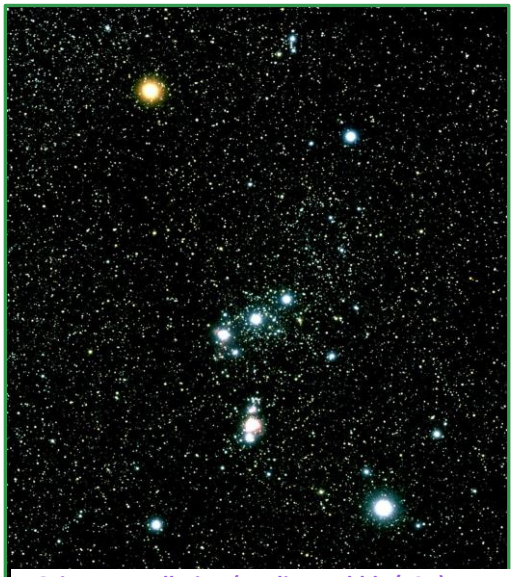
THE JOURNEY OF IDEAS
WORKSHEET

Activity 5.1.3 Discover the colors of the stars

When Al-Sufi started to observe the stars in Isfahan, he noticed the colours of some stars differed from others. This difference in colour had never been noted or recorded by Greek, Babylonian nor Egyptian astronomers! Al-Sufi thought that the colour is an important property of the stars and included it his catalogue together with their brightness's and positions. Stars are hot due to nuclear fusion in their central regions: due to the high pressure, cores of atoms (like hydrogen) collide and fusion into heavier ones (Helium) and into Carbon, Oxygen, etc. giving rise to the elements that we know in chemistry.

(a) Look carefully at the Orion constellation: do you remember the name of the corresponding Arabic constellation?

(b) Do you remember the name of the brightest star in the Orion constellation and what it means?



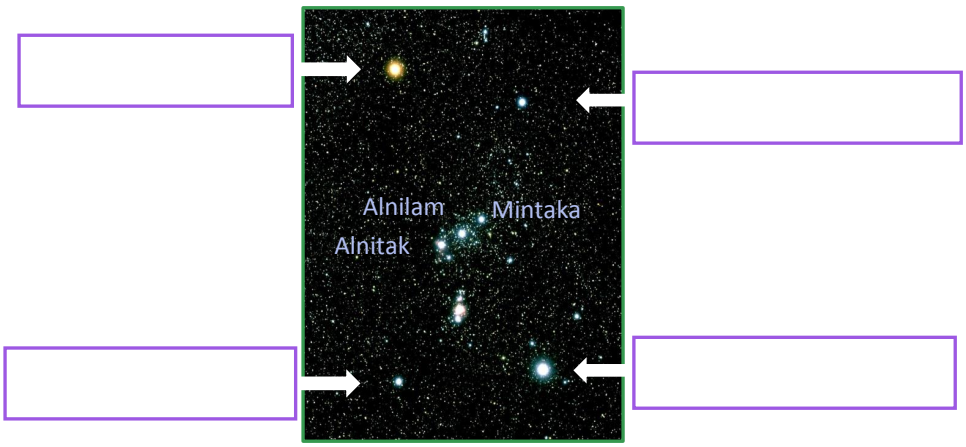
1. Orion constellation (credits: Hubble/ESA)

(c) Do you notice any difference between the colours of the stars in this constellation? What star colours do you see?

(d) Al-Sufi kept and used the Arabic names of stars in the Orion constellation in his "Book of the Constellations". You can find the meaning in the table below:

Name	Origin	Meaning
Betelgeuse	Arabic الجوزاء إبط	Hand of Al-Jawza
Bellatrix	Latin	Female Worrier
Saiph	Arabic سيف	Sword
Rigel	Arabic الرجل	Foot
Alnitak	Arabic النطاق	Belt
Alnilam	Arabic النظام	Belt of pearls
Mintaka	Arabic منطقة	Girdle

Try to fill in the names of the four stars from the table in the picture bellow:



2. Orion constellation (credits: Hubble/ESA)

The colours and temperature of the stars

Have you ever seen an iron bar heated on the fire? In case not, just have a look at the picture bellow. When the iron bar is heated and become hotter and hotter, it turns red, then yellow, then white and finally (before it melts) blue!

3. Iron bar (credits: Blender3D)

(e) Look at the picture of stars taken with the NASA/ESA Hubble Space Telescope and try to answer the following questions:

4. Credit: HST image

- Which are the hottest stars?

  _____

- Which are the coldest ones?

  _____

- Which stars have a medium temperature?

  _____

- Does our Sun have a high, low or medium temperature?

_____

We now know that stars have different colours because they are made up of hot glowing gas of different temperatures. Just as in the case of the iron bar, the star colours depend on how hot they are. The temperature of stars can sometimes reach 40 Million degrees in their inner cores! Al-Sufi didn´t know that the colours of stars are related to their temperatures, but he would certainly have loved to discover it!

(f) Take the constellation viewer and insert one after the other the cards with the following constellations:

- Orion
- Great Bear
- Lyon
- Lyra
- Taurus
- Scorpio

5. Credits: Scorza

For each constellation complete the table below: write the names of the brightest stars of these constellations, their colors as you see them in the viewer and with help of the table below, find out their temperatures:

Constellation name	Name of the brightest star	Color	Temperature

Surface temperatures in °C	Colour of the star	
30000 – 60000	Blue	
10000 – 30000	Blue white	
7500 – 10000	White	
6000 – 7500	Yellow white	
5000 – 6000	Yellow	
3500 – 5000	Orange	
< 3500	Red	

This resource was developed by Space Awareness. Space Awareness is funded by the European Commission's Horizon 2020 Programme under grant agreement n° 638653. This resource is part of the Islamic Astronomy Heritage Educational Kit, The Journey of Ideas created by Cecilia Scorza (House of Astronomy) in collaboration with Foundation for science technology and civilisation & 1001 inventions