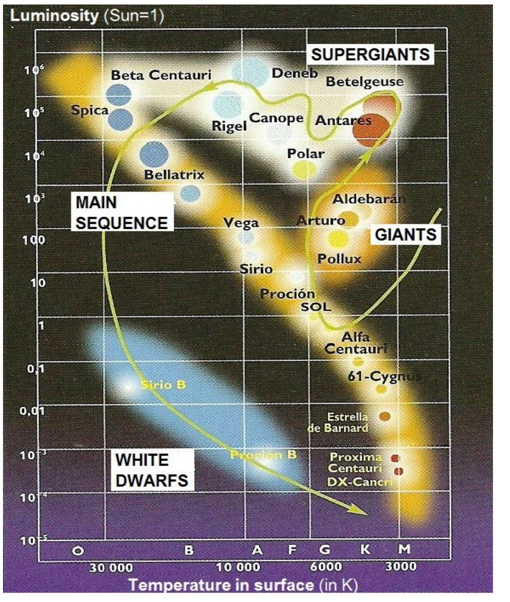
## READING ACTIVITIES (Answer key)

**3.2. In the Hertzprung-Russell diagram (or H-R diagram) has been represented the evolution of a star similar in mass to the Sun, since it was born until it die.**




a. What is the luminosity (or brightness) of a star?

It is the measurement of the **energy released** by the star. It is represented by its magnitude.

b. What is the difference between the apparent magnitude of a star and its absolute magnitude?

The **apparent magnitude** is the magnitude of the star perceived from the Earth and it is deceptive. We can see a star as very bright not because it really is but because it is close to us.

The **absolute magnitude** indicates the intrinsic brightness or luminosity of a star. That is to say, it is the magnitude that a star would have if it were at a parsec of distnce from the Earth.

c. The brightest stars in the diagram, will be the brightest ones seen from the Earth? Explain your answer.

No, because the apparent brightness depends on the distance. If the star is very far away from us we will see it with a little bright. But if it is near us we will see it very bright.

d. Why do they have different colours?

The colour of a star is due to its **surface temperature**. From the hottest to the coldest, they can be blue, blue white, white, yellowish white, yellow, orange and red.

e. What is the reason of their different sizes?

The size of a star depends on the **size of the nebula** that originates it. The bigger the nebula was, the bigger the star is. It can be also a consequence of the **stage of the life cycle** of a star. At the end of their life stars increase a lot their size (red giants or red supergiants) and then they contract (white dwarfs).

f. During its life the star displaces trough the diagram in the direction that the arrow indicates. How is this explained?

It is because **the star changes** its size, temperature and colour as it passes through the different **stages of its lifecycle**. So that depending on the moment we observe the star, the place that it occupies in the diagram is different. If could follow its complete lifecycle we could see the **apparent displacement** of the star through the diagram.

g. How does temperature vary along the star life?

The temperature will be **constant** while the star stays in the main sequence. Later it will **decrease** during the phase of red giant (or red supergiant) and then it will **increase** during the phase of white dwarf. Finally temperature **became 0 K** when the star transforms into black dwarf.

h. How will change the temperature and brightness of the Sun until its death?

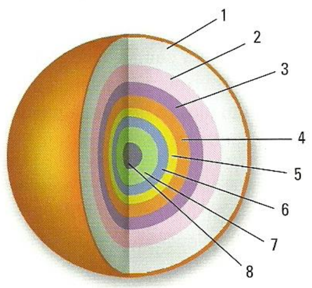
The temperature and brightness of the Sun will decreases when it will become a red giant and then temperature will increase and brightness will continue decreasing during the phase of white dwarf. Finally both parameters will become 0.

**3.3. What influence has the mass of a star in its evolution?**

The evolution of a star depends on its mass. The bigger its mass, the shorter its lifecycle.

- **Solar mass star**s have long lifecycles (10,000 m.y.). They end as red giants that explode giving as a result planetary nebulae and white dwarfs that end as black dwarfs.
- **Massive stars** have short lifecycles (10-20 m.y.). They end as red supergiants that explode very violently giving as a result supernovae and a super-compress nucleus that can be a neutron star (pulsar) or in the most massive stars, a black hole.

**3.4. The picture represents a red supergiant star just before to become a supernova.**




a. Indicate which chemical element is synthesising in each layer.

   Hydrogen (1), Helium (2), Carbon (3), Oxygen (4), neon (5), Magnesium (6), Silica (7) and Iron (8).

b. How does temperature vary as depth increases?

   The temperature **increases** with the depth.

c. How is the end of this kind of stars?

   They end as **supernova**. It is a violent explosion that spread out the components of the external layer of the star throughout the space.

d. Which are the oldest chemical elements? When were formed the iron and the carbon? Were gold or uranium formed during the Big Bang?

   - Hydrogen and Helium are the oldest chemical elements. They were formed **just after the Big Bang**.
   - Iron and Carbon were formed in the **nuclei of stars**.
   - Uranium and gold were formed during the **explosion of supernovae**.

e. The sentence "*We are star dust*" belongs to the famous astronomer and science communicator Carl Sagan. What do you think it is referred to?

   It is referred to the fact that the chemical element that form our bodies come from the nuclei of stars and from the explosion of supernovae. We are made of the remains of these stars.