

STCE's Number Puzzle – Solution and answers

1	2	3	4	5	6	7	8	9	10	11			
				1				-		1			
	3			3	2	8		3	1	5	7		
	4	9	9	,	0	0	4	7	8	3	8	4	seconds
	3	3			1	6	8	2		8			
	,	,			4								
	8	3											
		7											

The time of 499,00478384 seconds represents the astronomical unit divided by the speed of light, so it's basically the time needed by light (or any other electromagnetic radiation such as soft x-rays or solar radio emission) to cover the Sun-Earth distance when Earth is at exactly 149.597.870,7 km from the Sun. [Source: The Yearbook 2023 of the ROB - <https://www.astro.oma.be/en/information/publications/the-yearbook/> - pages 20-21]

Q-1 – Expressed in million kilometers, what has been the closest distance between Solar Orbiter and the Sun so far?

A-1 – On 12-13 October 2022, Solar Orbiter came as close as 0.293 astronomical units (AU) or 43.8 million kilometers to the Sun [Source – Space Weather JHelioViewer - http://swhv.oma.be/user_manual/] . Note that a value of 43.4 million kilometers, i.e. 29% of 1 AU, is fine too [ESA - <https://www.cosmos.esa.int/web/solar-orbiter>].

Q-2 – The USET telescopes (<https://www.sidc.be/uset/>) at the Royal Observatory of Belgium (ROB) observe the Sun in white light, H-alpha (in the red portion of the solar spectrum), and in Ca II K (in the blue portion of the solar spectrum). What is the wavelength (in nm) corresponding to the Ca II K line?

A-2 – The Ca II K telescope of the ROB/USET observed the Sun at a wavelength of 393,37 nm. [Source – USET information leaflet - <https://www.sidc.be/uset/telescopecaiik.php>]

Q-3 – For which Kp level do PECASUS operators (see Kauristie et al. 2021 - <https://www.mdpi.com/2072-4292/13/18/3685>) issue a “Severe HF COM” advisory for auroral absorption to civil aviation (ICAO)?

A-3 – PECASUS operators issue a “Severe HF COM” advisory for auroral absorption when Kp reaches 9 (extremely severe geomagnetic storm). [Source: Kauristie et al. 2021 - <https://www.mdpi.com/2072-4292/13/18/3685> - Table 1]

Q-4 – What is the NOAA number of the largest sunspot group that has appeared so far during Solar Cycle 25 (SC25) according to the NOAA/USAF network?

A-4 – Active region NOAA 13014 reached an area of 1190 MH or about 7 times the Earth’s surface area on 21 May 2022. [Solar Cycle Science - <http://solarcyclescience.com/activerregions.html>]

Q-5 – What is the highest daily sunspot number (final or provisional) recorded by SILSO (<https://www.sidc.be/silso/>) so far this solar cycle (SC25)?

A-5 – The highest daily sunspot number reported so far by SILSO for SC25 is 206 (provisional ISN) on 19 January 2023.

Q-6 – What is the total number of spotless days that were recorded by SILSO (<https://www.sidc.be/silso/>) during the transition from solar cycle 24 to the current solar cycle 25?

A-6 – There were a total of 848 days without a sunspot as reported by SILSO / Spotless Days page (<https://www.sidc.be/silso/spotless>).

Q-7 – There have been 15 X-class flares so far this solar cycle. What was the longest duration (in minutes) reached by any of these X-class events?

A-7 – The X2.2 flare on 17 February 2023 was produced by NOAA 13229 and lasted 72 minutes (see e.g. the STCE newsitem at <https://www.stce.be/news/629/welcome.html>).

Q-8 – What was the number of Starlink satellites that got destroyed early February 2022 following geomagnetic disturbances during the check-out procedure in their stand-by orbit?

A-8 – In the end, 38 Starlink satellites re-entered the Earth’s atmosphere (see the STCE newsitem at <https://www.stce.be/news/573/welcome.html>).

Q-9 – Dst-wise, what is the (preliminary) value in nT for the strongest geomagnetic storm recorded so far during SC25?

A-9 – The Disturbance storm-time (Dst) index reached a preliminary value of -138 nT during the strong geomagnetic storm of 27 February 2023 (see the STCE newsitem at

<https://www.stce.be/news/631/welcome.html> and the Kyoto WDC for Geomagnetism at https://wdc.kugi.kyoto-u.ac.jp/dst_realtime/).

Q-10 – What was the maximum proton flux (energies greater than 10 MeV) in pfu observed by GOES during the strongest proton event so far this solar cycle?

A-10 – GOES recorded a maximum proton flux (energies greater than 10 MeV) of 58 pfu on 26 February 2023. The proton event was associated with a n M6 flare that took place the previous day (see the STCE newsitem at <https://www.stce.be/news/631/welcome.html>).

Q-11 – What is the wavelength (in Angstrom) in which the PROBA2/SWAP instrument takes its solar EUV images?

A-11 – SWAP takes solar EUV images at a wavelength of 17.4 nm or 174 Angstrom (see the PROBA2 webpage at <https://proba2.sidc.be/about/sciencePayload>).