COMPARING STARS

Graphs and charts are essential tools in science. Scientists use them to make sense of data and to spot patterns and trends. Charts can show if two different quantities are related, or demonstrate that the data is random.

One of the most useful and powerful charts in astrophysics is the Hertzsprung–Russell Diagram, which plots the brightness of a star on a graph against its surface temperature. It was created by astronomers Ejnar Hertzsprung and Henry Norris Russell about 1910. Astronomers use the chart to infer information about the life and evolution of stars.

In this session you will work together to create a Hertzsprung–Russell Diagram using data from different stars.

The Pleiades star cluster by NASA, ESA and AURA/Caltec

ACTIVITY 1: WHO AM I?

Stars are not all the same and they don't last forever. Stars come in different sizes and have different temperatures. Each star goes through stages in its lifetime which depend on how massive it is.

Challenge someone in your class to play 'Who am I?' - use the information in the table on the next page to help you. The aim of the game is to guess the star life-stage stuck to your head.

Instructions and rules:

- ☆ Chose a **star life stage** from the table (this is only a selection of all possible stages). Write it on a sticky note and stick it to your partner's forehead, gently! Make sure they don't see the answer!
- ☆ The person wearing the sticky note asks questions about the star life stage using the information in the table, for example, "Am I more massive than the Sun?"
- ☆ They are NOT allowed to just ask which star life stage they are, for example, "Am I a Red Giant?"
- ☆ Take it in turns until everyone in your group has had a go or two

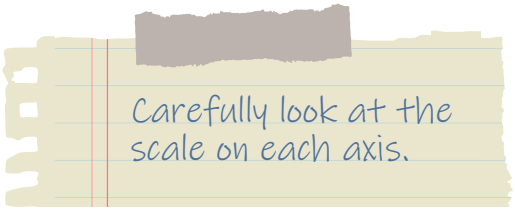
Star Life Stage	Information
Main Sequence	A star spends about 90% of its lifetime in this stage. Nuclear fusion of hydrogen within the star's core releases energy. The Sun is currently in this life stage.
Red Giant	A middle-aged star that has run out of hydrogen in its core but is fusing hydrogen in its shell – making it expand. It can grow up to 100 times the size it was as a Main Sequence star. Its colour reflects its cooler surface temperature.
Red Supergiant	A massive star that has run out of hydrogen in its core but begins to fuse heavier elements in shells surrounding the core. It expands up to 1000 times the size of the Sun. Its surface temperature remains cool, and its colour reflects its temperature.
White Dwarf	The dense compact core of a low-mass star that has come to the end of its lifetime. Although nuclear fusion has ended, the surface of the star remains very hot, such that it shines a bright blue/white. They can appear quite faint from a distance because they are so small.
Black Hole	The infinitely dense compact core of a high-mass star that has come to the end of its lifetime. The core is so dense that not even light can escape it making it appear black. They can be hard to find because they don't emit light.

ACTIVITY 2: CREATE A HERTZSPRUNG–RUSSELL DIAGRAM

You are going to work as a team to create your own Hertzsprung–Russell Diagram. Your teacher will give you a labelled empty chart and some star circles. You will use the information on your star circles to place them in the correct place on the chart.

The information on your stars circle includes:

- ☆ The **name** of star
- ☆ The **temperature** of star in Kelvin
- ☆ The **brightness** (or luminosity) of the star in number of Suns
- ☆ The **colour** of the star



Instructions:

1. Take turns to add your star circles data to the chart.
2. Share any observations or questions you have about the data with the rest of your group.
3. Keep going until all the data is plotted.

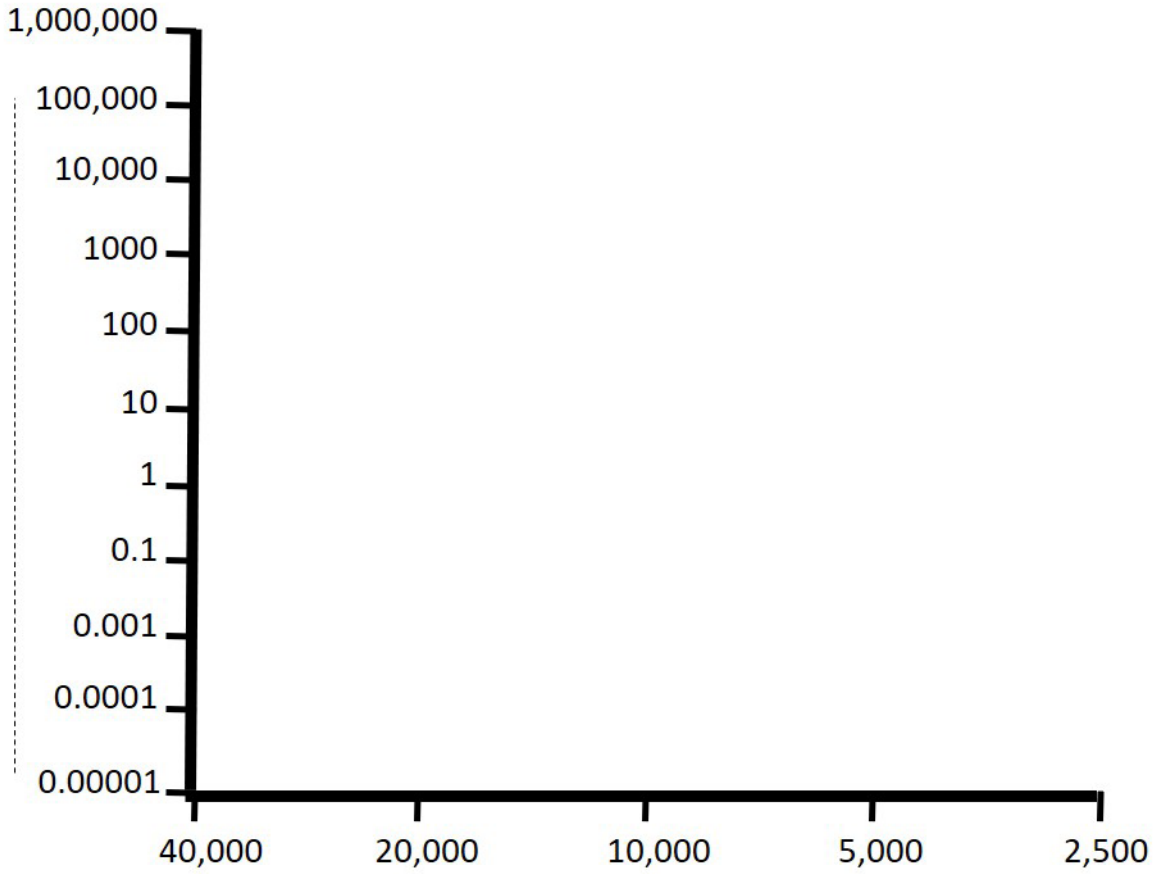
ACTIVITY 3: USING THE HERTZSPRUNG–RUSSELL DIAGRAM

Most stars, including the Sun, can be found in the main sequence of stars - a band running from the top-left to the bottom-right of the diagram. White dwarfs, giants, and supergiants fall outside of the main trend.

Use your classes chart and the blank template on the next page to complete the following:

1. Label the variables on the x-axis (horizontal axis) and the y-axis (vertical axis) using the dotted lines on the next page.
2. Draw a rough sketch of your class chart onto your blank template on the next page.
3. Label the areas on the template where you expect to find the following types of stars: main sequence, giants, supergiants, white dwarfs.
4. Next to the labels on the horizontal axis, indicate the corresponding star colour.

Your Hertzsprung-Russell Diagram:



Explain in 1 or 2 sentences what the Hertzsprung-Russell Diagram shows: