LIFE CYCLE OF STARS

In this session students will use balloons to replicate the stages of a star throughout its lifetime. They will then use the balloon star timeline to match the cards in the sorting game.

Learning Objectives, students will learn:

1. that not all stars are the same
2. how stages in the life cycles of stars differ
3. that the life of a star is dependent on its mass

Activity 1 requires each student to inflate a balloon. We have listed required resources based on a group of 16 students. If your group is larger you should increase the number of yellow and red balloons.

You can have as many red and yellow balloons as you need. This helps to show that the most massive and hottest stars (white and blue) are much rarer and that black holes and neutron stars are less likely to occur.

There should never be more than 1 blue and 2 white balloons.

You can skip the red balloon and its associated timeline if you have a very small group.

Each group will require the following:

REQUIRED RESOURCES
☆ Red balloons (8 minimum)
☆ Yellow balloons (5 minimum)
☆ Ping pong balls (13 minimum)
☆ White balloons (2 maximum)
☆ Marbles/grapes (2 maximum)
☆ Blue balloon (1 maximum)
☆ Ball bearing/tic tac (1 maximum)
☆ Pin to pop the balloons

Before the session

Read through the 'Activity 1: Balloon Game' instructions. Work out the best location to place your timeline (see page 5). You will need enough space for 8 stops in the timeline and enough space for all the students to stand at each point in the timeline.

ACTIVITY 1: BALLOON GAME

Ask this question before the balloon game:

Q. Are all stars the same?

A. They are all different but some can be grouped together by: (some examples) mass, heat, colour, size, age, death

WARNING

Check for any latex allergies before anyone handles the balloons.

Balloon game:

1. Draw a timeline (see page 5) of the main times on a board or along a wall. Make reference to the timeline being the top line of the balloon table where it goes from 10 million to 100 billion years.

2. Give each student a balloon (remember just 1 blue and 2 white) and ask them to blow up each balloon to about 8 cm diameter. They should hold the neck of the balloon closed, but should not tie it off.

   These balloons represent the creation of new stars. They form when gas and dust clump together through gravity. Once the pressure inside the clump is high enough, hydrogen atoms combine to form helium through nuclear fusion, and a star is born. The colour represents the surface temperature of the star.

   Nuclear fusion is the process by which lighter elements combine to form heavier elements. This process releases energy.

3. Guide the students to move along the timeline in stages using the times and instructions on the next page. When students arrive at each stop in the timeline, they should carry out the action listed for their colour of balloon. Ask the students to predict what will happen to their balloon as they move along the timeline.

   The remaining ball (ping pong/marble/ball bearing etc.) represents the core of the star and is all that remains at the end of its life. Show the relevant ball once the balloon is popped/ deflated. There are additional supporting science notes and questions to support discussion below.

Notes:
10 Million Years + Blue Stars: When hydrogen begins to run low, the star becomes a red giant. The outer shell of the star expands (up to 100 times the size of the original star) and cools.

11 Million Years + Blue Stars: A supernova is a tremendous explosion that occurs when lighter elements in a star's core have been converted into iron. A black hole forms when the core of a star collapses in on itself to create an object so dense that even light cannot escape its gravitational attraction.

55 Million Years + White Stars: A neutron star is only about 10 miles in diameter, but has a mass about 1.4 times that of the Sun and a magnetic field a trillion times stronger than the Earth's.

12.5 Billion Years + Yellow Stars: Planetary nebulae are the expanding shells of gas that are ejected by some stars. A white dwarf is a slowly cooling core of a star. One unusual property is that the more mass the white dwarf has, the smaller it is.

After all the stars are "dead", review the sequence you have just covered:

Questions to ask:

Which stars died first?
Which stars died last?
Which stars deflated?
Which stars exploded?
What is the main difference between the stars that exploded and deflated?
How common are the really massive stars that become black holes?

Which colour balloon was the Sun? **Yellow**

How will the fate of our Sun affect the fate of the Earth? **About 5 billion years from now, the Sun will turn into a red giant, with its outer surface expanding to about the radius of the Earth's orbit.**

Balloon game answers for students' sheets:
What colour are stars that are hottest? **Blue**.
What colour are stars that are coldest? **Red**.
Which stars will live the longest? **Red.**

ACTIVITIES 2 AND 3: CARD SORTING GAMES

Copy the images on the next page and ask the students to cut them out. Remember to keep the name on top of each image.

The students must arrange the images to correspond with the correct description on their sheets.

Activity 2 - Answers

Stage 1	Molecular Cloud
Stage 2	Protostars
Stage 3	Main Sequence (yellow)
Stage 4	Red Giant
Stage 5	Planetary Nebula
Stage 6	White Dwarf
Stage 7	Black Dwarf

Activity 3 - Answers

Stage 1	Molecular Cloud
Stage 2	Protostars
Stage 3	Main Sequence (blue)
Stage 4	Red Supergiant
Stage 5	Supernova
Stage 6a	Neutron Star
Stage 6b	Black Hole

ACTIVITY 4: CROSSWORD (ANSWERS)

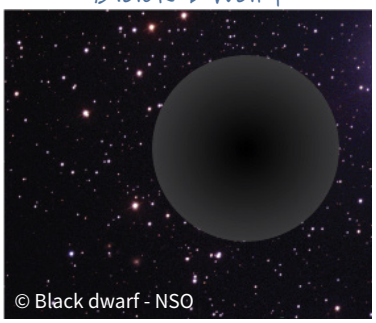
ACROSS:
4. Supernova
5. Red giant
8. Main sequence star
9. White dwarf
10. Protostar

DOWN:
1. Neutron star
2. Black hole
3. Molecular cloud
6. Nuclear fusion
7. Black dwarf

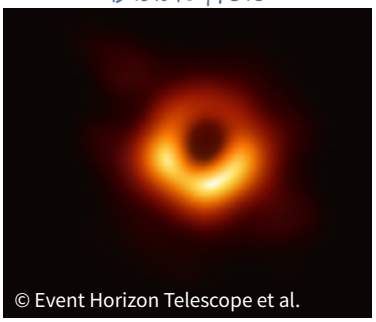
There are no spaces represented in the crossword grid.

Card Sorting Games: copy this page, give one to each group. Ask them to cut out the images below (ordered alphabetically). They need to match each title and image with its description in activities 2 and 3 in their workbook. There are 7 for each activity.

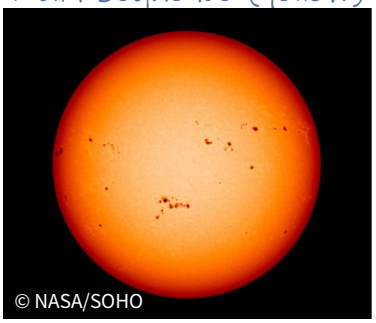
Black Dwarf



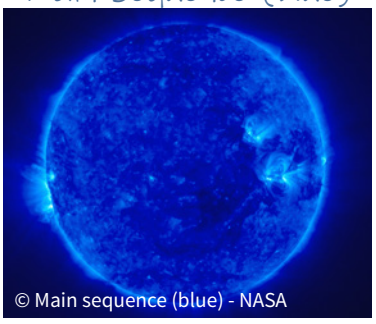
Black Hole



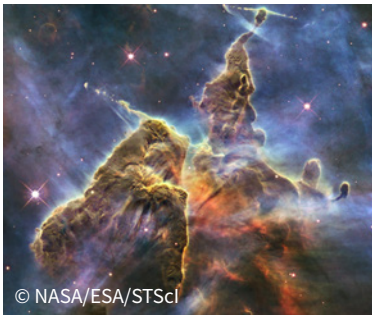
Main Sequence (yellow)



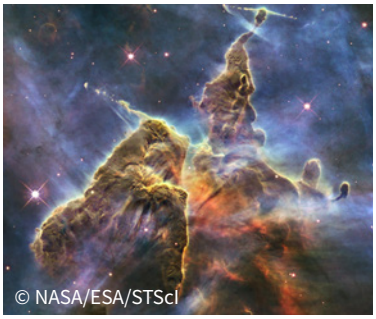
Main Sequence (blue)



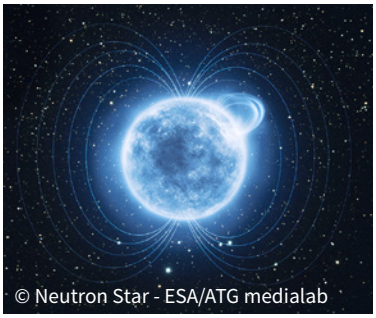
Molecular Cloud



Molecular Cloud



Neutron Star

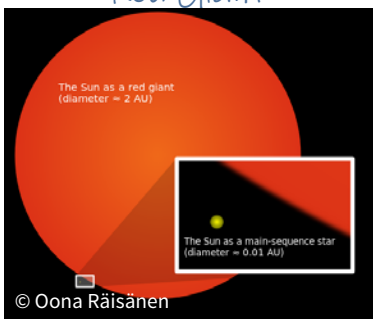


Planetary Nebula

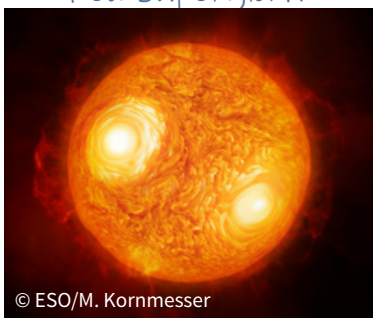
Protostars

Protostars

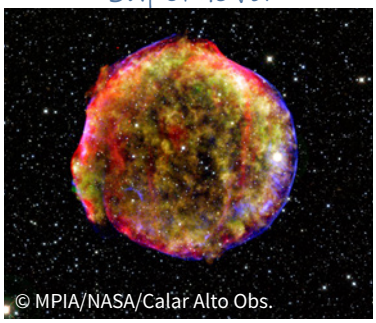
Red Giant



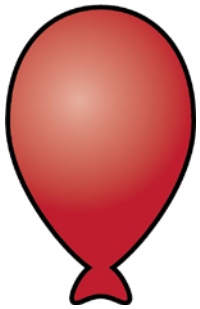
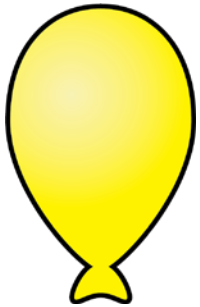
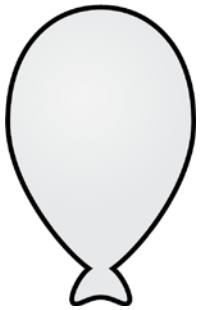
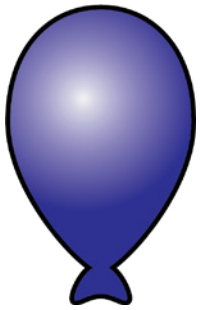
Red Supergiant



Supernova



White dwarf

Timeline:	10 Million Years	11 Million Years	50 Million Years	55 Million Years	10 Billion Years	12 Billion Years	12.5 Billion Years	100 Billion Years
	Wait. Do not change the diameter of the balloon.	Keep waiting.	Keep waiting.	Keep waiting.	Keep waiting.	Keep waiting.	Keep waiting.	Deflate balloon. **This star has become a white dwarf** (show ping pong ball as remains).
	Wait. Do not change the diameter of the balloon.	Keep waiting.	Keep waiting.	Keep waiting.	Blow up a little bit more. **This star is becoming a red giant.**	Blow up more. **This star is a red giant.**	Deflate the balloon. **Star releases its outer layers as a planetary nebula and becomes a white dwarf** (show ping pong ball as remains).	Still white dwarf.
	Wait. Do not change the diameter of the balloon.	Keep waiting.	Blow slightly more air into balloon. **This star is becoming a red giant.**	Quickly fully inflate balloon. Pop balloon. **This star exploded in a supernova and became a neutron star** (show marble/ grape as remains).	Still a neutron star.	Still a neutron star.	Still a neutron star.	Still a neutron star.
	Blow slightly more air into balloon. **This star is becoming a red giant.**	Quickly fully inflate balloon. Pop balloon. **This star exploded in a supernova and became a black hole** (show ball bearing/tic tac as remains).	Still black hole.	Still black hole.	Still black hole.	Still black hole.	Still black hole.	Still black hole.