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INSPECTOR BABA - SPACE MISSIONS(THEORY+PYQS)

➤ ISRO OVERVIEW & FOUNDATIONAL HISTORY:

- **Full Form** : Indian Space Research Organisation
- **Established** : 15 Aug 1969
- **Founder** : Dr. Vikram Sarabhai (*the Father of the Indian Space Program*)
- **Headquarters** : Bengaluru, Karnataka
- **Motto** : *"Space technology in the service of humankind"*
- **Parent Department** : Department of Space, Government of India
- **Former Name:** INCOSPAR (Indian National Committee for Space Research), Originally set up as INCOSPAR in 1962 by Prime Minister Nehru on Vikram Sarabhai's recommendation, it was renamed ISRO in 1969.
- **Current Chairman (as of Sept. 2026):** Dr. V. Narayanan, succeeded S. Somanath on Jan 25.
- **National Space Day:** Celebrated on 23 August every year to mark Chandrayaan-3 landing.

➤ Key ISRO Operational Centers & Functions :

Center Name	Location	Primary Operational Role
HSFC (Human Space Flight Centre)	Bengaluru, Karnataka	Lead center for astronaut training and Gaganyaan life-support systems.
LPSC (Liquid Propulsion Systems Centre)	Thiruvananthapuram & Bengaluru	Development of liquid and cryogenic propulsion stages.
NRSC (National Remote Sensing Centre)	Hyderabad, Telangana	Remote sensing data reception, processing, and aerial survey distribution.
SDSC-SHAR (Satish Dhawan Space Centre)	Sriharikota, Andhra Pradesh	Main spaceport with launch pads and vehicle integration facilities.
SAC (Space Applications Centre)	Ahmedabad, Gujarat	Development of optical and microwave communication/remote sensing payloads.
URSC (U R Rao Satellite Centre)	Bengaluru, Karnataka	Design, fabrication, and testing of satellite payloads.
VSSC (Vikram Sarabhai Space Centre)	Thiruvananthapuram, Kerala	Design & development of launch vehicles (PSLV, GSLV, LVM3).

➤ ISRO'S LAUNCH VEHICLES:

Launch Vehicle	Full Form	Overview & Key Details
ASLV	Augmented Satellite Launch Vehicle	Enhanced version of SLV, designed for higher payload capacity and improved flight stability.
GSLV	Geosynchronous Satellite Launch Vehicle	Designed to launch heavier communication satellites into higher Geostationary Transfer Orbits (GTO).
HLVM3	Human-rated LVM3	Specialized human-rated variant of LVM3 equipped to safely carry Indian astronauts for the Gaganyaan mission.
LVM3 (GSLV Mk-III)	Launch Vehicle Mk-III	ISRO's most powerful heavy-lift rocket (popularly called ' Bahubali '), key to landmark missions like Chandrayaan-2 and Chandrayaan-3.
NGLV	Next Generation Launch Vehicle	Future heavy-lift launcher currently under development, featuring reusable stages, methane-based propulsion, and up to 30 tonnes LEO capacity.
PSLV	Polar Satellite Launch Vehicle	ISRO's trusted workhorse, world-renowned for its exceptional reliability and versatile multi-orbit launching capabilities.
RLV	Reusable Launch Vehicle	Technological demonstrator prototype built to pioneer reusable space shuttle system technology.
SLV	Satellite Launch Vehicle	India's historic first satellite launch vehicle, which marked its debut success by placing Rohini-1 into orbit in 1980.
SSLV	Small Satellite Launch Vehicle	Modern, low-cost launcher created for rapid, on-demand placement of micro and nano satellites.

➤ TYPES OF INDIAN SATELLITES / SPACECRAFTS:

Type	Purpose	Examples
Communication Satellites	Telecom, broadcasting, telemedicine, tele-education	• INSAT series, GSAT series, CMS
Earth Observation Satellites	Mapping, meteorology, agriculture	• CARTOSAT, RESOURCESAT, OCEANSAT, EOS
Navigation Satellites	Accurate position and timing	NavIC (IRNSS) series: • NVS-02: Part of second-generation NavIC constellation • NVS-01: Launched on 29 May 2023 via GSLV-F12 - <i>Primary function:</i> Provide accurate regional navigation services over India and surrounding areas - <i>Features:</i> Carries L1 band signals for civilian devices (smartphones); includes rubidium atomic clocks for precise timekeeping Other Global Systems: • GPS (USA), GLONASS (Russia), Galileo (Europe), BeiDou (China), QZSS (Japan)
Scientific Satellites	Space research, exploration	• Chandrayaan (I, II, III), Mangalyaan (2013), Aditya-L1 (2023)
Technology Demonstration Satellites	Testing new space tech	• Microsat, INS series

➤ ARYABHATA - INDIA'S FIRST SATELLITE:

- **19 April 1975 — First Indigenous Satellite (Aryabhata):** India's first satellite, Aryabhata (named after the legendary ancient Indian astronomer 476–550 CE), was successfully launched into Earth orbit using a **Soviet Cosmos-3M** rocket from **Kapustin Yar, USSR**. Weighing 360 kg, it was a 26-sided polygon (polyhedron) covered with solar cells and was entirely designed and fabricated in India.
- **Scientific Objectives:** Designed to conduct pioneering scientific experiments in X-ray astronomy, solar physics, and aeronomy.
- **Historical Significance:** It laid the foundational cornerstone for India's future space programs and landmark missions, including INSAT, IRS, and Chandrayaan.

➤ **NISAR MISSION (NASA-ISRO SYNTHETIC APERTURE RADAR):**

- **Launch Date** : 30 July 2025
- **Launch Vehicle** : GSLV-F16 from Satish Dhawan Space Centre, Sriharikota
- **Partners Agencies** : Developed jointly by **NASA** (USA) and **ISRO** (India). It marks India's *first joint space mission with NASA*
- **Satellite Type** : High-resolution, dual-frequency **Radar Earth Observation Satellite**
- **Dual-Band SAR Radar:**
 - **L-band:** Provided by NASA
 - **S-band:** Provided by ISRO
- **Orbit** : Polar/Sun-synchronous orbit (SSO), revisits every 12 days (To achieve temporal resolution for global coverage and land deformation monitoring)
- **Launch Mass** : Approximately **2,400 kg**
- **Key Objectives** : Forest biomass, Land deformation, Earthquakes, Glaciers and ice, Natural disasters

➤ **AXIOM MISSION 4 (AX-4):**

- **Launch Date** : 25 June 2025
- **Launch Vehicle** : SpaceX Falcon 9
- **Launch Site** : NASA Kennedy Space Centre, Florida, USA
- **Spacecraft** : SpaceX Crew Dragon (reusable rocket)
- **Operator** : Axiom Space (US-based private space infrastructure company)
- **Destination** : International Space Station (ISS) in Low Earth Orbit (400 km)
- **Duration** : 18 days, completing 320 orbits and covering 8.4 million miles

Crew Members:

The mission carried four astronauts representing four different nations:

1. Peggy Whitson (Commander – USA / Axiom Space, making her 5th spaceflight).
2. **Group Captain Shubhanshu Shukla (Pilot – India / ISRO, *first Indian astronaut to visit and board the International Space Station*).**
3. Sławosz Uznański (Mission Specialist – Poland / ESA).
4. Tibor Kapu (Mission Specialist – Hungary)

Key Significance:

- **First Indian on the ISS:** Group Captain Shubhanshu Shukla became the **first Indian astronaut to visit and board the International Space Station**.
- **Historical Distinction:** While Wing Commander Rakesh Sharma was the first Indian citizen in space in 1984 aboard the Soviet *Soyuz T-11* spacecraft, Group Captain Shubhanshu Shukla is the first Indian to dock at and reside on the ISS.

- **Preparation for Gaganyaan:** The operational experience and microgravity training gained during Ax-4 directly feed into ISRO's crew training protocols for India's upcoming indigenous human spaceflight program, **Gaganyaan**.

➤ RLV-LEX3: PUSHPAK

(Reusable Launch Vehicle - Landing Experiment 3 — A Step Towards Reusable Space Access)

- **Launch Date** : 23 June 2024
- **Test Site** : Aeronautical Test Range (ATR), ATR Chitradurga, Karnataka.
- **Executing Agency** : ISRO in collaboration with the Indian Air Force (IAF).
- **Release Vehicle** : Carried to the release point using an **IAF Chinook helicopter**.
- **Altitude & Distance** : Released from an altitude of **4.5 km**
- **Vehicle** : Pushpak (ISRO's first RLV prototype)
- **Cross-range** : 500 m
- **Tested Technologies:**
 - Autonomous Runway Landing
 - Indigenous Guidance & Control
 - Hardware Reusability
- **Significance:**
 - Enhances ISRO's capabilities in autonomous navigation, control, and landing
 - Paves the way for India's future reusable space launch systems
 - Reduces cost of access to space through reusability

➤ CMS-03 SATELLITE (ALSO KNOWN AS GSAT-7R)

(INDIA'S HEAVIEST COMMUNICATION SATELLITE TO GTO)

- **Launch Date** : 2 November 2025.
- **Launch Site** : Satish Dhawan Space Centre, Sriharikota, Andhra Pradesh.
- **Launch Vehicle** : LVM3-M5 (Launch Vehicle Mark-3) also known as GSLV Mk-III or **Bahubali**.
- **Flight Milestones:**
 - Marked the **5th operational flight** of the heavy-lift LVM3 rocket.
 - Represented India's **103rd space launch mission**.
 - Injected into orbit just **16 minutes** after liftoff.
- **Target Orbit** : Placed into a **Geosynchronous Transfer Orbit (GTO)**.
- **Type** : Multi-band communication satellite
- **Agency Leadership** : Executed under the leadership of ISRO Chairman **V. Narayanan**
- **Launch Mass** : **4,410 kg** (approx. 4.41 tonnes).
- **National Record** : Holds the record for being **India's heaviest communication satellite** ever launched from Indian soil (Sriharikota) using an indigenous rocket
- **Coverage** : Wide oceanic region including Indian landmass (Indian Ocean and surrounding regions)
- **Strengthens** : Mobile networks, Internet services, Television broadcasting, Maritime communications.

➤ NVS-02

(NavIC Sereis)

- **Launch Date** : 29 January 2025
- **Launch Vehicle** : Launched aboard ISRO's GSLV-F15 rocket from the Satish Dhawan Space Centre (SDSC), Sriharikota
- **Historic Milestone** : The GSLV-F15 / NVS-02 flight marked ISRO's landmark **100th space launch mission**
- **Purpose** : Provides precise real-time positioning, navigation, and timing services
- **Carries** : L1-band signals
- **Indigenous Rubidium Atomic Clock**: Carried an indigenously developed Rubidium Atomic Clock onboard to achieve ultra-precise timekeeping essential for accurate positioning data

➤ ● ISRO'S CHANDRAYAAN SERIES:

1. CHANDRAYAAN-1 (2008 – 2009)

- **Launch Date & Vehicle**: 22 October 2008 using the **PSLV-C11 XL** rocket From **Sriharikota**.
- **Mission Profile** : India's maiden lunar exploration mission, comprising a Lunar Orbiter and the Moon Impact Probe (MIP).
- **Historic Milestone** : Re-ignited global interest in lunar research by making the landmark discovery of **water molecules (H₂O) and lunar hydration** across the moon's surface.
- **Mission Conclusion** : Concluded in August 2009 after communication with the spacecraft was lost.

2. CHANDRAYAAN-2 (2019)

- **Launch Date & Vehicle** : 22 July 2019 aboard the **GSLV Mk III-M1 (LVM3)** rocket.
- **Mission Components** : Consisted of three primary elements — an **Orbiter**, the **Vikram Lander**, and the **Pragyan Rover**.
- **Landing Attempt** : During the final descent on 6–7 September 2019, the Vikram lander experienced a communications loss and hard-landed near the lunar south pole.
- **Key Designations & Achievements**:
 - The crash-landing site was officially named **Tiranga Point**.
 - Despite the lander setback, the **Orbiter** remains fully operational in lunar orbit, collecting high-resolution imagery and discovering buried water ice near the polar regions.

3. CHANDRAYAAN-3 (2023)

- **Launch & Landing Dates**: Launched on 14 July 2023 aboard the **LVM3-M4** rocket and achieved a flawless soft landing on **23 August 2023**.

- **Global Benchmark:** India became **the first country in history to soft land on the Lunar South Pole** and **the fourth nation** overall to execute a soft landing on the Moon.
- **Key Designations:**
 - Landing Site Name : **Shiv Shakti Point.**
 - **23 August:** Officially declared as **National Space Day** by the Government of India.
- **Modules & Payloads:**
 - **Vikram Lander** : Equipped with **ChaSTE** (thermal property analyzer) and **ILSA** (seismometer).
 - **Pragyan Rover** : Carried **LIBS** and **APXS** instruments for in-situ elemental and chemical analysis of the lunar soil.
 - **RAMBHA-LP:** Designed to probe and measure lunar surface plasma density¹⁰¹¹.
 - **SHAPE** : Located on the Propulsion Module to study Earth's spectral and polarimetric properties from lunar orbit.
 - **LRA (Laser Retroreflector Array):** Provided by NASA for laser-ranging studies.
- **Major Discoveries & Experiments:**
 - The Vikram lander successfully demonstrated a **Hop Experiment** (a short vertical jump on the moon's surface).
 - Discovered a buried crater near the south pole with a depth of approximately **4.4 km**.
 - Determined that the lunar regolith near the south pole exhibits a distinct two-layer (cake-like) thermal structure.

4. CHANDRAYAAN-4 (Lunar Sample Return Mission 2027–2028)

Key Details

- **Primary Objective** : Aimed at retrieving approximately **3 kg of lunar regolith (soil) and rock samples** from the south pole (near Shiv Shakti Point / Mons Mountain MM4) and bringing them back to Earth.
- **Execution Plan** : Planned as a complex, multi-stage mission requiring two separate LVM3 rocket launches.
- **Student Payload** : Features the "ShaktiSat" payload, an initiative led by Space Kidz India involving female students.
- **Landing Region** : Lunar polar / southern polar region.
- **Significance:**
 - Demonstrates lunar take-off, sample return, docking and sample preservation.
 - Helps develop India's indigenous lunar sample-return capability.

5. CHANDRAYAAN-5/ LUPEX (2028–2029)

- **Joint Collaboration** : Formally known as the **Lunar Polar Exploration (LUPEX)** mission, conducted jointly by **ISRO (India)** and **JAXA (Japan)**.
- **Launch Architecture** : Will be launched using Japan's **H3 Rocket**.

- **Division of Roles** : ISRO will provide the **Lander**, while JAXA will supply the heavy **350 kg Rover**
- **Scientific Goal** : Investigate the exact quantity, quality, and distribution of water-ice resources in the permanently shadowed (dark) regions of the lunar south pole.

Objectives

- Explore the Moon's south pole.
- Search for water ice and other lunar resources.
- Test technologies for lunar surface survival.

➤ **ADITYA-L1 (India's First Solar Mission)**

- **Launch Date** : 2 September 2023
- **Launch Vehicle** : PSLV-C57 (XL) From Satish Dhawan Space Centre, Sriharikota
- **Destination** : Sun–Earth Lagrange Point L1
- **Mission Type** : Solar Observatory-Focused on studying the Sun's outer atmosphere
- **Distance** : L1 is located approximately **1.5 million km** (15 lakh) from Earth
- **Mission Life** : 5.2 years (planned)
- **Duration** : 127 Days
- **Developed by** : ISRO, with payloads built by Indian institutes like IUCAA, IIA, and ISAC

Core Scientific Objectives:

- Study solar corona, Solar wind & Magnetic fields
- Monitor Solar flares & Coronal Mass Ejections (CMEs)
- Improve space weather prediction to help safeguard Earth's satellites, communication networks, and power distribution grids from disruptions caused by **solar geomagnetic storms**

Onboard Scientific Payloads:

Aditya-L1 carries 7 specialized instruments to study the Sun:

1. **VELC (Visible Emission Line Coronagraph)** : Designed for corona imaging and tracking Coronal Mass Ejections.
2. **SUIT (Solar Ultraviolet Imaging Telescope)** : Captures ultraviolet images of the solar disk (photosphere and chromosphere) and records solar flare activity.
3. **ASPEX (Aditya Solar Wind Particle Experiment)** : Features the Solar Wind Ion Spectrometer (SWIS) to measure the directional flow of solar wind protons and helium nuclei.
4. **PAPA (Plasma Analyser Package for Aditya)**: Analyzes solar wind plasma parameters.
5. **SoLEXS (Solar Low Energy X-ray Spectrometer)** : Monitors soft X-ray emissions during solar flare activity.
6. **HEL1OS (High Energy L1 Orbiting X-ray Spectrometer)**: Measures high-energy X-ray flares from the Sun.
7. **Magnetometer (MAG)**: Measures interplanetary magnetic fields at the L1 point.

➤ GAGANYAAN MISSION:

The **Gaganyaan Program** is India's flagship human spaceflight initiative managed by the Indian Space Research Organisation (ISRO). It aims to demonstrate indigenous human spaceflight capability by placing a crew into Low Earth Orbit and bringing them back safely to Earth

- **Astronauts** : 3 Astronauts
- **Orbit** : 400 km Low Earth Orbit (LEO)
- **Mission Duration** : 3 Days in orbit
- **Launch Vehicle** : Human-rated LVM3 (HLVM3- Human-Rated Launch Vehicle Mark-3)
- **Developed by** : ISRO, HAL, DRDO; Training support from Russia

Significance:

- Increased global collaborations in space science
- Advancement in space-related R&D and technology
- Boost to India's human spaceflight capability

Long-Term Strategic Importance:

- **National Milestone** : Successful completion will make India **the 4th nation in the world** (after the US, Russia, and China) to independently send humans into space.
- **Stepping Stone for BAS** : Gaganyaan serves as the foundational technology demonstrator for India's plan to build the Bharatiya Antariksh Station (BAS) in Low Earth Orbit by 2035.

Mission Phases:

Mission Name	Mission Type	Primary Focus / Key Highlights	Payload / Special Notes
Gaganyaan-1	Uncrewed	Experimental early flight testing; critical systems & safety tests	Vyommitra (Humanoid Robot)
Gaganyaan-2	Uncrewed	Technology & safety validation; testing crew escape, life support & re-entry	Systems testing
Gaganyaan-3	Uncrewed	End-to-end complete testing of all major systems	Final validation before crewed flight

➤ SpaDeX Mission:

(SPACE DOCKING EXPERIMENT)

- **Launch Date & Vehicle** : 30 December 2024 & PSLV-C60
- **Core Objective** : Demonstrate rendezvous, in-orbit docking and undocking technology using two small spacecraft.

Strategic Importance

- **Space Station Construction** : Essential for building and assembling modules for the Bharatiya Antariksh Station (BAS).

- **Human Spaceflight** : Enables emergency crew rescue, orbital crew transfers, and cargo resupply for Gaganyaan.
- **Complex Future Missions** : Crucial technology for Chandrayaan-4 (lunar sample return) and multi-launch deep-space explorations.
- **Satellite Servicing** : Lays the foundation for in-orbit refueling, satellite repair, and space debris management.

➤ SHUKRAYAAN-1

INDIA'S FIRST MISSION TO VENUS

- **Launch Date** : Planned for 29 March 2028
- **Expected Orbit Insertion:** July 19, 2028 (112-day transit)
- **Launch Vehicle** : LVM3 (GSLV Mk III) heavy-lift rocket
- **Mission Type** : Venus Orbiter to study Venus's surface & atmosphere
- **Payloads** : Synthetic Aperture Radar (VSAR), Ground Penetrating Radar
- **Primary Purpose** : Investigate Venus' surface and atmosphere

Core Scientific Objectives:

- Subsurface & Geological Mapping
- Atmospheric & Cloud Dynamics
- Solar Wind & Ionosphere Interactions
- Thermal & Planetary Evolution

➤ MANGALYAAN-1

MARS ORBITER MISSION (MOM)

- **Launch Date** : November 5, 2013
- **Launch Vehicle** : **PSLV-C25** (Polar Satellite Launch Vehicle - XL variant)
- **Mission Type** : India's first interplanetary mission.
- **Launch Site** : Satish Dhawan Space Centre, Sriharikota
- **Mars Orbit Insertion:** September 24, 2014, after a 298-day interplanetary cruise
- **Mission Duration** : Planned for 6 months; lasted over 7 years
- **End of Mission** : April 2022 (spacecraft battery exhausted after an extended eclipse)

Technical Specifications

- **Satellite Mass** : 1,337 kg
- **Power** : 840 watts (generated via three solar panels)
- **Orbit** : Highly elliptical Mars orbit (Periareon ~421 km, Apoareon ~76,993 km)
- **Satellite Bus:** I-1K platform

Scientific Objectives

- Demonstrate India's interplanetary mission capabilities.
- Study Martian surface features, morphology, mineralogy, and atmosphere.
- Investigate methane presence and dust storms.

Scientific Payloads (5 Instruments)

1. **Mars Colour Camera (MCC)** : Captured images of Mars.
2. **Methane Sensor for Mars (MSM)** : Searched for methane traces.
3. **Thermal Infrared Imaging Spectrometer (TIS)** : Studied surface temperature.
4. **Lyman Alpha Photometer (LAP)** : Measured hydrogen escape.
5. **Mars Exospheric Neutral Composition Analyzer (MENCA)**: Analyzed upper atmosphere.

➤ MANGALYAAN-2

MARS LANDER MISSION

- **Launch Date** : Expected to launch around **2030**
- **Mission** : Follow-on to India's Mars Orbiter Mission (MOM)
- **Launch Rocket** : Planned to be launched using India's heavy-lift **LVM3 (GSLV Mk-III)** rocket
- **Key Focus** : Study of Martian surface, atmosphere and planetary science
- **Goal** : India's first attempt at soft landing on Mars.

➤ BHARATIYA ANTARIKSHA STATION:

- **First Module Launch** : 2028 (planned)
- **Full Operational Date** : 2035
- **Orbit Type** : Low Earth Orbit (LEO) at ~400–450 km (51.6° inclination)
- **Launch Vehicles** : LVM3, LVM3-SC & NGLV (Next Generation Launch Vehicle)
- **Primary Purpose** : Sustained human spaceflight, microgravity experiments, and precursor for 2040 crewed lunar missions
- **Significance** : India's leap into orbital infrastructure and space tourism; part of Space Vision 2047.

➤ INSAT-3DS

(INDIA'S LATEST ADVANCED METEOROLOGICAL SATELLITE)

- **Satellite Name** : INSAT-3DS
- **Launch Date** : February 17, 2024
- **Launch Vehicle** : GSLV-F14 (Geosynchronous Satellite Launch Vehicle)
- **Launch Site** : Satish Dhawan Space Centre, Sriharikota
- **Orbit** : Initially placed in Geosynchronous Transfer Orbit (GTO); later maneuvered into Geostationary Orbit

Purpose & Capabilities

- **Type** : Meteorological satellite (identical to INSAT-3D and 3DR)
- **Primary Payloads:**
 - **6-channel Imager** : Captures cloud patterns, storm systems, and land/ocean surfaces.
 - **19-channel Sounder** : Measures atmospheric temperature and humidity profiles.

- **Objectives:**

- Improve weather forecasting accuracy
- Enhance cyclone tracking and storm warnings
- Support oceanographic and environmental monitoring
- Aid in search and rescue operations via transponders

Applications

- **Disaster management** : Real-time alerts for cyclones, floods, and storms.
- **Agriculture** : Rainfall prediction and drought assessment.
- **Aviation & Marine** : Weather updates for flight and shipping safety.
- **Climate studies** : Long-term data for climate modeling and research.

System Integration

- Part of the INSAT series, India's largest domestic satellite system
- Controlled by Master Control Facilities in Hassan and Bhopal

➤ OTHER ACCOMPLISHED MISSIONS:

Mission	Launch Date	Launch Vehicle	Other Facts
Amazonia-01	February 2021	PSLV-C51	First earth observation satellite developed by Brazil
DS-EO Mission	June 2022	PSLV-C53	3 satellites of Singapore and two Indian start-up companies were launched
EOS-03	August 2021	GSLV-F10	India's first state of the art earth satellite which failed
EOS-04	February 2022	PSLV-C52	Radar imaging satellite, accompanied by INS-2TD and INSPIRESat-1
GSAT-24	June 2022	Ariane5	DTH service provider to TATA company
One Web India-1	October 2022	LVM3-M2	First commercial mission of LVM3 and 36 satellites were launched.
SpaDeX	30 Dec 2024)	PSLV-C60	ISRO's pioneering mission to demonstrate in-orbit docking technology , marking India's entry into an elite group of spacefaring nations.

➤ VIKSIT BHARAT SPACE VISION 2047:

Key Milestones

1. Bharatiya Antariksha Station (BAS):

- India's sovereign space station placed in Low Earth Orbit (~400 km).
- Module 1 planned for launch in 2028
- Complete operational assembly targeted by 2035

2. Manned Lunar Landing (2040):

- Targeted timeframe to land an Indian astronaut on the Moon and ensure safe return to Earth by 2040.

3. Chandrayaan-4 (2027–2028):

- Planned launch : 2027 – 2028
- Lunar Sample Return mission utilizing two LVM3 launch vehicles to collect lunar soil/rock samples near Shiv Shakti Point and return them safely to Earth.

4. LUPEX / Chandrayaan-5 (2028–2029):

- Planned launch : 2028 – 2029
- Lunar Polar Exploration mission in joint collaboration with JAXA (Japan). JAXA provides the H3 launch vehicle and rover, while ISRO provides the lunar lander.

5. Shukrayaan-1 /Venus Orbiter Mission(2028):

- Planned launch : 2028 (India's first mission to Venus)
- Mission to explore Venusian atmospheric chemistry, surface topography, and solar wind interactions.

6. Next Generation Launch Vehicle (NGLV):

- Launch Window : 2031-2032 (More powerful, reusable launch vehicle)

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IMPORTANT QUESTIONS ASKED IN RECENT SSC EXAMS

Q.1 Which Indian satellite is used for weather forecasting?

- A. Aryabhata
- B. INSAT - 3D
- C. Cartosat
- D. Mangalyaan

Answer: B

Explanation:

- **INSAT-3D** is an advanced meteorological (weather) satellite developed by ISRO equipped with enhanced meteorological payloads (an Imager and a Sounder) specifically designed for weather forecasting, monitoring tropical cyclones, atmospheric profile measurements, and disaster management.
- **Aryabhata** was India's first satellite (1975), launched for experimental space research.
- **Cartosat** series satellites are used for Earth observation and high-resolution land cartography/mapping.
- **Mangalyaan (MOM)** was India's first interplanetary mission sent to orbit Mars.

Q.2 Identify the incorrect match of satellite type and application:

- | | |
|-----------------------------|--------------------------|
| A. Weather satellite | - Cyclone tracking |
| B. Communication satellite | - TV broadcast |
| C. Navigation satellite | - Forest fire monitoring |
| D. Remote sensing satellite | - Land use mapping |

Answer: C

Explanation: Navigation satellites (such as IRNSS/NavIC or GPS) provide precise positioning, location tracking, velocity, and timing data. They are not primarily used for environmental imaging like monitoring forest fires.

Q.3 Fill in the Blanks:

NISAR maps the global surface every _____

- | | |
|------------|-----------|
| A. 3 days | C. 24 hrs |
| B. 12 days | D. 5 days |

Answer: B

Q.4 What is the orbital regime of the NISAR (NASA-ISRO Synthetic Aperture Radar) satellite?

- | | |
|--------|--------|
| A. GEO | C. LEO |
| B. HEO | D. SSO |

Answer: C

Explanation: NISAR operates in **Low Earth Orbit (LEO)** at an altitude of approximately 747 km above Earth's surface in a sun-synchronous orbit.

- Operating in LEO allows high-resolution Synthetic Aperture Radar (SAR) imaging of the Earth's land and ice surfaces.

Q.5 Why is the NISAR (NASA-ISRO Synthetic Aperture Radar) mission designed to revisit the same location every 12 days?

- A. To support low-earth orbit operations at reduced altitude
- B. To enable cost-efficient satellite passes through optimized fuel consumption
- C. To ensure consistent caching of data before transmission to ground stations
- D. To achieve temporal resolution for global coverage and land deformation monitoring

Answer: D

Explanation:

- Revisiting the exact same position on Earth every 12 days provides consistent **temporal resolution**.
- By comparing radar measurements from the exact same angle 12 days apart (using radar interferometry), scientists can measure tiny millimeter-scale changes in land surface deformation, tectonic movement, volcanic swelling, and groundwater changes over time.

Q.6 What is the primary function of the NVS-02 satellite launched aboard GSLV-F15?

- A. It supports meteorological observations for cyclone prediction.
- B. It enables satellite-based television broadcasting.
- C. It boosts India's navigation system by offering precise position and timing data.
- D. It conducts deep-space communication with planetary probes.

Answer: C

Explanation:

- **NVS-02** is part of ISRO's second-generation **NavIC (Navigation with Indian Constellation)** satellite series.
- Its primary role is to provide real-time, highly accurate positioning, navigation, and precise timing services over India and surrounding regions up to 1,500 km.

Q.7 Why is "Space Situational Awareness (SSA)" program by ISRO important?

- A. Tracks energy usage in orbit
- B. Monitors space debris and protects Indian space assets
- C. Observes black holes in the deep sky
- D. Provides satellite TV services across Asia

Answer: B

Explanation: Space Situational Awareness (SSA)—executed under initiatives like ISRO's **Project NETRA**—is designed to continuously monitor space debris, operational satellites, and potential orbital collisions to safeguard India's critical space infrastructure and operational satellites in orbit.

Q.8 Which of the following is NOT a benefit of the Gaganyaan mission?

- A. Increased global collaborations in space science
- B. Advancement in space-related R&D and technology
- C. Boost to India's human spaceflight capability
- D. Reduction in Earth's temperature

Answer: D

Explanation:

- The **Gaganyaan mission** aims to demonstrate India's human spaceflight capability by sending astronauts to Low Earth Orbit and returning them safely.
- While it advances R&D, tech capabilities, human space travel, and international collaboration, space exploration missions have no physical mechanism or objective to lower Earth's climate temperature.

Q.9 Gaganyaan is planned to orbit Earth at approximately what altitude?

- A. 100 km
- B. 400 km
- C. 1000 km
- D. 36,000 km

Answer: B

Explanation: The Gaganyaan crewed module is planned to be launched into a **Low Earth Orbit (LEO)** at an altitude of approximately **400 km** for a duration of **3 days** before returning safely to Earth.

Q.10 What does the designation HLVM3 stand for in the Gaganyaan mission context?

- A. Heavy LVM3
- B. Hybrid LVM3
- C. Human LVM3
- D. High LVM3

Answer: C

Explanation:

- **HLVM3** stands for **Human Rated Launch Vehicle Mark-3** (modified version of LVM3 / GSLV Mk-III).
- It has been modified with human-rating requirements (including a Crew Escape System - CES) to safely transport humans into orbit for the Gaganyaan mission.

Q.11 When did India successfully complete the SpaDeX docking operation?

- A. 30th December 2024
- B. 1st January 2025
- C. 16th January 2025
- D. 26th January 2025

Answer: C

Explanation: ISRO launched the **SpaDeX** (Space Docking Experiment) mission to demonstrate autonomous in-space docking using two satellites (SDX-01 Chaser and SDX-02 Target). The successful space docking experiment execution/milestone took place on **16th January 2025**.

Q.12 Read the following statements marked as Assertion (A) and Reason (R). Choose the correct option:

Assertion (A): The Satish Dhawan Space Centre (SDSC-SHAR) is ISRO's main spaceport for launching satellites and rockets.

Reason (R): SDSC-SHAR currently houses multiple operational launch pads and extensive facilities for the integration and final preparation of launch vehicles and spacecraft before liftoff.

- A. Both A and R are true, and R is the correct explanation of A
- B. Both A and R are true, but R is not the correct explanation of A
- C. A is true, but R is false
- D. A is false, but R is true

Answer: A

Q.13 What is the contribution of Vikram Sarabhai Space Centre (VSSC) to India's space program?

- A. Launch site for ISRO missions
- B. Designs and builds launch vehicles
- C. Trains Indian astronauts
- D. Controls ISRO satellites

Answer: B

Explanation:

- Located in Thiruvananthapuram, Kerala, **VSSC (Vikram Sarabhai Space Centre)** is ISRO's lead center responsible for the design, development, and building of launch vehicles (such as PSLV, GSLV, and LVM3).
- Launch sites are managed by SDSC SHAR, satellite control is handled by ISTRAC/MCF, and astronaut training is managed by ISRO's Human Space Flight Centre (HSFC).

Q.14 Read the following statements marked as Assertion (A) and Reason (R). Choose the correct option:

Assertion (A): India is actively developing a Third Launch Pad (TLP) at the Satish Dhawan Space Centre (SDSC-SHAR).

Reason (R): The Third Launch Pad is specifically designed to significantly boost India's space launch frequency and accommodate larger, next-generation launch vehicles like NGLV.

- A. Both A and R are true, and R is the correct explanation of A
- B. Both A and R are true, and R is not the correct explanation of A
- C. A is true, but R is false
- D. A is false, but R is true

Answer: A

Q.15 What astronomical observation is most severely hampered by increasing levels of urban light pollution?

- A. Sunspots
- B. Planetary transit
- C. Deep-sky objects
- D. Lunar phases

Answer: C

Explanation:

- **Deep-sky objects** (such as distant galaxies, faint nebulae, and star clusters) emit low levels of light. Urban artificial light pollution brightens the night sky background, washing out faint contrast and severely obstructing visual and optical observations.
- Bright solar system targets like the Sun (sunspots), Moon (lunar phases), and bright planets are much less affected by light pollution.

Q.16 Read the following statements marked as Assertion (A) and Reason (R). Choose the correct option:

Assertion (A): The PSLV-C59 mission, launched in Dec. 2024, achieved a notable milestone for international space cooperation.

Reason (R): This mission successfully deployed the Proba-3 satellites, marking the first dedicated satellite launch for ESA's unique formation-flying experiment.

- A. Both A and R are true, and R is the correct explanation of A
- B. Both A and R are true, but R is not the correct explanation of A
- C. A is true, but R is false
- D. A is false, but R is true

Answer: A

Explanation:

- **Assertion (A)** is correct as the PSLV mission launched the European Space Agency's (ESA) Proba-3 spacecraft under a commercial and cooperative space mission.
- **Reason (R)** is correct as Proba-3 consists of two formation-flying spacecraft (Coronagraph and Occulter) designed to study the solar corona, proving R directly explains why this mission is a key international space milestone.

Q17. What does LHDAC stand for in Chandrayaan-3 landing navigation?

- (A) Lander Hazard Detection and Avoidance Camera
- (B) Lunar High-Definition Aerial Camera
- (C) Laser Homing Distance and Altitude Counter
- (D) Landing Height Determination and Assessment Camera

Answer: A

Explanation: LHDAC worked alongside processing algorithms to identify craters and boulders during autonomous descent to ensure a safe touchdown.

Q18. Which Indian mission was the first to detect global lunar hydration?

- (A) Chandrayaan-1
- (B) Chandrayaan-2
- (C) Chandrayaan-3
- (D) MOM

Answer: A

Explanation: Chandrayaan-1 was the first mission to discover evidence of widespread lunar hydration.

Q19. Which space agency contributed the Laser Retroreflector Array (LRA) payload on Chandrayaan-3?

- (A) ESA
- (B) JAXA
- (C) NASA
- (D) Roscosmos

Answer: C

Explanation: The Laser Retroreflector Array (LRA) carried on the Chandrayaan-3 lander was provided by NASA to serve as a passive target for lunar laser ranging.

Q20. What is the primary operational advantage of ISRO's SSLV?

- (A) It can carry 10-tonne payloads to deep space.
- (B) It is designed for on-demand, low-cost launches
- (C) It uses nuclear propulsion.
- (D) It requires no ground launchpad.

Answer: B

Explanation: The SSLV was specifically developed to enable rapid assembly (within days), minimal launch infrastructure, low cost, and frequent "on-demand" launches for small/micro-satellites.

Q21. How many days did Aditya-L1 take to reach its insertion point at L1?

- (A) 60
- (B) 127
- (C) 180
- (D) 365

Answer: B

Explanation: Aditya-L1 traveled approximately 1.5 million kilometers over 127 days to reach its halo orbit around Lagrange Point 1 (L1) in January 2024.

Q22. Why is Lagrange Point 1 (L1) optimal for Aditya-L1?

- (A) It is closest to the Moon.
- (B) It allows smooth soft-landing opportunities.
- (C) It will study the solar corona from Lagrange Point 1 (unobstructed continuous view without eclipses).
- (D) It sits inside Earth's lower atmosphere.

Answer: C

Explanation: Positioned at L1, Aditya-L1 enjoys an unobstructed, continuous view of the Sun without any occultation or eclipses.

Q23. Consider statements regarding the James Webb Space Telescope (JWST):

- 1. It focuses primarily on Infrared astronomy.
 - 2. It orbits Sun-Earth Lagrange Point 2 (L2).
 - 3. It uses coronagraphs inside instruments to image exoplanets.
- (A) 1 and 2 only
 - (B) 2 and 3 only
 - (C) 1 and 3 only
 - (D) All 1, 2 and 3

Answer: D

Explanation: 1 is correct: JWST focuses on Infrared astronomy. 2 is correct: It orbits Sun-Earth L2. 3 is correct: It uses coronagraphs inside instruments like NIRCams and MIRI to block starlight and image exoplanets directly.

Q24. The "L" in Aditya-L1 stands for:

- (A) Lunar
- (B) Lagrangian
- (C) Linear
- (D) Launch

Answer: B

Explanation: Aditya-L1 operates in a halo orbit around Lagrange Point 1 (L1), a point where gravitational forces of the Earth and Sun create an equilibrium zone.

Q25. Which statement about XPoSat's POLIX payload is correct?

- (A) POLIX studies solar surface temperature.
- (B) POLIX measures optical infrared spectra of Venus.
- (C) POLIX measures radio communications.
- (D) POLIX measures X-ray polarization (8-30 keV) to study black holes.

Answer: D

Explanation: POLIX (Polarimeter Instrument in X-rays) measures degree and angle of polarization in medium energy X-ray bands (8–30 keV) from celestial sources like neutron stars and black holes.

Q26. What is the full form of PSLV?

- (A) Polar Satellite Launch Vehicle
- (B) Primary Satellite Launch Vehicle
- (C) Payload Satellite Launch Vehicle
- (D) Precise Satellite Launch Vehicle

Answer: A

Q27. Assertion (A): ISRO uses generative design algorithms in rocket component fabrication.

Reason (R): Generative design algorithms can only be applied to fuel tanks.

- (A) Both A and R are true, and R is the correct explanation of A
- (B) Both A and R are true, but R is NOT the correct explanation of A
- (C) A is true, but R is false
- (D) A is false, but R is true

Answer: C

Explanation: Assertion (A) is true because ISRO uses generative design algorithms to minimize weight and optimize structural integrity. Reason (R) is false because generative design is used across metal fittings, brackets, and adapters, not just fuel tanks.

Q28. What is the main objective of using generative design in space hardware?

- (A) To replace metal with plastic components completely
- (B) To reduce structural weight while maintaining performance
- (C) To bypass quality inspection tests
- (D) To simplify rocket fuel chemistry

Answer: B

Explanation: Generative design uses AI/algorithmic modeling to generate mass-efficient geometries, removing unnecessary structural material while maintaining mechanical strength.

Q29. Assertion (A): Spark Torch Igniters allow multiple reliable engine restarts in a space vacuum.

Reason (R): Vacuum conditions make traditional pyrotechnic ignition methods difficult.

- (A) Both A and R are true, and R is the correct explanation of A
- (B) Both A and R are true, but R is NOT the correct explanation of A
- (C) A is true, but R is false
- (D) A is false, but R is true

Answer: A

Explanation: Vacuum conditions make traditional ignition methods difficult. Spark Torch Igniters allow multiple reliable engine restarts in a space vacuum, which is essential for orbital maneuvering and controlled booster return burns.

Q30. Space weather events triggered by solar flares can cause all of the following EXCEPT:

- (A) Disruption of satellite communication
- (B) Power grid failures on Earth
- (C) Alteration of ocean currents
- (D) Auroral displays at high latitudes

Answer: C

Explanation: Space weather affects upper atmosphere and electromagnetic systems (GPS, radio, power grids), but has no direct impact on deep ocean currents.

Q31. Which Aditya-L1 payload directly samples the solar wind plasma particles?

- (A) ASPEX
- (B) SUI
- (C) VELC
- (D) MAG

Answer: A

Explanation: ASPEX (Aditya Solar Wind Particle Experiment) directly samples solar wind particles at L1.

Q32. The outermost atmospheric layer of the Sun studied by Aditya-L1 is the:

- (A) Photosphere
- (B) Corona
- (C) Chromosphere
- (D) Core

Answer: B

Explanation: A primary scientific target of Aditya-L1 is the solar Corona and the mechanism behind coronal heating.

Q33. Assertion (A): PSLV is known as the "Workhorse of ISRO".

Reason (R): It has consistently and reliably delivered numerous national and international payloads into orbit.

- (A) Both A and R are true, and R is the correct explanation of A
- (B) Both A and R are true, but R is NOT the correct explanation of A
- (C) A is true, but R is false
- (D) A is false, but R is true

Answer: A

Explanation: PSLV earned the title "Workhorse of ISRO" because of its exceptionally high success rate (>95%) across dozens of missions (launching Chandrayaan-1, Mangalyaan, AstroSat, and hundreds of foreign commercial satellites).

Q34. What is the role of generative design in aerospace structure optimization?

- (A) Increasing the physical size of rocket fairings
- (B) Optimizing mechanical configurations for minimum mass and maximum structural resilience
- (C) Generating solar power during launch phases
- (D) Replacing launch control software systems

Answer: B

Explanation: In aerospace applications, mass reduction directly increases payload capability. Generative design computes optimal material distribution to minimize structural mass while maintaining stiffness and strength.

Q35. Which camera instrument onboard MOM provided images of Mars and its moons?

- (A) SUIT
- (B) LHDAC
- (C) VELC
- (D) MCC (Mars Colour Camera)

Answer: D

Explanation: The Mars Colour Camera (MCC) onboard MOM captured full-disk, high-resolution optical imagery of Mars and its moons (Phobos and Deimos).

Q36. What is the primary target of ISRO's Shukrayaan-1 mission?

- (A) Investigate Venus' surface and atmosphere
- (B) Land a rover on Mercury
- (C) Explore the ring system of Saturn
- (D) Search for ice on Pluto

Answer: A

Explanation: Shukrayaan-1 aims to study Venusian atmospheric chemistry, subsurface radar properties, and solar wind interactions.

Q37. Which space mission earned India the title of first Asian nation to reach Mars orbit?

- (A) Chandrayaan-2
- (B) AstroSat
- (C) Aditya-L1
- (D) Mangalyaan (Mars Orbiter Mission)

Answer: D

Explanation: Mangalyaan was India's first interplanetary mission to Mars.

Q38. What is the payload capacity of GSLV Mk-III into Geosynchronous Transfer Orbit (GTO)?

- (A) 4000 kg
- (B) 2500 kg
- (C) 5000 kg
- (D) 3000 kg

Answer: A

Explanation: The GSLV Mk-III (LVM3) is India's heaviest operational launch vehicle, capable of carrying up to 4,000 kg (4 tonnes) of payload into Geosynchronous Transfer Orbit (GTO) and up to 8,000 kg into Low Earth Orbit (LEO).

Q39. Which launch vehicle was used in ISRO's first successful operational PSLV developmental flight?

- (A) PSLV-D2
- (B) PSLV-D1
- (C) PSLV-C1
- (D) SLV-3

Answer: A

Explanation: PSLV-D2 (Developmental Flight 2), launched on October 15, 1994, was the first successful flight of the PSLV series, injecting the IRS-P2 satellite into polar sun-synchronous orbit.

Q40. Which was India's first experimental satellite launch vehicle?

- (A) SLV-3
- (B) ASLV
- (C) PSLV
- (D) GSLV

Answer: A

Explanation: The Satellite Launch Vehicle-3 (SLV-3) was India's first experimental satellite launch vehicle developed in the late 1970s and 1980s under Dr. A.P.J. Abdul Kalam. On July 18, 1980, it successfully placed the Rohini RS-1 satellite into orbit.

Q41. Which launch vehicle was nicknamed "Fat Boy" by ISRO scientists?

- (A) PSLV-XL
- (B) GSLV MK III
- (C) SSLV
- (D) ASLV

Answer: B

Explanation: Due to its massive structure, heavy payload capacity, and short, thick appearance compared to PSLV, the GSLV Mk-III (LVM3) was informally nicknamed "Fat Boy" by ISRO scientists.

Q42. Why is liquid hydrogen considered an efficient cryogenic rocket propellant?

- (A) It is easy to store at room temperature.
- (B) It has low explosive reactivity.
- (C) Because it has the highest energy output per kilogram.
- (D) It produces zero combustion thrust.

Answer: C

Explanation: Liquid hydrogen (LH₂) combined with liquid oxygen (LOX) offers an exceptionally high Specific Impulse (Isp), delivering the highest energy release per unit mass among conventional chemical rocket fuels.

Q43. Which rocket is India's first reusable hybrid rocket, launched by a private space startup?

- (A) Vikram-S
- (B) Agni-V
- (C) Skyroot-1
- (D) RHUMI-1

Answer: D

Explanation: Developed by Tamil Nadu-based space startup *Space Zone India*, RHUMI-1 is India's first reusable hybrid rocket, launched utilizing a combination of solid fuel and liquid oxidizer.

Q44. Which PSLV mission created a world record by placing 104 satellites in orbit in a single launch?

- (A) PSLV-C11
- (B) PSLV-C25

- (C) PSLV-C35
- (D) PSLV-C37

Answer: D

Explanation: On February 15, 2017, ISRO's PSLV-C37 created a world record by successfully launching 104 satellites into orbit in a single launch mission.

Q45. Who is known as the "Agni Putri" for her contributions to the Agni missile program?

- A. Dr. Tessy Thomas
- B. Dr. Sudha Murthy

- C. Dr. Ritu Karidhal
- D. Dr. Anuradha TK

Answer: A

Explanation: Dr. Tessy Thomas served as Project Director for DRDO's Agni-IV and Agni-V missile programs. As the first woman scientist to head a missile project in India, she is widely known as "Agni Putri" or the "Missile Woman of India".

Q46. Which is the first private company to launch a rocket into space in India?

- A. Skyroot Aerospace
- B. Bellatrix Aerospace

- C. Agnikul Cosmos
- D. Pixxel

Answer: A

Explanation: Hyderabad-based startup **Skyroot Aerospace** became India's first private firm to launch a rocket with its **Vikram-S** sub-orbital rocket in November 2022.

Q47. Which of the following is an example of artificial satellites? I. Sputnik-I II. GSAT-12

- A. Only I
- B. Only II
- C. Both I and II
- D. Neither I nor II

Answer: C

Explanation: Both are artificial (man-made) satellites. **Sputnik-I** was the world's first satellite, while **GSAT-12** is an Indian communication satellite launched by ISRO.

Q48. In the context of space research in India, what does "N" stand for in INCOSPAR?

- A. National
- B. Nano

- C. Neutrino
- D. Nodal

Answer: A

Explanation: **INCOSPAR** stands for the **Indian National Committee for Space Research**. Founded in 1962 under Dr. Vikram Sarabhai, it was later restructured into **ISRO** in 1969.

Q49. Which ISRO initiative launched with "**Catch them young**" aims to introduce school students to space science?

- A. Vidyarthi Vigyan Manthan
- B. YUVIKA - Young Scientist Programme
- C. SPARK
- D. NISHTHA

Answer: B

Explanation: YUVIKA (Yuva Vigyani Karyakram) is designed to impart basic knowledge on space technology, space science, and space applications to young school students (primarily 9th graders).

Q50. Which country became the first to soft-land a spacecraft on the far side of the Moon?

- (A) USA
- (B) China
- (C) Russia
- (D) India

Answer: B

Explanation: China's Chang'e 4 mission (carrying the *Yutu-2* rover) became the first spacecraft to make a soft landing on the far side of the Moon (Von Kármán crater) in January 2019.

Q51. In which year did India lose radio contact with Chandrayaan-1?

- (A) 2009
- (B) 2008
- (C) 2010
- (D) 2011

Answer: A

Explanation: Launched in October 2008, Chandrayaan-1 operated for about 312 days until contact was lost on August 29, 2009.

Q52. The RAMBHA-LP payload on Chandrayaan-3 measured near-surface:

- (A) Plasma
- (B) Seismic waves
- (C) Soil thermal conductivity
- (D) Elemental abundance

Answer: A

Explanation: RAMBHA-LP (Radio Anatomy of Moon Bound Hypersensitive ionosphere and Atmosphere - Langmuir Probe) measures near-surface plasma density and variations on the Moon over time.

Q53. Which launch vehicle was used to launch Chandrayaan-2?

- (A) PSLV-C11
- (B) PSLV-C25
- (C) GSLV (GSLV Mk-III M1)
- (D) SSLV-D1

Answer: C

Explanation: Chandrayaan-2 was launched on July 22, 2019, using the GSLV Mk-III M1 launch vehicle.

Q54. What was the core primary objective of Chandrayaan-3?

- (A) To demonstrate a safe lunar landing and rover operation
- (B) To return lunar soil samples back to Earth
- (C) To establish a human base on the Moon
- (D) To destroy lunar orbital debris

Answer: A

Q55. What is the joint objective of the ISRO-JAXA LUPEX mission?

- (A) To deploy a crewed station in lunar orbit
- (B) To map Mars surface features
- (C) Investigate the quantity and quality of water on the Moon and explore its dark side
- (D) To capture asteroid samples

Answer: C

Explanation: LUPEX (Lunar Polar Exploration Mission) is a joint mission by ISRO and JAXA (Japan) aimed at exploring the lunar south pole for volatile water ice.

Q56. Which of the following is NOT a payload on India's Aditya-L1 solar observatory?

- (A) VELC
- (B) SUIT
- (C) POLIX (X-ray polarimeter)
- (D) PAPA

Answer: C

Explanation: POLIX is the primary payload of XPoSat (X-ray Polarimeter Satellite), not Aditya-L1. Aditya-L1 features SUIT, VELC, SOLEXS, HELIOS, ASPEX, PAPA, and MAG.

Q57. India's first dedicated space observatory to study the Sun is:

- (A) AstroSat
- (B) Aditya-L1
- (C) XPoSat
- (D) EOS-04

Answer: B

Explanation: Launched in September 2023, Aditya-L1 is India's first dedicated space observatory to study the Sun from Sun-Earth Lagrange Point 1.

Q58. What is the function of the Solar Wind Ion Spectrometer (SWIS) instrument on Aditya-L1?

- (A) Measures solar ultraviolet radiation
- (B) Captures high-resolution images of solar flares
- (C) Tracks lunar gravitational anomalies
- (D) Detects directional flow of solar wind protons and helium nuclei

Answer: D

Explanation: SWIS (part of the ASPEX payload on Aditya-L1) measures the energy spectrum and directional distribution of solar wind protons and alpha particles (helium nuclei).

Q59. Which space agency launched the Parker Solar Probe?

- (A) ISRO
- (B) ESA
- (C) NASA
- (D) JAXA

Answer: C

Explanation: The Parker Solar Probe is a flagship mission launched by NASA in 2018 to fly through the outer solar corona.

Q60. Solar storms can disrupt which of the following technological infrastructure?

1. Power grids
2. GPS navigation systems
3. High-frequency radio communications
4. Undersea long-distance cable nodes

- (A) 1 and 2 only
(B) 1, 2, and 3 only
(C) 2 and 3 only
(D) 1, 2, 3, and 4 all of these

Answer: D

Explanation: Severe solar storms induce Geomagnetically Induced Currents (GICs) that affect power grids, disrupt ionospheric signals for GPS, interfere with HF radio communication nodes, and generate stray currents in long metallic pipelines.

Q61. Consider the statements regarding Aditya-L1:

1. SUIT provides images of the solar disk in Near-UV wavelengths.
2. SOLEXS monitors soft X-ray flare emissions.

- (A) Both 1 and 2
(B) 1 only
(C) 2 only
(D) Neither 1 nor 2

Answer: A

Explanation: Statement 1 is correct: SUIT images the disk in Near-UV (200-400 nm). Statement 2 is correct: SOLEXS measures soft X-ray emissions to analyze solar flares.

Q62. Which space mission was launched by NASA to investigate the habitability of Jupiter's icy moon Europa?

- (A) Juice (C) Cassini
(B) Europa Clipper (D) Juno

Answer: B

Explanation: NASA's Europa Clipper mission was launched to investigate whether Jupiter's icy moon Europa could harbor conditions suitable for life.

Q63. Which launch vehicle launched the Mars Orbiter Mission (Mangalyaan)?

- (A) GSLV Mk-II (C) PSLV (PSLV-C25)
(B) GSLV Mk-III (D) SSLV

Answer: C

Explanation: Mangalyaan was launched on November 5, 2013, using the PSLV-C25 launch vehicle.

Q64. What was India's first interplanetary mission?

- (A) Mangalyaan
- (B) Chandrayaan-1
- (C) Aditya-L1
- (D) AstroSat

Answer: A

Q65. NavIC is India's independent satellite system developed for:

- (A) Lunar mapping
- (B) Deep space communications
- (C) Regional navigation
- (D) Asteroid tracking

Answer: C

Explanation: NavIC (Navigation with Indian Constellation / IRNSS) provides autonomous regional satellite positioning and navigation services covering India and a region extending 1,500 km around it.

Q66. Heavy communication satellites like CMS-03 are placed into which orbit initially?

- (A) Low Earth Orbit
- (B) Polar Orbit
- (C) Geosynchronous Transfer Orbit
- (D) Sun-Synchronous Orbit

Answer: C

Explanation: High-mass communication satellites like CMS-03 are injected into a Geosynchronous Transfer Orbit (GTO) before raising themselves to Geostationary orbit.

Q67. Which satellite was deployed during the GSLV-F15 launch mission?

- (A) EOS-07
- (B) GSAT-20
- (C) NVS-02
- (D) INSAT-3DS

Answer: C

Explanation: GSLV-F15 was configured to launch NVS-02, a second-generation navigation satellite for the NavIC constellation featuring an indigenous atomic clock.

Q68. What is the approximate launch mass of CMS-03 heavy communication satellite?

- (A) 1200 kg
- (B) 2500 kg
- (B) 4400 kg
- (D) 6000 kg

Answer: C

Explanation: CMS-03 (or GSAT-20 / GSAT-N2 class heavy communication satellite) has a launch weight in the ~4,400 kg class.

Q69. What is the primary purpose of ISRO's CMS series satellites?

- (A) Ocean surface salinity monitoring
- (B) Communication services
- (C) Cosmic ray tracking
- (D) Soil moisture mapping

Answer: B

Explanation: The CMS series (Communication Satellite) provides telecommunications, broadband connectivity, and television broadcasting services.

Q70. What was the planned goal of the GSLV-F16 mission?

- (A) Deploying Navigation satellite NVS-01
- (B) It launched NISAR into sun-synchronous orbit
- (C) Launching GSAT-7A
- (D) Deploying Chandrayaan orbiter

Answer: B

Explanation: GSLV-F16 was designated to deploy the joint NASA-ISRO NISAR radar satellite into a Sun-Synchronous Polar Orbit.

Q71. Who chaired the Calendar Reform Committee in 1952 to introduce the Indian National Calendar?

- (A) Meghnad Saha
- (B) Homi J. Bhabha
- (C) Vikram Sarabhai
- (D) C.V. Raman

Answer: A

Explanation: Eminent Indian astrophysicist Meghnad Saha chaired the Indian Calendar Reform Committee in 1952 to standardize the National Indian Calendar (Saka Calendar).

Q72. What is the operational orbital altitude of NISAR satellite?

- (A) 400 km
- (B) 550 km
- (C) 747 km
- (D) 1000 km

Answer: C

Explanation: NISAR operates at a nominal orbital altitude of 747 km in a sun-synchronous orbit.

Q73. What service does NavIC primarily provide?

- (A) Weather forecasts for Europe
- (B) Deep space planetary tracking
- (C) Offers regional navigation and positioning services
- (D) Ocean thermal energy conversion

Answer: C

Explanation: NavIC provides positioning and timing services covering the Indian subcontinent and surrounding regions.

Q74. What type of payload technology is used on the NISAR mission?

- (A) Optical photography camera
- (B) Gamma-ray telescope
- (C) Radar imaging (Synthetic Aperture Radar)
- (D) Infrared sounder

Answer: C

Explanation: NISAR is an all-weather, day-and-night Synthetic Aperture Radar (SAR) imaging mission.

Q75. What is the primary purpose of ISRO's MiniSAR technology?

- (A) Deep space radio communication
- (B) Solar power generation
- (C) To provide high-resolution X-Band radar imagery using compact airborne systems
- (D) Water extraction on Moon

Answer: C

Explanation: ISRO's MiniSAR miniaturizes radar components to allow flexible, high-resolution radar imaging from smaller airborne and satellite platforms.

Q76. Which two radar frequency bands are integrated into NISAR?

- (A) X & K bands
- (B) C & X bands
- (C) L & S Bands
- (D) Ku & Ka bands

Answer: C

Explanation: NISAR combines NASA's L-band (24 cm wavelength) and ISRO's S-band (12 cm wavelength) SAR sensors.

Q77. Which space agency operates the CryoSat ice-monitoring Earth observation program?

- (A) ISRO
- (B) NASA
- (C) JAXA
- (D) ESA

Answer: D

Explanation: CryoSat is an Earth Observation satellite program operated by the European Space Agency (ESA) to measure ice sheet thickness.

Q78. Statements regarding remote sensing satellites:

- I. They can assess ground moisture and crop health.
 - II. They monitor drought and vegetation condition.
- (A) Only I is true
 - (B) Only II is true
 - (C) Both I and II
 - (D) Neither I nor II

Answer: C

Explanation: Remote sensing satellites assess ground moisture, vegetation health (NDVI), crop yields, and drought severity.

Q79. What is the approximate orbital speed of a satellite in Geostationary Orbit ?

- (A) 11.2 km/s
- (B) 7.8 km/s
- (C) 5.5 km/s
- (D) 3 km/s

Answer: D

Explanation: Satellites in Geostationary Orbit (~35,786 km altitude) orbit at a speed of approximately 3.07 km/s to match Earth's rotational period.

Q80. In which year did India launch its first sounding Meteorological rocket from Thumba, Kerala?

(A) 1947

(C) 1963

(B) 1955

(D) 1975

Answer: C

Explanation: India launched its first sounding rocket (Nike-Apache) from Thumba Equatorial Rocket Launching Station (TERLS) on November 21, 1963.

Q81. Earth remote sensing satellites (EOS) are primarily designed to:

A. Drill into Earth's crust

B. Monitor weather, land use, and environmental changes on Earth

C. Build underground transport systems

D. Study internal structure using seismic waves

Answer: B

Explanation: Remote sensing satellites observe physical features of Earth from space without physical contact, capturing imagery for agriculture, land-use mapping, weather tracking, forestry, and environmental assessment.

Q82. How can NISAR provide valuable information for understanding the relationship between fluid injection and earthquake?

A. By tracking changes in ground surface elevation associated with pumping and injection

B. By measuring seismic activity in real time

C. By monitoring water table levels

D. By analyzing satellite imagery of earthquake damage

Answer: A

Explanation: Injecting or extracting subsurface fluids causes millimeter-scale elevation shifts in the Earth's crust. NISAR's Synthetic Aperture Radar can measure surface movement at fine scales, helping scientists link ground deformation to fluid activity and induced seismic activity.

Q83. What capability does Project NETRA provide to ISRO?

A. Deep-space communication

B. Space debris tracking and situational awareness

C. Human-rated life support

D. Lunar landing navigation

Answer: B

Explanation: NETRA (Network for space object Tracking and Analysis) gives ISRO Space Situational Awareness (SSA) capability to monitor operational Indian satellites, detect space debris, and evaluate potential collision risks in orbit.

Q84. The International Space Station (ISS) is located at about _____ Km from the Earth surface.

A. 400

B. 1000

C. 5000

D. 22000

Answer: A

Explanation: The ISS orbits in Low Earth Orbit (LEO) at an average altitude of approximately **400 kilometres** (ranging between 370 and 460 km) above Earth.

Q85. The International Space Station travels on an orbital inclination of _____ degrees.

A. 51.6

C. 234.6

B. 184.3

D. 312.5

Answer: A

Explanation: The orbit of the ISS is inclined at **51.6 degrees** relative to Earth's equator. This inclination allows launch vehicles from various international launch sites (like Baikonur in Kazakhstan) to easily reach the station.

Q86. Which of the following is the CORRECT objective of ISRO's Gaganyaan mission?

A. Establishing a permanent space station

B. Sending Indian astronauts into low-Earth orbit

C. Sending an unmanned rover to the Moon

D. Launching a solar probe

Answer: B

Explanation: The primary goal of the Gaganyaan program is to demonstrate human spaceflight capability by placing Indian astronauts into a Low Earth Orbit.

Q87. What is the name of the female-looking half-humanoid robot for Gaganyaan-G1?

A. Manavi

C. Bhumika

B. Vyommitra

D. Rokshak

Answer: B

Explanation: **Vyommitra** is an ISRO-developed half-humanoid robot (combining "Vyoma" meaning Space and "Mitra" meaning Friend) built to fly aboard uncrewed Gaganyaan test missions to evaluate life support and environmental parameters before human spaceflights.

Q88. The International Space Station circles Earth roughly _____ times a day.

A. 36

C. 16

B. 8

D. 24

Answer: C

Explanation: Traveling at approximately 28,000 km/h, the ISS completes one orbit around Earth every 90 minutes, amounting to roughly **16 orbits in 24 hours**.

Q89. Which was the first artificial satellite to orbit Earth in 1957?

A. Sputnik 1

C. Vanguard 1

B. Explorer 1

D. Luna 1

Answer: A

Explanation: Launched on **October 4, 1957**, by the Soviet Union, **Sputnik 1** was the world's first artificial satellite, inaugurating the Space Age.

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