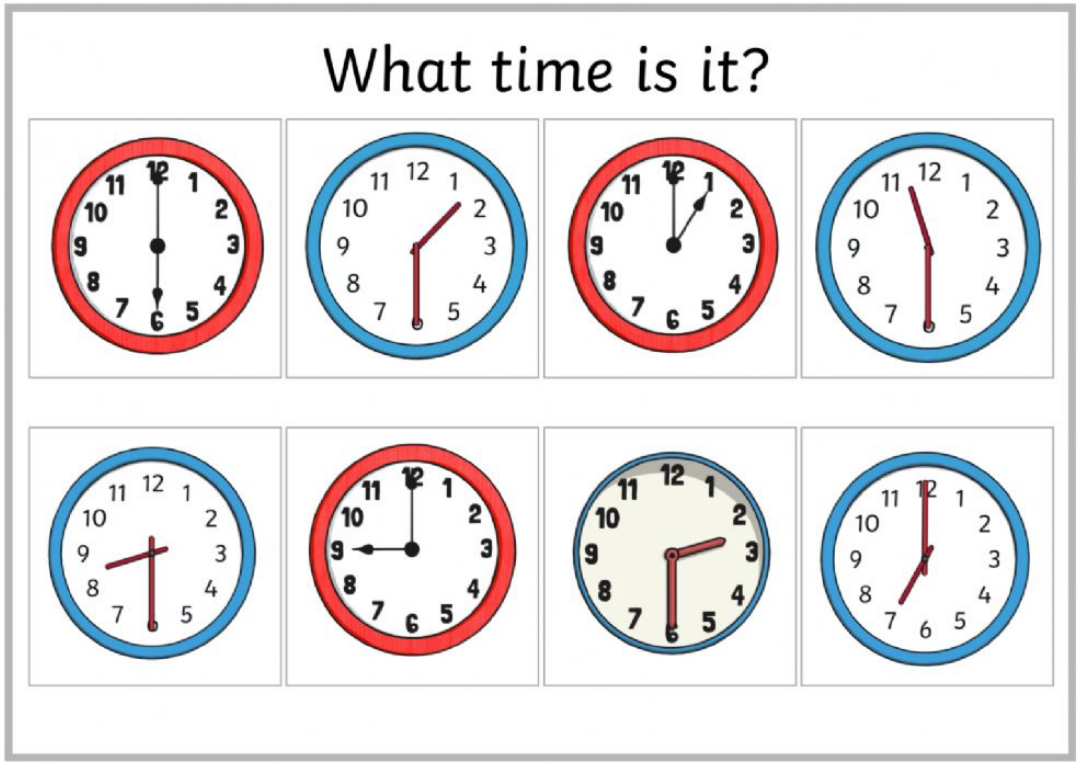
TIME, CLIMATE & CALENDAR

Collected by Ashit Sarkar - mostly from Google

We all so easily take for granted the above topics, usually without knowing their details, and still comfortably use them so regularly. Think back of ages ago, when all living beings were only aware that there were the regular periodic changing cycles with sunlight or its absence (for unknown reasons then) - that were called 'day' or 'night'. Even counting days or numbers, or for that matter measuring time or dates, were unknown or was very limited then! It took centuries or more to develop them and/or understand them by scientists and philosophers to work out and tell us the "how and why" on these topics, and in what way they affected all of us. This article attempts to explain them in some detail.

- **# Time is defined as the duration in which all things happen or a precise instant that something happens. Time is the basis to note events in the past, present, and future. We also use it to make comparisons and measure the speed at which things move. Local time implies the time of a place determined on the basis of the apparent movement of the sun. Standard time is the synchronization of clocks within a geographical area or region to a single time standard, set in a country by law.**
- **# A sundial was an early tool that was used to measure the local daylight time, typically involving a shadow cast across a marked surface. Galileo, around 400 years ago, discovered pendulums to accurately measure time. A pendulum is a free-swinging weight hanging from a pivot.**
- **# The pendulum clock remained the most accurate timekeeper until the 1930s.**
- **# The sundials, water clocks, mechanical clocks, pendulums & hourglasses that measure hours, minutes, and seconds have since been improved for more accuracy with the invention of quartz oscillators, digital displays, and atomic clocks of today.**
- **# US's NIST-F2 is the ultraprecise atomic clock to maintain the perfect time for 300 million years.**
- **# Different parts of the world are located in different time zones. This means that while you are having breakfast in the morning, someone in another part of the world is having dinner.**
- **# Some use Daylight Saving Time (DST) by setting the clocks forward one hour from standard time during the summer months, and back again in the fall, in order to make better use of natural daylight. About 70 countries utilize DST in at least a part of the country. DST doesn't operate in India (only a single time zone applies across the whole of India now, earlier we used to have two time zones, Bombay Time and Calcutta Time, first established in 1884 during the British Raj). Indian Standard Time (IST) is 5.5 hrs ahead of Greenwich Mean Time (GMT) used by the UK during their summer.**

- # The polar night occurs in the northernmost and southernmost regions of the Earth when the night lasts for more than 24 hours. The opposite phenomenon, the polar day, or midnight sun, occurs when the Sun stays above the horizon for more than 24 hours. This occurs only inside the polar circles. The earth is tilted on its axis, because of which very poor sunlight is allowed to reach the north and south poles. When the north pole is tilted towards the sun it experiences continuous daylight for six months and when the pole is tilted on the other side, it experiences continuous night for six months.
- # Normal years have 365 days but a Leap year has 366. The Earth takes 365 days, 5 hrs, 48 mins, and 45 seconds to go around the Sun so we add an extra day in February every four years (but not for century years unless divisible by 400) to keep calendars/seasons aligned.
- # There are 60 seconds in a minute, 60 minutes in an hour, and 24 hours in a day.
- # 10 years is known as a decade, 100 years as a century, and 1000 years as a millennium.
- # Milliseconds, microseconds, and nanoseconds are examples of very small units of time.



Initial belief that the earth was flat and stationary was first found to be untrue, that we now know for sure. The earliest traces of a counter-intuitive idea that it is the Earth that is actually moving and the Sun is at the center of the solar system (heliocentrism) is found in several Vedic Sanskrit texts written in ancient India. Yajnavalkya (c. 9th-8th century BC) recognized that the Earth is spherical and believed that the Sun was "the center of the spheres" as described in the Vedas at the time "The Sun never sets nor rises. When people think the sun is setting, it is not so; they are mistaken. It only changes about after reaching the end of the day and makes night below and day to what is on the other side." This is one of the first recorded references to the sun as the center, before the early Greek philosophers, who later noted the spherical Earth. Pythagoras (6th century BC) was among those said to have originated the idea. It was Copernicus, who rightly

observed (1543) that the planets revolve around the Sun, and Kepler (1609) who correctly defined their orbits.

The rotating Earth goes around the Sun once every Earth year. This spinning movement is called the Earth's rotation. At the same time that the Earth spins on its axis, it also orbits or revolves around the Sun. As the Earth rotates on its axis, we have day and night. The side of the Earth-facing the Sun is bathed in light and heat (daytime). The side of the Earth- facing away from the Sun, out towards space, is darker and colder (night time). As schoolchildren, we had learned that the earth is moving about our sun in a very nearly circular orbit. It covers this route at a speed of nearly 30 km per second or 67,000 miles per hour. The Sun, too, moves in a circular orbit around the center of the Milky Way galaxy, traveling at about 220 km per second (137 miles per second). Even at that high speed, it takes the Sun 230 million years to complete one revolution of the galactic center.

On Earth, a solar day is around 24 hours. Another way to measure a day is to count the amount of time it takes for a planet to completely spin around and make one full rotation. This is called a sidereal day. On Earth, a sidereal day is almost exactly 23 hrs and 56 mins. The solar year is 365 days 5 hrs 48 mins 46 seconds, also called tropical year, or year of the seasons, and is the time between two successive occurrences of the vernal equinox (the moment when the Sun apparently crosses the celestial equator moving north).

We can't feel Earth rotating because we're all moving with it, at the same constant speed, and the gravity holds us. Earth spins on its axis once every 23 hrs and 56 mins day, as mentioned above. It's because you and everything else - including Earth's oceans and atmosphere - are spinning along with the Earth at the same constant speed.

The Earth is round. So, the sun's rays fall unevenly on the Earth's surface. The polar regions are at an angle where there is little or no sunlight. Result: Extreme cold winters. The sun's rays fall directly on regions near the equator. Result: Very warm, almost no winters. The difference in temperature makes the air and water move in currents. Warm air rises, creating space for more air beneath, while cool air settles down.

The most important factor contributing to Earth's climate change is the angle at which the earth is tilted from the vertical, also known as Earth's obliquity. The current tilt angle is approximately 23.5 degrees. The axial tilt angle affects climate largely by determining which parts of the earth get more sunlight whilst going around the sun during different stages of the year. This is the primary cause for the different season's that Earth experiences throughout the year and the differing lengths of the days and nights, the intensity of the seasons for higher latitudes, and the differing periods for summer & winter in the Northern & Southern hemispheres. For example, if there were no axial tilt, i.e. Earth's obliquity would be zero degrees, then there would be no change in the seasons or the lengths of days/nights during any year. This would be because there would be no difference in the amount of solar irradiation received, year-round, anywhere on Earth.

The moon revolves around the Earth the way the Earth revolves around the sun. It takes approximately 27 days to complete a full orbit around the Earth and appears to go down or up depending on the Earth's rotation. The moon also

influences life as we know it on Earth. It influences our oceans, weather, and the hours in our days. Without the moon, tides would fall, nights would be darker, seasons would change, and the length of our days would alter. A lunar eclipse occurs when the Moon passes through the Earth's shadow and similarly, a solar eclipse occurs when part of the Earth passes through the Moon's shadow.

Counting System: The Babylonians got their number system from the Sumerians, the first people in the world to develop 4,000 to 5,000 years ago, the Sumerian system was positional, the value of a symbol depended on its position relative to other symbols. The 12-hour clock can be traced back as far as Mesopotamia and ancient Egypt. Both an Egyptian sundial for daytime use and an Egyptian water clock for night-time use were found in the tomb of Pharaoh Amenhotep - dating to c. 1500 BC, these clocks divided their respective times of use into 12 hours each.

Archaeologists have reconstructed methods of timekeeping that go back to prehistoric times. In the 11th century in Persia, a calendar reform led by Khayyam was announced in 1079, when the length of the year was measured as 365.24219858156 days. The natural day-and-night division of a calendar day forms the fundamental basis as to why each day is split into two cycles. Originally there were two cycles: one cycle which could be tracked by the position of the Sun (day), followed by one cycle which could be tracked by the Moon and stars (night). This eventually evolved into the two 12-hour periods which are used today, starting at midnight (a.m.) and noon (p.m.). Noon itself is rarely abbreviated today.

The Chinese calendar's origins can be traced as far back as the 14th century BC. It is believed that Emperor Huangdi had introduced the current form of the calendar around 2637 BC. Scientists believe the moon was used as a form of the calendar as far back as 6000 years ago. Calendars have been changing ever since and are very accurate in modern times.

The Egyptians were probably the first to adopt a mainly solar calendar. This so-called 'heliacal rising' always preceded the flood by a few days. Based on this knowledge, they devised a 365-day calendar that seems to have begun in 4236 B.C. - the earliest recorded year in history.

In 1582, when Pope Gregory XIII introduced his Gregorian calendar, Europe adhered to the Julian calendar, first implemented by Julius Caesar in 46 B.C. The Roman emperor's system miscalculated the length of the solar year by 11 minutes, the calendar had since fallen out of sync with the seasons. The Gregorian calendar is more accurate than the Julian because it still had a leap year every four years, except for years that are divisible by 100, and unless that year is divisible by 400 (so 2000 was a leap year, but 2100 will not be). Of course, nothing is perfect, and the Gregorian calendar is no exception: in 4909, it will be a full day ahead, if no further correction is made!

The majority of countries in the world use the Gregorian calendar as their sole civil calendar. Countries that do not use the Gregorian calendar include Afghanistan and Iran (which use the *Solar Hijri* calendar), Ethiopia (Ethiopian calendar), and Nepal (*Vikram Samvat*).

Iran and Afghanistan have the *Solar Hijri* calendar, which is one of the world's most accurate calendar systems. It is also known as Persian Calendar, Iranian

Calendar, and SH Calendar. It is based on astronomical observations of the Earth's movements around the Sun. A year in the *Solar Hijri* calendar is divided into 12 months of varying lengths. The first 6 months have 31 days, and months 7 to 11 have 30 days. The last month, *Esfand* has 29 days in a common year and 30 days in a leap year.

A year in the Ethiopian calendar is 13 months long, with 12 months of 30 days each. The last month has 5 days in a common year and 6 days during a leap year. Like in the Julian calendar, a leap year in the Ethiopian calendar happens every 4 years without exception.

***Vikram Samvat* calendar (named after the Indian Emperor) is the official calendar of Nepal that follows the historical Hindu calendar because of the family marriage between Indian Emperor Vikramaditya & Nepali Lichchhavi kings. In India, the Gregorian calendar is the official calendar, used with the Hindu calendar, called *Panchanga*, which is an ancient time reckoning system used for, among other things, determining the dates of Hindu festivals. It is a lunisolar calendar (a lunisolar calendar is a calendar in many cultures whose date indicates both the Moon phase and the time of the solar year) with many regional variations. One of the most striking features of the Hindu calendar system is its intricacy. It offers a multi-dimensional method of structuring time, combining information about lunar days, solar days, lunar months, solar months, the movements of the Sun, and the Moon in relation to stellar constellations, and other astronomically defined time spans, and also the auspicious/inauspicious days and times. This makes the Hindu calendar vastly more complex than the western calendar, which is built around only two basic units of time: solar days and solar years. The Buddhists around the world also similarly use the Hindu lunisolar calendar system to determine the dates of their religious holidays.**

During the past century, human activities have released very large amounts of increasing carbon dioxide and other greenhouse gases into the atmosphere, severely affecting the climate. Most of the gases come from using fossil fuels to produce energy. Greenhouse gases are like a blanket around the Earth, trapping energy in the atmosphere and causing global warming. The greenhouse effect results in sea level rising with devastating effects on coastal habitats farther inland, and agricultural soil contamination with salt, and lost habitat for humans, fish, birds, and plants. While climate change cannot be stopped, it can be certainly be slowed by using alternative energy sources, observing healthy ecosystems, by maintaining our soil, and recycling nutrients. These are the ESSENTIAL foundations for all civilizations and to sustain our economies. Unless everyone is consciously making an effort, the future of our lovely planet is doomed.

Simple, is it not?? It is hoped that there is something useful for you...