



30 Days Revision Module Day 25 - S&T I (UPSC Prelims 2021)

1) Consider the following statements about the “GPS-aided GEO Augmented Navigation” (GAGAN):

1. It has the capability to provide services to the countries outside Asia also.
2. All the aircraft irrespective to their mode of operation can establish their connectivity with GAGAN.
3. Recently, its capacity is enlarged to provide weather forecasting services to the fishermen in the Indian Ocean.

Which of the statements given above is/are correct?

- a. 1 only
- b. 1 and 3 only
- c. 2 and 3 only
- d. 3 only

Answer : a

- GAGAN footprint extends from Africa to Australia and has expansion capability for seamless navigation services across the region. Hence, it has the capability to provide services to the countries outside Asia also.
- The objective of GAGAN to establish, deploy and certify satellite based augmentation system for safety-of-life civil aviation applications in India. The system is interoperable with other international SBAS systems like US-WAAS, European EGNOS, and Japanese MSAS etc. Only civil aviation aircrafts can establish their connectivity with GAGAN.
- The drawback of GAGAN is that it only allows one-way communication, meaning it can't be used by fishermen to make calls.
- GEMINI (Gagan Enabled Mariner's Instrument for Navigation and Information) is a device developed to effectively disseminate emergency information and communication to fishermen on Ocean States Forecasting and Mapping of Potential Fishing Zones (PFZ).

2) Which of the following is/are considered to be the primary scientific goals of study at the world's largest radio telescope “FAST”?

1. Pulsar observations
2. Detecting gravitational waves
3. Search for aliens
4. Neutral Hydrogen survey

Select the correct answer using the code given below.

- a. 2 only
- b. 4 only
- c. 1, 3 and 4 only
- d. 1, 2, 3 and 4

Answer : c

FAST's science goals include:

1. Large scale neutral hydrogen survey
2. Pulsar observations
3. Leading the international very long baseline interferometry (VLBI) network
4. Detection of interstellar molecules
5. Detect interstellar communication signals
6. Pulsar timing array
7. Hunt for extraterrestrial life.

3) Consider the following statements with reference to 'Mars Opposition'

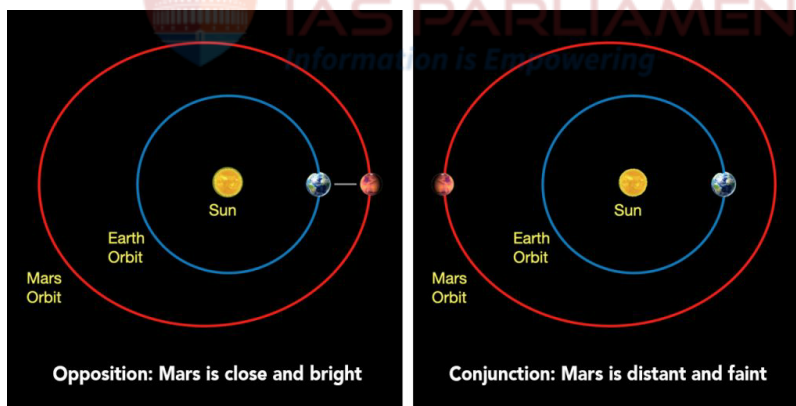
1. It is the event when the sun, Earth and Mars are lined up, with Mars in the middle
2. It takes place every one year and one month
3. Mars appears brighter in the sky during this event

Which of the statements given above is/are correct?

- a. 1 and 2 only
- b. 2 and 3 only
- c. 3 only
- d. 1, 2 and 3

Answer : c

- During opposition, Mars and the sun are on directly opposite sides of Earth. To put in a perspective of the spinning world, Mars rises in the east just as the sun sets in the west. Sun, Earth and an outer planet (Mars in this case) are lined up, with the Earth in the middle.
- Mars oppositions happen about every 26 months.
- Mars will appear as a bright star to the unaided eye.



4) 'Giant Metrewave Radio Telescope' sometimes seen in the news recently, is located in

- a. India
- b. United States of America
- c. China
- d. Norway

Answer : a

- NCRA(The National Centre for Radio Astrophysics) has set up a unique facility for radio astronomical research using the metre wavelengths range of the radio spectrum, known as the Giant Metrewave Radio Telescope (GMRT).
- It is located at a site about 80 km north of Pune,India.
- GMRT consists of 30 fully steerable gigantic parabolic dishes of 45m diameter each spread over distances of upto 25 km.
- It is one of the most challenging experimental programmes in basic sciences undertaken by

Indian scientists and engineers.

5) The Mission hope, recently seen in the news, is related with which of the following?

- It is China's mission to bring back the moon's rock to the Earth
- It is NASA's mission to land on the Asteroid
- Japan's mission to go out of the heliosphere
- It is the first mission from the Middle East country to Mars

Answer : d

- Hope is the UAE's fourth space mission and first interplanetary mission. With this, the UAE has become the fifth country after the US, Russia, China, the EU, and India, to reach the Martian orbit.

6) Consider the following statements with reference to Black holes

- Black holes are a direct consequence of Albert Einstein's general theory of relativity.
- A Black hole is formed when stars collapse.
- The gravity inside a black hole is very weak.

Which of the statements given above are correct?

- 1 and 2 only
- 2 and 3 only
- 1 and 3 only
- 1, 2 and 3

Answer : a

- Black holes are a direct consequence of Albert Einstein's general theory of relativity.
- The most commonly known way a black hole forms is by stellar death.
- Black holes are points in space that are so dense they create deep gravity sinks. Beyond a certain region, not even light can escape the powerful tug of a black hole's gravity.

7) The Great Conjunction, which is a recent phenomenon in international space science, indicates which of the following event?

- It is a very rare event of both Earth and Jupiter comes very closer.
- It is a close encounter of Jupiter and Saturn in the night sky.
- The Earth and Venus came very closer in the night sky.
- The Earth was in the position of Perigee towards the Sun.

Answer : b

- Jupiter caught up to and passed Saturn, in an astronomical event known as a "Great Conjunction."
- What makes this year's spectacle so rare is that it's been nearly 400 years since the planets passed this close to each other in the sky, and nearly 800 years since the alignment of Saturn and Jupiter occurred at night, as it will for 2020, allowing nearly everyone around the world to witness this "great conjunction."

8) "Arktika-M satellite", sometimes seen in the news recently, belongs to

- India
- Russia
- United States of America
- China

Answer : a

- 'Arktika-M satellite' will be Russia's first ever satellite for monitoring the Arctic climate and environment with the help of remote sensing and emergency communications satellites.

9) Due to the Global warming and climate change, there is an increase in the occurrence of cyclones and extreme weather events across the Globe. In order to predict these atmospheric disturbances, which of the following programmes/satellites can be useful?

1. HySIS
2. EMISAT
3. TOPS
4. CYGNSS
5. Copernicus

Select the correct answer using the code given below.

- a. 2 only
- b. 1, 3 and 4 only
- c. 3, 4 and 5 only
- d. 1, 2, 3, 4 and 5

Answer : c

- HySIS (Hyperspectral Imaging Satellite) is an Earth observation satellite which will provide hyperspectral imaging services to India for a range of applications in agriculture, forestry and in the assessment of geography such as coastal zones and inland waterways.
- EMISAT is an Indian reconnaissance satellite under Defence Research and Development Organisation (DRDO) project Kautilya which is a package that provides space-based electronic signal intelligence or ELINT.
- The spacecraft helps in improving the situational awareness of the Indian Armed Forces as it will provide information and location of enemy radars. Hence, it is not used to predict atmospheric disturbances.
- The Terrestrial Observation and Prediction System (TOPS) is a flexible modeling system that integrates ecosystem models with satellite and surface weather observations to produce ecosystem nowcasts and forecasts useful in natural resources management, public health, and disaster management.
- The Cyclone Global Navigation Satellite System (CYGNSS) is a space-based system developed by the University of Michigan and Southwest Research Institute with the aim of improving hurricane forecasting by better understanding the interactions between the sea and the air near the core of a storm.
- Copernicus is the European Union's Earth observation programme aims at achieving a global, continuous, autonomous, high quality, wide range Earth observation capacity.
- Providing accurate, timely and easily accessible information to, among other things, improve the management of the environment, understand and mitigate the effects of climate change, and ensure civil security.

10) Consider the following statements about the "Ion rocket":

1. It is an electric propulsion system which enables modern spacecraft to travel farther, faster and cheaper than chemical propulsion technology.
2. India's Reusable Launch Vehicle (Hyper Plane) uses this technology which enables it to achieve hypersonic speed and to operate in the Outer Space.

Which of the statements given above is/are correct?

- a. 1 only
- b. 2 only
- c. Both 1 and 2
- d. Neither 1 nor 2

Answer : a

- The ion propulsion system's efficient use of fuel and electrical power enable modern spacecraft to travel farther, faster and cheaper than any other propulsion technology currently available. Ion thrusters have many in-space propulsion applications. The best applications make use of the long mission interval when significant thrust is not needed.
- India's Reusable Launch Vehicle (RLV) does not use ion propulsion system. It uses scramjet engine for propulsion.

11) Which one of the following ongoing/proposed mission of ISRO is capable to connect two flying objects in space, either to transfer vyomanauts or material from one to the other, or two join two structures to make a bigger one?

- ASPIRE
- SPADEX
- NISAR
- Gaganyaan

Answer : b

- Docking refers to connecting of two flying objects in space, either to transfer men or material from one to the other, or two join two structures to make a bigger one.
- SPADEX or Space Docking Experiment is a twin spacecraft mission being developed by Indian Space Research Organisation to mature technologies related to orbital rendezvous, docking, formation flying and remote robotic arm operations, with scope of applications in human spaceflight, in-space satellite servicing and other proximity operations.
- The NASA-ISRO Synthetic Aperture Radar (NISAR) mission is a joint project between NASA and ISRO to co-develop and launch a dual-frequency synthetic aperture radar on an Earth observation satellite.
- Gaganyaan is an Indian crewed orbital spacecraft intended to be the formative spacecraft of the Indian Human Spaceflight Programme.

12) With reference to the Solar Missions of various space agencies, consider the following statements:

1. Solar Orbiter (SolO) is the first man-made object to orbit the atmosphere of Sun and it recently captured the images of Sun's Polar Regions.
2. Both Parker and Aditya-L1 missions will study the coronal regions of the Sun from the interplanetary space.

Which of the statements given above is/are **not correct**?

- 1 only
- 2 only
- Both 1 and 2
- Neither 1 nor 2

Answer : c

- Solar Orbiter (SolO) is not the first man-made object to orbit the atmosphere of Sun. SolO will use the gravity of Venus and Earth to swing itself out of the ecliptic plane, passing inside the orbit of Mercury, and will be able to get a bird's eye view of the sun's poles for the first time.
- Hence, it will not orbit the atmosphere of the Sun. It recently captured the images of Sun's Polar Regions.
- Aditya-L1 will observe Sun's Corona, Chromosphere and photosphere of the sun and it will be inserted in a halo orbit around the L1, which is 1.5 million km from the Earth.
- Parker Solar Probe will travel through the sun's atmosphere closer to the surface than any spacecraft before it.
- Hence, only Aditya-L1 mission will study the coronal regions of the Sun from the interplanetary space.

13) Consider the following passage:

"This observatory is intended to observe as many of the galaxy's stars as possible. It is designed to measure stellar positions, distances, motions, and brightness with more precision than any instrument before, with the goal of cataloguing approximately 1 billion objects. It is designed to observe each object about 70 times or so in order to track their motions and velocities over time, accurate enough to measure the width of a hair from 2,000 kilometres away. Through data collected by this observatory, astronomers have just released a new 3D atlas of the galaxy and its stars moving through space. This is the most precise 3D map of the Milky Way ever made".

Which one of the following space observatories is described in the above passage?

- a. Hubble Space Telescope
- b. Astrosat
- c. Gaia
- d. James Web Space Telescope

Answer : c

- The Hubble Space Telescope is a space telescope that was launched into low Earth orbit in 1990 and remains in operation. It was not the first space telescope, but it is one of the largest and most versatile, well known both as a vital research tool and as a public relations boon for astronomy.
- Astrosat is India's first dedicated multi-wavelength space telescope. It was launched on a PSLV-XL on 28 September 2015. With the success of this satellite, ISRO has proposed launching AstroSat-2 as a successor for Astrosat.
- Gaia space observatory was launched in 2013 is intended to observe as many of the galaxy's stars as possible. It is designed to measure stellar positions, distances, motions, and brightness with more precision than any instrument before, with the goal of cataloguing approximately 1 billion objects. It is designed to observe each object about 70 times or so in order to track their motions and velocities over time, accurate enough to measure the width of a hair from 2,000 kilometers away.
- The James Webb Space Telescope is a space telescope that is planned to succeed the Hubble Space Telescope as NASA's flagship astrophysics mission.

14) Which of the following are advantages of launching communication satellites in the Low Earth Orbit?

1. Footprint of the satellites can be increased.
2. Communication latency can be eliminated.
3. Speed of the Internet connections can be increased.

Select the correct answer using the code given below.

- a. 3 only
- b. 2 only
- c. 1 and 3 only
- d. 1, 2 and 3

Answer : a

- A low Earth orbit (LEO) is an Earth-centred orbit with an altitude of 2,000 km or less (approximately one-third of the radius of Earth), or with at least 11.25 periods per day.
- Satellites in LEO have a small momentary field of view, only able to observe and communicate with a fraction of the Earth at a time, meaning a network (or "constellation") of satellites is required in order to provide continuous coverage. Hence, the Footprint of the satellites will be decreased.
- A low Earth orbit requires the lowest amount of energy for satellite placement. It provides high bandwidth and low communication latency. Satellites and space stations in LEO are more accessible for crew and servicing.
- Due to low communication latency, the speed of Internet connections can be increased.

15) Consider the following statements:

1. In the Solar System, among 8 planets, only Earth and Mars are suitable for human habitation.
2. Exoplanets are planets outside the Solar System having similar habitable conditions like Earth and Mars.
3. Till recently discovered exo-planetary systems, only TRAPPIST-1 system has planets all suitable for human habitation.

Which of the statements given above is/are correct?

- a. 1 only
- b. 1 and 3 only
- c. 2 and 3 only
- d. None of the above

Answer : a

- In the Solar System, among 8 planets, only Earth and Mars are suitable for human habitation because Mars isn't too cold or too hot, its soil contains water to extract, day/night rhythm is very similar to ours here on Earth and so on. But other planets are not within the habitable zone.
- Exoplanets are the planets that orbit around other stars located outside our solar system. Exoplanets are also called extrasolar planets. They are not necessarily to have similar habitable conditions like Earth and Mars.
- TRAPPIST-1 system has seven planets a,b,c,d,e,f and g. Only three (e, f, and g) are considered to be within its habitable zone. There are other habitable exoplanets discovered before like Proxima Centauri b, Kepler-452b etc.,

16) Consider the following statements about the Missile Shaurya:

1. It is medium range ballistic missile.
2. It is capable of travelling at the speed of sound.
3. It can be fired from the ships and fighter aircrafts.

Which of the statements given above is/are correct?

- a. 2 only
- b. 2 and 3 only
- c. 1, 2 and 3 only
- d. None of the above

Answer : a

- Shaurya is a land variant of short range SLBM K-15 Sagarika, which has a range of at least 750 kilometers. Hence, it is a short-range ballistic missile.
- Missile Shaurya is capable of travelling 7.5 times the speed of sound.
- Shaurya is a land-based parallel of the submarine-launched K-15 missile. The K family of missiles is primarily Submarine Launched Ballistic Missiles (SLBMs), which have been indigenously developed by DRDO.

17) Consider the following statements about the "Small Satellite Launch Vehicle" (SSLV):

1. SSLV can able to carry Nano, Pico and Femto satellites upto the payload of 450 Kilograms to the Geostationary Orbit.
2. SSLV will be launched from a dedicated launch pad at Kulasekharapatnam by Antrix Corporation, a commercial arm of ISRO.

Which of the statements given above is/are correct?

- a. 1 only

- b. 2 only
- c. Both 1 and 2
- d. Neither 1 nor 2

Answer : d

- The Small Satellite Launch Vehicle (or SSLV) is a small-lift launch vehicle being developed by the Indian Space Research Organisation (ISRO) with payload capacity to deliver 500 kg to low Earth orbit (500 km) or 300 kg to Sun-synchronous orbit (500 km) for launching small satellites, with the capability to support multiple orbital drop-offs.
- It will not carry the payload to the Geostationary Orbit.
- SSLV will be launched from a dedicated launch pad at Kulasekharapatnam in Tamil Nadu by NewSpace India Limited (NSIL), a commercial arm of ISRO.

18) The term “Kessler Syndrome” is used to indicate

- a. A genetic chromosome 21 disorder causing developmental and intellectual delays
- b. Skin infection which affects the epidermal layer and is the result of high exposure to sunlight
- c. Phenomena of collision between space debris to produce more debris and further increase the likelihood of more collision
- d. A mitochondrial disease that is hereditary and is passing on among generations

Answer : c

- Kessler Syndrome is a scenario in which the density of objects in low Earth orbit (LEO) is high enough that collisions between objects could cause a cascade where each collision generates space debris that increases the likelihood of further collisions.

19) With reference to the Quick Reaction Surface to Air Missile (Maitri), consider the following statements:

1. It is propelled by solid fuel and liquid fuel in its first and second stage respectively.
2. It is most effective for High Flying target above the height of 50 km.

Which of the statements given above is/are correct?

- a. 1 only
- b. 2 only
- c. Both 1 and 2
- d. Neither 1 nor 2

Answer : d

- The missile is propelled by a single-stage solid propellant rocket motor and uses all indigenous subsystems.
- The QRSAM system has achieved a major milestone by a direct hit at medium range and medium altitudes.

20) With reference to lifecycle of a star, arrange the following events/processes in the correct sequential order (from star birth to its death):

1. Red giant
2. Protostar
3. Fusion ignition
4. White dwarf

Select the correct answer using the code given below.

- a. 1-2-3-4
- b. 2-1-3-4
- c. 2-3-1-4

d. 2-3-4-1

Answer : c

- The star is born from the giant cloud of gas and dust called the nebula. This collapses into a protostar as the gravitational force of attraction starts working on it.
- As the contraction occurs the temperature begins to rise. Eventually, the temperature reaches 15 million degrees at the centre of the star. This gives rise to Nuclear fusion.
- This will make the clouds to glow and eventually becomes stable for millions of years. When the core is out of supply of Hydrogen star reaches its Red Gaint phase.

