

Study Points:

- 12.1 Artificial satellite
- 12.2 Artificial satellite launching
- 12.3 Types of artificial satellites
- 12.4 Use of artificial satellite
- 12.5 Main artificial satellites of India
- 12.6 Indian space research organization.

You know that in our solar system eight planets - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune, are revolving around the sun. Similarly, some objects are also revolving around these planets are called satellite. These satellites are natural satellites for example - Moon is earth's natural satellite. Can man also made any satellite? Let us know about it.

12.1 Artificial satellite

The man-made satellites which are revolving around the earth or other planets are called artificial satellites. These are different from natural satellites.

Today you are using the television, radio, mobile, etc. all these are working due to artificial satellites. The powerful telecommunication on earth has become possible only due to artificial satellite.

12.2 Artificial satellite launching

How do these satellites sent into space and how do these remain there? Let us know about it by doing an activity.

Activity-1

Take objects like ball, stone, rubber, duster, etc. and throw them upwards one-by-one. Observe all the things and tell that in which direction all these objects move. We see that all the objects reach at certain height and return back to earth. These observations indicate that earth attracts these objects. Due to this attraction of earth all objects thrown upwards return back to earth. This effect is called gravitational attraction.



Fig 12.1 Satellite launching

The artificial satellites are sent into space in this way, does the earth attract them due to earth's gravitational attraction? Then, in what way the artificial satellite is to be sent into space, so, it never returns to earth?

Let us try to understand this by following activity.

Activity-2

Take a ball and throw it upward slowly and observe it. You will see that it reaches at certain height and returns towards earth. Now, again throw it upwards with more velocity and observe the distance covered by it. Again throw it upwards with much more velocity and observe the distance covered by it. We note that with increase in upward velocity, the distance (height) covered by object.

The bullet fired by the gun, rockets in crackers etc. have high velocity when these are fired upwards. So, these objects reach at more height compared to objects throw by hands, and return back to earth. Similarly, if we can provide an object with such high velocity by the high quality rocket, then it crosses the earth's gravitational attraction and will never return to earth.

“The minimum velocity on earth by which the object is thrown upwards and crosses the earth's gravitational attraction, is called escape velocity. It is 11.2 km/sec for any object on earth.”

So, if any object thrown upwards with a velocity more than escape velocity, it goes into space. But if any object thrown upwards with a velocity few less than escape velocity then it does not cross the earth's gravitational attraction and revolve in certain orbit around the earth. It is called artificial satellite. The artificial satellites are sent into space by rocket or satellite launching vehicle.

12.3 Types of artificial satellites

There are two types of man-made satellite based on distance of satellite related to earth in space and application of satellite. These are (1) Geo-stationary satellite and (2) polar satellite.

Geo-stationary satellite:

We know that each satellite revolves around the earth in a certain orbit. Any satellite which revolves around the earth seems stationary on viewing from a certain position on earth, is called geo-stationary satellite. This satellite positioned at 36000 km upward distance from earth surface. It revolves in equatorial linear orbit.

Let us know about it

The time period of revolution of Geo-stationary satellite is 24 hours which is equal to rotation period of earth. So, the geo-stationary satellite also revolves around the earth from west to east in 24 hours in its own orbit. That is why it seems stationary viewing from earth surface.





Fig 12.2 (A) Geo-stationary satellite



Fig 12.2 (B) Collection of data through satellite dish positioned on school.

Geo-stationary satellites are used in, satellite telephones, satellite televisions, satellite radios, etc., for worldwide telecommunication. That is why, geo-stationary satellites are also called telecommunication satellite.

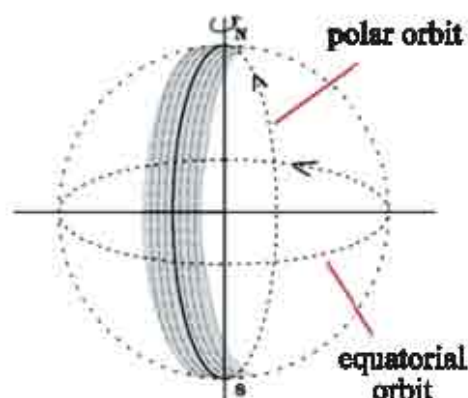
Polar satellite:

Satellite which revolves in polar orbits of earth is called polar satellite. Polar satellites revolve at less height from the earth surface. The satellite's distance from earth's surface is 500 to 800 km approximately.

The many important information like images of clouds, information about atmosphere, hole in ozone layer, etc., are collected by polar satellites. The information collected by polar satellites are used in remote sensing, whether science, environmental study, etc. The important thing is that a polar satellite can observe earth's whole surface, once or twice a day through its camera.



Fig. 12.3 a) Polar satellite



(b) Satellite revolving orbit.

To get information about the object without direct contact to the object, is called remote sensing.



Kalpana Chawla

(March 17, 1962 – February 1, 2003)

First Indian lady space traveller who died in space shuttle of Columbia during returning back.

Fig. 12.4 Kalpana Chawla

India has launched many remote sensing satellites namely - IRS-1A, IRS-2B, IRS-3C, etc. How do we get the signals on radio, television, mobiles, etc. through the satellites? Let us know about it.

See the fig. 12.5 and discuss among each other and tell how is communication arrangement taking place through artificial satellite?

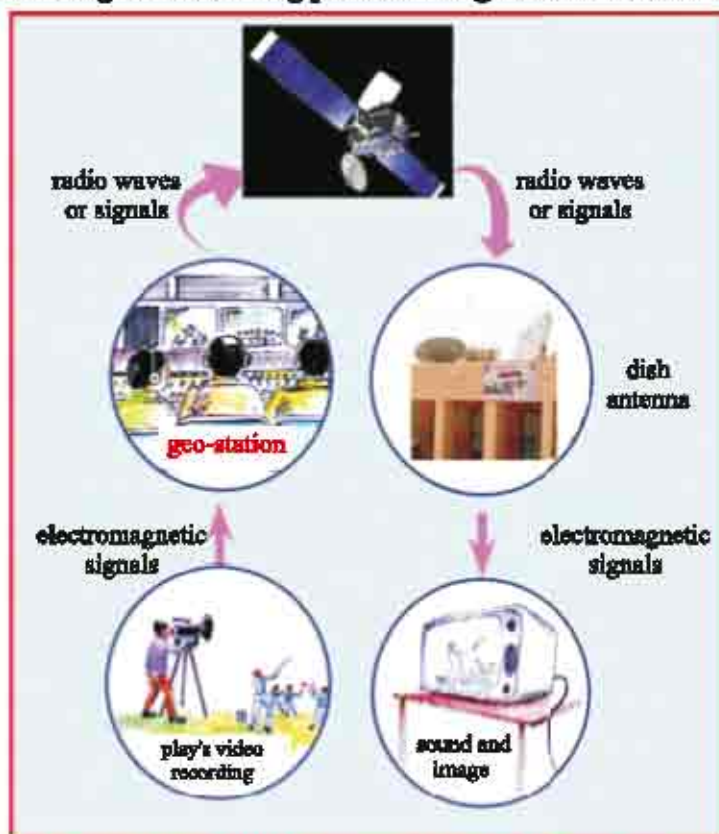


Fig. 12.5 Satellite communication system

Note : microwaves and radio waves can propagate in vacuum or without any medium.

12.4 Uses of artificial satellite

Artificial satellites are very useful to us. In many areas we are getting information and facility using artificial satellites. For example:-

1. Telecommunication means - Telephone, Mobile, Television, Internet, etc. receives signal from different locations on earth and transmit it to another position of earth.
2. To obtain the information about the data collected from meteorological and geological areas.
3. To estimate the crop area and production.
4. To provide warning about the drought and flood and to estimate the loss from these calamities.
5. To discover underground water reservoir and water management.
6. To identify the mineral in geological repositories.
7. To assist the forest conservation by surveying the forest areas.
8. To monitor the airports, sea ports, and defence post, etc. So that it preserve the security management easily.
9. To spy monitoring of army activities.
10. To get information about the events happening in space and atmosphere.
11. To identify the exact location of aeroplane, ship, person, and object.

12.5 Main artificial satellites of India

Now-a-days, the satellites are sent into space for different purpose by the many countries of world. First artificial satellite was sent into space on 4th October, 1957 by Russia. After that many individual satellite sent into space by many countries. Now-a-days, earth has more than 3000 artificial satellites.

The first artificial satellite was sent in space in 1975 by India. Since then, many than 70 different types of satellite have been sent into space by India. These satellites are sent by different space shuttles. Most of Indian satellites are sent in space through America, Russia, European satellite-launching rockets and space shuttles.

The main satellites are sent into space, with the help of Indian Space Research Organization (ISRO), of India. These are following -

1. First Indian artificial satellite was "Aryabhata". It was named on famous ancient Indian mathematician "Aryabhata".



Fig. 12.6 Aryabhata

- It was launch into space in April 19, 1975 through Baikonur space station of European union. Its main purpose was to study the earth atmosphere.
2. After that, in 1979, Bhaskar-1 was sent into space which was the India's first experimental satellite in remote sensing area.
 3. At the end of 1980, India has started to launch polar satellite into space. These are named as Indian remote sensing satellites i.e. IRS series satellites. These are used for natural resource management, survey, climate forecasting, and space application.
 4. In starting of 1980, The INSAT series satellites were launched into space with the help of European launching vehicle. These are used to gather information about weather and telecommunication.
 5. ISRO has launched a satellite on February 5, 2003 for obtaining information about weather. It was named as Kalpana-1 in memory of first Indian space traveller Kalpna Chawla. It is first satellite which is related to weather science.
 6. India launched its first educational satellite EDUSAT in 2004 (<http://isro.gov.in>)

12.6 Indian Space Research Organization

Indian National committee for space research (INCOSPAR) was called by Department of Atomic Energy in 1962 led by famous scientist Homi Jahangir Bhabha. It was re-established in 1969 as ISRO (ISRO - Indian Space Research Organization). In India, manufacturing of satellites, development and launching are done by ISRO. Dr. Vikram Ambalal Sarabhai is credited to start Indian space programme.



Fig. 12.7 Eduset

Space and planets related research and development works are being carried out with the help of space based experiments done by ISRO. Dr. A.P.J. Abdul Kalam played a vital role in manufacturing of Indian satellite launching vehicle during working on many important projects of ISRO. Nowadays, India become self-reliant in manufacturing of the high standard satellite launching vehicle. America and other countries also use Indian satellite launching vehicles to launch their artificial satellite. ISRO has launched more than 50 satellites of other countries.

ISRO's centres are in all over India. Its main launching centre is at Shri Harikota (SHAR), Chennai. National centre for space related research is Physical Research Laboratory at Ahmedabad (PRL). Vikram Sarabhai Space Centre is located in Thiruvananthapuram. A remote sensing centre is also located at Jodhpur, Rajasthan, to study the obtained maps, information and other data, etc., from artificial satellites.

Dr. Vikram Ambalal Sarabhai

Dr. Vikram Ambalal Sarabhai was born on August 12, 1919 in Ahmedabad, India. He was main scientist of India and was honoured with 'Padma Bhushan' in the field of science and technology by the government of India in 1966.

Vikram Sarabhai made recognition of India on world fame. He received his doctorate on "Cosmic ray physics" from Cambridge (U.K.). He wrote 86 scientific research paper and established 40 institutions in the different field. Among them for space research are Vikram Sarabhai space centre, Thiruvananthapuram and space application centre Ahmedabad. Dr. Vikram Sarabhai was a scientist, visionary, industrial manager and also having interest in music, photography, fine arts. Dr. Vikram Sarabhai died on 30 december, 1971 in the age of 52 years. Posthumously he was honoured by the "Padma Vibhushan"



Dr. A. P. J. Abdul Kalam

Dr. A. P. J. Abdul Kalam was born on October 15, 1931. Dr. Kalam, as a scientist and engineer, was involved in many important projects of defence research and development organization (DRDO) and Indian space research organization (ISRO).



During the work in ISRO he played a major role in development of India's first indigenous Satellite Launching Vehicle (S.L.V. - 3) and with help of it in July 1980, the Rohini satellite was successfully established in near earth's orbit. In this way, India also became member of the 'International space club'. Dr. Kalam had special contribution in missile development program of India. That is why, Dr. Kalam also known as "Missile man". Dr Kalam was also 11th president of India. In addition to education work, Dr. Kalam had written many books. The Government of India had honoured him with Padma Bhushan, Padma Vibhushan, Bharat Ratna, and many others prizes. Dr Kalam died on July 27, 2015 in Shillong, Meghalaya.

What have you learnt

- Man-made objects revolve in a certain orbits around the earth or other planets are called the artificial satellites.
- The minimum velocity by which an object thrown upwards and crosses the gravitational attraction forever, is called the escape velocity.
- The escape velocity for earth is 11.2 km/sec.
- The satellite which is seen at fixed position viewing from same location is called geo-stationary satellite. The geo-stationary satellite is also called communication satellite.
- Those satellite revolve in polar orbits of earth is called polar satellites. The polar satellites send information's and data related to climate, geology, earth-water, etc. over passing through various positions at different times and locations in a day.

- The artificial satellites proved their utility in telecommunication sector, climate information and warning alerts, scientific research, to identify water and minerals geological repositories, surveying the forest areas, spying, identifying the location of person and mobile, etc.
- The first Indian artificial satellite 'Aryabhata' was launched in April 19, 1975 from Baikonur space centre of earlier European union.
- Indian space research organization (ISRO) is doing an important work in manufacturing and developing of artificial satellite and satellite launching vehicles and also satellite launching and space science.

Exercises

Choose the correct answer.

- If any object is thrown upwards with velocity more than 11.2 km/sec then the object will -
 (A) Return to earth (B) revolve around the earth
 (C) Went into space (D) Non of the above ()
- The name of first Indian artificial satellite launched in space is -
 (A) Bhaskar -1 (B) Aryabhata
 (C) Kalpana -1 (D) INSAT - 1 ()
- The satellite is used for communication is called -
 (A) Polar satellite (B) S.L. V.
 (C) Geo-stationary satellite (D) I. R. S. - 1 ()

Fill in the blanks with suitable words.

- The minimum velocity by which an object thrown upwards it crosses the gravitational attraction of earth is called as.....
- Geo-stationary satellite revolvesorbit of earth.
- The first Indian artificial satellitewas launched in April 19, 1975.

Short answer questions

1. Explain the difference between the artificial satellite and natural satellite.
2. The objects, which are thrown upwards from earth, return back to earth whereas artificial satellite does not return back. Why?
3. Differentiate between geo-stationary satellite and polar satellite on the basis of orbital motion, distance from earth and its uses.

Long answer questions:

1. What do you mean by artificial satellite? Write its uses.
2. Write down any five Indian satellite's names, launching year and their uses.
3. Describe the various types of artificial satellites.
4. Write an essay on contribution of Indian space research organization in Indian space programme.

Activity work:

1. Prepare a scrap book by collecting the news, diagrams, other essays about the artificial satellite with the help of newspapers, scientific journals, and internet, etc.
2. Write an essay on ISRO's work, achievements, and targets. (<https://isro.gov.in>)
3. Make a list of major Indian space research centres and their places (<https://isro.gov.in>)
4. Prepare a chart of Artificial satellites sent by India and hang it in your classroom.

