

# **What is the Rabbinical 19 year calculated calendar?**

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## Introduction

The Rabbinical Jewish calendar is the calendar used by our brother Rabbinical Jews and other groups following their teachings of the Oral Laws. It is a derived calendar, and like any calendar system has its own set of rules in the calculating days. Why should we even care about this calendar, or any other calendar? A very important reason - to know when to observe Yehovah's set times. The is shown in Vayiqra/Leviticus 23:2, 4 which reads:

דַּבֵּר אֶל־בְּנֵי יִשְׂרָאֵל וְאָמַרְתָּ אֲלֵהֶם מוֹעֲדֵי יְהוָה אֲשֶׁר־תִּקְרְאוּ  
אֹתָם מִקְרָאֵי קֹדֶשׁ אֵלֶּה הֵם מוֹעֲדָי: <sup>2</sup>

אֵלֶּה מוֹעֲדֵי יְהוָה מִקְרָאֵי קֹדֶשׁ אֲשֶׁר־תִּקְרְאוּ אֹתָם בְּמוֹעֲדָם: <sup>4</sup>

Which is transliterated:

2 Daber el benei Yisrael ve'amar'ta 'alehem moadei Yehovah asher tiq're'u otam miqra'ei qodesh elleh hem moadai.

4 Elleh moadei Yehovah miqra'ei qodesh asher tiq're'u otam bamoadam.

Which says when translated:

2 Speak to Children of Yisrael and you say to them from appointments of Yehovah, which you will proclaim you from readings/proclaimings set-apart. These they My set appointments.

4 These set appointments of Yehovah from readings/proclaimings set-apart which you will proclaim you in their set appointment.

The Mo'ad (מועד) is reference number 4150 and many will say it means season or set-time. It is from the verb ya'ad (עָד) which in the Kal form of the verb it is appointed as in setting or selecting something. In Shemot 21:8, it is written, "...who designated her for himself,..." The word designated is ye'adah or appointed her because it is in the feminine form. So we can see that Mo'ad being prefixed by a Mem is from and so Mo'ad would be from appointment of from selecting. It does not mean in any way season. Tiq're'u is third person plural form of Kara which is to read or proclaim. Miqra'ei is the mem prefix saying from once more and ei suffix denote plurality. So we can see that if Mo'ad is used in other places then it will also carry the similar meaning. What this also shows us is that these are times, which are set by Yehovah, and so we must look to the written Torah to find these.

The Calendar system that we all use today is the Gregorian calendar. It starts in the Middle of winter and is strictly a solar-based calendar. Though the months have a link to the Moon there is little correlation with the cycle of the moon. Why would I even bring this up in a discussion of the Rabbanite 19 year calendar? Because if you example our modern calendar system it too is calculated. We have fixed months with adjustment to keep the months in season by use of

Equinoxes/Solstices, and leap days. The Rabbinical calendar is also has set days for months but because of certain rules they have to adjust days in some months by adding a day like a leap day. We are going to examine this calendar now.

### ***The Rabbinical Jewish calendar***

In the article [The Calendar in Jewish History](#), from Britannica Online, version 97 © 1996, it lists a history of the calendar in Jewish history. They state that there is little knowledge that can be found documented before the Babylonian Exile for a calendar. It also states that the Bible refers to the calendar in vague language. The earliest dated calendar from documented history, they state, is the Gezer Calendar, which has been estimated to exist in the reign of King Solomon. The article also states that whatever power was dominant at that time in history the Jewish people followed the dominant power's calendar for their civil calendar. The Babylonian names and the reckoning of the year from the seventh month are from the Babylonian calendar. This allowed the Jewish people to have predetermined months with fixed new moon days. It is also noted that even Aramaic documents from the New Testament period have little reference to a calendar system. Only the Qumran Dead Sea Scrolls indicate a calendar. The only calendar information is from Talmudic sources. (See Appendix A for full article)

This calendar was made openly available to all Jewish peoples in the year 358 C.E. by Hillel II.

**“In early rabbinic times the day of the New Moon was established by the Sanhedrin in Jerusalem, after accepting the evidence of an eyewitness who had claimed to see the new moon. Sometimes rabbis would deliberately postpone Rosh Hodesh so as to prevent the Day of Atonement from falling on a Friday or a Sunday. The permanent calendar was fixed by Hillel II in 358 C.E. and this provided for exact dates of each Rosh Hodesh based on astronomical and mathematical calculations”**

The key here is that the current calendar in use was not established at the time of Moses but developed later after the custom of observing months was in use. Since we are trying to determine what is the Rabbinical Jewish Calendar, then let us look into some of the expert's writings on the subject. Let us start with Arthur Spier, the author of the book “The Comprehensive Hebrew Calendar”. This book is very technical, but can give us some good information on the calendar:

**“Since Biblical times the months and years of the Jewish Calendar have been established by the cycles of the moon and the sun. The traditional law prescribes that the month shall follow closely the course of the moon, from its Molad (birth, conjunction) to the next New Moon. Furthermore, the lunar months must correspond to the seasons of the year, which are governed by the sun.”(Spier, pg. 1)**

Notice that the calendar is to follow the cycles of the sun and moon. It was a sincere effort to devise rules that would keep Yehovah's Holy Days in the proper seasons and to allow for the keeping of certain non-scriptural celebrations that the Rabbis felt were important. Notice the statement that the months follow closely the new moon. This is not supported in scripture. If you look into the Tanakh you would see that months are new moon to new moon.

Bamidbar/Numbers 10:10

10 And on your joyous occasions—your fixed festivals and new moon days (uvayom sim'chat'khem uvamo'adeikem uvarashei chad'sheykhem

וּבְיוֹם שְׂמִחַתְכֶם וּבְמוֹעֲדֵיכֶם וּבְרֵאשֵׁי חַדְשֵׁיכֶם)—you shall sound the trumpets over your burnt offerings and your sacrifices of well-being. They shall be a reminder of you before Eloheykhem: I am, Yehovah Eloheykhem.

“And in days your joy and in set appointments yours and in head months yours” is what it is saying in Hebrew. This was the blowing of the trumpets as a signal to start each event. Thus the start of each month was to be recognized and signaled as well as the start of each day of the appointments. Therefore, the month must follow the cycle of the moon from new moon to new moon.

**Spier continues “This method of observation and intercalation was in use throughout the second temple period (516 B.C.E - 70 C.E.) . . . In order to prevent the Jews scattered all over the surface of the earth from celebrating their new moons, festivals and holidays at different times, he made public the system of calendar calculation which up to then had been a closely guarded secret. It had been used in the past only to check observation and testimonies of witnesses, and determine the beginnings of the spring seasons.” (Spier, pg. 1)**

You can see from this statement that the calculated calendar came in use after Hillel II released it. Also he states that it came about by 516 B.C.E in which there is no evidence. We know that the Pharisees came into history in around 110 B.C.E. and did hold the Priesthood at a time of Queen Salome Alexandra (139-67B.C.E) and continued to hold that position until she dies in 67 B.C.E and then Aristobulus H. takes the kingship and appoints the Sadducees back to the priesthood. (Gribetz, pgs 50-51) It is unlikely that with this was occurring until they has gained control of the temple. Later we see that Hillel in his Jerusalem Academy formulate the beginning of the Pharisaic Interpretations of the Torah in 10 C.E. and in 15 C.E he started to abrogate the release of loans by prosbul or court that would not be subjected to the Shabbat year restrictions. It would appear that the formulation of Pharisaic rule could at the earliest happen in 110 B.C.E. or after. We know Hillel II release it but why?

**“The nasi Hillel II fixes the Jewish Calendar on the basis of astronomical calculations. Diaspora Jews no longer depend on the Sanhedrin for new moon announcements, which had been outlawed by Constantinus II.” (Gribetz, pg. 74)**

This shows us that it was done because the observing of the new moon was no longer possible. Thus, an alternative method was used. As we will see this calculated calendar was of necessity in one way but the things added to it where to manipulate it. This was done in the period after the formulation and development of the Mishnah, which started in 200 C.E. and before the starting of formation of the Talmud in 499 C.E. The Sanhedrin, which is talked about doing this, came into being around 20 C.E.

**“The Jewish court of 71 , the Sanhedrin, performs secular administration in Judea but issues religious policy for all imperial Jews. Headed by the High Priest, but comprising Jews from all over the area with a significant and**

**influential contingent of Pharisees, the Sanhedrin regulates Temple matters and fixes the calendar.” (Gribetz, pg. 57)**

The earliest this fixed calendar system came into being as a practice of this group was 20 C.E. and beyond. The new moon today, with the calculated calendar, guarantees to the followers of the Jewish Calendar that they can know exactly when the beginning of the months because now the months are fixed alternating 29 and 30 day months. Just like the Gregorian calendar the Jewish Calendar has its fixed months. Let us continue with Mr. Spier.

**“Nowadays the day, hour and parts of the Molad are announced before the Proclamation of the New Moon in the Sabbath morning service preceding the week of the New Moon. This custom keeps alive the memory of the time when the Sanhedrin sanctified the months on the basis of observation.” (Spier, pg. 13)**

We see that Arthur Spier shows us that the original way even the Rabbanites keep the start of each month was the observation.

**“The Hebrew calendar is based on two fundamental facts of tradition:**

- a. **The length of the lunar month is: 29d, 12h, 793p. [p=parts, parts = 3 1/3 seconds]**
- b. **In every cycle of 19 years there will be 7 leap years.**

**. . . Rosh Hashanah, the first day of Tishri, should be on the day of the Molad, except for the so-called Delioth (postponements), which take place in four specific cases. . . These are the four Delioth (postponements):**

- a. **When the Molad Tishri occurs on a Sunday, Wednesday, or Friday, Rosh Hashanah is postponed to the following day.**
- b. **When the Molad Tishri Occurs at noon (18h) or later, Rosh Hashanah is postponed to the next day. (or if this day is Sunday, Wednesday, or Friday to Monday, Thursday or the Sabbath because of deliah (a).)**
- c. **When the Molad of a common year falls on a Tuesday, 204 parts after 3 a.m., i.e., 3d 9h 204p or later, Rosh Hashanah is postponed to Wednesday, and, because of deliah (a). further postponed to Thursday.**
- d. **When, in a common year succeeding a leap year, the Molad Tishri occurs on Monday morning 589 parts after 9 a.m., i.e., 2d 15h 589p or later, Rosh Hashanah is postponed to the next day.**

**Note: In more than 60 % of all years Rosh Hashanah does not occur on the day of the Molad but is postponed according to one of the Delioth. Therefore the Delioth are actually not the exceptions to the rule but the rule. . . Deliah (a) mainly fulfills the following three religious requirements: Yom Kippur (Tishri 10) shall not occur on the day before or after the Sabbath and Hoshana Rabba (Tishri 21) shall not occur on the Sabbath.” (Spier, pg. 14 - 15)**

The reason I didn't give you an explanation for the previous quote was I wanted you to see the basic rules of the calendar for yourself and see how complex they are. When I first read them it brought to mind the story of a bad insurance policy that only pays off when a comet hits your house at three seconds after midnight.

Let me now try to explain some of the terms introduced here. The text that reads 29d 12h 793p is saying 29 days, 12 hours, and 793 parts. The Molad is the conjunction or alignment of the sun, moon and earth. It is at this point the moon is an astronomical new moon, which is different from the sighted new moon. We'll see more on this later. Deliot is not a Biblical Hebrew word. It is Modern Hebrew. I believe it should be Dechiyah (דחייה) or Dechiyot (דחיות), which means postponement. But since Arthur Spier uses the term, we will continue to reference it. The Molad Tishri is the new moon of the seventh month. A common year is a year that has 12 lunar months and a leap year is a year with 13 lunar months. I now want you to look and see some key points from this quote. First the length of a month is a little more than 29 1/2 days. The day of Rosh Hashanah (What they call the start of the year is actually Yom Teru'ah) is the first day of Tishri (seventh month). This first day of the seventh month, which should be on the new moon can be moved to another day or two depending on four postponement rules. These postponement rules are not exceptions but the rule with 60 % of the time the Day of Shouting (Yom Teruah) does not fall on the new moon.

I don't know about you but when I first learned about this I found this quite enlightening and disturbing. This is all done to 1) make sure the Day of Atonement (Yom HaKippurim) does not fall on a day before or after the weekly Sabbath, and 2) that Hoshanah Rabbah can be observed. What is Hoshanah Rabbah? It is referred to as the Feast of Willows. See if you can find it in Miqra. Let me give you a quote from another author who explains it. Harold Kushner states,

**“. . . the Day of Atonement with its 24 hour fast, never falls on a Friday or Sunday where it would bump up against the Sabbath , or so that the seventh day of the Sukkott festival in the fall, when we pray for an abundance and economic prosperity, never falls on a Sabbath, when such prayers would be inappropriate.” (Kushner, pgs. 91-92)**

The use willows, which are known to grow by sources of water, and use them in prayer for rain with these branches. I would like you now to take your Tanakh and look through it completely and see if you can find a place other than the second Pesach where a day is postponed, or the commandment to celebrate on the seventh day of the Feast of Booths (Chag HaSukkot) the Hoshanah Rabbah. Thus, requiring that the Hoshanah Rabbah not fall on the Shabbat. I can assure you, you won't find it.

Let us finish with Mr. Spier:

**“With the introduction of the permanent calendar, the solar and lunar years have been adjusted by calculation which guarantees the coincidence of the lunar months with the seasons as required by law. Therefore the independent computation of the beginning of the four seasons, the Tekufoth, has lost its importance. Nevertheless, in our annual calendar we find the dates of the four Tekufoth listed as:**

**Tekufath Tishri (Fall Equinox)  
Tekufath Nisan(Spring Equinox)  
(Spier, pg. 19)**

**Tekufath Tebeth (Winter Solstice)  
Tekufath Tammuz(Summer Solstice)”**

In my paper on “The Beginning of the Year and the New Moon”, I point out problems with using the tekufot (plural) or tekofah (singular). Whether it is the Precession of the Equinoxes or the term itself, which never refers in Biblical Hebrew to an Equinox or Solstice. In fact, the earliest evidence of the tekufot is the mosaic in the Beit Alpha synagogue in Israel. Even earlier than the current Rabbinical Jewish calendar system was a system of calculation to find the four seasons. You can see that after the Rabbinical Jewish calendar of today took the place of observation of the new moon, and that the independent Tekufoth (Seasons) calculations lost their importance. This must mean that one time they (Tekufoth) were a key in the establishing of the beginning of each season for the Rabbinical Jewish Calendar.

**In the article The Calendar in Jewish History, from Britannica Online, version 97 © 1996, It details the parts of the calendar. “In the religious calendar, the commencement of the month was determined by the observation of the crescent New Moon, and the date of the Passover was tied in with the ripening of barley. The actual witnessing of the New Moon and observing of the stand of crops in Judaea were required for the functioning of the religious calendar. The Jews of the Diaspora, or Dispersion, who generally used the civil calendar of their respective countries, were informed by messengers from Palestine about the coming festivals. This practice is already attested for 143 BC. After the destruction of the Temple in AD 70, rabbinic leaders took over from the priests the fixing of the religious calendar. Visual observation of the New Moon was supplemented and toward AD 200, in fact, supplanted by secret astronomical calculation. But the people of the Diaspora were often reluctant to wait for the arbitrary decision of the calendar makers in the Holy Land. Thus, in Syrian Antioch in AD 328-342, the Passover was always celebrated in (Julian) March, the month of the spring equinox, without regard to the Palestinian rules and rulings. To preserve the unity of Israel, the patriarch Hillel II, in 358/359, published the "secret" of calendar making, which essentially consisted of the use of the Babylonian 19-year cycle with some modifications required by the Jewish ritual.”(excerpt from appendix A)**

Let us now look at another expert in the calendar, namely Rabbi Nathan Bushwick.

**“There are three independent units of time, the day, the month, and the year. The first step in understanding the calendar is understanding the relationships between them, and how a unified system can be formed from them. The great civilizations of the world have struggled with this problem. For us [Jews], the answer has always been found in the Torah [oral?] handed down from generation, and forms the basis of the Jewish Calendar to this day” (Bushwick, pg. 6)**

I agree with the Rabbi here in that indeed the calendar is in the Written Torah and elaborated throughout the Tanakh. The understanding of the units of time is essential to our discussion of the calendar.

## ***The Day***



**“The Jewish day starts at sunset the previous evening rather than at midnight.” (Kushner, pg. 91)**

Vayiqra/Leviticus 23:32

**32** It shall be a sabbath of complete rest for you, and you shall practice self-denial; on the ninth day of the month at evening, **from evening to evening (me’erev ad erev – from evening until evening מֵעֶרֶב עַד-עֶרֶב)**, you shall observe this your sabbath.

Here this shows the complete day starts at evening and end at evening. So when is evening.

Yehoshua/Joshua 8:29

**29** And the king of Ai was impaled on a stake **until the evening. At sunset (ad et-ha’arev ukhevo hashemesh – until the evening and as goes the sun עַד-עֵת** **הָעֶרֶב וְכַבֹּא הַשֶּׁמֶשׁ)**, Joshua had the corpse taken down from the stake and it was left lying at the entrance to the city gate. They raised a great heap of stones over it, which is there to this day.

Evening is when the sun goes down.

Devarim/Deuteronomy 23:12

**12** **Toward evening (vehayah lif’not erev וְהָיָה לְפָנוֹת-עֶרֶב)** he shall bathe in water, **and at sundown (ukhevo hashemesh וְכַבֹּא הַשֶּׁמֶשׁ)** he may reenter the camp.

Again the evening is at the going down of the sun. Earlier it says, And shall be to faces evening, so it is like he is looking to evening as in waiting for it.

### ***The Month***

**“The Jewish calendar, with one interesting exception [postponements], is based on the moon rather than the sun. Each month begins with the appearance of the new moon, the first sliver of light after the moon has gone dark (the word month comes from the word moon) and lasts twenty-nine or thirty days, the time it takes for the moon to go through an entire cycle from new to half to full to half to dark again. Several important Jewish holidays occur on the fifteenth day of the month, when the moon is full.” (Kushner, pg. 89)**

**“The moment that the moon passes between the Earth and the sun is called the Molad - the birth of the moon. It is the theoretical beginning of the new month” (Bushwick, pgs. 39-40)**

**“The Hebrew month, which is based on the lunar calendar, begins with the appearance of the new moon. To the Jews of antiquity, the first of the month was an important date, and Torah speaks of it as one of the holidays. ‘Also in the day of your gladness, and on your solemn days, and in the beginning of months, you shall blow the trumpets [shofar] . . . ‘ (Numbers 10:10) In the wilderness the shofar was used to call the people together and signal that the time had come to break camp and move on; in the Temple the shofar counted among the musical instruments. . . . During the Second Temple period and for a time thereafter, the first of the month was determined by the evidence of witnesses who came before the Sanhedrin and testified that they had seen the new moon.” (Bialer, pg. 137)**

**“It was in the exile of the 6th century B.C.E that the Hebrew months were given their Babylonian names, prior to that we know them by number and association, as in the Torah’s designation of Rosh Hashanah as the first day of the seventh month.” (Rosenberg, pg. 5)**

It is interesting that Rosenberg says the designation of Rosh Hashanah is the first day of the seventh month when this is really reserved for the 1 of the month of the Aviv or called Nisan today.

The Hebrew months are also detailed in the article [The Calendar in Jewish History](#), from Britannica Online, version 97 © 1996, where it shows that the months as listed consist of 30 day(full) months and 29 day(defective) months. The months Nisan, Sivan, Av, Tishri, Shevat, and, in a leap year, First Adar are always full (30 days); whereas, Iyyar, Tammuz, Elul, Tevet, and Adar (known as Second Adar, or Adar Sheni, in a leap year) are always defective or short a day (29 days), while Cheshvan and Kislev will vary. You can see then that they are fixed and do not truly start with the new moon. (See appendix A) As does the article of the Jewish Encyclopedia in Appendix B.

## ***The Year***

**“The Jewish Year consists of twelve months, alternating twenty-nine and thirty days in length, which adds up to a year of 354 days long.” (Kushner, pg. 90)**

**“The number of days in a year varies. The number of days in a synodic month multiplied by 12 in a common year and by 13 in a leap year would yield fractional figures. Hence, again reckoning complete days only, the common year has 353, 354, or 355 days and the leap year 383, 384, or 385 days. A year in which both Heshvan and Kislev are full, called complete (shelema), has 355 or (if a leap year) 385 days; a normal (sedura) year, in which Heshvan is defective and Kislev full, has 354 or 384 days; while a defective (hasera) year, in which both these months are defective, has 353 or 383 days. The character of a year (qevi'a, literally "fixing") is described by three letters of the Hebrew alphabet, the first and third giving, respectively, the days of the weeks on which the New Year occurs and Passover begins, while the second is the initial of the Hebrew word for defective, normal, or complete. There are 14 types of qevi'ot, seven in common and seven in leap**

**years. The New Year begins on Tishri 1, which may be the day of the Molad of Tishri but is often delayed by one or two days for various reasons. Thus, in order to prevent the Day of Atonement (Tishri 10) from falling on a Friday or a Sunday and the seventh day of Tabernacles (Tishri 21) from falling on a Saturday, the New Year must avoid commencing on Sundays, Wednesdays, or Fridays. Again, if the Molad of Tishri occurs at noon or later, the New Year is delayed by one or, if this would cause it to fall as above, two days. These delays (dehiyyot) necessitate, by reason of the above-mentioned limits on the number of days in the year, two other delays.”(Excerpt from Appendix A.)**

## ***Analysis***

What I have shown here is the background on the Rabbinical Jewish Calendar as well as some counterpoints in the Miqra. I listed it in this way to identify some points for us to review and consider. Let us break down what we have found. First, the day starts and ends at sunset (evening). No are problems so far. Second, the month starts with the approximate new moon, which depends on the falling of certain days in the calendar. The approximate would mean it may or may not coincide with the sighting of the new moon. This would be another problem. Third, The months of the year alternate 29 and 30 days making up a year of 354 days. If you look and observe the lunation or cycle from new moon to new moon you will see it does not always alternate 30 days and 29 days. This is based on the elliptical orbit of the moon, which is egg shaped and moves slower at one point (apogee) and quicker at the other point (perigee). If the month follows the lunation (cycle of the moon) it is correct. See terms for these in the Appendix C. We have seen that the Rabbinical Jewish Calendar is a fixed month calendar and is independent of the new moon. Therefore, it is not correct and we know that the seventh month is off 60% of the time according to Arthur Spier.

The beginning of the seventh month is the New Year and used to determine the beginning of the first month. This is wrong. The beginning of the year is the first day of the first month. The reference to the New Year is from Babylon and is not referenced in the Tanakh. The reason for using the seventh month is to utilize the postponements (delaying of a day) in establishing the first day of the seventh month (Yom Teruah) as well as other observances in the seventh month are on an acceptable date to them and is also a part of the Babylonian calendar. Then they count backward 177 days to establish the beginning of the year. 177 days are half the 354-day cycle of a lunar year. The first day of the seventh month (Yom Teruah) can be moved to prevent back-to-back Sabbaths especially the Day of Atonement/Yom HaKippurim and to allow for the celebrating the seventh day of the Feast of Booth/Chag HaSukkot on a non-Sabbath day. Again, wrong. Nowhere does it say in all the Tanakh to postpone, move, or delay the first of the seventh month. Another question is: if the first of the seventh month is moved and used to establish the first month what happens to the rest of the Holy Days? They are adjusted also. In looking into the Rabbinical Jewish Calendar, I hope you too are able see the problems that I have shown. The derived calendar, though it does keep the Holy Days in the proper season, does not follow the cycle of the moon, and combined with the postponements, can throw off the Holy Days by 1 to 2 days.

So some might say what is the big deal? Here is the big deal. Yom Ha Kippurim is a day that we are to do no work (melakhah). What happens if the actual day you keep is not the day from the

sighting of the new moon of the seventh month? You will not be celebrating it on its appointed day. What was the punishment of the person who did not fast or worked on this day?

Vayiqra/Leviticus 23:

26 Yehovah spoke to Moses, saying: 27 Mark, the tenth day of this seventh month is the Day of Atonement. It shall be a sacred occasion for you: you shall practice self-denial, and you shall bring an offering by fire to Yehovah; 28 you shall do no work throughout that day. For it is a Day of Atonement, on which expiation is made on your behalf before Yehovah Eloheykha. 29 Indeed, any person who does not practice self-denial throughout that day shall **be cut off from his kin (venikh'retah me'ameyha וְנִכְרְתָה מֵעַמִּיהָ)**; 30 and whoever does any work throughout that day, I will cause that person to perish from among his people (veha'avad'tiy et-nefesh hahiv miqerev amah וְהָאֲבִדְתִי אֶת־הַנֶּפֶשׁ הַהוּא מִקֶּרֶב עַמִּיהָ). 31 Do no work whatever; it is a law for all time, throughout the ages in all your settlements. 32 It shall be a sabbath of complete rest for you, and you shall practice self-denial; on the ninth day of the month at evening, from evening to evening, you shall observe this your sabbath.

So we see here in verse 29, the penalty for not fasting is cut off from the people. That generally means to be removed from them like exile. It can also mean to literally cut off like in death. In verse 30 we see the one who works is destroyed (avad) or put to death. So not keeping this on the right day can literally mean your life. Because on any other day, you will eat and work with the exception the weekly Shabbat in which you are forbidden to work. The keeping the days on the right days is very important. That is where the Rabbinical 19 year Jewish calendar falls short.

So why are so many people still keeping it given that there is this great problem? One, it is predictable and they truly believe that as long as it's in the right season they are OK. It is because of the ideas that the moon is for Seasons.

Tehillim/Psalms 104:19

19 He made the moon to mark the seasons (le'mo'adim לְמוֹעֲדִים); the sun knows when to set.

It shows us clearly that this is a mistranslation as it is not season but set appointments and so this has been perpetuated with the Tekufot/Circuit to keep the calculated calendar in tune with the seasons. Two, it's embedded into the minds of most to follow this that a Sanhedrin is needed to approve the new moon sightings. The command to observe the month of the Aviv and every New Moon following it was not dependant on an oversight group. The Priest had a hand in the determining the Aviv because of the need for the Omer of Barley to be brought. Additionally, from the article of Calendar History in Appendix B states:

**In the times of the Second Temple it appears from the Mishnah (R. H. i. 7) that the priests had a court to which witnesses came and reported. This function was afterward taken over by the civil court (see B. Zuckermann, "Materialien zur Entwicklung der Altjüdischen Zeitrechnung im Talmud, "Breslau, 1882).**

Three, its tradition and would cause problems for the whole community to change. Clearly, there were times in Tanakh when the whole community was wrong and had to be shown what is right. We are told not to after the majority to do wrong.

Shemot/Exodus 23:2

2 You shall neither side with the mighty to do wrong—you shall not give perverse testimony in a dispute so as to pervert it in favor of the mighty (JPS)

לֹא־תִהְיֶה אַחֲרֵי־רַבִּים לְרָעַת וְלֹא־תִעָנֶה עַל־רֵב לְנֹטֹת אַחֲרָי רַבִּים לְהַטֹּת:<sup>2</sup>

Lo-tih'yeh acharei-rabbah l'ra'ot velo ta'aneh al-riv lin-tot acharei rabbim lehatot.

Not you shall follow after many to harms and not he answer/testify to controversy to follow after many to overthrow.

We are not to follow the many. We are to choose the right ways. So in following a calculated calendar like what we have reviewed today we must think about the possible results of not looking for the New Moon and setting Yehovah's moadim.

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## Appendix A – Britannica Article.

“The Calendar in Jewish History.Britannica Online.version 97.” Quoted with permission of owner, Britannica, Inc.

“The calendar in Jewish history. Present knowledge of the Jewish calendar in use before the period of the Babylonian Exile is both limited and uncertain. The Bible refers to calendar matters only incidentally, and the dating of components of Mosaic Law remains doubtful. The earliest datable source for the Hebrew calendar is the Gezer Calendar, written probably in the age of Solomon, in the late 10th century BC. The inscription indicates the length of main agricultural tasks within the cycle of 12 lunations. The calendar term here is yereah, which in Hebrew denotes both "moon" and "month." The second Hebrew term for month, hodesh, properly means the "newness" of the lunar crescent. Thus, the Hebrew months were lunar. They are not named in pre-exilic sources except in the biblical report of the building of Solomon's Temple in I Kings, where the names of three months, two of them also attested in the Phoenician calendar, are given; the months are usually numbered rather than named. The "beginning of the months" was the month of the Passover (see JUDAISM: The cycle of the religious year). In some passages, the Passover month is that of hodesh ha-aviv, the lunation that coincides with the barley being in the ear. Thus, the Hebrew calendar is tied in with the course of the Sun, which determines ripening of the grain. It is not known how the lunar year of 354 days was adjusted to the solar year of 365 days. The Bible never mentions intercalation. The year shana, properly "change" (of seasons), was the agricultural and, thus, liturgical year. There is no reference to the New Year's day in the Bible.

After the conquest of Jerusalem (587 BC), the Babylonians introduced their cyclic calendar (see above Babylonian calendars) and the reckoning of their regnal years from Nisanu 1, about the spring equinox. The Jews now had a finite calendar year with a New Year's day, and they adopted the Babylonian month names, which they continue to use. From 587 BC until AD 70, the Jewish civil year was Babylonian, except for the period of Alexander the Great and the Ptolemies (332-200 BC), when the Macedonian calendar was used. The situation after the destruction of the Temple in Jerusalem in AD 70 remains unclear. It is not known whether the Romans introduced their Julian calendar or the calendar that the Jews of Palestine used after AD 70 for their business transactions. There is no calendar reference in the New Testament; the contemporary Aramaic documents from Judaea are rare and prove only that the Jews dated events according to the years of the Roman emperors. The abundant data in the Talmudic sources concern only the religious calendar.

In the religious calendar, the commencement of the month was determined by the observation of the crescent New Moon, and the date of the Passover was tied in with the ripening of barley. The actual witnessing of the New Moon and observing of the stand of crops in Judaea were required for the functioning of the religious calendar. The Jews of the Diaspora, or Dispersion, who generally used the civil calendar of their respective countries, were informed by messengers from Palestine about the coming festivals. This practice is already attested for 143 BC. After the destruction of the Temple in AD 70, rabbinic leaders took over from the priests the fixing of the religious calendar. Visual observation of the New Moon was supplemented and toward AD 200, in fact, supplanted by secret astronomical calculation. But the people of the Diaspora were often reluctant to wait for the arbitrary decision of the calendar makers in the Holy Land. Thus, in Syrian Antioch in AD 328-342, the Passover was always celebrated in (Julian) March, the month of the spring equinox, without regard to the Palestinian rules and rulings. To preserve the unity of

Israel, the patriarch Hillel II, in 358/359, published the "secret" of calendar making, which essentially consisted of the use of the Babylonian 19-year cycle with some modifications required by the Jewish ritual.

The application of these principles occasioned controversies as late as the 10th century AD. In the 8th century, the Karaites, following Muslim practice, returned to the actual observation of the crescent New Moon and of the stand of barley in Judaea. But some centuries later they also had to use a precalculated calendar. The Samaritans, likewise, used a computed calendar.

Because of the importance of the Sabbath as a time divider, the seven-day week served as a time unit in Jewish worship and life. As long as the length of a year and of every month remained unpredictable, it was convenient to count weeks. The origin of the biblical septenary, or seven-day, week remains unknown; its days were counted from the Sabbath (Saturday for the Jews and Sunday for Christians). A visionary, probably writing in the Persian or early Hellenistic age under the name of the prediluvian Enoch, suggested the religious calendar of 364 days, or 52 weeks, based on the week, in which all festivals always fall on the same weekday. His idea was later taken up by the Qumran community. (E.J.Bi.)

### ***The structure of the calendar.***

The Jewish calendar in use today is lunisolar, the years being solar and the months lunar, but it also allows for a week of seven days. Because the year exceeds 12 lunar months by about 11 days, a 13th month of 30 days is intercalated in the third, sixth, eighth, 11th, 14th, 17th, and 19th years of a 19-year cycle. For practical purposes--e.g., for reckoning the commencement of the Sabbath--the day begins at sunset; but the calendar day of 24 hours always begins at 6 PM. The hour is divided into 1,080 parts (halaqim; this division is originally Babylonian), each part (heleq) equalling  $3 \frac{1}{3}$  seconds. The heleq is further divided into 76 rega'im.

The synodic month is the average interval between two mean conjunctions of the Sun and Moon, when these bodies are as near as possible in the sky, which is reckoned at 29 days 12 hours 44 minutes  $3 \frac{1}{3}$  seconds; a conjunction is called a molad. This is also a Babylonian value. In the calendar month, however, only complete days are reckoned, the "full" month containing 30 days and the "defective" month 29 days. The months Nisan, Sivan (Siwan), Av, Tishri, Shevat, and, in a leap year, First Adar are always full; Iyyar, Tammuz, Elul, Tevet, and Adar (known as Second Adar, or Adar Sheni, in a leap year) are always defective, while Heshvan (Heshwan) and Kislev (Kislew) vary. The calendar, thus, is schematic and independent of the true New Moon. The number of days in a year varies. The number of days in a synodic month multiplied by 12 in a common year and by 13 in a leap year would yield fractional figures. Hence, again reckoning complete days only, the common year has 353, 354, or 355 days and the leap year 383, 384, or 385 days. A year in which both Heshvan and Kislev are full, called complete (shelema), has 355 or (if a leap year) 385 days; a normal (sedura) year, in which Heshvan is defective and Kislev full, has 354 or 384 days; while a defective (hasera) year, in which both these months are defective, has 353 or 383 days. The character of a year (qevi'a, literally "fixing") is described by three letters of the Hebrew alphabet, the first and third giving, respectively, the days of the weeks on which the New Year occurs and Passover begins, while the second is the initial of the Hebrew word for defective, normal, or complete. There are 14 types of qevi'ot, seven in common and seven in leap years. The New Year begins on Tishri 1, which may be the day of the molad of Tishri but is often delayed by one or two days for various reasons. Thus, in order to prevent the Day of Atonement (Tishri 10) from falling on a Friday or a Sunday and the seventh day of Tabernacles (Tishri 21) from falling on a Saturday, the New Year must avoid commencing on



Sundays, Wednesdays, or Fridays. Again, if the molad of Tishri occurs at noon or later, the New Year is delayed by one or, if this would cause it to fall as above, two days. These delays (dehiyyot) necessitate, by reason of the above-mentioned limits on the number of days in the year, two other delays.

The mean beginning of the four seasons is called tequfa (literally "orbit," or "course"); the tequfa of Nisan denotes the mean Sun at the vernal equinox, that of Tammuz at the summer solstice, that of Tishri at the autumnal equinox, and that of Tevet at the winter solstice. As 52 weeks are the equivalent to 364 days, and the length of the solar year is nearly  $365 \frac{1}{4}$  days, the tequfot move forward in the week by about  $1 \frac{1}{4}$  days each year. Accordingly, reckoning the length of the year at the approximate value of  $365 \frac{1}{4}$  days, they are held to revert after 28 years ( $28 \times 1 \frac{1}{4} = 35$  days) to the same hour on the same day of the week (Tuesday, 6 PM) as at the beginning. This cycle is called the great, or solar, cycle (mahzor gadol or hamma). The present Jewish calendar is mainly based on the more accurate value 365 days, 5 hours, 55 minutes,  $25 \frac{25}{57}$  seconds--in excess of the true tropical year by about 6 minutes 40 seconds. Thus, it is advanced by one day in about 228 years with regard to the equinox."

## Appendix B The Jewish Encyclopedia History of the Calendar Article

### CALENDAR, HISTORY OF:

By : Joseph Jacobs Cyrus Adler

The history of the Jewish calendar may be divided into three periods—the Biblical, the Talmudic, and the post-Talmudic. The first rested purely on the observation of the sun and the moon, the second on observation and reckoning, the third entirely on reckoning. The study of astronomy was largely due to the need of fixing the dates of the festivals. The command (Deut. xvi. 1), "Keep the month of Abib," made it necessary to be acquainted with the position of the sun; and the command, "Also observe the moon and sanctify it," made it necessary to study the phases of the moon. The oldest term in Hebrew for the science of the calendar is קביעותא דירחא ("fixing of the month"); later קדוש החדש ("sanctification of the new moon"); קדוש החדש על פי ראייה ("sanctification of the new moon by means of observation"); פי חשבון קדוש החדש על ("sanctification of the new moon by means of reckoning"); ידעיה בקביעותא דירחא ("science of fixing the month"); הלכות קדוש החדש ("rules for the sanctification of the new moon"). Among other names besides these we find סוד העבור ("the secret of intercalation"). The medieval and modern name is לוח.

### ***Babylonian Calendar.***

The Babylonian year, which influenced the French time reckoning, seems to have consisted of 12 months of 30 days each, intercalary months being added by the priests when necessary. Two Babylonian calendars are preserved in the inscriptions, and in both each month has 30 days as far as can be learnt. In later times, however, months of 29 days alternated with those of 30. The method of intercalation is uncertain, and the practise seems to have varied. The Babylonian years were soli-lunar; that is to say, the year of 12 months containing 354 days was bound to the solar year of 365 days by intercalating, as occasion required, a thirteenth month. Out of every 11 years there were 7 with 12 months and 4 with 13 months. Strassmeier and Epping, in "Astronomisches aus Babylon," have shown that the ancient Babylonians were sufficiently advanced in astronomy to enable them to draw up almanacs in which the eclipses of the sun and moon and the times of new and full moon were predicted ("Proc. Soc. Bib. Arch., 1891-1892," p. 112). The Talmud (Yerushalmi, Rosh ha-Shanah i. 1) correctly states that the Jews got the names of the months at the time of the Babylonian exile. There is no mention of an intercalary month in the Bible, and it is not known whether the correction was applied in ancient times by the addition of 1 month in 3 years or by the adding of 10 or 11 days at the end of each year.

### ***Bound Lunar Year.***

Astronomers know this kind of year as a bound lunar year. The Greeks had a similar year. Even the Christian year, although a purely solar year, is forced to take account of the moon for the fixing of the date of Easter. The Mohammedans, on the other hand, have a free lunar year. It thus seems plain that the Jewish year was not a simple lunar year; for while the Jewish festivals no doubt were fixed on given days of lunar months, they also had a dependence on the position of the sun. Thus the Passover Feast was to be celebrated in the month of the wheat harvest (אביב), and the Feast of Tabernacles, also called חג האסיף, took place in the fall. Sometimes the feasts are mentioned as taking place in certain lunar months (Lev. xxiii.; Num. xxviii., xxix.), and at other

times they are fixed in accordance with certain crops; that is, with the solar year. In post-Talmudic times Nisan, Siwan, Ab, Tishri, Kislew, and Shebat had 30 days, and Iyyar, Tammuz, Elul, Heshwan, Tebet, and Adar, 29. In leap-year, Adar had 30 days and We-Adar 29. According to Pirke Rabbi Eliezer, there was a lunar solar cycle of 48 years. This cycle was followed by the Hellenists, Essenes, and early Christians. In the times of the Second Temple it appears from the Mishnah (R. H. i. 7) that the priests had a court to which witnesses came and reported. This function was afterward taken over by the civil court (see B. Zuckermann, "Materialien zur Entwicklung der Altjüdischen Zeitrechnung im Talmud," Breslau, 1882). The fixing of the lengths of the months and the intercalation of months was the prerogative of the Sanhedrin, at whose head there was a patriarch or **נשיא**. The entire Sanhedrin was not called upon to act in this matter, the decision being left to a special court of three. The Sanhedrin met on the 29th of each month to await the report of the witnesses. From before the destruction of the Temple certain rules were in existence. The new moon can not occur before a lapse of 29½ days and ⅔ of an hour. If the moon could not be exactly determined, one month was to have 30 days and the next 29. The full months were not to be less than 4 nor more than 8, so that the year could not be less than 352 days nor more than 356. After the destruction of the Temple (70 C.E.) Jo□anan ben Zakkai removed the Sanhedrin to Jabneh. To this body he transferred decisions concerning the calendar, which had previously belonged to the patriarch. After this the witnesses of the new moon came direct to the Sanhedrin.

### ***Empirical Determination of Leap-Year.***

Every two or three years, as the case might be, an extra month was intercalated. The intercalation seems to have depended on actual calculation of the relative lengths of the solar and lunar years, which were handed down by tradition in the patriarchal family. Moreover, it was possible to judge by the grain harvest. If the month of Nisan arrived and the sun was at such a distance from the vernal equinox that it could not reach it by the 16th of the month, then this month was not called Nisan, but Adar Sheni (second). On the evening before the announcement of the intercalation the patriarch assembled certain scholars who assisted in the decision. It was then announced to the various Jewish communities by letters. To this epistle was added the reason for the intercalation. A copy of such a letter of Rabban Gamaliel is preserved in the Talmud (Sanh. xi. 2). The country people and the inhabitants of Babylonia were informed of the beginning of the month by fire-signals, which were readily carried from station to station in the mountain country. These signals could not be carried to the exiles in Egypt, Asia Minor, and Greece, who, being accordingly left in doubt, celebrated two days as the new moon. Owing to the weather it was frequently impossible to observe the new moon. In order to remove any uncertainty with regard to the length of the year on this account, it was ordained that the year should not have less than 4 nor more than 8 full months. After the fixing of the calendar it was settled that the year should not have less than 5 nor more than 7 full months. R. Gamaliel II. (80-116 C.E.) used to receive the reports of the witnesses in person, and showed them representations of the moon to test their accuracy. On one occasion he fixed the first of Tishri after the testimony of two suspected witnesses. The accuracy of the decision was disputed by Rabbi Joshua, who was thereupon commanded by the patriarch to appear before him prepared for travel on the day which was, according to his (Joshua's) calculation, the Day of Atonement, an order with which he most reluctantly complied. During the persecutions under Hadrian and in the time of his successor, Antoninus Pius, the martyr Rabbi Akiba and his pupils attempted to lay down rules for the intercalation of a month. Under the patriarchate of Simon III. (140-163) a great quarrel arose concerning the feast-days and the leap-year, which threatened to cause a permanent schism between the Babylonian and the Palestinian communities—a result which was only averted by the exercise of much diplomacy.

## ***Talmudic Period.***

Under the patriarchate of Rabbi Judah I., surnamed "the Holy" (163-193), the Samaritans, in order to confuse the Jews, set up fire-signals at improper times, and thus caused the Jews to fall into error with regard to the day of the new moon. Rabbi Judah accordingly abolished the fire-signals and employed messengers. The inhabitants of countries who could not be reached by messengers before the feast were accordingly in doubt, and used to celebrate two days of the holidays. By this time the fixing of the new moon according to the testimony of witnesses seems to have lost its importance, and astronomical calculations were in the main relied upon. One of the important figures in the history of the calendar was Samuel (born about 165, died about 250), surnamed "Yarhinai" because of his familiarity with the moon. He was an astronomer, and it was said that he knew the courses of the heavens as well as the streets of his city (Ber. 58b). He was director of a school in Nehardea (Babylonia), and while there arranged a calendar of the feasts in order that his fellow-countrymen might be independent of Judea. He also calculated the calendar for sixty years. His calculations greatly influenced the subsequent calendar of Hillel. According to Bartolucci his tables are preserved in the Vatican. A contemporary of his, R. Adda (born 183), also left a work on the calendar. Mar Samuel reckoned the solar year at 365 days and 6 hours, and Rab Adda at 365 days, 5 hours, 55 minutes, and 25  $\frac{25}{57}$  seconds. In 325 the Council of Nice was held, and by that time the equinox had retrograded to March 21. This council made no practical change in the existing civil calendar, but addressed itself to the reform of the Church calendar, which was soli-lunar on the Jewish system. Great disputes had arisen as to the time of celebrating Easter. Moreover, the Church was not fully established, many Christians being still simply Jewish sectarians. A new rule was therefore made, which, while still keeping Easter dependent on the moon, prevented it from coinciding with Passover. Under the patriarchate of Rabbi Judah III. (300-330) the testimony of the witnesses with regard to the appearance of the new moon was received as a mere formality, the settlement of the day depending entirely on calculation. This innovation seems to have been viewed with disfavor by some members of the Sanhedrin, particularly Rabbi Jose, who wrote to both the Babylonian and the Alexandrian communities, advising them to follow the customs of their fathers and continue to celebrate two days, an advice which was followed, and is still followed, by the majority of Jews living outside of Palestine. Under the reign of Constantius (337-361) the persecutions of the Jews reached such a height that all religious exercises, including the computation of the calendar, were forbidden under pain of severe punishment. The Sanhedrin was apparently prevented from inserting the intercalary month in the spring; it accordingly placed it after the month of Ab (July-August).

## ***Post-Talmudic Period.***

The persecutions under Constantius finally decided the patriarch, Hillel II. (330-365), to publish rules for the computation of the calendar, which had hitherto been regarded as a secret science. The political difficulties attendant upon the meetings of the Sanhedrin became so numerous in this period, and the consequent uncertainty of the feast-days was so great, that R. Huna b. Abin made known the following secret of the calendar to Raba in Babylonia: Whenever it becomes apparent that the winter will last till the 16th of Nisan, make the year a leap-year without hesitation. This unselfish promulgation of the calendar, though it destroyed the hold of the patriarchs on the scattered Judeans, fixed the celebration of the Jewish feasts upon the same day everywhere. Later Jewish writers agree that the calendar was fixed by Hillel II. in the year 670 of the Seleucidan era; that is, 4119 A.M. or 359 C.E. Some, however, as Isaac Israeli, have fixed the date as late as 500. Saadia afterward formulated calendar rules, after having disputed the correctness of the calendar established by the Karaites. That there is a slight error in the Jewish calendar—due to inaccuracies in the length of both the lunar and the solar years upon which it is based—has been asserted by a number of writers.

### ***Error in the Calendar.***

According to Isidore Loeb the Jewish cycle in 19 years exceeds the Gregorian by 2 hours, 8 minutes, and 15.3 seconds. This makes a difference in a hundred cycles (1900 years) of 8 days, 21 hours, 45 minutes, and 5 seconds ("Tables du Calendrier Juif," p. 6, Paris, 1886). The assumed duration of the solar year is 6 minutes, 39 25/57 seconds in excess of the true astronomical value, which will cause the dates of the commencement of future Jewish years, which are so calculated, to advance from the equinox a day in error in 216 years ("Encyc. Brit." s. v. "Calendar," 9th ed., iv. 678). The following calculation of the differences between the Jewish and Gregorian lengths of the year and month was privately made for the writer by Prof. William Harkness, formerly astronomical director of the United States Naval Observatory at Washington: 1 year = 365d. 05h. 997 12/19 halakim or 365d. 05h. 55m. 25.439 s. 48m. 46.069 s. true value (29d. 12h. 793 halakim) 235 = 6939d. 16h. 595 halakim = 19 years 29d. 12h. 44m. 3 1/3s. True value = 29d. 12h. 44m. 02.841s. According to these calculations the Jewish year exceeds the Gregorian by 6 m. 39.37s. and the Jewish month by .492 s. Insignificant as these differences may appear, they will cause a considerable divergence in the relations between Nisan and spring as time goes on, and may require a Pan-Judaic Synod to adjust.

### ***Writers on the Calendar:***

Mashallah, 754-813; Sahl ben Rabban al-Tabari, 800; Sind ben Ali, 829-832; Shabbethai b. Abraham Donolo, 949; Hasan, judge of Cordova, 972; Abraham b. Hiyya, d. 1136; Abraham ibn Ezra, 1093-1168; Isaac b. Joseph Israeli, 1310; Immanuel b. Jacob of Tarrascon, 1330-1346; Elia Misrahi, d. 1490; Abraham b. Samuel Zacuto, professor of astronomy at Saragossa, 1492, Moses Isserles, d. 1573; David Gans (d. 1613), a friend of Kepler and Tycho Brahe; Raphael Levi Hannover, 1734; Israel Lyons, 1773, member of an English polar expedition. Besides the following works of the Talmudic period: **ברייתא דסוד העבור**, Baraita of the secret of intercalation (R. H. xx. 2); **ברייתא דרב אדא: ברייתא דשמואל** (Pirke de Rabbi Eliezer ha-Gadol b. Hyrcanus). Bibliography: L. M. Lewisohn, *Geschichte und System des Jüdischen Kalenderwesens*, Leipzig, 1853 (Schriften herausgegeben vom Institute zur Förderung der Israelitischen Literatur); also the works of Steinschneider, Scaliger, and Ideler. J. A.

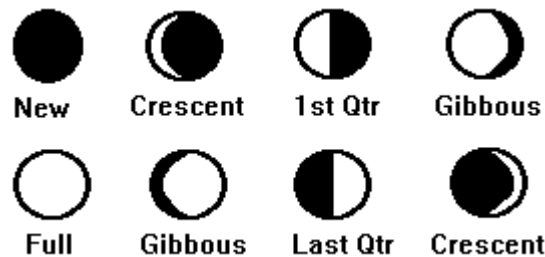
## Appendix C - Glossary

### ASTRONOMICAL INFORMATION

Science for some time has been able to track the movements of the heavenly bodies. What is to follow is specific astronomical information on terms used in this book.

*Sun* - This body consists of a mixture of hydrogen and helium with a mixture of fast moving electrons. Such a mixture is called a plasma. The sun through fusion reactions provides the light and warmth we need on earth. It is also the light source for the moon. (Turk, pgs. 523-526)

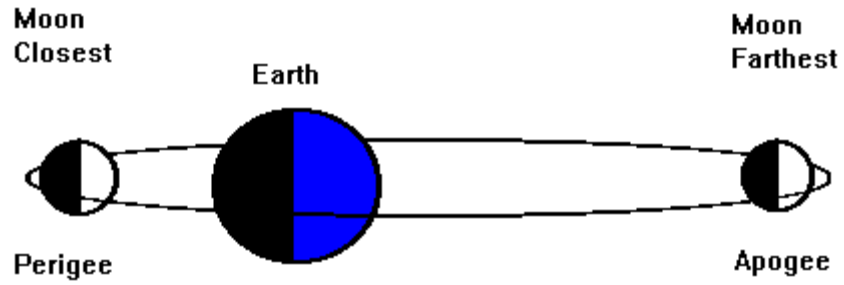
*Moon* - To any casual observer he phases of the moon can be seen. When it is fully lit is called a full moon, and when it is fully dark it is called a new moon. This occurs because the moon itself has no independent light source. It relies on the sun to provide reflective light to the earth. It also has a slightly tilted orbit around the Earth. Because of this the observer sees a full moon and can not see the new moon. (Turk, pgs. 513-516)



*Lunation* - The period of time it takes the moon to complete a cycle of phases that takes an average of 29.51 days. (Moon Watcher 1997, pg. 4) The Moon as its cycle goes from new to full is said to be waxing (growing brighter) and from full to dark it is said to be waning (growing dimmer).

*Eclipse* - “A phenomenon that occurs when a heavenly body is shadowed by another and therefore rendered invisible. When the Moon lies directly between the Earth and the Sun, we observe a solar eclipse; when the Earth lies between the Sun and Moon, we observe a lunar eclipse.” (Turk, pg. 611)

*Elliptical orbit* - Like most orbits, the path of the Moon around the Earth is an ellipse with a closest approach, perigee, and farthest point called apogee. When at the perigee the moon moves fastest and slowest at its apogee. (Moon Watcher 1997, pg. 4)



*Equinox* - "Either of two times during a year when the sun shines directly overhead at the Equator. During the equinox, every portion of the Earth receive 12 hours of daylight and 12 hours of darkness" (Turk, pgs. 611-612)