

# The Sun: Geography Notes for UPSC Exam

The topic about the Sun will help the aspirants to know the basic concepts and make their foundation strong while preparing for the UPSC IAS Exam.

The sun is the source of heat and light and the midpoint and for the solar system. It is made up of enormously hot gas. It gives the pulling force that binds the solar system.

## Key facts about the Sun

- The Sun is by far the largest object in the solar system. It contains more than 99.8% of the total mass of the Solar System with only Jupiter having the remaining 1.2%.
- The Sun is personified in many mythologies: the Greeks called it Helios, Ancient Indian called it Surya, Romans called it Sol.
- The Sun is, at present, about 70% hydrogen and 28% helium by mass everything else amounts to less than 2%. This changes slowly over time as the Sun converts hydrogen to helium in its core.
- The outer layers of the Sun exhibit differential rotation: at the equator the surface rotates once every 25.4 days; near the poles it's as much as 36 days. This odd behavior is due to the fact that the Sun is not a solid body like the Earth. Similar effects are seen in the gas planets. The differential rotation extends considerably down into the interior of the Sun but the core of the Sun rotates as a solid body.
- Conditions at the Sun's core (approximately the inner 25% of its radius) are extreme. The temperature is 15.6 million Kelvin and the pressure is 250 billion atmospheres. At the center of the core the Sun's density is more than 150 times that of water.
- The surface of the Sun, called the photosphere, is at a temperature of about 5800 K. Sunspots are "cool" regions, only 3800 K (they look dark only by comparison with the surrounding regions). Sunspots can be very large, as much as 50,000 km in diameter. Sunspots are caused by complicated and not very well understood interactions with the Sun's magnetic field.
- The Sun's magnetic field is very strong (by terrestrial standards) and very complicated. Its magnetosphere (also known as the heliosphere) extends well beyond Pluto.
- The Sun's output is not entirely constant. Nor is the amount of sunspot activity. There was a period of very low sunspot activity in the latter half of the 17th century called the Maunder Minimum. It coincides with an abnormally cold period in northern Europe sometimes known as the Little Ice Age. Since the formation of the solar system the Sun's output has increased by about 40%.
- The Sun is about 4.5 billion years old. Since its birth it has used up about half of the hydrogen in its core. It will continue to radiate "peacefully" for another 5 billion years or so (although its luminosity will approximately double in that time). But eventually it will

run out of hydrogen fuel. It will then be forced into radical changes which, though commonplace by stellar standards, will result in the total destruction of the Earth.

## Characteristics of the Sun

The various characteristics of the Sun are given in the tables below:

<b>Orbital Characteristics</b>	
Mean distance from Earth	1 au $\approx$ $1.496 \times 10^8$ km 8 min 19 s at light speed
Visual brightness (V)	-26.74
Absolute magnitude	4.83
Spectral classification (G)	G2V
Metallicity Angular size	Z = 0.0122
Angular Size	31.6–32.7 minutes of arc

The physical characteristics of the Sun is highlighted below:

<b>Physical Characteristics</b>	
Equatorial radius	695,700 km 696,342 km 109 $\times$ Earth
Equatorial circumference	$4.379 \times 10^6$ km 109 $\times$ Earth
Flattening Surface area	$9 \times 10^{-6}$
Volume	$1.41 \times 10^{18}$ km <sup>3</sup> 1,300,000 $\times$ Earth
Mass	$1.9884 \times 10^{30}$ kg 333,000 $\times$ Earth
Average Density	1.408 g/cm <sup>3</sup> 0.255 $\times$ Earth
Center Density	162.2 g/cm <sup>3</sup> 12.4 $\times$ Earth

Temperature	Center (modeled): $1.57 \times 10^7 \text{K}$ Photosphere (effective): 5,772 K Corona: $\approx 5 \times 10^6 \text{K}$
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## Questions related to the Sun

### What is the composition of the Sun?

The Sun is a huge, glowing sphere of hot gas. Most of this gas is hydrogen (about 70%) and helium (about 28%). Carbon, nitrogen and oxygen make up 1.5% and the other 0.5% is made up of small amounts of many other elements such as neon, iron, silicon, magnesium and sulfur.

### How old is the Sun?

The Sun is one of 100 billion stars in our Milky Way galaxy. Scientists estimate that the Sun is about 4.5 billion years old, or approximately halfway through its life cycle.

### What is Inside the Sun?

The sun is a big ball of gas and plasma. Most of the gas — 91 percent — is hydrogen. It is converted into energy in the sun's core. The energy moves outward through the interior layers, into the sun's atmosphere, and is released into the solar system as heat and light.