



Science Unit: *Space*

Lesson 4: *How Hot and How Big?*

School year: 2006/2007

Developed for: Sexsmith Elementary School, Vancouver School District

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Grade level: Presented to grades 2 and 3, appropriate for grades 2-6 with age appropriate modifications.

Duration of lesson: 1 hour and 20 minutes

Notes: Half of the lesson was delivered to two classes together - the Star Size and Colour activity requires a large number of students.

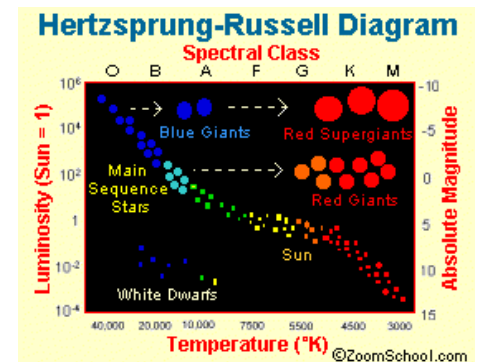
Objectives

1. Students will be able to recognize that stars have different colours
2. Students will be able to correlate star colour with star brightness
3. Students will be able to correlate star brightness with star size

Background Information

Stars like humans come in different sizes and colours. However, unlike people a star's colour and brightness is highly dependent on its size. We can get clues about how hot a star is and a star's age from a star's colour. Stars are often classified based on size, temperature and spectra (or its colour).

There are 7 main types of stars: O, B, A, F, G, K and M (easy mnemonic: Oh, be a fine girl, kiss me!). O and B stars are uncommon but very bright and M stars are common but dull. Astronomers use a diagram (the Hertzsprung-Russell plot) to graph a star's colour, temperature, luminosity, spectral type, and evolutionary stage. The largest and brightest stars, the O, B and A stars are blue. F stars are blue to white. G stars are white to yellow. K stars are orange to red and M stars are red.



Our sun is a yellow star, which indicates that the sun is a medium-sized star. Rigel is a blue star. Rigel is located in the Orion constellation, forming Orion's right foot, and it's an extremely large and bright star. Betelgeuse (pronounced beetle juice), which forms Orion's left shoulder, is an example of a red star. However, Betelgeuse is one of the stars that escape the general rule of size and the amount of heat a star produces. Betelgeuse is a Red supergiant, these stars are extremely large but not very hot.

As a general rule, we could say that blue stars are massive, bright, hot stars and red stars are small, dull, cool stars. The exceptions to this rule are Red Giants, which are cool but bright and massive in size.



Vocabulary

<u>Prediction:</u>	An educated guess of the outcome of an experiment
<u>Luminosity:</u>	The total brightness of a star, the total amount of energy a star radiates each second
<u>Magnitude:</u>	The measured brightness of a star, the amount of energy we can see from the Earth

Materials for this lesson

- Exploring Stars DVD (see reference section of lesson)
- Blue tape
- White tape
- Star Chart worksheet
- Yellow tape
- Orange tape
- Red tape
- Video Report worksheet
- 2 Lighters
- 2 Pasteur glass pipettes (if you cannot find the pipets use paper clip wires)
- 1 timer (see **notes 1 and 3**)

In the Classroom

Introductory Discussion (Hook)

1. Review the material learned up to this lesson - make it a charades game.
2. Have the students watch the first two sections of the Exploring Stars DVD – the first section is about the characteristics of stars and the second section reviews the lifecycle of a star.
3. Ask the students to write down on their video report sheet any new facts they might learn from the video, as a well as any questions they might have.
4. Ask students to share with the class the new facts they learned, lead a discussion about those facts until they understand the correlation of size and the colour of a star.
5. Guide the students to correlate the size with the amount of gas bumping and its production of heat (learned in the last lesson), so they can associate large stars with hot and bright stars.
6. When they understand that blue is hotter than yellow do the Lighter Flame Colours Experiment/Demo.

Science Activity/Experiment

Activity Title: Lighter Flames Colour Experiment/Demo

Purpose of Activity: To show how blue stars are hotter than yellow stars – help correlate colour and amount of heat.

Activity Instructions:

1. Show the students two lighter that are exactly the same model and two glass pipettes. Explain that glass pipettes are made of very fine glass.
2. Light the lighters and hold in plain view of the students, ask them how many colours they see in the flame – (blue and yellow)
3. Ask them what happens to fine glass when you heat it – it melts (in the case of a paper clip wire it becomes red)



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4. Ask them to predict what will happen to the glass pipettes when you place them on the different colour flames – the blue flame is in fact hotter than the yellow flame, so the glass pipette placed in the blue flame should melt faster. Explain what a prediction means and that it is the way scientists learn about everything in our world.
 - If you have two people in the classroom have each person light the lighter and both will place the pipettes on the different flames at the same time. The person with the pipette in the blue flame should gently support/press the tip of the pipette to the spark wheel such that when the pipette gets hot enough it will bend easily creating an awe effect.
 - The person with the pipette on the yellow flame will not be able to do the same thing because the yellow flame is much higher, thus farther away from the spark wheel.
 - It is normal for the pipette on the yellow flame to go black, just wipe it with your finger after the glass cools to show the difference between the bent pipette and the straight one.
 - These pipettes are very easily broken, so be careful not to apply too much pressure when supporting the tip on the spark wheel.

NOTE 1: If you are doing this activity as a demo and there is only one adult present, you will only be able to hold one lighter and one pipette (paper clip wire) at a time. Have one of the students time you with a timer or they could simply count out loud.

NOTE 2: This activity was designed as a demo, but if the students are old enough just give a pair of students 2 lighters and 2 glass pipettes or 2 paper clips and let them conduct the experiment and observations.

NOTE 3: If you are using paper clips it is also a good idea to count how long it takes for each to become red. Thin metal clips will work better and if you have access to a Bunsen burner or a propane canister blow torch with a regulator, it is better than using a lighter.

Science Activity/Experiment

Activity Title: Star Size and Colour

Purpose of Activity: To show that blue stars are bigger than red stars – help correlate star colour with star size.

Activity Instructions:

****This activity will work better if you have at least 40 kids participating****

1. For 40 kids cut pieces of tape long enough to go on around their arm:
 - 30 pieces of blue tape (~80%)
 - 4 pieces of white tape (~7%)
 - 3 pieces of yellow tape (~6%)
 - 2 pieces of orange tape (~5%)
 - 1 piece of red tape (~2%)

For any other number of kids just use the percentages to calculate the amount of tape for each colour. Just round the numbers to the nearest integer.

2. Place one piece of tape on each student and take them to an open area where they would be able to run and play a tag game
3. Explain to the students that they are not trying to run away from people but they are trying to find people with the same colour tape as them. Once they found someone they should hold hands and keep on seeking more people with the same colour tape.



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4. When the majority

have found their group ask them to stop

- Have the blue group with 30 children form a large ring around the smaller groups
- Have the smaller groups also form rings
- Draw attention to how much bigger a blue star is compared to the other colour stars

5. Take the students back to the classroom and give them the Star Chart worksheet to fill out

- The first column the students should draw the star and write the number of kids in that group
- The second column they should colour the box with the appropriate colour, or just write the colour name
- The third column has a thermometer that goes from very hot to cool, from top to bottom. Students should calculate how much bigger one group is compared to the total using fractions.

Eg. The blue group had 30 / 40 kids = 3/4, so 75% of the thermometer should be coloured blue from the top to the bottom. Then they had 10 / 40 kids left to be divided into 4 parts. The white group had 4 kids / 10 kids left, so 40% of the leftover space should be coloured white.

- If your numbers are complicated, draw the boundary lines (based on the percentages given with the tapes) on the sheet and ask them to colour the thermometer accordingly.

Scientific Report: the video report worksheet and the star chart worksheet will be their scientific reports for this lesson.

Closure:

Play a quick slightly altered Simon Says game – divide the students into two groups facing each other: brightness and size. The teacher is the colour. When you say a colour the groups will have to act accordingly. You could come up with actions for the intermediate colours.

Colour	Size group will do:	Brightness group will do:
Blue	Large	Hold their arms and legs out and inflate their cheeks to a maximum
White		Jump up and down
Yellow	Medium	Hold their arms down and leave not inflate their cheeks
Orange		Stand up
Red	Small	Hold their arms and legs close to their bodies and make a fish mouth (suck in their cheeks)
		crouch

References

1. <http://school.discovery.com/lessonplans/programs/exploringstars/> . Discovery Education. DiscoverySchool.com. Lesson Plans Library. Accessed April 2007. [Place to purchase the Exploring stars DVD/Video]
2. <http://www.enchantedlearning.com/subjects/astronomy/glossary/indexh.shtml> . Source of the Hertzsprung-Russell diagram on page 1 of this lesson.



Teacher Assessment of Learning


1. Do the students know the possible colours of stars?
2. Are the students able to correlate star colour and star size?
3. Are the students able to correlate star colour and the amount of heat a star produces?
4. Do the students understand that bigger stars are hotter and therefore brighter?

Extension of Lesson Plan

1. This lesson can be modified for higher grades – where the students are able to conduct experiments using fire.
2. Using blue, white, yellow, orange and red balloons ask the students to make a star of each colour. The balloons should be inflated in according to the size of each colour star. Then for fun they could decorate the balloons and tie it on a string in crescent order of size.

Name: _____

Star Chart

Star size	Star colour	Heat
Number of kids: _____		Very Hot 
Number of kids: _____		
Number of kids: _____		
Number of kids: _____		
Number of kids: _____		Cool

Name: _____ Date: _____



Video Report



TITLE: _____

FACTS I LEARNED:

QUESTIONS I HAVE:

ILLUSTRATIONS: