



Stages of Stellar Evolution

Evolution of Stars. Activity 8

Classroom Activity

Material List:

- Worksheet

Outline

By watching a presentation you will get the information about stages of stellar evolution. Then using the computer animation you will explore the changes of stellar parameters during different stages of stellar evolution. Finally you will draw a schematic diagram of stellar evolution.

Procedure:

Step 1. To Do:

Watch the presentation *Stages of Stellar Evolution* to get the general information about the stellar evolution and answer the questions:

1. A recipe. What do you need to make the star? _____

2. Write down 4 evolutionary stages of the star if the initial mass is less than 8 solar masses!

3. Write down 4 evolutionary stages of the star if the initial mass exceeds 8 solar masses but the final mass is less than 2,3 solar masses!

4. Write down 4 evolutionary stages of the star if the initial mass exceeds 25 solar masses and the final mass is more than 2,3 solar masses!

Step 2. To Do:

Go to the online page <https://starinabox.lco.global/> and start the software by pressing "Open the lid". Field to the left represents the Temperature-luminosity diagram with the main sequence highlighted. Set the speed of the animation to „fast“. Change the mass of the star to 0,2 solar units and check that the right side window "Compare the size" is chosen.

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Push the “Start” button and watch the changes of temperature, luminosity, size and colour of the star over time. Write down the final stage of evolution that appears on the main field. Switch to “Stages in your star’s life” and write down the intermediate stage(s) between the main sequence stage and final stage. Switch to “Mass” and write down the final mass of the star. Note that the first line of the worksheet table is already filled.

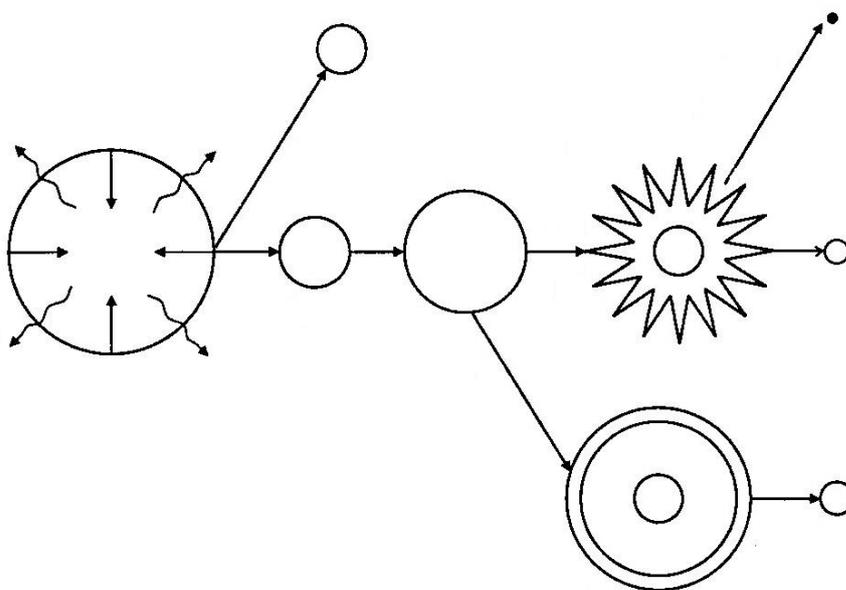
Switch to “Data table” and calculate the sum of main sequence and giant(s) phase duration. To go back, push the “Open the lid” button. Repeat for other stellar masses up to 40 solar units and fill the worksheet table.

Finally fill the worksheet table column “Remnant”. For stars of mass between 0,8 and 8 solar units it will be **planetary nebula**. For stars of higher mass it will be **supernova remnant**.

Initial mass, solar units	Intermediate stage(s)	Remnant	Final stage	End mass, solar units	Duration, millions of years
0,2	No	No	White dwarf	0,183	1 034 300
0,65					
1					
2					
4					
6					
10					
20					
30					
40					

Assessment:

Carefully watch the schematic picture of stellar evolution shown by the teacher and label the stellar evolution stages on the diagram!



Answer the questions:

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1. What will be the final evolution stage of the Sun? _____
2. Betelgeuse has an initial mass of 20 solar masses. What will be the final evolution stage of this star? _____
3. A star with the initial mass of 40 solar units becomes a black hole of about 10 solar masses. Where the all other mass is gone?

4. *Live fast, die young*. To which stars this slogan can be applied and why their lifespan is so short? _____

5. Age of the Universe is 14 billion years. Are there stars that will last longer than this period of time? _____