10. Space Mission

Extra Questions

1) Complete the analogy

IRNSS: Direction showing satellite :: INSAT…….

Ans – Weather satellite

2) Moon mission……:: mars mission : mangalyaan

Ans – Chandrayaan 1

3) Satellite in HEO : 24 hrs :: satellite in LEO :

Ans – 90 min

4) Medium earth orbit : 2000 km to 35280 km to 35780 km :: Low earth orbit……..

Ans – 180 km to 2000 km

5) Hubble telescope : 569 km high from the earth's surface :: Revolving orbit of Hubble telescope :_____

Ans – Low earth orbit

6) True or false

If a spacecraft has to be sent away from the influence of the earth's gravitational field, its velocity must be less than the escape velocity

Ans – False

7) The escape velocity on the moon is less than that on the earth

Budhraj Elearning

Ans – True

8) A satellite needs a specific velocity to revolve in a specific orbit.

Ans – True

9) If the height of the orbit of a satellite increases, its velocity also increase

Ans – False

10) The satellite work on solar energy

Ans – True

11) GSAT is geosynchronous satellite

Ans – True

12) The orbit LEO has the height is 2000 km to 35780 km above earths surface

Ans – False

13) The geostationary satellite are useful in study of polar regions

Ans – false

14) The international space station revolve in lower earth orbits (LEO)

Ans – True

15) The launch vehicles with more than one stages are used

Buddhiraj Elearning

Ans – True

16) Define the following :

1) Natural satellite – A natural satellite is an astronomical object orbiting the earth or any other planet.

17) Artificial satellite – If a man made object revolves around the earth or any other planet in a fixed orbit, it is called an artificial satellite.

18) High earth orbits : If height of satellites orbit above earth's surface is greater than or equal to 35780 km, the orbit is called high earth orbit.

19) Medium Earth orbit : If height of satellite orbit above the earths surface is in between 2000 km and 35780 km the orbits are called medium earth orbit.

20) Low Earth orbit : If height of satellite orbit above earths surface is in between 180 km and 2000 km, the orbits are called low earth orbits.

21) What do you mean by the orbit of a satellite?

Ans – Orbit of a satellite is its path around the earth.

22) Which factor decides the orbit of satellites?

Ans – The function of a satellite decides the orbit of the satellite.

23) What is a high earth orbit satellite?

Buddhiraj Learning

Ans – A satellite orbiting at a height equal to or greater than 35780 km above the earth's surface is called a high earth orbit satellite.

24) What is a launch vehicle?

Ans – A rocket used to carry an artificial satellite to a desired height above the earth's surface and then project it with a proper velocity so that the satellite orbits the earth in the desired orbit is called a launch vehicle.

25) Give two examples of law earth orbit satellites

Ans – Weather satellite and International space station are law earth orbit satellite.

26) Name the launch vehicle developed by India

Ans – The launch vehicle developed by india is known as PSLV, i.e polar satellite launch vehicle.

27) Match the following

A	B	Answer
i) HEO	a) study of polar regions	a) Meteorology and TV, telephone signals.
ii) MEO	b) Scientific experiments and atmospheric studies.	b) Study of polar regions
iii) LEO	c) Meteorology and TV, telephone signals	c) Scientific experiments and atmospheric studies.

Buddhiraj Learning

28) Match the column

Column A	Column B	Answer
1) Clouds over India	a) Low earth orbit	• Weather satellite
2) Global communication	b) PSLV	• Communication satellite
3) Launch vehicle made by ISRO	c) Communication satellite.	• PSLV
4) International space station	d) EDUSAT	• Law Earth orbit
5) Navigational satellite	e) Weather satellite. f) Medium Earth orbit	• Medium Earth orbit.

29) What is meant by an artificial satellite?

How are the satellite classification based on their function.

Ans – A natural satellite is an astronomical object orbiting the earth or any other planet. The moon is the only natural satellite of the earth Some other planets in the solar system have more than one natural satellites. Similarly if of manmade object resolves around called an artificial satellite. The first artificial satellite sputnik was sent to space by soviet union in 1957.Today more than thousand satellites are orbiting the earth. The satellite works on solar energy. So, solar photovoltaic panels are attached on both sides of these satellites like wings. Instruments are

Buddhiraj Elearning

installed in the satellites to receive and transmit signals from and to the earth.

30) What is meant by the orbit of satellite?

Ans – Orbit of a satellite is its path around the earth. Orbit of artificial satellites can be classified on various basis.

1) On the basis of the angle of the orbital planet: orbital plane of a satellite can be the equatorial plane of the earth or it can be at an angle to it.

2) On the basis of the nature of the orbit: orbital plane can be circular or elliptical in shape.

3) On the basis of the height of the satellite: orbit of a satellite can be HEO, MEO or LEO

31) Give difference between

(HEO)	(MEO)
i) Height of satellite in HEO is greater than or equal to 35780 km	i) Height of satellite in MEO is in between 2000 km and 35780 km.
ii)These are not useful in study of polar regions	ii) These are useful in study of polar regions
iii) These orbits complete on revolution in almost 24hrs	iii) These orbits complete one revolution in 2 to 24 hrs.
iv) These satellites appear to be stationary and hence are called geosynchronous satellite.	iv) These satellites revolve with different velocities and hence do not appear stationary.

Buddhiraj Elearning

v) These are used in application like meteorology and for carrying telephone television signals.	v) These are used in application for navigation eg. Global positioning satellite (GPS)

32) What is meant by a satellite launch vehicle?

Ans – Satellite launch vehicles are used, to place the satellites in their specific orbits.

The functioning of the satellite launch vehicles is based on the Newton's third law of motion.

The launch vehicle uses specific type of fuel. The gas produced due to combustion of the fuel expands due to its high temperature and is expelled forcefully through the nozzles at rear side of the launch vehicle.

As a reaction of this, a thrust acts on the vehicle, which drives the vehicles high into the space.

The structure of the launch vehicle is decided by the weight of the satellite and the type of satellite orbit.

The fuel of the vehicle also depends on these factors.

The fuel forms a major portion of the total weight of the launch vehicle.

Thus, the vehicle has to carry a large weight of the fuel with it.

Budding Learning

To overcome this problem, launch vehicles with more than one stage are used.

Due to this, the weight of the vehicle can be reduced step by step, after its launching.

For launching the vehicle, the fuel and engine in the first stage are used.

This imparts a specific velocity to the vehicle and takes it to a certain height.

Once the fuel in this first stage is exhausted from the main body of the vehicle and fall either into a sea or on an unpopulated land.

33) Write a note on moon mission?

Ans – Since the moon is the closest astronomical object to us, the first space mission to objects in the solar system were the mission to the moon. Such missions have so far been executed by USA, Soviet Union, European Countries, China, Japan and India.

The space craft's in the Luna series sent by soviet union reduced near the moon.

Luna 2, launched in 1959 was first such craft.

After that, till 1975 is space craft's made chemical analysis of the moon and also measured its gravity, density and radiations.

Buddhiraj Elearning

Last four crafts even landed on the moon and brought the samples of stones on the moon for analysis in the laboratories.

All these missions were unmanned.

America also executed moon missions from 1962 to 1972.

The specialty of these missions was that some of these were manned mission.

In July, 1969 Neil Armstrong became the first human to step at the moon.

In 2008, Indian space research organization (ISRO) successfully launched chandrayaan 1 and placed it an into an orbit around the moon.

It sent useful information to earth for about a year.

The most important discovery made during the mission was the presence of water on the moon surface.

India was the first country to discover this.

34) Mars missions.

Ans – Next to the moon, the astronomical object nearest to the earth is the mars.

Many nations sent space crafts to the mars.

Mars mission is difficult and almost half the missions were unsuccessful.

Pudhiraj Elearning

However, ISRO's performance in this mission is remarkable and we all must be proud of it.

The spacecraft 'mangalyaan' made by ISRO using minimum expenses was launched in November, 2013 and was placed into orbit around the mars in September, 2014

It obtained very useful information about the surface of the Mars and the atmosphere around it.

35) Write a note on space missions away from earth.

Ans – As we have seen above, artificial satellite are being used for making our life more and more enriched.

However, in the previous standard, we have learnt about how the telescopes aboard artificial satellites are used to gather information about various object in the universe.

Similarly some space missions are used to gain further knowledge about the universe.

In these mission, spacecrafts are sent to the near by objects in the solar system to observe them more closely.

New information has been obtained form such mission and it is helping us to understand the creation and evolution of our solar system.

For such missions, the spacecrafts must escape the earth's gravitational force to travel into the outer space.

Pudhiraj Learning

To achieve this, the initial velocity of the moving object must be greater than the escape velocity of the earth as we have learnt in the chapter on gravity.

Escape velocity on a planet can be obtained using following formula:

$$V_{esc} = \sqrt{\frac{2GM}{R}}$$

G = Gravitational constant = $6.67 \times 10^{-11}\ Nm^2/Kg^2$

M = Mass of the planet = $6 \times 10^{24} kg$ (for earth)

R = Radius of the planet = $6.4 \times 10^{6} m$ (for earth)

$$V_{esc} = \sqrt{\frac{2 \times 6.67 \times 10^{-11} \times 6 \times 10^{24}}{6.4 \times 10^{6}}} = 11.8 \times 10^{3} m/s = 11.18\ km/s$$

Thus, if a spacecraft is to escape the earth's gravitational force to travel to the outer space, it must have minimum velocity of $11.2 km/s$

36) How are satellite classified based on their functions?

Ans – <u>i) Weather satellite:</u>

Weather satellite collect the information regarding weather of the region.

It towards temperature, air pressure, wind direction, humidity, cloud cover etc.

Buddhiraj Learning

ii) Communication satellite:

In order to establish communication between different place on the earth through mobile phones or computer assisted internet, communication satellite are used.

iii) Broadcasting satellite:

Broadcasting satellite are used to transmit various radio & television programmes & even live programmes from any place on the earth to any other place.

iv) Navigational satellite:

Navigational satellite assist the surface, water & air transportation & co-ordinate their busy schedule.

These satellites also assist the user with current live maps as well as real time traffic conditions.

v) Military satellite:

Every sovereign nation needs to keep the real time information about the borders.

Satellite helps to monitor all movement of neighboring countries or enemy countries.

vi) Earth observation satellite:

These satellites observe & provide the real time information about the earth.

37) Write short note on High Earth Orbits

Buddhini Learning

Ans – If the height of the satellites orbit above the earth's surface is greater than or equal to 35780 km. a satellite revolving in an orbit 35780 km above the earth's surface, will take around 24 hours to complete one revolution the earth also takes almost 24 hrs for one revolution.

If the satellite is revolving in an orbit parallel earth around itself & that for the satellite to satellite will appear to be stationary with respect to the earth.

For a passenger in one vehicle, another vehicle, moving parallel to him with equal velocity, appears to be stationary.

This is what happens here also. These satellite are, therefore called geosynchronous, satellite. since, these satellites are stationary with reference to the earth, they can observe a specific portion of the earth, continuously.

Therefore, they are used n applications like meteorology & for carrying signals for telephone television, radio etc.

38) Write a note on medium earth orbit

Ans – If the height of the satellite orbit above the earth's surface is in between 2000 km & 35180 km, the orbits are called medium earth orbits.

The geostationary satellites orbit above the equator. These are, therefore, not useful in the study of Polar Regions.

Buddhiraj Learning

For this purpose, elliptical medium earth orbits passing over the polar region are used.

These orbits are called polar orbits. In these orbits, the satellites complete one revolution in 2 to 24 hours.

Some of these satellites revolve in circular orbits at a height of around 20-200 km above the earth's surface. Global positioning satellites revolve in such orbits.

39) Write a note on low earth orbits.

Ans – If the height of the satellites orbit above the earth's surface is in between 180 km & 2000 km, the orbits are called low earth orbits.

The satellites used for scientific experiments & atmospheric studies revolve in low earth orbits.

Depending on the height of their orbits, they complete one revolution in around 90 minutes.

International space station & Hubble telescope also revolve in 20w earth orbits.

40) How are the orbits of artificial satellites classified?

Ans – 1) High Earth orbit (HEO) satellites than 35780 km above the earth's surface is called a High Earth orbit satellite.

The critical velocity (V_e) of a satellite revolving surface is 3.03 km/s

ii) Medium Earth orbit (MEO) satellite:

Buddhiraj Elearning

A satellite orbiting at a height between 2000 km & 35780 km above the earth's surface is called a medium earth orbit satellite. The orbit path of such a satellite is normally elliptical & passes through the north & the south polar regions.

iii) Low Earth orbit (LEO) satellite.

A satellite orbiting at a height between 180 km & 2000 km above the earth's surface is called a low earth orbit.

Normally, these satellites take 90 minutes to complete one revolution around the earth weather satellites space telescope & International space station are low earth orbit satellites.

41) If the mass of a planet is eight times the mass of the earth & its radius is twice the its radius is twice the radius of the earth, what will be the escape velocity for that planet?

Ans – Given,

i) The mass of the planet (m) is eight times the mass of the earth i.e $8 \times 6 \times 10^{24}$ kg

ii) The radius of the planet (B) is twice the radius of the earth, i.e $2 \times 6.4 \times 10^{6}$ km

iii) G = 6.67×10^{-11} N – m^2/kg^2

Escape velocity for that planet

$$V_{esc} = \sqrt{\frac{2GM}{R}}$$

Buddhiraj Learning

$$= \sqrt{\frac{2 \times 6.67 \times 10^{-11} N - \frac{m^2}{kg^2} \times 8 \times 6 \times 10^{24} kg}{2 \times 6.4 \times 10^{6}\ m}}$$

$$= \sqrt{\frac{6.67 \times 3}{4}} \times\ 10^{8}\ m/s$$

$$= \sqrt{\frac{20.01}{4}} \times 10^{4}\ m/s$$

$$= 2.237 \times 10^{4}\ m/s$$

$$= 22.37\ km/s$$

42) If the mass of a planet is 8 times that of the earth & its radius is twice the radius of the earth, what will be the escape velocity for that planet? (Escape velocity for the earth = 11.2 km/s)

Ans – Given:

Mass of the planet = 8Mp, radius of the planet, Rp = 2RE

escape velocity for the earth V_{esc} =?

$$V_{esc} = \sqrt{\frac{2GMp}{Rp}}$$

$$= \sqrt{\frac{2G(8M_E)}{2R_E}}$$

Buddhiraj Elearning

$$= \sqrt{\frac{8}{2} \times \frac{2GM_E}{R_E}}$$

$$= \sqrt{4} \times V_{esc}$$

$$\because V_{esc} = \sqrt{\frac{2GM_E}{R_E}}$$

$$= 2 \times 11.2$$

$$V_{esc} = 22.4 \text{ km/s}$$

43) Why is it beneficial to use satellite launch vehicle made up of more than one stage ?

Ans:- (1) Earlier Satellite launch vehicles (SLV) used to be of a single stage vehicles. Such SLVs used to be very heavy as well as expensive in terms of its fuel consumption . as a result , SLVs with multiple stages were developed.

(2) In multistage SLVs, as the journey of the launch vehicle progresses and the vehicle achieves a specific velocity and a certain height , the fuel of the first stage is exhausted and the empty fuel tank gets detached from the main body of the launch vehicle and falls back into a sea or an unpopulated land . as the fuel in the first stage is exhausted , the engine in second stage is ignited . however , the weight of the launch vehicle is now less than what it was earlier and hence it can move with higher

Buddhiraj Elearning

velocity . thus ,it saves fuel consumption . hence , it is beneficial to use a multistage satellite launch vehicle.

44) why are geostationary satellites not useful for studies of polar regions ?

Ans:- Geostationary satellites have two distinct characteristics:

(1) Geostationary satellites are HEO satellites and are placed at 35780 km above the earth's surface.
(2) A geostationary Satellite revolves in the equatorial plane of the earth , and thus , it can never fly above the polar regions.
Hence , geostationary satellites are not useful for studies of polar regions.

45) What are Space expeditions ? explain their need and importance in your words.

Ans:- A mission planned (i) for establishing artificial satellites in the earth's orbit , using them for research or for the benefit of life or (ii) for sending a spacecraft to the various components of the solar system or outside is called a space expedition.

space missions are now essential to understand the origin and evolution of our solar system as well as to study the universe beyond the solar system.

Buddhiraj Elearning

46) What is meant by space debris ? why is there need to manage the debris ?

Ans:- In a space nonessential object such as the parts of launchers and satellites , revolving around the earth are called the debris in space.

The debris can be harmful to the artificial satellites . it can collide with the satellites or spacecrafts and damage them. Therefore, the future of artificial satellites or spacecrafts are in danger.

Hence it is necessary to manage the debris.

47) What is a high earth orbit Satellite ?

Ans:- A satellite orbiting at a height equal to or greater than 35780 km above the earth's surface is called a high earth orbit satellite.

48) What is launch vehicle ?

Ans- A rocket used to carry an artificial satellite to a desired height above the earth's surface and then project it with a proper velocity so that the satellite orbits the earth in the desired orbit is called a launch vehicle

49) Where does the signal to your TV set come from ?

Ans- (1) Television centre or studio transmits the TV programme which first reaches the satellite . the dish antenna of

Buddhiraj Elearning

the cable operator in our area receives these signals . the TV programmes reach our TV set through a cable connected between the cable operators receiving station and our TV set.

(2) Alternatively , a small portable dish antenna fixed on the rooftop is also used to receive the TV signals directly from the satellites. Finally, a cable connected to the dish antenna and TV set brings the programme to our TV set

50) You may have seen photographs showing the position of monsoon clouds over the country in the newspaper . how are these images obtained ?

Ans- weather satellites take photographs of the sky above the earth's surface at regular intervals . some satellites , capable of receiving radio signals , also collect the information of weather conditions and finally images of the sky are built with computers. Territorial boundaries of the states and the country are drawn later on these images . such satellite images with imposed boundaries are printed in media or shown on the television.

Buddhi Learning