

The Crescent

(RELIGIOUS AND SCIENTIFIC INFORMATION
REGARDING ITS APPEARANCE)

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Trinidad & Tobago

The Crescent

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the name of Allāh, the Beneficent, the Merciful

INTRODUCTION

“And the sun moves onto its destination. That is the ordinance of the Mighty, the Knower. And the moon. We have ordained for it stages till it becomes again as an old dry palm-branch. Neither is it for the sun to overtake the moon, nor can the night outstrip the day. And all float on in an orbit.” (Qur’an: 36, 38-40).

The Holy Qur’an is not a book of science but it contains scientific principles which are operating in the Universe. Man’s ability understand these principles by means of mathematical computation, establishes the workings of the Universe and its measurement (Taqdir) as ordained by its Creator.

The Qur’an establishes as a principle that the moon has been given stages. An attempt is now made to focus our attention on this daily phenomenon which is often taken for granted. The stages of the moon manifest a visible example to all mankind, of the existence of a Living God, the Master and Controller of the Universe, whose principle of Taqdir (measurement) is operating with every moment that passes.

5th May, 1985

ISLAM AND CALCULATIONS

Islam is a religion that is based on Truth. Indeed it is called the Religion of Truth in the Holy Qur'an (48 : 28). Truth is known through the use of reason and intellect and so the Holy Qur'an in several places appeals to the use of reason and intellect. (2 : 73, 242; 6 : 152; etc.). Nay, it goes further and describes as cattle those who fail to use their faculties for acquiring knowledge (7 : 179; 8 : 22). The first revelation of the Qur'an enjoined reading (i.e. the acquiring of knowledge) and promised that Allah will teach man what he knows not (96 : 1 – 5).

Reflecting on the Five Pillars of Islam we see that they all encourage the increase in knowledge, particularly in the science of calculations and computation. In teaching about Faith, the First Pillar of Islam, the Qur'an tells us that Allah is ONE (112 : 1), not Two nor Three (16 : 51; 4 : 171). It speaks of the Heavens and Earth being created in **Six** periods (50 : 38); of our entire life being in accordance with a measure (80 : 19), and even the Day of Judgement is called the Day of Counting (38 : 26). The Qur'an also indicates that reflecting on the heavens and the earth leads to Glorification of Allah and eventually to Faith in Him (3 : 189-197).

Prayer, the Second Pillar of Islam, is ordained in computed times (4 : 103), the Solar system being used to compute these times (17 : 78). Fasting, the Third Pillar of Islam is likewise observed for a computed number of days (2 : 184) after witnessing the Month of Ramadaan (2 : 185). Its duration is determined by computing dawn and dusk (2 : 187).

Spending of wealth is the Fourth Pillar of Islam and its rewards are associated with large computation (2 : 261). Zakaat according to

the Holy Prophet, upon whom be peace, is payment of a calculated portion of wealth. Pilgrimage too, the Fifth Pillar of Islam is an appointed time (2 : 189) which is well known (2 : 197). Thus the Five Pillars of Islam involve calculations of some kind.

RAMADAAN

The month of Ramadaan is an important month to the Muslim community in that it is the month in which the Holy Qur'an was revealed as well as the month in which we are required to fulfill one of the pillars of faith – viz., Fasting. While the Qur'an has not directly indicated to us when this month is to be determined, it is the Holy Prophet who has guided us to the fact that Ramadaan is a lunar month whose beginning and end are determined by the new moon. Indeed the Holy Qur'an says: "*They ask thee about the New Moons. Say, they are predeterminable times (or places) for men and for Pilgrimage*" (2 : 189). The word *mawaaqeet* in this verse is the plural of *meeqaat* which means a place or time that is fixed beforehand for the performance of some action or duty. Thus for Hajj the Holy Prophet has fixed *mawaaqeet* i.e. predetermined places where *Ihraam* (the pilgrim's garb) is to be put on. The Holy Qur'an has not intended that fasting should be performed in a haphazard manner and so it indicates that fasting is prescribed for a **predetermined** number of days (2 : 184).

Fasting in Islam is performed using the knowledge of the two systems of reckoning given by Allah viz. the Lunar system and the Solar system. By means of the Lunar system we determine the period or month of the fast, whereas by means of the Solar system we determine the extent or duration of the fast (2 : 187). The Qur'an thus recognises both of these systems for the purpose of computation as the following verses indicate:

“He has made the sun and moon for counting” (6 : 97)

“He has made the sun and the moon and measured for it stages that you might know the determining of years and counting.” (10: 5)

“He has made subservient to you the sun and the moon following their courses.” (14 : 33) (It should be noted that in Yusuf Ali’s translation of the Qur’an, the note (1909) to this verse states: “Because there are laws here which man can understand and calculate.”)

“The moon, we have ordained for it stages.” (36 : 39)

“The sun and the moon follow courses (exactly) computed.” (55 : 5 – Yusuf Ali’s translation).

Since the Muslim community has for hundred of years adopted sighting of the new moon with the physical eye to determine the beginning and end of Ramadaan, it is felt that the use of any other method is against the teachings of Islam. This is a total fallacy, for the change in understanding of a Law is not the rejection of that Law. Several practices given to us by the Holy Prophet have already been changed to suit the circumstances of the times as knowledge increases. Yet Islam has not been affected in a negative way by these changes. For example, the Holy Prophet tells us that the Angel Gabriel indicated to him the time of prayer relevant to the length of his shadow; yet muslims today do not use this method to fix the times of prayer. Rather they almost always use the scientific invention of the clock, and most mosques now have a timetable showing the times of prayer. No one considers this as contravening the sunnah of the Prophet which is to use one’s shadow. Similarly, the payment of Zakaat in dollars and cents rather than in dinaars and dirhams or in cheques rather than cattle and sheep does not mean that the Law of Zakaat has changed. Just as currency notes can replace the dinar without affecting the principle of Zakaat, so too calculations can replace the sighting of the moon with the physical eyes without affecting the principle that Fasting begins and ends

with the new moon. Followers of Imam Shaafi'ee uphold on this point that the word of the astronomer is incumbent upon himself and those who accept him as true. (*Kitaabul Fiqh 'alal madhaahibil 'arab 'ah*, page 517).

CALCULATION ENJOINED BY THE PROPHET

There are many who consider the calculation of the new moon as a thing against the teaching of the Holy Prophet. What they do not realise, however, is that calculation is ENJOINED by the Holy Prophet himself. Calculation does not replace the physical sighting of the moon, it complements it; for the Holy Prophet Muhammad himself has said if the moon is hidden from you then have it calculated. Thus it is the Prophet, himself who has given us the the injunction to calculate the appearance of the moon and this is fully in accordance with the Qur'anic information that the moon (as well as the sun) have been created for calculation (6 : 97; 10 : 5). How could the Holy Prophet intend an exclusively literal interpretation of his sayings when he himself objected to a too literal interpretation of the Holy Qur'an concerning the starting of the daily fast? Bukhaari 31 : 16 reports a companion as saying: **"When it was revealed 'until a white thread becomes distinct to you from the black thread' (2 : 187), I took a black thread and a white thread and put them under my pillow, and I looked at them during the night but I could not distinguish between them; then I came to the Messenger of Allah in the morning and I mentioned this to him. He said, 'By this is meant only the blackness of the night and the whiteness of the day.'"** Thus when the Holy Prophet has permitted the use of intelligence and estimation in interpreting the Holy Qur'an rather than a literal acceptance, how much more will he permit the use of intelligence and estimation in the interpretation of his sayings.

In order to substantiate this permission of the Prophet to calculate the appearance of the new moon, it is necessary to look a little closely at the Hadith on this subject. Bukhaari 31 : 11 relates the following three Hadith:

- 1) **“Fast not until you see the Crescent, cease not fasting until you see it. Should it be overcast, you then measure it.”**
- 2) **“The month is 29 nights, so fast not until you see it, but if it is over cast on you then complete the number 30.”**
- 3) **“Fast on seeing it, cease fasting on seeing it. Should it be not visible then complete the number 30 of Sha’baan.”**

In the First Hadith the Holy Prophet clearly refers to the crescent and gives the injunction ‘to see’ for the beginning and the end of the fast. But if it is clouded then measure it (i.e. the crescent). Here the Prophet clearly states that the crescent (not the days in the month) must be measured.

In the second Hadith the Prophet refers to the month as having 29 nights. But in this Hadith he speaks only of starting the fast (not ending of it) and it is here that he states should it be clouded then complete the number 30.

In the third Hadith the Prophet while he mentions neither the month nor the moon refers to both the starting of the fast and the ending of it. But here he indicates if it is hidden then complete Sha’baan as thirty days.

From these Hadith it must be understood that the Holy Prophet Muhammad enjoined the sighting of the crescent moon, but if or when it could not be seen then calculation must be resorted to. Thus when the Prophet himself has enjoined calculation how can anyone say that to calculate the appearance of the crescent is against the tradition of Muhammad.

Indeed there is another tradition in Bukhaari 31 : 13 which states: “We are an illiterate nation, we neither write nor know counting. The month is thus and thus i.e. sometimes 29 and some-

times 30.” Scholars of Islam have interpreted this Hadith to mean that the Prophet and his companions relied on sighting with physical eye because they did not know how to count. They use this Hadith to substantiate that when the Muslim community knows how to count and calculate, then it should rely on calculation rather than sighting. Thus on the basis of this Hadith the Scholars say, if a Muslim community does not know how to calculate then it should determine fasting and Eid by sighting with the physical eye, but when it knows calculation then it should determine fasting and Eid by calculation.

THE MEANING OF SIGHTING

In all the Hadith quoted above the Arabic word for ‘seeing’ is **RU’YAT**. This word literally means to see with the eyes or mind or to see with the heart. Imam Raghīb speaks of four senses of **ru’yat**: (a) seeing with the senses (b) seeing with the imagination (c) seeing by pondering (d) seeing with the mind. He has quoted several verses of the Qur’an to illustrate these meanings. In 2 : 258; 12 : 4; 24 : 41; 69 : 7; and 89 : 6 for example **ru’yat** could not possibly mean seeing with the physical eye. Also in chapter 53 : 11-18 the Qur’an speaks of the Holy Prophet seeing with his heart in his experience of the Mi’raaj. In other places in the Holy Qur’an **ru’yat** means too see by observation, through knowledge of history, archeology, travelling etc. Thus the words “until you see it” in the hadith means seeing with the eye as well as with any other form of knowledge.

This interpretation is fully in accordance with the Qur’an which says of Ramadaan “*whoever of you witnesses the month, he should fast therein.*” (2 : 185) The word **SHAHIDA** in this verse which is translated as to witness or to be present in, also means to have evidence or decisive knowledge about a thing. Thus Muslims bear witness to the Oneness of Allah because of their sure knowledge of

His existence even though they do not see Him with the physical eye.

It is surprising that some Muslims reject scientific means when it comes to sighting of the moon but they depend on scientific means in the dissemination of the knowledge of that sighting. Few muslims look for the new moon, the majority depend upon the radio, television and the print media. Indeed the persons who set themselves up as authorities to announce the sighting of the moon, often do not see the new moon themselves. They receive information of the new moon through the telephone. If it is lawful to declare Fasting and Eid on the basis of information received through the scientific instrument – the telephone, then it is also lawful to declare the Fast and the day of Eid on the basis of information received through the use of other scientific instruments.

The Islamic Cultural Centre, London the largest organisation of muslims in the U.K., in its book 'SIYAM-FASTING' by Dr. Muhammad Ibraheem Al-Geyoushi on pages 12 & 13 states: **"We know about the moon and its phases and about changes in the weather; so this leads us to the following point about is it acceptable, from the religious point of view, to rely on the knowledge of the modern scientists regarding the moon or not ? All of us know how great this knowledge is, through which we know the movements of the moon, the sun and the other stars for hundred of years to come. We have seen man travelling to the moon, therefore we have no right to refuse knowledge coming from this source, particularly as we will find there is no objection from the religious point of view to accepting such knowledge.**

MSA and the New Moon

Some muslims are even prepared to reject the physical sighting of the moon if it is contrary to scientific knowledge. Thus The Muslim Students of America (MSA) in 'Islamic Horizons' May 1984

page 4 states:

"MSA Fiqh Committee declares the following principles.....

(5) Any announcement of the beginning or the end of Ramadaan that comes in complete contradiction to the undisputed established astronomical knowledge may be disregarded by an unanimous decision of the Fiqh Committee. The Committee will be guided in making its decision by the following:

- (a) If the moon sets before sunset, the report of the sighting will be ignored.**
- (b) If the moon sets 0 – 20 minutes after the sun, a sighting is remotely possible subject to further evidence and investigation.**
- (c) If the moon sets anytime after twenty minutes of the sun, there is a good possibility of sighting the crescent and the evidence will be acceptable."**

The position of the Ahmadiyya Anjuman Isha'at-i-Islam Inc. Trinidad and Tobago in relying upon calculation to determine the start of Fasting and the day of Eid, is therefore fully in accordance with the teachings of the Holy Qur'an, the injunctions of the Holy Prophet Muhammad, the Islamic Scholars and also the views of modern day muslims. It must be noted that one cannot evade calculation. Before even looking for the new moon muslims check astronomical charts to see when the moon is born and whether it will be visible. If the weather is cloudy and the moon is not visible then they go back to the charts to see when Sha'baan began and then count thirty days. But suppose it was clouded at the beginning of Sha'baan and the moon was not seen, how can we know at the end of the month how many days Sha'baan had when we never saw the new moon at the beginning of the month? *It is quite possible too, if Sha'baan has 29 days and Ramadaan, 29 days also that if Sha'baan is completed to 30 days and the Eid moon is seen, then the fast would have only been 28 days which will be against Shari'ah. Calculation avoids such error being committed.*

The Holy Prophet said: ***“Seek Lailatul Qadr in one of the odd nights during the last ten nights of Ramadaan.”*** If one did not know beforehand when Ramadaan ended, how could one know when the last ten nights started ? If Ramadaan is of 30 days then the last ten nights would begin on the 20th night, but if Ramadaan is of 29 days then the last ten nights would commence on the nineteenth night. Thus it is important to know beforehand when Ramadaan ends in order to determine Lailatul Qadr (the Night of Majesty) and I’tikaaf (seclusion in the mosque).

Already a pattern is emerging whereby the Muslim world is moving towards relying on calculations to celebrate Islamic Festivals uniformly all over the world... It is our hope that the information supplied in this booklet will be beneficial to the Muslim community worldwide.

The Calendar

The moon has always held a prestigious position in the affairs of man. Like the sun, it is the source by which time is measured. The sun has given us the measurement of the day (24 hours) by virtue of its effect on the earth's rotation. Three hundred and sixty five and a quarter ($365\frac{1}{4}$) of these rotations on its axis, which is the earth's revolution about the sun, have given rise to the solar year. The year has been divided into twelve months, but the months are not equal. Sometimes they are of thirty (30) or thirty one (31) days and one month (February) has twenty eight (28) days except for a leap year when an additional day is imposed on it. Though the word 'month' is derived from the word 'moon,' the months of the solar year as we know them today in our present Gregorian Calendar, have no relation to the motion of the moon.

The solar year consists of $365\frac{1}{4}$ days. It is the time the earth takes to make one complete revolution in its journey around the sun. The lunar month consists of $29\frac{1}{2}$ days (29d 12h 44m 3s). It is the time the moon takes to make one complete revolution in its journey around the earth. The lunar year with 12 lunar months consists of 354 days. The difference of $11\frac{1}{4}$ days with respect to the solar year has been made up in the 12 months of the solar year in a very arbitrary manner. Four (4) months have been given thirty (30) days each. Seven (7) months have been given thirty one (31) days each. One month has been given twenty eight (28) days, all of which total three hundred and sixty five (365) days. The calendar is still short of the solar year by a quarter of a day ($\frac{1}{4}$). This shortfall is compensated every fourth year (leap year) by adding an extra day to one of the months. February, the shortest month, accommodates this day.

The Gregorian Calendar which we use today was designed by Pope Gregory XIII in 1582 to correct anomalies which existed in the Julian Calendar that preceded it. The Julian Calendar was drawn up in 46 B.C. when Julius Caesar ordered that the moon be dis-

regarded in the calculations of the calendar and divided the solar year into 12 months.

The moon however, has been the criterion by which time was measured from time immemorial. The Hebrew calendar which is supposed to have started with creation, is based on the moon and consists of 12 lunar months. The Chinese Calendar is based on the moon and consists of 12 lunar months. The Islamic Calendar is based on the moon and consists of 12 lunar months. The Christian world bases its festivals on the moon. The Council of Nicaea in 325 A.D. decreed that Easter Sunday be the first Sunday after the first full moon of the Vernal Equinox (March 21). Easter Monday, Good Friday and Ash Wednesday then easily fall into place.

The Islamic Calendar is based on the moon. There are 12 lunar months alternately 30 and 29 days long. The appearance of a crescent determines the beginning of a month. The word 'appearance' has been used deliberately instead of 'sighting,' for the purpose of this analysis is to arrive at that distinction in the context of the confusion which seems to exist for only one day of the entire 354 days orbit of the moon. The determination of 1st Shawwal (Eid-ul-Fitr) seems to perplex Muslims every year. In an effort to remove this cloud, it would be necessary to ponder on the movement of the moon and understand how it travels in the scheme of creation. Such a task would require mathematical tools. Since this book is written for the benefit of all Muslims, mathematical calculations would be kept to a minimum and as simple as possible.

The Moon-Earth-Sun System

The moon is a satellite of the Earth 240 000 miles away. It has a surface area about 1/16 that of the earth's. It rotates on its axis, making a complete rotation in the same time that it takes to make one complete revolution as it orbits the earth. Thus from earth we always see only one side of the moon – that part of the moon

which receives light from the sun and reflects it to earth. The earth rotates on its own axis making a complete turn in 24 hours. As it orbits the sun, it makes a complete revolution in its orbit when it has spun $365\frac{1}{4}$ rotations on its own axis. The Moon-Earth-Sun system is a system moving in space in which the moon orbits the earth as the earth orbits the sun.

Since the bodies are moving, it would be necessary to consider them from some reference point. The earth traces out an elliptical orbit around the sun. In this case we are considering the earth's orbit around the sun. Equally we may look at it as the sun's apparent movement with respect to the earth, as our observations are taken from earth. Thus on any day the sun rises in the east, ascends higher in the sky and sets in the west. An observer looking at the sun sees the sunrise in the east. Since the earth is rotating from west to east, the observer sees the sun overhead at midday as the earth has rotated eastwards. After about six hours again, the earth has made a further rotation eastwards and the sun is now seen to the west of the observer until it eventually goes under the horizon and out of sight. This is the time we refer to as sunset. To the observer the sun appears to trace out a semi-circular path in its transit across the sky.

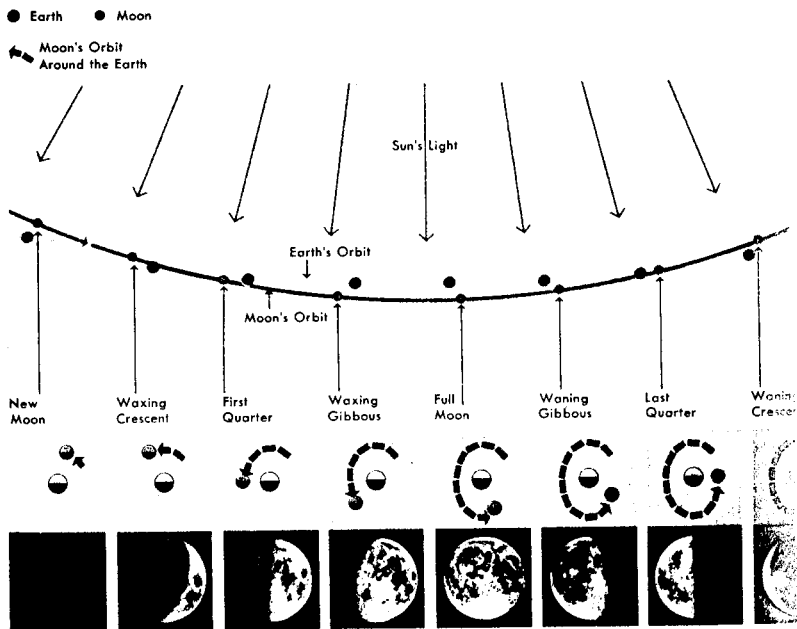
The moon also rotates from west to east. All day long it follows the sun westwards across the sky but steadily lags behind it because of its eastward orbital motion around the earth. Thus on the night of the full moon, after the sun has set, the moon rises in the east and seems to follow the path traced out by the sun during the day. As the night progresses it ascends higher in the sky and shines throughout the night as it moves in a westward direction across the sky.

Phases of the Moon

The moon does not emit light of its own. The light which we know as 'moonlight' is the light from the sun reflected by the moon. The amount of sunlight reflected by the surface of the moon deter-

mines the particular phase of the moon. When the phase is new moon the centres of the earth, sun and moon are in the same straight line. The moon, however, is between the earth and the sun and no light is reflected from the moon, even though half of the moon's surface is always under sunlight. At full moon, the positions of the earth and moon are reversed, i.e. the earth is now between the moon and the sun. First quarter and last quarter are the positions of the moon at right angles to this alignment.

WHY THE MOON HAS PHASES



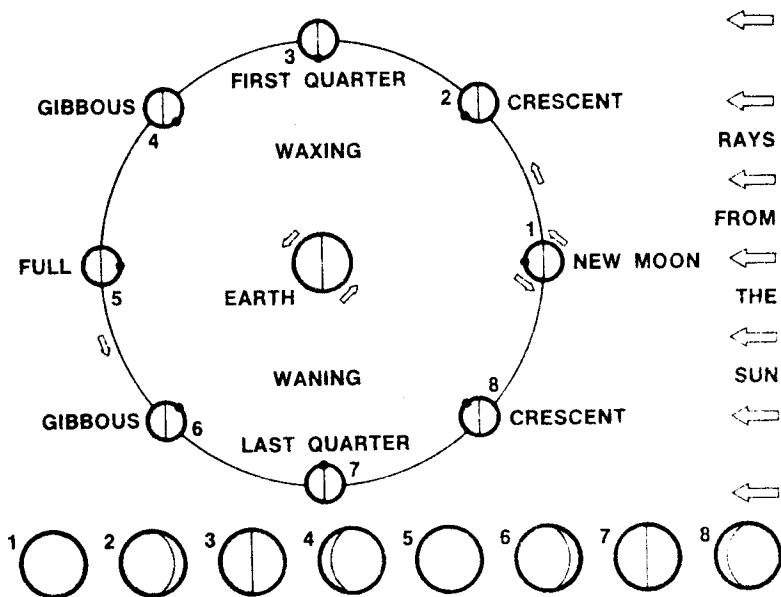
The moon can only be seen when light is reflected from it. At new moon there is no reflected light. New moon can never be seen (except during a Solar Eclipse). Let us assume that new moon occurs today in Trinidad at sunset. No part of the moon can be seen. Tomorrow at sunset, the earth would have made one rotation

on its axis and 24 hours would have passed. During this passage of 24 hours, the moon would have moved in its orbit around the earth, a comparable 49 minutes. Its centre would no longer be aligned with the centre of the earth and sun. The moon would have moved outside of this alignment. A small part of the moon's surface which is sunlit, reflects light and a crescent is formed. The moon is '24 hours old' at sunset and appears on the western horizon for about 27 minutes and then goes under the horizon due to the earth's eastward rotation. The next day the moon is 24 hours older and appears higher in the sky than the night before. A larger surface area of the moon captures reflected sunlight and the crescent grows larger. It stays a longer period in the sky before it again goes under the horizon due to the earth's eastwards rotation. Each subsequent night a greater surface area of the moon reflects light from the sun and the moon increases its altitude in the sky. These varying amounts of reflected light are referred to as the phases of the moon. About seven days after new moon, the moon is directly above us and first quarter exists. About seven days later, it is full moon and the moon seems to rise from the east and shines all night. The moon then appears to lose its lighting property and in another seven days at the phase of last quarter, only part of the moon's surface reflects light. In about seven days again, it would have completely gone to the position of new moon and starts a new cycle for another lunar month.

New Moon

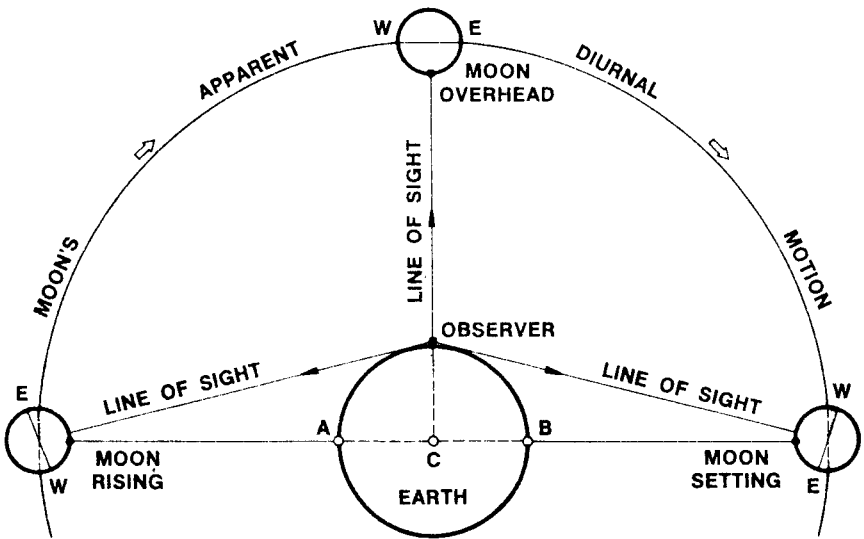
It can be appreciated that the phases of the moon is a measure of the amount of sunlight reflected by the moon. At all times one side of the moon is fully lighted by the sun. The other side is always dark. The position of the moon relative to the earth and the sun determines the phases of the moon. It is these positions which determine the amount of reflected light cast upon the earth from the sunlit side of the moon. The amount of 'moonlight' as seen by the

observer on earth is a reflection of the particular phase of the moon. When the position of the moon is such that no sunlight is reflected by the moon, the phase is new moon. Thus the moon can never be seen when it is new moon (except in an eclipse), as there is no reflected light from it.



The moon moves in its orbit as the earth rotates on its axis. The earth makes one rotation (360 degrees) each day (24 hours). Thus it turns at the rate of 15 degrees each hour. When we look at the sky, all celestial objects appear to move 15 degrees westward every hour, since the earth rotates on its axis in an eastward direction. The moon moves in the same direction as the earth in its orbit around the earth. It moves eastwards from the sun about 12 degrees per day. In its transit across the sky, the moon lags behind the sun $\frac{4}{5}$ ($\frac{12}{15}$) of an hour every day. Consequently the moon 'rises' and 'sets' 48 minutes later each day. It is for this reason that each night the moon is seen higher in the sky between new moon and full moon.

When it is new moon, the moon is in alignment with the earth and the sun. At the beginning of any lunar month, at sunset, the moon has aged by a certain number of hours and has moved away from this alignment. A very small portion of the moon's sunlit surface reflects light and a faint crescent appears. This heralds the beginning of the lunar month. The crescent is visible only after sunset. The crescent which we see is reflected light from a fraction of the moon's surface and as such the intensity of the reflected light is very weak. The faint crescent is obscured from us by light from the sun. Only after the sun has set and light from the sun has completely disappeared, is it possible to observe the faint crescent. If the crescent is below the horizon, it is impossible to observe it. Visibility of the crescent moon is therefore its position with respect to its height in the sky above the horizon. The height above the horizon would be referred to as its altitude.



The dates and times of the new moon are usually published in diaries and calendars based on computations from sources such as the Science Research Council, United Kingdom. It must always be

ascertained whether such times are local or GMT (Greenwich Mean Time). GMT times are universally used and are converted to the local situation. GMT time is the time at 0° Longitude which passes through London. Countries west of this line would have earlier times while those east of it would have later times. The world is divided into 24 time zones. Trinidad lies in the time zone minus four (-4). Times in Trinidad would therefore be 4 hours earlier than at Greenwich.

Calculations

The earth rotates on its axis making a complete circle (360 degrees) in 24 hours. It therefore rotates 1 degree in 4 minutes. The moon orbits the earth making a circle (360 degrees) in 29.5 days. Thus when the moon travels the path of a circle in 29.5 days, the earth has travelled a circle in 24 hours.

$$\begin{aligned}
 29.5 \text{ days} & \Rightarrow 24 \text{ hours} \\
 1 \text{ day} & \Rightarrow \frac{24}{29.5} \text{ hours} \\
 & = = 48.8 \text{ mins} \\
 1 \text{ day (24 hours)} & \Rightarrow \frac{48.8 \text{ mins}}{4 \text{ mins}} = 12.2^{\circ}
 \end{aligned}$$

Thus after 24 hours, the altitude of the moon increases by 12.2°

As was previously discussed, the faint crescent after new moon can only be seen when light from the sun has disappeared. At the time of sunset, when the sun has gone under the horizon, the last ray of sunlight leaving the sun takes eight (8) minutes to reach the earth. Adjustment must therefore be made for such light. Furthermore, when the sun has set, there is a ring of haze low on the horizon, within which visibility is low. a further adjustment is therefore necessary and an allowance of 4° (16 mins) is made. Thus the total adjustment to be made is 24 minutes.

Let us now examine these calculations with respect to the new moon on June 18, 1985

June 18, 1985 (New Moon)	11.58 a.m. GMT Time
June 18, 1985 (New Moon)	7.58 TT Time
June 18, 1985 - Sunset -	6.30 p.m. TT Time
Age of Moon at sunset	10 hours 32 minutes

$$10 \text{ h } 32 \text{ m} \Rightarrow \frac{10\text{h } 32\text{m}}{24\text{h}} \times 12.2^{\circ} = 5.35^{\circ}$$

Altitude of the moon is 5.35°

$$1^{\circ} \Rightarrow 4 \text{ mins}$$

$$5.35^{\circ} \Rightarrow 21.4 \text{ mins}$$

Since this time is below our adjustment time of 24 minutes, the visibility time is NIL. The Crescent cannot be seen in Trinidad on June 18, 1985.

June 19, 1985:

$$\text{Age of moon at sunset} = 34\text{h } 32\text{m}$$

$$34\text{h } 32\text{m} \Rightarrow \frac{34\text{h } 32\text{m}}{24\text{h}} \times 12.2^{\circ}$$

$$= 17.5^{\circ}$$

$$\text{Altitude of the moon} = 17.5^{\circ}$$

$$17.5^{\circ} \Rightarrow 70 \text{ mins}$$

$$\text{Adjustment} = 24 \text{ mins}$$

$$\text{Visibility Time} = 46 \text{ mins}$$

The moon's crescent would be visible for 46 minutes on June 19, 1985 24 minutes after sunset. Eid-ul-Fitr would therefore be on June 20, 1985.

Over the years, Muslims have speculated whether a moon 20 hours old, 19 hours old or 18 hours old is visible. Based upon the mathematical principles above, an attempt is now made to give an insight as to how the ages of the moon determine visibility.

Age of New Moon at Sunset	Altitude	Equivalent in minutes	Adjustment in minutes	Visibility Period
10 hours	5.08 ⁰	20.31	- 24	Nil
11 hours	5.59 ⁰	22.4	- 24	Nil
12 hours	6.10 ⁰	24.4	- 24	0.4 mins
13 hours	6.61 ⁰	26.4	- 24	2.4 mins
14 hours	7.12 ⁰	28.4	- 24	4.4 mins
14½ hours	7.37 ⁰	29.5	- 24	5.5 mins
15 hours	7.63 ⁰	30.5	- 24	6.5 mins
16 hours	8.13 ⁰	32.5	- 24	8.5 mins
17 hours	8.64 ⁰	34.6	- 24	10.6 mins
18 hours	9.15 ⁰	36.6	- 24	12.6 mins
19 hours	9.66 ⁰	38.6	- 24	14.6 mins
20 hours	10.17 ⁰	40.7	- 24	16.7 mins

Conclusion

When the new moon is only ten hours old a faint crescent exists in the western horizon. It is however, very low on the horizon and would be obscured by the ring of light (haze) low on the horizon which occurs at twilight after the sun has set. The crescent is therefore not visible. Above twelve hours there is a very short visibility period before the moon goes under the horizon as the earth turns eastwards.

Information received from the meteorological office at Piareo.

indicates that the youngest moon seen on record was of age 14½ hours. In Trinidad, the youngest moon seen by members of the Ahmadiyya Anjuman Isha'at-i-Islam Inc., was of age 17 hours. The Anjuman uses this age as its cut-off point. Once the moon is 17 hours old or above, the crescent moon has appeared and it is visible, since it has already been seen at this age. It is necessary to emphasize that the Anjuman relies **BOTH ON CALCULATION AND SIGHT**. It calculates the age of the moon. If its age is above 17 hours the crescent has appeared and is visible. (since it has been seen before) and the new lunar month has begun. This applies for every month of the Islamic year.

It is perhaps very evident that no mention has been made of weather conditions in determining the visibility of the crescent. The phases of the moon as discussed, depend upon the amount of light from the sun which is reflected by the moon. Since at new moon the moon is between the earth and the sun, the crescent which appears after new moon, receives its light direct from the sun and in no way is it affected by weather conditions on earth. What is affected is our vision which is impaired by clouds that might exist above the earth. This is true even for the full moon whose brightness is at times totally blotted out by heavy dark clouds on a rainy day. Weather conditions on earth do not affect the phases of the moon. They temporarily impair our observation of the phase. So too would fog, smoke, Sahara Dust, pollution and the effects of nuclear warfare. Thus the crescent which heralds any lunar month may not be 'sighted' by us due to atmospheric conditions, but the crescent has appeared and of greater significance is the fact that the new lunar month has begun oblivious to weather and other conditions on earth. Such is the ordinance of the Creator of the Heavens and the Earth for all mankind for all times.

"The sun and the moon follow a reckoning" (Qur'an- 55:5).

"But nay, I call to witness the sunset redness

And the night and that which it drives on