaller than Earth
   - _____ Dwarfs are small hot stars
2. _____:
   - even smaller, diameters of about 20-30 km (12-18 miles)
   - A _____ is a spinning neutron star that sends out beams of radiation

Can we organize all of this together?

Yes! In the early 1900s, the Danish astronomer Ejnar Hertzsprung & American astronomer Henry Russell developed an important tool for studying stars. They made a graph that showed the temperature on the _____ and the luminosity on the _____. This graph is called the Hertzsprung-Russell, or H-R, diagram. Each dot represents a star with a given temperature & luminosity.

What's so special about this diagram? It gives you a TON of information.
List 5 things that it tells you about a star:

1.
2.
3.
4.
5.