

CHAPTER 9: STARS AND GALAXIES

Characteristics of the Sun

1. The Sun is located about 150 million kilometres from the Earth.
2. The Sun is made up of hot gases, mostly hydrogen and helium.
3. The size of the Earth at 1 392 000 km in diameter is 100 times wider than the Earth.
4. At 1.98×10^{30} kg, its mass is 300 000 times more than the mass of the Earth.
5. The temperature at its surface which range from 5500°C to 6000°C are hot enough to melt almost anything.

draw photograph 9.1 page 179

draw table 9.1 page 179

The structure of the Sun

1. The Sun's atmosphere consists of three parts:
 - a. **The Corona**
 - the outermost layer of the Sun's atmosphere.
 - b. **The chromosphere**
 - the layer of gases below the corona that is bright-red in colour.
 - c. **The photosphere**
 - The layer of dense gas that appears yellow from the Earth.

draw figure 9.1 page 180

The structure of the Sun

the structure of the Sun		brief explanation
	Corona	<ul style="list-style-type: none"> - the outermost layer of the Sun's atmosphere - Can only be seen during the eclipse of the Sun. - The temperature of the corona is about 1.5 million $^{\circ}\text{C}$
	Chromosphere	<ul style="list-style-type: none"> - the layer of gases below the corona that is bright-red in colour. - Can only be seen during the eclipse of the Sun, just like the corona. - The temperature range of the chromosphere is from 10 000 to 500 000 $^{\circ}\text{C}$. - Prominences and solar flares occurs here.
	Photosphere	<ul style="list-style-type: none"> - The layer of dense gas that appears yellow from the Earth. - This layer of gases is about 500 km thick. - The temperature of the photosphere is about 6000 $^{\circ}\text{C}$. - Sunspots occur here.
The core of the Sun		<ul style="list-style-type: none"> - consists of hydrogen and helium gases. - Nuclear reactions occur continuously in the core to generate and give out heat and light energy. - The core temperature is very high, about 15 million $^{\circ}\text{C}$

The Phenomena that occur on the Surface of the Sun and the Effects on the Earth.

1. Several phenomena occur on the surface of the Sun. These are:

a. Prominence

- hot gases that shots out from the chromosphere. These gas explosions produce very bright light.

- prominence occur over and around sunspots.
- prominence may erupt a few days after their formation.

b. solar flare

- explosion of gas that occur suddenly in the chromosphere.
- occur near the sunspots.
- solar flares are violent explosions on the surface of the Sun.
- flares usually last for a few minutes to a few hours.
- The eruption of prominences and the occurrence of solar flares release large amounts of solar materials into space.
- the solar material consists of hot electrically charged and magnetised particles, travelling at supersonic speed.
- the continuous flow of these particles is known as solar wind.
- the solar wind blows past the Earth and affects people and their activities.

c. sunspot

- dark spots on the photosphere.
- sunspots usually appear as pairs or group around the equator of the Sun.
- Sunspots appear due to the concentration of magnetic fields generated by the Sun.
- sunspots have lower temperature compared to their surroundings.
- sunspots can last from one hour to months after their formation.

draw photograph 9.2 page 181

2. Apart from releasing heat and light energy, sunspot, prominence and solar flare affect the weather and communications on Earth.
3. Charged particles resulting from the solar flares reach the North Pole or South Pole and collide with gas (oxygen & nitrogen) molecules in the atmosphere.

4. Colourful lights consisting of green lights, yellow lights and red lights are produced.
5. These lights can be seen at night and known as the **aurora**. (look at photograph 9.3 on page 182)

The effects of the phenomena on the surface of the Sun on the Earth

Effect on	Explanation
Communication system	
navigation systems	salin @ Photostat dari mukasurat 181, Table 9.2
satellites	
Radiation hazards	
electric power	

How energy is generated by the Sun

1. Energy is generated by the Sun through **nuclear fusion** in the core of the Sun.
2. A nuclear reaction can produce large amounts of energy. A nuclear reaction where several atoms of one type of element merge together to form a different element.
3. The Sun mainly made up of hydrogen. Under high temperature in the core of the Sun, hydrogen atoms undergo nuclear fusion to form **helium** atoms and a large amount of **energy** is produced.
4. The energy produced is in the form of **heat and light**.



Formative exercise 9.1 on page 183

The Stars and the Galaxies in the Universe

What is a big Star?

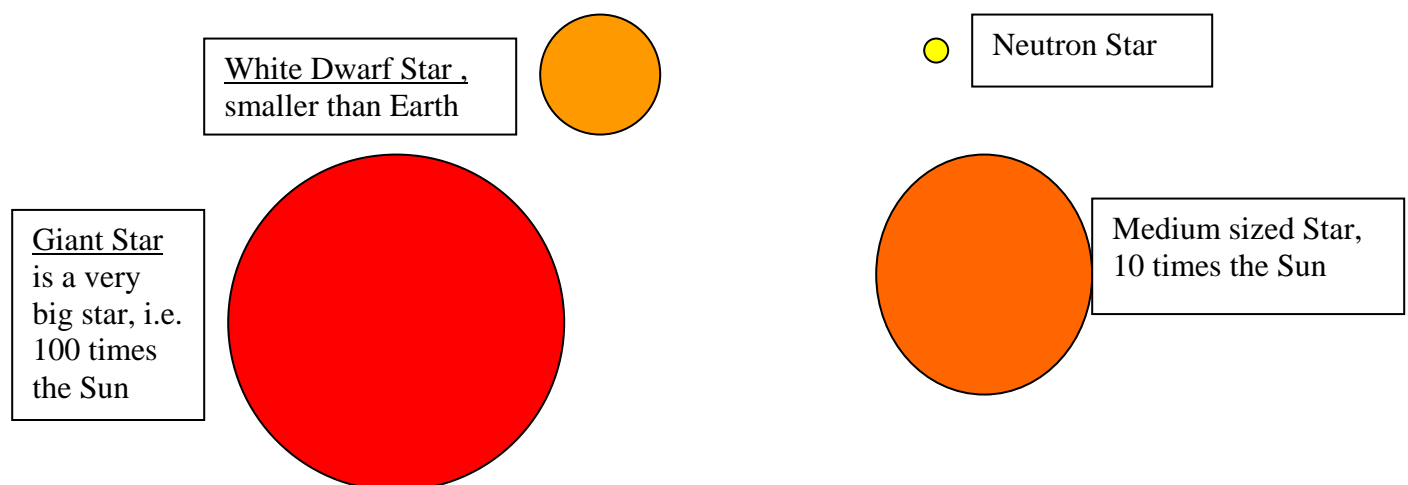
1. A star is a big ball of hot gases.
2. The gases are mostly hydrogen and helium.
3. A star emits light and heat which are generated by nuclear reactions.
4. A star is different from a planet because it can give off its own light.
5. The Sun actually one of the stars in the Universe. Its is the nearest star to the Earth. Its is stable, medium sized star formed about 4.6 billion years ago.

The Bright Stars in the Sky

1. Stars vary in brightness. The brightness of a star is affected by its distance from Earth.
2. The brightest star seen from the Earth is **Sirius**.
3. Sirius emits white light.
4. **Rigel** is another example of bright star. Rigel emits a bluish light.

The Various Types of Stars

1. We can classify stars using characteristics such as
 - a. Brightness surface
 - b. size
 - c. temperature and colour.
2. The brightness/colour of star depends on its size and temperature. The temperature of stars varies from 3000°C to 5000°C .
3. Stars with higher temperature are **blue**. Stars with lower temperature are **red**.



4. Astronomers found that there are four main group of stars, namely **white dwarf**, **neutron stars**, **giants** and **supergiants**.
5. Neutron stars are very dense, small stars.
6. White dwarfs are dim, compact stars.
7. Most stars are medium sized and stable. They neither contract and expand.
8. Ninety percent of all stars belong to this group, including the Sun.
9. Giant are large stars. Their diameters are 10 to 100 times that of the Sun. Supergiants are even larger than giants.

The Formation of Stars

1. Stars are formed within large clusters of dust and gases.
2. A star is born from a nebula.
3. These cloud of dust and gases are called **nebulae**.
4. The dust consists of solid such as iron and silicates.
5. The gases are mostly hydrogen and helium.
6. The formation of a star starts when a nebula is pulled into its core due to the force of gravity.

Gases and particles in the nebula are pulled by strong gravitational forces to form a lump.



Strong gravitational forces cause the lump of gases to shrink and is compressed until it becomes very compact to form a core.



The core becomes increasingly smaller and compact as a result of an increasing gravitational force,



When temperature and pressure in the core become very high, nuclear reaction occurs.



Hydrogen gas turned into helium. A lot of heat and light are released. The core shines and a star is born.

7. As the nebula collapses, it starts to spin.
8. The spinning clouds pull in more hydrogen gas over million of year.
9. Collisions occur between hydrogen atoms in the spinning nebula, producing heat.
10. When the temperature reaches 15000°C , nuclear fusion takes place in the core of the nebula.
11. Hydrogen atoms combine to form helium atoms, releasing a large amount of heat and light energy.

The Death of Stars

1. A star will die when all the hydrogen gas in its core is used up in nuclear reactions.
2. The lifespan of a star is determined by the original mass of the star.
3. A star with a big mass has a shorter lifespan compared to a star with a small mass.
4. example, star that are 50 times bigger than the Sun live for only a few million years. Star that are smaller than the Sun can live more than 10 billion years.
5. A die star will become either a white dwarf, neutron star or black hole when its dies, depending on its size as shown in figure 9.3, 9.4 and 9.5 respectively.

Nebulae → star medium size → red giant → planetary nebula → white dwarf Percubaan PMR 2010

Nebulae → star large → red supergiant → supernova → neutron star

Nebulae → star super-large → red supergiant → supernova → black hole

Draw figure 9.3, 9.4 and 9.5 page 186

The Galaxies

1. A galaxy is a group of stars held together by gravity.
2. There may be million or even billion of stars in a galaxy.
3. There are three main types of galaxies, depending on their shape.
4. They can be spiral, elliptical or irregular as shown below.

Draw photograph 9.5 page 187

Different types of galaxies

Spiral	elliptical	irregular
A spiral galaxy consists of a central group of stars with arms spiralling outwards.	An elliptical galaxy is shaped like a flattened sphere.	An irregular galaxy has no definite shape.

The Milky Way

1. The Milky Way has a spiral shape and contains about 200 billion stars.
2. Our Sun is one of the stars in the Milky Way.
3. Our **Solar System** consists of nine planets and their moons, orbiting around the Sun.
4. The Earth is the third planet from the Sun.

The Universe

1. The Universe consists of all matter, energy and space.
2. There are billions of galaxies in the Universe.

The end..... now you must practice....do the exercise...