

Prepared by:
144000teachers.org
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Time Calculation

Greenwich (GMT) or
Universal Time Coordinated (UTC)



“Let nothing be done through strife or vainglory; but in lowliness of mind let each esteem other better than themselves.”
Philippians 2:3.

“Come now, and let us reason together, saith the LORD.”
Isaiah 1:18.

I. Time Calculation – A Brief History Greenwich Mean Time (GMT)

“The Royal Observatory Greenwich is the home of Greenwich Mean Time (GMT). But what is GMT and why is it so important? What does GMT mean?”

Greenwich Mean Time is the yearly average (or ‘mean’) of the time each day when the Sun crosses the Prime Meridian at the Royal Observatory Greenwich. Essentially, mean time is clock time rather than solar (astronomical) time. Solar time varies throughout the year, as the time interval between the Sun crossing a set meridian line changes.

But each day measured by a clock has the same length, equal to the average (mean) length of a solar day. It is a way of standardizing and regularizing time so we can all know exactly what time it is for our (or anyone’s) location. Today GMT is reckoned from one midnight to the next.

How did Greenwich Mean Time begin?

It was not until the invention of the pendulum clock in the 1650s that it was possible to work out the relationship between mean (clock) time and solar time. John Flamsteed came up with the formula for converting solar time to mean time, and published a set of conversion tables in the early 1670s. Soon after, he was appointed as the first Astronomer Royal and moved into the new Royal Observatory in Greenwich. Here he had the best pendulum clocks installed and set them to the local time. This was Greenwich Mean Time, or the average time when the Sun crossed the meridian at Greenwich. At first though, Greenwich time was only really important to astronomers.”

<https://www.rmg.co.uk/stories/topics/greenwich-mean-time-gmt>



I. Time Calculation – A Brief Lesson

Lines of Longitude – Prime Meridian – Lines of Latitude

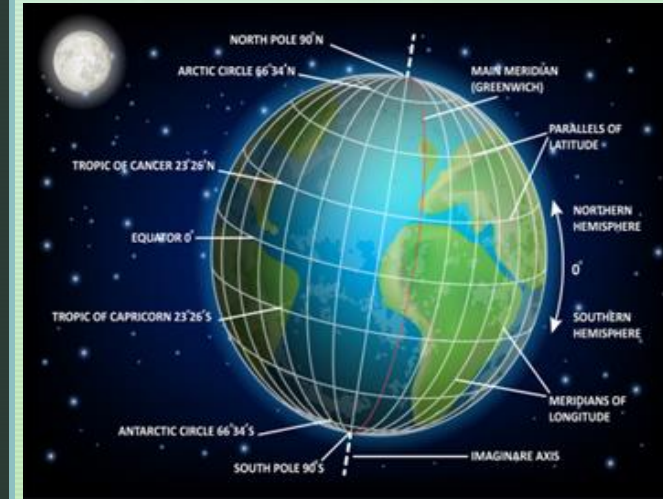
“The *Prime Meridian* is an *imaginary* line on a map of Earth. It is the starting point for the measuring system called longitude. Longitude is a system of *imaginary* north-south lines called meridians. The Earth is a spinning sphere, or ball. The center of the spin is a line called the Earth’s axis. The axis meets the Earth’s surface at two points – the North Pole and the South Pole. Each meridian runs between the North Pole and the South Pole.

Meridians are used to measure distance in degrees east or west from the prime meridian. The prime meridian is 0° longitude. The 180th meridian is the line of longitude that is exactly opposite the prime meridian. It is 180° longitude. Lines of longitude east of the prime meridian are numbered from 1 to 179 east (E). Lines of longitude west of the prime meridian are numbered from 1 to 179 west (W).

Other lines on a globe are called *Lines of Latitude*. They are used to describe positions north or south of the Equator. The Equator is half way between the North Pole and the South Pole. Lines of latitude circle the Earth parallel to the Equator. For this reason they are also called parallels. The distance between each parallel is also measured in degrees.

Together, the lines of latitude and longitude can describe the location of any place on Earth. For example, the city of Paris, France is located at 48.8566 degrees North and 2.3522 degrees East. Sydney Harbor in Australia is 33.8523 degrees South and 151.2108 degrees East.”

<https://www.britannica.com/video/196698/Lines-latitude-longitude-position-place-Earth>



Prime Meridian - Greenwich

I. Time Calculation – A Brief History Greenwich – Longitude

Greenwich (GMT) and the quest for longitude

“In the 1700s, the fifth Astronomer Royal Nevil Maskelyne brought Greenwich Mean Time to a wider audience. In 1767 Maskelyne introduced the Nautical Almanac as part of the great 18th century quest to determine longitude. These were tables of ‘lunar distance’ data based on observations at Greenwich and using GMT as the time standard. This data enabled navigators to find their position at sea. GMT was also crucial to the other great solution to the ‘longitude problem’, represented by [John Harrison’s famous timekeepers](#). By the mid-1850s, almost all public clocks in Britain were set to Greenwich Mean Time and it finally became Britain’s legal standard time in 1880.

In 1884 the Greenwich Meridian was recommended as the Prime Meridian of the World. There were two main reasons for this. The first was that the USA had already chosen Greenwich as the basis for its own national time zone system. The second was that in the late 19th century, 72% of the world’s commerce depended on sea-charts which used Greenwich as the Prime Meridian. The recommendation was based on the argument that naming Greenwich as Longitude 0° would be of advantage to the largest number of people.

The Prime Meridian at Greenwich therefore became the centre of world time and the basis for the global system of time zones. The Airy Transit Circle (telescope) became the telescope that would define the Prime Meridian of the World. Astronomer Royal George Biddell Airy designed it, and it is located at the Royal Observatory Greenwich. It was recommended that the meridian line would indicate 0° longitude. Therefore this also became the start of the Universal Day.” <https://www.rmg.co.uk/stories/topics/greenwich-mean-time-gmt>



I. Time Calculation – A Brief History Greenwich – Shepherd Gate Clock

“The Shepherd gate clock can be seen at the gates to the Royal Observatory. It was the first clock ever to show Greenwich Mean Time directly to the public. It is a 'slave' clock, connected to the Shepherd master clock which was installed at the Royal Observatory in 1852.

From that time until 1893, the Shepherd master clock was the heart of Britain's time system. Its time was sent by telegraph wires to London, Edinburgh, Glasgow, Dublin, Belfast and many other cities. By 1866, time signals were also sent from the clock to Harvard University in Cambridge, Massachusetts via the new transatlantic submarine cable.

In terms of the distribution of accurate time into everyday life, it is one of the most important clocks ever made.

The first thing you notice about the clock is that it has 24 hours on its face rather than the usual 12. That means at 12 noon the hour hand is pointing straight down rather than straight up.

The clock originally indicated astronomical time, in which the counting of the 24 hours of each day starts at noon. The clock was changed in the 20th century to indicate Greenwich Mean Time, in which the counting of the 24 hours of each day starts at midnight. It continues to show Greenwich Mean Time and is not adjusted for British Summer Time.” <https://www.rmg.co.uk/stories/topics/greenwich-mean-time-gmt>



II. Time Calculation – A Brief Lesson of Chemistry and History

Universal Time Coordinated – UTC – Caesium or Cesium Clock

Earth's Rotation Defines the Length of Day

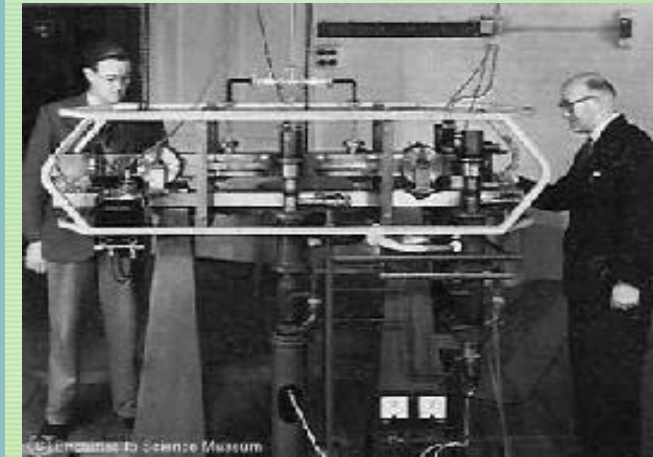
“Modern timekeeping defines a day as the sum of 24 hours—but that is not entirely correct. The Earth's rotation is not constant, so in terms of solar time, most days are a little longer or shorter than that. The Moon is—very gradually—slowing the Earth's rotation because of friction produced by tides. Over the course of a century, the length of a day increases by a couple of milliseconds (where 1 millisecond equals 0.001 seconds). Within this general trend, however, there is fluctuation: sometimes the Earth spins a bit faster, sometimes a bit slower. Recently, our planet has been speeding up a little, making for slightly shorter days.” <https://www.timeanddate.com/time/earth-rotation.html>

A More Accurate Way to Calculate Time: Atomic Clock – Caesium or Cesium – 1955

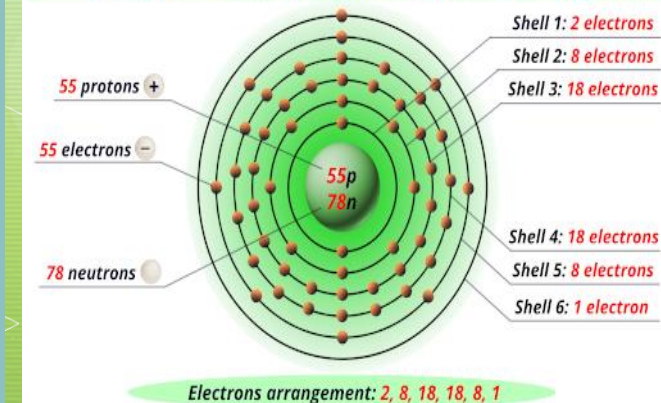
“A "cesium(-beam) atomic clock" (or "cesium-beam frequency standard") is a device that uses as a reference the exact frequency of the microwave spectral line emitted by atoms of the metallic element cesium, in particular its isotope of atomic weight 133 ("Cs-133"). The integral of frequency is time, so this frequency, 9,192,631,770 hertz (Hz = cycles/second), provides the fundamental unit of time, which may thus be measured by cesium clocks.

Today, cesium clocks measure frequency with an accuracy of from 2 to 3 parts in 10 to the 14th or (2×10^{14}) i.e. 0.0002 Hz; this corresponds to a time measurement accuracy of 2 nanoseconds per day or one second in 1.4 millions years. It is the most accurate realization of a unit that mankind has yet achieved. A cesium clock operates by exposing cesium atoms to microwaves until they vibrate at one of their resonant frequencies and then counting the corresponding cycles as a measure of time.”

<http://gisweb.massey.ac.nz/topic/webreferencesites/gps/usnavy/cesium.html#:~:text=Today%2C%20cesium%20clocks%20measure%20frequency,that%20mankind%20has%20yet%20achieved.>



Caesium: Protons-55, Neutrons-78, Electrons-55



III. Time Calculation – Replacement of Method to Calculate Time Greenwich Time (GMT) to Coordinated Universal Time (UTC)

From Greenwich Mean Time to Coordinated Universal Time

“Coordinated Universal Time (UTC) replaced Greenwich Mean Time (GMT) as the World Standard for time in 1972. UTC is based on atomic measurements, while GMT is based on Earth's rotation.

Greenwich Mean Time (GMT) is still the standard time for the Prime Meridian (Zero Longitude) and civil time in UK when Daylight Saving Time is not in use.

At the 1884 International Meridian Conference held in Washington, DC, USA, local mean solar time at the Royal Observatory, Greenwich in England was chosen to define the Universal Day. It started down from 0 hours at mean midnight. This agreed with civil Greenwich Mean Time (GMT), used in Great Britain since 1847.

In contrast, astronomical GMT began at mean noon, 12 hours after mean midnight of the same date until 1 January 1925, whereas nautical GMT began at mean noon, 12 hours before mean midnight of the same date, at least until 1805 in the British Navy. It persisted much longer elsewhere because it was mentioned at the 1884 conference. In 1884 the Greenwich Meridian was used for two-thirds of all charts and maps as their Prime Meridian.

In 1928, the term Universal Time (UT) was introduced by the International Astronomical Union (IAU) to refer to GMT with the day starting at midnight. Until the 1950s, broadcast time signals were based on UT, and hence on the rotation of the Earth.”

<https://greenwichmeantime.com/articles/history/utc/>



III. Time Calculation – Today Universal Time Coordinated – UTC – Caesium or Cesium Atomic Clock

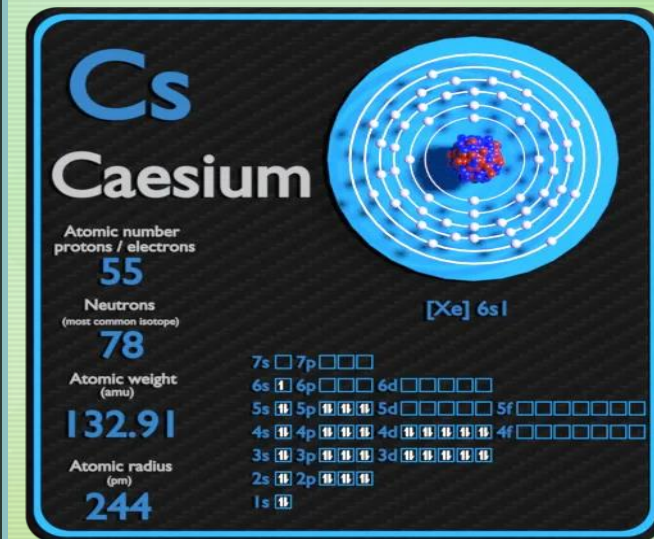
A More Accurate Way to Calculate Time: Atomic Clock – Caesium or Cesium

“The frequency involved is that of the energy absorbed from the incident photons when they excite the outermost electron in a cesium atom to jump ("transition") from a lower to a higher orbit.

According to quantum theory, atoms can only exist in certain discrete ("quantized") energy states depending on what orbits about their nuclei are occupied by their electrons. Different transitions are possible; those in question refer to a change in the electron and nuclear spin ("hyperfine") energy level of the lowest set of orbits called the "ground state." Cesium is the best choice of atom for such a measurement because all of its 55 electrons but the outermost are confined to orbits in stable shells of electromagnetic force. Thus, the outermost electron is not disturbed much by the others. The cesium atoms are kept in a very good vacuum of about 10 trillionths of an atmosphere so that the cesium atoms are little affected by other particles. All this means that they radiate in a narrow spectral line whose wavelength or frequency can be accurately determined.

The U.S. Naval Observatory operates about 70 such cesium clocks, as well as other precision clocks like hydrogen masers, in 18 vaults whose temperature and, usually, humidity are closely controlled in order to minimize perturbations by their environment. The time measurements are made by devices called time-interval counters that compare each clock's time against that one "Master Clock," whose frequency is steered to match its time to the average of the other clocks. This time is the Observatory's measure of the atomic time called Coordinated Universal Time (UTC). Some cesium clocks are transported to remote locations in order to synchronize other clocks.”

<http://qisweb.massey.ac.nz/topic/webreferencesites/gps/usnavy/cesium.html#:~:text=Today%2C%20cesium%20clocks%20measure%20frequency,that%20man%20kind%20has%20yet%20achieved.>



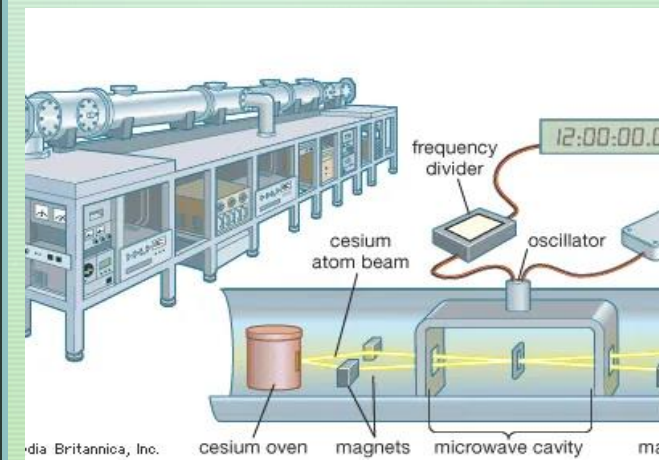
III. Time Calculation – The Atomic Clock Greenwich Time (GMT) to Coordinated Universal Time (UTC)

“Atomic clocks are type of clock that uses certain resonance frequencies of atoms (usually cesium or rubidium) to keep time with extreme accuracy. The electronic components of atomic clocks are regulated by the frequency of the microwave electromagnetic radiation.

Only when this radiation is maintained at a highly specific frequency will it induce the quantum transition (energy change) of the cesium or rubidium atoms. In an atomic clock these quantum transitions are observed and maintained in a feedback loop that trims the frequency of the electromagnetic radiation; like the recurrent events in other types of clocks, these waves are then counted.

In 1967, the 13th General Conference on Weights and Measures redefined the second, the unit of time in the International System of Units, in terms of the cesium standard so as to equal the second of: Ephemeris Time. The conference defined the second as “the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium – 133 – atom.”

<https://www.britannica.com/technology/atomic-clock>



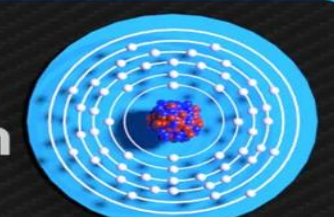
Cs Caesium

Atomic number
protons / electrons
55

Neutrons
(most common isotope)
78

Atomic weight
(amu)
132.91

Atomic radius
(pm)
244



[Xe] 6s¹

7s 7p

6s 6p 6d

5s 5p 5d

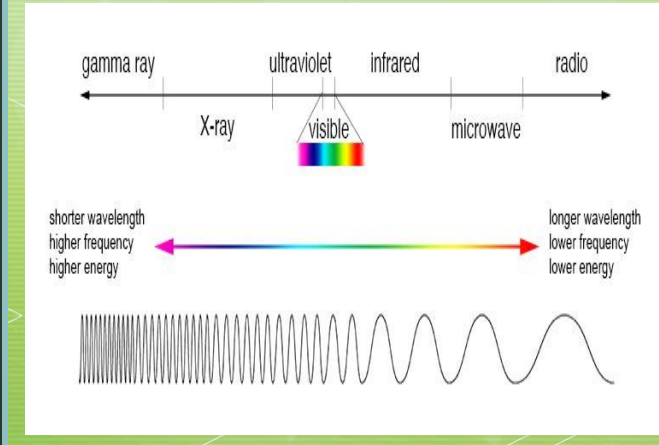
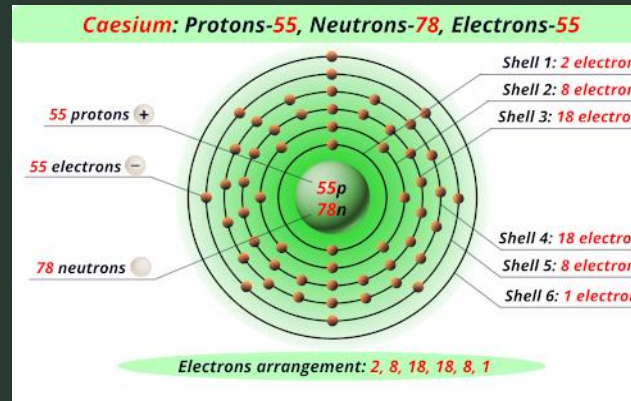
4s 4p 4d

3s 3p 3d

2s 2p

1s

1 1A H	2 2A He	3 3A Li	4 4A Be	5 5A B	6 6A C	7 7A N	8 8A O	9 9A F	10 10A Ne	11 11A Na	12 12A Mg	13 13A Al	14 14A Si	15 15A P	16 16A S	17 17A Cl	18 18A Ar	19 1A K	20 2A Ca	21 3A Sc	22 4A Ti	23 5A V	24 6A Cr	25 7A Mn	26 8A Fe	27 9A Co	28 10A Ni	29 11A Cu	30 12A Zn	31 13A Ga	32 14A Ge	33 15A As	34 16A Se	35 17A Br	36 18A Kr	37 1A Rb	38 2A Sr	39 3A Y	40 4A Zr	41 5A Nb	42 6A Mo	43 7A Tc	44 8A Ru	45 9A Rh	46 10A Pd	47 11A Ag	48 12A Cd	49 13A In	50 14A Sn	51 15A Sb	52 16A Te	53 17A I	54 18A Xe	55 1A Cs	56 2A Ba	57 3A La	58 4A Ce	59 5A Pr	60 6A Nd	61 7A Pm	62 8A Sm	63 9A Eu	64 10A Gd	65 11A Tb	66 12A Dy	67 13A Ho	68 14A Er	69 15A Tm	70 16A Yb	71 17A Lu	72 1A Fr	73 2A Ra	74 3A Ac	75 4A Th	76 5A Pa	77 6A U	78 7A Np	79 8A Pu	80 9A Am	81 10A Cm	82 11A Bk	83 12A Cf	84 13A Es	85 14A Fm	86 15A Md	87 16A No	88 17A Lr	89 18A Og
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IV. Time Calculation – Today Cesium Production and Usages

- Cesium world production

“Although cesium is much less abundant than the other alkali metals, it is still more common than elements like arsenic, iodine and uranium. Few cesium minerals are known, pollucite is the main: they are silicate magmas cooled from granites. World production of cesium compounds is just 20 tons per year, coming mainly from the Bernic lake (Canada) with a little from Zimbabwe and South-West Africa.”

<https://www.lenntech.com/periodic/elements/cs.htm>

- Cesium and GPS

“The cesium is so constant in the speed it vibrates that this extremely accurate time allows satellites to accurately determine where someone is based on GPS data and how long it will take someone to get to somewhere else.”

<https://education.nationalgeographic.org/resource/gps>

- Health effects of cesium

Each component of the diet contributes potassium evenly to the diet; however, almost a half of cesium is estimated to be contributed by meat, eggs and milk products. Thus, the daily intake of cesium varies greatly depending on the dietary intake of this component. Humans may be exposed to cesium by breathing, drinking or eating. In air the levels of cesium are generally low, but radioactive cesium has been detected at some levels in surface water and in many types of foods.

The amount of cesium in foods and drinks depends upon the emission of radioactive cesium through nuclear power plants, mainly through accidents. These accidents have not occurred since the Chernobyl disaster in 1986. People that work in the nuclear power industry may be exposed to higher levels of cesium, but many precautionary measurements can be taken to prevent this.” <https://www.lenntech.com/periodic/elements/cs.htm>



IV. Time Calculation – Today From Health to Environment

“Cesium-137 is used in small amounts for calibration of radiation detection equipment, such as Geiger-Mueller counters. In larger amounts, Cs-137 is used in: Medical radiation therapy devices for treating cancer.”

<https://www.google.com/search?q=Cesium-137+is+used+in+small+amounts+for+calibration+of+radiation+detection+equipment&og=Cesium-137+is+used+in+small+amounts+for+calibration+of+radiation+detection+equipment&aqs=chrome..69i57j69i59.2613j0j7&sourceid=chrome&ie=UTF-8>

“It is not very likely that people experience health effects that can be related to cesium itself. When contact with radioactive cesium occurs, which is highly unlikely, a person can experience cell damage due to radiation of the cesium particles. Due to this, effects such as nausea, vomiting, diarrhea and bleeding may occur. When the exposure lasts a long time people may even lose consciousness. Coma or even death may then follow. How serious the effects are depends upon the resistance of individual persons and the duration of exposure and the concentration a person is exposed to. Exposure to such a large amount could come from the mishandling of a strong industrial source of Cs-137, a nuclear detonation or a major nuclear accident. Large amounts of Cs-137 are not found in the environment under normal circumstances.” <https://www.epa.gov/radiation/radionuclide-basics-cesium-137#:~:text=nuclear%20reactor%20accidents.,Cesium%20Sources,flow%20of%20liquid%20through%20pipes.>

- Environmental effects of cesium

Cesium occurs naturally in the environment mainly from erosion and weathering of rocks and minerals. It is also released into the air, water and soil through mining and milling of ores. Radioactive isotopes of cesium may be released into the air by nuclear power plants and during nuclear accidents and nuclear weapons testing.”

<https://www.lenntech.com/periodic/elements/cs.htm>

Note: While Cesium-55 can be used to create clocks and GPS, Cesium-137 can also kill. So is Hydrogen, a component of water and the main atom used to make the Hydrogen bomb.



Chernobyl: Cs-137 contamination

**1090 square mile
"exclusion zone"
>104 Curies/sq mile**



**3840 square miles
strict radiation dose-control zone
39-104 Curies/sq mile**



V. Time Calculation and Observation

Methods to Ascertain Time – Bible and History – Millerites' Method

- Greenwich Time (GMT) Versus Universal Time Coordinated (CTU) in the light of October 22nd, 1844
 The purpose of this research was to evaluate the difference between these 2 methods of time calculation developed over the centuries, reaching out to the Millerites and to our time. Which methods did William Miller and his associates used to ascertain the Great Day of Atonement in 1844? Which methods should we use today?
- Extensive Studies of the sure Word of Prophecy – Chapters 18 – 22 of The Great Controversy
 The method by which William Miller ascertained the October 22nd, 1844 date as the Great Day of Atonement is well explained in Chapter 18 of The Great Controversy. His study of the whole Bible is the method we should all use in order to understand the Word of God and especially the prophecies and synchronism and chronology: “I could but regard the *chronological* portions of the Bible as being as much a portion of the word of God, and as much entitled to our serious consideration, as any other portion of the Scriptures. I therefore felt that in endeavoring to comprehend what God had in His mercy seen fit to reveal to us, I had no right to pass over the prophetic periods [Daniel 8:14; 9:24-27].”—Bliss, page 75.” The Great Controversy, 324, edited.
- Studies of History and Events Confirming Prophecies valid for his time and for us today
 Great Lisbon’s Earthquake – Falling of the Stars – The Ottoman Empire’s signs of upcoming fall.
- Calculation of the October 22nd, 1844 based on Greenwich Time (GMT)
 The Greenwich Mean Time method of calculation was in use at the time of William Miller and the US Naval Observatory was established in 1830: “The U.S. Naval Observatory is one of the oldest scientific agencies in the country. It was established in 1830 as the Depot of Charts and Instruments. Its primary mission was to care for the U.S. Navy’s chronometers, charts and other navigational equipment.”
<https://crf.usno.navy.mil/organization#:~:text=The%20U.S.%20Naval%20Observatory%20is,charts%20and%20other%20navigational%20equipment.>
- “The writings of the Christian Jewish scholar, Joseph Samuel C.F. Frey exerted a marked influence upon Snow and his associates in fixing upon October 22nd, 1844.” It is based on Greenwich Time calculation.
<https://144000teachers.org/wp-content/uploads/2022/06/Firm-Platform-Solid-Foundation-pdf.pdf>

Conclusion to the Matter The Case of Greenwich (GMT) Versus Universal Time Coordinated (UTC)

A Matter of Choice

- Evidence 1. Human beings created in the image of their Maker were given by rights the freedom of choice. This freedom cannot be impeached by vain philosophy or totalitarian methods enforcing rules, more specifically when it comes to the study of the Word of God.
- Evidence 2. The principles of True Education are clearly expressed in Isaiah 28:9-13. "For precept must be upon precept, precept upon precept; line upon line, line upon line; here a little, and there a little". And we know that "God teaches by the enunciation of principles, or universal laws [Isaiah 28:9-13], and the Holy Spirit which comes by faith enlightens the senses that they may grasp the illustrations of these laws in the physical world."
https://144000teachers.org/wp-content/uploads/2021/12/True-Education-A-Revelation.pptx3_pptx-no-audio.pdf
- Evidence 3. We have attempted in our research titled: The Firm Platform – Calculation and Observation of Biblical Time to demonstrate that time is illustrated by the Creator through the science of Astronomy and can be both calculated and observed.
<https://144000teachers.org/wp-content/uploads/2022/06/Firm-Platform-Solid-Foundation-pdf.pdf>

In this present research, we have confirmed that the Greenwich (GMT) method was the one the Millerites used to ascertain October 22nd, 1844. We have also demonstrated that the Greenwich method based on the earth's rotation has been replaced in 1972, by the Atomic Clock Cesium accuracy, in most countries around the world, as the method to calculate time with an accuracy of 10^{14} compared to the method of longitude and latitude used by the Greenwich method. After calculating the October 22nd date of 1844 with the data of USNO based on the Atomic Clock Cesium accuracy, the conclusion was clear: the results are the same when reckoning 1844.

Conclusion

The scientific value of the Universal Time Coordinated (UTC) based on the Atomic Clock of Cesium accuracy used by USNO, is the method we have chosen to ascertain the Biblical Calendar for 2020-2030 at 144000teachers.org.

Thus far, our data have proven accurate. If opponents apply the method used to ascertain October 22nd, 1844 of the Luni-Solar Barley Harvest, New Moon Horned Crescent and confirmed by: Biblical, Astronomical, Chronological, Historical and Spirit of Prophecy principles, we will be glad to hear them out in writings, avoiding thus the unchristian methods of bullying, character attacks and plain unacceptable abuse. We rest our case!

"Come now, and let us reason together, saith the LORD."
Isaiah 1:18.