
DAYTIME AND NIGHTTIME
IN ŻYRARDÓW

DEFINITIONS

- Daytime is the time between the sunrise and sunset, that is between the moment when the upper edge of the sun's disk becomes visible above the horizon and the moment when it disappears below the horizon.
- Nighttime is the time between the sunset and sunrise defined as above.

WHAT DETERMINES THE DAY LENGTH

- Latitude
- Date

Given that Earth's own axis of rotation is tilted about 23.4° to the line perpendicular to its orbital plane, the length of daytime varies with the seasons on the planet's surface, depending on the observer's latitude. Areas tilted toward the Sun are experiencing summer. Their tilt toward the Sun leads to more than half of the day seeing daylight. The further you are from the equator, the longer a day will be in summer and the shorter it will be in winter.

HOW DOES DAYTIME VARY FROM ONE DAY TO THE NEXT?

In the northern hemisphere days are longest at the time of the summer solstice (when the Earth's north pole has its maximum tilt toward the Sun) in June and the shortest at the winter solstice (when the Earth's south pole has its maximum tilt toward the Sun) in December. At the two equinoxes (the time or date at which the sun crosses the celestial equator) in March and September the length of the day is about 12 hours.

DATES OF SOLSTICES AND EQUINOXES

- The solstices always occur between June 20 and 22 and between December 20 and 23 with the 21st and 22nd being the most common dates.
- The September equinox is on or around September 22, while the first equinox of the year, the March Equinox, takes place on or around March 21 every year.
- The dates vary because of the difference between how the Gregorian calendar defines a year (365 days) and the time it actually takes for Earth to complete its orbit around the Sun (about 365 and 1/4 days).

DAYTIME AND NIGHTTIME IN ŻYRARDÓW (LATITUDE 52°02’55”N)

DATE	SUNRISE	SUNSET	DAYTIME
Sept. 24, 2018	6.27	18.32	12h05m11s
Sept. 25, 2018	6.28	18.30	12h01m12s
Sept. 26, 2018	6.30	18.27	11h57m12s
Dec. 21, 2018	7.44	15.28	7h44m04s
Dec. 22, 2018	7.44	15.28	7h44m04s
Dec. 23, 2018	7.45	15.29	7h44m11s
March 17, 2019	5.48	17.45	11h56m37s
March 18, 2019	5.45	17.46	12h00m40s
March 19, 2019	5.43	17.48	12h04m43s
June 20, 2019	4.17	21.02	16h44m.30s
June 21, 2019	4.17	21.02	16h44m35s
June 22, 2019	4.17	21.02	16h44m33s

CHARACTERISTIC DAYS FOR ŻYRARDÓW IN THE SCHOOL YEAR 2018/2019

- The longest day: June 21, 2019 (16h44m35s)
- The shortest day: Dec. 21 and 22, 2019 (7h44m04s)
- Day almost the same as night: Sept. 25, 2019 (12h01m12) and March 18, 2019 (12h00m40s)
- Autumn equinox: Sept. 23, 2018 (12h09m10s)
- Spring equinox: March 20, 2019 (12h08m46s)

As you can see, the dates of the daytimes whose lengths are the closest to 12 hours in Żyrardów do not coincide with the dates of the equinoxes.

WHY DAYTIME CLOSEST TO 12 HOURS DOES NOT HAPPEN ON EQUINOX?

Equinoxes are not day-long events. They mark the exact moment twice a year when the Earth's axis is not tilted toward or away from the Sun at all. However, the axial tilt of around 23.4 degrees, remains the same. So, even if day and night aren’t exactly equal on the day of the equinox, there are days when day and night are both very close to 12 hours. Locations that are not on the equator do get to experience equal day and night twice a year, usually a few days before or after the equinoxes. This date depends on the latitude, and can vary by as much as several weeks from place to place.

WHY DAY AND NIGHT ARE NOT EXACTLY EQUAL ON EQUINOX?

This is because of two reasons: the way sunrise and sunset are defined and atmospheric refraction of sunlight.

DIFFERENCE IN DEFINITIONS

On the equinoxes, the geometric centre of the sun is above the horizon for 12 hours. However, ‘sunrise’ is defined as the moment the upper edge of the sun's disk becomes visible above the horizon – not when the centre of the sun is visible. In the same sense, ‘sunset’ refers to the moment the Sun's upper edge, not the centre, disappears below the horizon. The time it takes for the sun to fully rise and set, which is several minutes, is added to the day and subtracted from the night, and therefore the equinox day lasts a little longer than 12 hours.

ATMOSPHERIC REFRACTION

Atmospheric refraction, or bending of the light, causes the Sun's upper edge to be visible from Earth several minutes before the edge actually reaches the horizon. The same thing happens at sunset, when you can see the sun for several minutes after it has actually dipped under the horizon. This causes every day on Earth – including the days of the equinoxes – to be at least 6 minutes longer than it would have been without this refraction.

The extent of refraction depends on atmospheric pressure and temperature. The calculations in the Sunrise and Sunset Calculator assume the standard atmospheric pressure of 101.325 kPa and temperature of 15° C.

MEASUREMENTS

We planned to check the differences between the calculated times of sunsets and sunrises in Żyrardów shown in the table in this presentation and the real ones, at least on the four characteristic days, but we failed, due to the fact that we didn’t manage to find a place where the sunrise or sunset can be seen on a naked horizon, so we were not able to measure the exact time when the Sun's upper edge appears above the horizon or disappears below it.

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