1. Reasons for Widespread Drug Abuse in India

Drug abuse refers to the excessive or inappropriate use of drugs, leading to numerous harmful consequences. The prevalence of drug abuse is rising in India, with several contributing factors:

Reasons for Widespread Drug Abuse in India

- **Social Factors:** The disintegration of joint families and declining moral values have led many individuals to pursue pleasure as the ultimate goal in life.
- **Peer Pressure:** Individuals, particularly in educational institutions, often feel influenced by their peers who engage in drug use, perceiving it as a cool and status-enhancing behaviour.
- **Economic Prosperity:** Increased disposable income in regions like Punjab and Maharashtra has contributed to higher rates of drug abuse.
- **Proximity to Golden Crescent and Golden Triangle:** Regions where drug production is prevalent make drugs more readily available.

Government Initiatives Against Drug Abuse in India

- **Legal Framework:** The **Narcotic Drugs and Psychotropic Substances Act, 1985**, and the **Prevention of Illicit Traffic Act, 1988**, provide the legal foundation for combating drug abuse.
- **International Conventions:** India is a signatory to three United Nations drug conventions, demonstrating its commitment to addressing drug-related issues on a global scale.
- **Enforcement Agencies:** The **Narcotics Control Bureau** and other agencies work to combat drug trafficking effectively.
- **National Action Plan:** This plan focuses on raising awareness, promoting community outreach, and providing treatment for affected individuals.
- **Awareness Programs:** Initiatives like the **Nasha Mukt Bharat campaign** and the integration of drug education into curricula aim to inform and educate the public.
- **Technological Intervention:** The launch of portals like the **NCORD portal** and the **e-portal SIMS** enables the digitization of drug seizure data and the adoption of modern technology for detection and prevention.

Way Forward

- **Policy Focus:** Informed policy-making should be based on periodic surveys to understand the evolving nature of drug abuse.
- **Legal Reforms:** Creating a conducive legal environment is essential, ensuring that cases are resolved in a timely manner.
- **Community Involvement:** Engaging NGOs and citizens, including the elderly, in awareness and rehabilitation efforts can enhance community support.
- **Reducing Stigma:** Viewing drug addiction as a health issue rather than a moral failing is crucial, as many individuals may feel trapped by their circumstances.
- **Enhanced Treatment Facilities:** Scaling up evidence-based treatment services will ensure that affected individuals receive the necessary care and support.

GS PAPER II AGREEMENTS INVOLVING INDIA AND/OR AFFECTING INDIA'S INTERESTS BILATERAL REGIONAL AND GLOBAL GROUPINGS

Taking stock of global nuclear disarmament

Albert Einstein famously stated, **"I do not know with what weapons World War III will be fought, but World War IV will be fought with sticks and stones.**" This profound statement highlights the catastrophic potential of nuclear weapons, suggesting that a third world war involving such armaments could result in unparalleled destruction, leaving nothing but devastation in its wake. The nuclear warfare could possibly destroy civilization as we know it, rendering advanced technology and weapons useless in a post-apocalyptic world where humanity may be reduced to primitive survival. In light of this, the discourse surrounding nuclear disarmament becomes not just a political necessity but a moral imperative, as the consequences of inaction could be nothing short of annihilation.

Treaties to Prevent the Development of Nuclear Weapons

1. Treaty on the Non-Proliferation of Nuclear Weapons (NPT)

- **Introduction:** The Non-Proliferation Treaty (NPT) was introduced to prevent the spread of nuclear weapons and promote nuclear disarmament. It was opened for signature in 1968 and came into force in 1970. The treaty represents a landmark international agreement aimed at preventing the escalation of nuclear weapons, ensuring that nuclear energy is used only for peaceful purposes, and fostering global cooperation in nuclear disarmament.
- **Nuclear Weapon States and Their Obligations:** The NPT recognizes five nuclear-weapon states (NWS) – the United States, Russia (formerly the USSR), France, China, and the United Kingdom – all of which are permanent members of the UN Security Council. These states are obligated under the treaty to pursue disarmament negotiations in good faith and to not transfer nuclear weapons or nuclear technology to non-nuclear weapon states (NNWS).
- **Obligations for Non-Nuclear Weapon States:** Non-nuclear weapon states (NNWS) that are signatories to the NPT are required to refrain from acquiring or developing nuclear weapons. In exchange for their commitment, they are assured access to nuclear technology for peaceful purposes, such as energy production, under strict international safeguards. This framework is designed to prevent the proliferation of nuclear weapons while allowing for the beneficial use of nuclear technology.

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- **Limitations and Challenges of the NPT:**
  - **Discriminatory:** The NPT has faced significant criticism for creating a division between nuclear "haves" and "have-nots," with critics arguing that it perpetuates an unequal global power structure. The United States has defended the treaty as the most practical approach to nuclear disarmament currently available. However, countries like India have refused to sign the treaty, citing its discriminatory nature. Pakistan and Israel also did not sign the treaty, further highlighting the perceived inequities and limitations of the NPT framework.
  - **Misuse:** North Korea's involvement with the NPT illustrates both compliance and violation. Initially, North Korea signed the treaty and received nuclear technology under the guise of peaceful purposes. However, it withdrew from the NPT in 2003 and developed nuclear weapons, defying international norms.
  - **Failed to build global Consensus:** India and Pakistan, both non-signatories, conducted nuclear tests in 1998, openly demonstrating their nuclear capabilities and challenging the effectiveness of the NPT in preventing nuclear proliferation.

Despite the treaty's intent, little progress has been made toward global nuclear disarmament, and some nations, such as China, continue to expand their arsenals. Additionally, countries like Iran are actively pursuing uranium enrichment, raising concerns that they could soon emerge as nuclear powers, further undermining the treaty's objectives.

Note: Disarmament refers to the reduction or elimination of nuclear weapons. NPT is credited positively in this regard.

2. Treaty on the Prohibition of Nuclear Weapons (TPNW)

- **Background:** In 2017, scientists and NGOs collaborated to create the Treaty on the Prohibition of Nuclear Weapons (TPNW). This treaty is considered more idealistic than earlier more practical treaties.
- **Goal:** The primary goal of the TPNW is to **completely eliminate nuclear weapons** from the planet. However, achieving this may not be fully possible, as nuclear states might not relinquish their arsenals easily.
- **Scope:** The TPNW is more ambitious than previous treaties, as it **prohibits the development, testing, production, stockpiling, transfer, or use of nuclear weapons.**
- **Signatories:** As of July 2024, the TPNW had **70** states parties, with an additional 27 states having signed but not yet ratified the treaty. Upon ratification by these additional states, the total would rise to 97, representing approximately 50% of the states bound by international treaties on weapons of mass destruction.
- **Current Status:** Many nuclear powers and their allies have still not signed or ratified the TPNW. However, **discussions on this treaty are on the agenda for the upcoming UN General Assembly session**. Some observers are anticipating how nuclear power states will respond to this treaty. If they express support, there may be hope for disarmament as a possible future. Conversely, a lack of support would diminish hopes for the elimination of nuclear weapons.
  - Recently, a group of former leaders and officials from NATO states has urged their countries to support the Treaty on the Prohibition of Nuclear Weapons (TPNW). This includes notable figures like former NATO Secretaries-General and a former UN Secretary-General.
- **Limitations of the TPNW:** Currently, there are **no penalties or enforcement mechanisms** in place for states that sign the TPNW but subsequently use nuclear power. The treaty lacks a robust implementation framework, which makes it difficult to enforce compliance.

India's Approach to Nuclear Weapons

- India never signed the Treaty on the Non-Proliferation of Nuclear Weapons (NPT); however, it has **never actively undermined the treaty.** While India did develop its own nuclear weapons, it **has not shared this technology with other states.** India has maintained that it follows the treaty's **provisions in spirit, even if not in letter.**
- India has benefitted from the existence of the NPT, as it has prevented several states from developing nuclear weapons. The new treaty, the Treaty on the Prohibition of Nuclear Weapons (TPNW), could similarly assist India.

GS PAPER III CONSERVATIONENVIRONMENTAL POLLUTION AND DEGRADATION

Climate change means we may have to learn to live with invasive species

Invasive species are often viewed with suspicion, leading to a widespread misconception about their impact on native ecosystems. From non-native "weeds" to insects and aquatic invaders, introduced species continue to be misunderstood and often mismanaged. It's important to recognize that the vast majority of intentionally or unintentionally introduced species do not pose a threat to native ecosystems.

Invasive Species

Invasive species are plants, insects, and aquatic organisms that are not native to their current habitats. They often spread into new ecosystems, disrupting local biodiversity. These species are also referred to as non-native or introduced species.

Misconceptions About Invasive Species

There is a common misconception that **all invasive species are harmful** when introduced into new ecosystems. While some can pose significant threats, this is not universally true. Many introduced species do not negatively impact their new environments and can, in fact, play beneficial roles.

The Impact of Climate Change

As climate change progresses, our relationship with invasive species is evolving. Invasive species can be classified into two categories:

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- **Accidental Introductions**: These species often arrive unintentionally, such as the **zebra mussel,** which was transported via ballast water in ships from the Black Sea to other regions, where it has since become a significant threat to local infrastructure.
- **Deliberate Introductions**: Some invasive species are intentionally introduced, as seen with **lantana**, which was brought to India from South America by British colonists. Lantana has proliferated rapidly, becoming a menace in many national parks like Jim Corbett National Park etc. by outcompeting native vegetation and harming agricultural crops, thereby threatening local biodiversity.
- **Efforts to Control Invasive Species:** Many efforts aimed at controlling invasive species have **proven ineffective and time-consuming.** These species often integrate deeply into their ecosystems, making eradication difficult. For instance, herbicides used to eliminate invasive plants can inadvertently harm native flora, leading to **declines in beneficial species like butterflies**.

Extra Edge:

- **Zebra mussels** (*Dreissena polymorpha*) are harmful invasive species that disrupt ecosystems and cause significant economic damage. They filter large volumes of water, depleting phytoplankton—the primary food source for many native aquatic organisms—thereby disrupting food webs and harming fish populations. Their tendency to **attach to hard surfaces leads to blockages in water intake pipes and cooling systems**, resulting in costly repairs for industries reliant on water supply. Additionally, zebra mussels **alter habitats by increasing water clarity**, which can promote the growth of certain aquatic plants while competing with native mussels for food and space, ultimately reducing biodiversity. Furthermore, they can transport pathogens that threaten local species, compounding the ecological challenges they pose.
- **Lantana (*Lantana camara*)** is a highly invasive plant species that has significant negative impacts on ecosystems, particularly in tropical and subtropical regions like India. Originally introduced for **ornamental purposes** and as ground cover, lantana spreads rapidly, forming **dense thickets that outcompete native vegetation.** This aggressive growth i**nhibits the regeneration of native plants** and reduces **biodiversity**, as it can **smother other flora and disrupt local ecosystems.**In agricultural settings, lantana poses a challenge by encroaching on cropland, reducing crop yields, and being **toxic to livestock if ingested.** Its ability to thrive in various conditions, from disturbed sites to undisturbed forests, makes it a formidable adversary in conservation efforts.

Rethinking Conservation Approaches

Traditional conservation strategies aimed at preserving forests and ecosystems in their original state are becoming less effective in the face of climate change. As ecosystems naturally adapt, some invasive species may provide benefits in specific contexts. For example, the **Siberian elm**, while considered invasive, has shown an ability to adapt to drier conditions. In areas where native plants struggle, this species can provide essential ecosystem functions, such as photosynthesis and habitat for wildlife.

- **Case-by-Case Assessment**: Governments and conservation organisations should adopt a nuanced approach to managing invasive species. Instead of demonising all introduced species, they should assess the potential benefits or harms of each species individually.
- **Prioritise Effective Control Measures**: Species that pose a significant threat should be targeted for removal, while those that contribute positively to local ecosystems should be allowed to remain.
- **Ongoing Monitoring**: Continuous observation and research are essential to understand the dynamic roles of introduced species in ecosystems, allowing for informed decision-making regarding management practices

GENERAL STUDIES-2; TOPIC: EFFECT OF POLICIES AND POLITICS OF DEVELOPED AND DEVELOPING COUNTRIES ON INDIA'S INTERESTS.

China's Decision to Restrict Antimony Exports and Its Implications

- **Recently China announced restrictions on the export of antimony, a critical mineral essential for several military and strategic technologies,** including missiles, infrared sensors, and nuclear weapons.
- **China justified this move under "national security",** and it aligns with its broader strategy of leveraging critical mineral exports to maintain a competitive edge in global geopolitics.

China's Dominance in Critical Minerals:

- **China dominates the global supply chain for critical minerals, including rare earth elements. It controls:**
  - 60% of rare earth production,
  - 60% of critical mineral production, and
  - 80% of processing capabilities.
- This dominance **makes China's decisions highly impactful**, especially for countries dependent on these minerals for their defense and technology sectors, such as the U.S., European Union, India, and Japan.
- **In 2010, after a diplomatic dispute with Japan, China halted the export of rare earth elements to Japan,** which highlighted global dependency on China for critical mineral supplies and sparked discussions on supply chain vulnerabilities.

Series of Moves and Countermoves:

- The latest restrictions on antimony are part of a series of **countermeasures China initiated in response to the U.S.'s restrictions on advanced technology exports.**

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- **In 2023, China imposed curbs on the export of critical minerals like gallium and germanium**, used in high-tech sectors such as solar cells and computer chips, following the U.S.'s export controls on semiconductors and related technologies.
- Similarly, **China imposed restrictions on the export of graphite**, critical for electric vehicle (EV) batteries and nuclear reactors.

Weaponization of Critical Minerals:

- **China's export controls are seen as a shift from the politicization to the weaponization of critical minerals.**
- **This strategy allows China to:**
  - **Demonstrate its dominance in the global critical mineral supply chain**, reminding the West of their dependency,
  - Respond to Western efforts to decouple from Chinese supply chains, especially in the high-tech and defense sectors,
  - Curtail Western efforts to build alternative supply chains, particularly for dual-use applications, which are vital for both civilian and military purposes.
- Minerals like rare earth elements are essential in the manufacture of advanced military technologies such as the Virginia-class submarines and F-35 fighter jets.

China's Hardening Foreign Policy:

- China's critical mineral export controls reflect a **broader hardening of foreign policy.** The country is using statecraft tactics, reminiscent of historical strategies like the U.S. oil embargo on Japan in 1940, to strike at its adversaries' weak points.
- **By controlling these strategic resources, China aims to:**
  - Slow down the West's technological and military advancements,
  - Undermine their efforts to develop alternative supply chains for critical minerals, and
  - Respond reciprocally to Western restrictions.

Impact on India:

- **India, like other nations, is vulnerable to China's monopoly on critical minerals**.
- **India is heavily dependent on imports of minerals** such as lithium, cobalt, nickel, and copper, vital for sectors like electronics and renewable energy.
- In FY23, India's import cost for these critical minerals reached approximately ₹34,000 crore.
- The growing demand for critical minerals in India, coupled with its dependency on imports, **exacerbates the nation's vulnerability to China's mineral export controls**.
- India must act urgently to develop alternative supply chains and foster partnerships with like-minded countries to reduce its strategic dependence on China.

Global and Regional Implications:

- **The European Union, Japan, and the U.S. have all initiated efforts to diversify their supply chains to reduce reliance on China for critical minerals**. This includes:
  - Partnering with countries like Australia and Canada that have significant mineral reserves,
  - Strengthening domestic extraction and processing capabilities, and
  - Collaborating on technology transfer to establish alternative supply chains.
- China's monopoly and willingness to restrict exports could lead to **geopolitical realignments** and spur further efforts by nations to form alliances centered on securing critical mineral supplies.

Way Forward:

- **India's participation in global frameworks like the Quad (involving Australia, Japan, and the U.S.) can be leveraged to build a collective strategy for critical mineral security.**
- India should also focus on **developing domestic capabilities in mineral exploration,** extraction, and processing to reduce its import dependency.
- **Investing in research and development for alternatives to critical minerals used in defense, technology, and renewable energy sectors can mitigate the impact of shortages and diversify the technological base.**
- International frameworks like the **Bilateral Critical Minerals Partnership** should also be leveraged for knowledge sharing and strategic investments.
- India should create **strategic reserves of essential minerals**, similar to those of oil, to ensure uninterrupted access in times of geopolitical tensions or supply chain disruptions.
- India should draft a **National Critical Minerals Policy** that focuses on sustainable exploration, extraction, and processing.

PRELIM FACTS

1.PARAM Rudra

Context: The Prime Minister inaugurated **three new PARAM Rudra** supercomputers worth ₹130 crore under the National Supercomputing Mission (NSM).

- These supercomputers have been deployed in **Pune, Delhi, and Kolkata** to aid advanced research in areas like physics, cosmology, earth sciences, and weather prediction.

Significance:

- These supercomputers will propel India's scientific research capabilities, making state-of-the-art technology accessible to young scientists.

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- They will assist in areas like disaster management, industrial growth, agriculture (weather and soil analysis), and boost national capability in science and technology.
- Part of India's strategy towards self-reliance and leadership in Industry 4.0.

Supercomputers in India:

- **Origin:** India began focusing on supercomputing in 1987 after being denied the purchase of a Cray X-MP by the USA. This led to India's development of indigenous supercomputers.
- **Major Indian Supercomputers:**
  1. **PARAM Series (developed by C-DAC):** Includes PARAM Siddhi AI, PARAM Pravega, PARAM Utkarsh, and PARAM Shivay.
  2. **Pratyush and Mihir** (for weather forecasting) and AI Supercomputer **AIRAWAT** (ranked 75th globally as of 2023).
- **Applications:** Supercomputers in India are utilized for weather forecasting, genomic sequencing, space exploration, aviation engineering, defense applications, and oil & gas exploration.
- **Significance:** Supercomputers drive innovation, research, and are instrumental in critical areas like artificial intelligence, quantum computing, and national security, positioning India as a global leader in technology.

2.Eastern Rajasthan Canal Project (ERCP)

Context: A new memorandum of agreement will be signed shortly between the Rajasthan and Madhya Pradesh governments for implementing a modified project for linking of Eastern Rajasthan Canal Project (ERCP).

- **Aim:** To address drinking water and irrigation needs in 13 districts of Rajasthan. The project will link rivers such as Chambal, Parvati, and Kali Sindh for better water resource utilization, benefiting both states.

Rivers Involved in the Project:

1. **Chambal River:**
   - **Origin:** Singar Chouri peak, Vindhya mountains, Indore, Madhya Pradesh.
   - **Tributaries:** Banas, Kali Sindh, Sipra, Parbati.
2. **Parvati River:**
   - **Origin:** Vindhya Range, Sehore District, Madhya Pradesh.
   - **Tributaries:** None significant.
3. **Kali Sindh River:**
   - **Origin:** Bagli, Dewas District, Madhya Pradesh.
   - **Tributaries:** Parwan, Niwaj, Ahu.

Significance: The ERCP will help harvest surplus water during the rainy season for the water-scarce regions of Rajasthan, ensuring a sustainable solution for drinking water and irrigation till 2051.

3.Semiconductor Fabrication Plant

Context: India and the U.S. have announced a collaboration to establish India's first semiconductor fabrication plant focused on defense and national security.

- This initiative aims to reduce dependency on imports and boost India's advanced technology capabilities.

Firms Involved:

- **Bharat Semi and 3rdiTech:** Indian start-ups focusing on designing military-specific chips. Founded by **Vrinda Kapoor, Vinayak Dalmia, and Mukul Sarkar**, these firms have worked with the Indian Armed Forces and U.S. military s**ince 2019.**

India's Semiconductor Initiatives:

1. **India Semiconductor Mission (ISM):** Provides a 50% capex subsidy for semiconductor projects.
2. **Fab Plant for National Security**: Aims to manufacture defense-related chips domestically, reducing reliance on imports for critical technologies like missile seekers and night vision devices.
3. **Self-Reliance Initiatives:** Aligned with Make in India and Atmanirbhar Bharat, this initiative strengthens India's role in the global semiconductor supply chain.

4.SASTRA Ramanujan Prize

Context: The 2024 SASTRA Ramanujan Prize will be awarded to **Alexander Dunn** of the Georgia Institute of Technology, U.S.

SASTRA Ramanujan Prize:

- **Origin:** The award was instituted by the Shanmugha Arts, Science, Technology & Research Academy (SASTRA) in 2005.
- **Given By:** SASTRA University, Tamil Nadu, India.
- **Award Details:** A cash prize of USD 10,000 is presented annually.
- **Eligibility:** It is awarded to individuals aged 32 and below for outstanding contributions in the field of mathematics, particularly those influenced by the work of Srinivasa Ramanujan.

Srinivasa Ramanujan:

- **Born:** 22nd December 1887 in Erode, Tamil Nadu.
- **Key Contributions:** Ramanujan made significant contributions to the analytical theory of numbers, elliptic functions, and partition theory. He also worked on hypergeometric series and Euler's constant.
- **Mentorship:** British mathematician G.H. Hardy recognized his talent in 1913 and invited him to Cambridge, where Ramanujan's work flourished.

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5.GlobE Network

Context: India has been elected to the fifteen-member steering committee of the Global Operational Network of Anti-Corruption Law Enforcement Authorities (GlobE Network), an international initiative aimed at addressing corruption and financial crime.

About the GlobE Network:

- **Origin:** Launched in June 2021 under the G20 framework during a UN General Assembly Special Session against Corruption (UNGASS).
- **Members:** It currently includes 121 member countries and 219 authorities worldwide.
- **Aim:** To facilitate international cooperation in combating cross-border corruption and financial crime, and to support asset recovery efforts.
- **Powers:** The network enables global agencies to exchange criminal intelligence, best practices, and devise joint strategies to fight corruption.
- **Significance of India's Election:** India's election to the steering committee allows it to actively contribute to global anti-corruption efforts, leveraging its expertise in tackling corruption, and enhancing its leadership role on the international stage, particularly after its G20 Presidency in 2023.

6.DRDO Deep Technology Initiative

Context: Backed by the ₹1-lakh crore corpus for promoting transformative potential research, announced in the interim Budget, DRDO is set to launch a first-of-its-kind initiative that will remodel its research programme towards emerging technologies for military usage.

- **Significance:** DRDO is funding five high-value deep tech projects, with up to ₹50 crore allocated per project, focusing on indigenisation and reducing dependency on imports. These projects are intended to drive research in emerging technologies like **quantum, blockchain, and artificial intelligence** with a long-term impact on national security.
- **Global Inspiration:** The programme is modeled on similar global initiatives like the U.S. **DARPA**, with the aim of revolutionising defence capabilities through futuristic and disruptive technologies.
- **Project Funding and Collaboration:** The Technology Development Fund (TDF) engages **MSMEs and start-ups** for R&D in military hardware and software. Funding will be rolled out in five tranches, with the first installment capped at 20%, based on project appraisals by an integrated expert team.

7.ABHED Jackets

Context: The Defence Research & Development Organisation (DRDO) in collaboration with the Indian Institute of Technology (IIT) Delhi has developed **Light Weight Bullet Proof Jackets** called **ABHED** (Advanced Ballistics for High Energy Defeat). These jackets are designed to offer enhanced protection while maintaining lightweight features, meeting the evolving needs of the Indian Armed Forces.

Features:

1. Made from **polymers** and **indigenous boron carbide ceramic material**, ensuring both strength and reduced weight.
2. Developed at the **DRDO Industry Academia Centre of Excellence (DIA-CoE)** at IIT Delhi using advanced simulation and material characterization techniques.
3. Provides **360-degree protection** with modular-design and front/rear armour plates.
4. Weight ranges from **8.2 kg to 9.5 kg** depending on the required **BIS level standards**.
5. Lighter than the maximum weight specified by the **General Staff Qualitative Requirement** of the Indian Army and meets the highest threat level standards.

Significance:

- Enhances **soldier mobility** by reducing the burden of heavy protective gear.
- Developed with **indigenous materials** contributing to **self-reliance** in defense production.
- Aligns with the **Make in India** initiative, reducing dependence on foreign imports for critical defense equipment.
- Contributes to **national security** by providing state-of-the-art protective gear tailored for the specific needs of the Indian Army.

8.First Mission to Venus

Context: The Union Cabinet last week approved India's first mission to Venus that ISRO aims to launch in March 2028. This is the country's second interplanetary mission after the Mars Orbiter Mission launched in 2013.

Features and Roadmap:

1. India's first mission to **Venus**, planned by **ISRO**, will launch in **March 2028**.
2. The mission will study Venus' **surface, sub-surface, atmosphere, ionosphere**, and its interaction with the Sun.
3. **Scientific payloads** include an **L and S band Synthetic Aperture Radar**, a thermal camera, and experiments to study interplanetary dust and high-energy particles.
4. India will use **aero-braking** to gradually lower the satellite's orbit around Venus, utilizing the planet's atmosphere to slow down and achieve the desired altitude.

Significance:

1. Provides **insights into Venus**, offering clues about **Earth's evolution**, especially regarding atmospheric and climate changes.
2. Enhances India's position in **global space exploration**, marking its second major interplanetary mission after the **Mars Orbiter Mission**.

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ANSWER WRITING

Some invasive species could be more beneficial than harmful in the context of climate change." Critically evaluate the statement and provide examples to support your argument. (15 Marks, 250 words)

Invasive species are often seen as harmful disruptors of ecosystems. However, in the context of climate change, some invasive species may offer environmental benefits. While they pose risks to native biodiversity, their ability to adapt quickly to new conditions can sometimes help stabilise ecosystems or enhance carbon sequestration.

Benefits of Invasive Species in Preventing Climate Change:

- **Carbon Sequestration:** Certain invasive plant species have the potential to absorb significant amounts of carbon dioxide, aiding in climate change mitigation.
  For example: Prosopis juliflora, an invasive species in India, absorbs CO_2, contributing to **carbon storage** in degraded lands.
- **Soil Stabilisation:** Invasive species like **Spartina alterniflora** can stabilise coastal soils, preventing erosion and protecting areas vulnerable to rising sea levels.
- **Resilience to Drought:** Some invasive species, like the **Siberian elm**, are more drought-resistant and provide vegetation cover where native species fail, maintaining ecosystem services.
- **Support for Pollinators:** Invasive plant species can offer food resources for pollinators when native plants are scarce due to climate shifts.
  For example: Lonicera japonica (Japanese honeysuckle) in the **eastern U.S.** has become a critical nectar source for bees during certain seasons.
- **Biodiversity in Degraded Ecosystems:** In areas where native biodiversity has already been lost, invasive species can fill ecological gaps, offering some level of ecosystem function.
  For example: The invasive **Eucalyptus** tree in **South Africa** has helped regenerate deforested areas, offering habitat for local species.

Negative Impacts of Invasive Species:

- **Biodiversity Loss:** Invasive species often outcompete native species, leading to declines in local biodiversity.
  For example: Lantana camara in **India** has overtaken native plant species, disrupting ecosystems in places like **Jim Corbett National Park**.
- **Ecosystem Disruption:** Many invasive species alter the structure and functioning of ecosystems, negatively impacting food chains and water resources.
  For example: Zebra mussels in the **Great Lakes** region have disrupted aquatic ecosystems by over-filtering water and depleting food for native species.
- **Economic Damage:** Invasive species can cause significant economic losses by affecting agriculture, forestry, and fisheries.
  For example: Fall armyworm infestations have led to major crop losses in **India**, particularly in maize cultivation.
- **Threat to Native Species:** Many invasive species are known to be aggressive competitors, reducing the chances of survival for native flora and fauna.
  For example: Kudzu in the **southeastern U.S.** has grown over native trees, effectively suffocating them.
- **Alteration of Fire Regimes:** Some invasive plants are highly flammable, leading to more frequent and intense wildfires that threaten both native ecosystems and human settlements.
  For example: Gamba grass in **Australia** increases the intensity of wildfires, threatening native habitats.

Way Forward:

- **Adaptive Management:** A nuanced approach should be adopted where invasive species are evaluated based on both their positive and negative impacts on ecosystems.
  For example: Conservation authorities could selectively manage **Prosopis juliflora** in India to balance its ecological benefits and threats.
- **Restoration of Native Habitats:** Investment in habitat restoration projects to help native species recover and reduce the dominance of invasive species.
  For example: The **National Mission** for **Green India** supports reforestation initiatives in degraded areas.
- **Enhanced Monitoring:** Establish continuous monitoring systems to track the spread and impact of invasive species, ensuring timely interventions.
  For example: India's **National Action Plan on Invasive Alien Species (NAPINVAS)** tracks the movement of species like the **Fall armyworm** across states.
- **Public Awareness and Education:** Encourage local communities to participate in monitoring and controlling invasive species while educating them on their potential impacts.
  For example: Eco-sensitive zones in Kerala involve locals in removing **water hyacinth**, an invasive aquatic plant.
- **International Collaboration:** Strengthen cross-border collaborations to share information and strategies for managing invasive species, particularly in areas affected by climate change.
  For example: India's participation in **Convention on Biological Diversity (CBD)** emphasises invasive species management.

While invasive species pose significant challenges, some may offer benefits in the context of climate change, such as **stabilising ecosystems** and enhancing **carbon sequestration.** A balanced, case-by-case approach that considers both positive and negative impacts is essential to effectively manage invasive species while promoting **ecological resilience** and **biodiversity conservation.**

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MCQ

1. Consider the following statements:
   1. Supercomputers in India are utilized for weather forecasting, genomic sequencing, space exploration, aviation engineering, defense applications, and oil & gas exploration.
   2. **PARAM Series** Includes PARAM Siddhi AI, PARAM Pravega, PARAM Utkarsh, and PARAM Shivay

   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
2. Consider the following statements
   1. The Group of Four (G4) countries—pakistan, Brazil, Germany, and Japan—are seeking urgent reform of the UN Security Council (UNSC) to include both permanent and non-permanent members from developing countries.
   2. 32 developing nations including India, from Asia, Africa, Latin America, the Caribbean, and Pacific Small Island Developing States are members of L69 Grouping

   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
3. Consider the following statements
   1. India Semiconductor Mission (ISM) provides a 70% capex subsidy for semiconductor projects.
   2. India and the U.S. have announced a collaboration to establish India's first semiconductor fabrication plant focused on defense and national security

   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
4. Consider the following statements:
   1. The 2024 SASTRA Ramanujan Prize will be awarded to **Alexander Dunn** of the Georgia Institute of Technology, U.S.
   2. Ramanujan made significant contributions to the analytical theory of numbers, elliptic functions, and partition theory. He also worked on hypergeometric series and Euler's constant

   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
5. Consider the following statements regarding the Periodic Labour Force Survey (PLFS):
   1. PLFS is conducted by the Ministry of Labour and Employment.
   2. PLFS covers households from both rural and urban regions.
   3. The survey tracks unemployment rates across various demographics.
   4. The data collected is used to inform inflation-related policies.

   Which of the statements given above is/are correct?
   a) 1 and 4 onlyb) 1, 2, and 3 only
   c) 2 and 3 only d) 2, 3, and 4 only
6. Consider the following statements regarding the objectives of the Quad's Cancer Moonshot Initiative:
   1. The initiative is primarily focused on reducing all types of cancer across the globe.
   2. HPV vaccination and early screening are key components of the initiative's efforts to reduce cervical cancer deaths.
   3. The initiative will work with organizations like Gavi to lower screening costs and improve cancer care access.

   How many of the above statements is/are incorrect?
   a) Only one b) Only two
   c) All three d) None
7. Consider the following statements regarding the CSIRT-Power facility:
   1. CSIRT-Power focuses exclusively on protecting the defense infrastructure of India.
   2. It was established under the Digital India Mission framework.
   3. The primary objective of CSIRT-Power is to facilitate internet access for rural communities.

   Which of the statements given above is/are correct?
   a) 1 only b) 2 and 3 only
   c) 3 only **d) None of these**
8. Consider the following statements about the 2024 UN Summit of the Future:
   1. The Summit primarily focuses on issues related to space exploration and ocean governance.
   2. The "Pact for the Future" is an action-oriented agreement aiming to address global challenges like sustainable development and digital cooperation.
   3. One of the outcomes of the Summit is the establishment of a Global Digital Compact.

   Which of the statements given above is/are correct?
   a) 1 and 2 only**b) 2 and 3 only**
   c) 1 and 3 onlyd) None of these
9. Consider the following statements about Coalition for Disaster Resilient Infrastructure's (CDRI) partnerships and objectives:
   1. CDRI works closely with private-sector organizations to promote the construction of disaster-resilient infrastructure.
   2. CDRI's initiatives aim to enhance last-mile connectivity, such as roads and telecom services.
   3. The focus of CDRI is on reducing disaster risks, especially in underserved regions.

   How many of the above statements is/are correct?
   a) Only one **b) Only two**
   c) All three d) None
10. Consider the following statements about cervical cancer in the Indo-Pacific region:
    1. Cervical cancer is the leading cause of cancer deaths among women in the Indo-Pacific.
    2. Access to HPV vaccines and early screening for cervical cancer remains limited in the region.
    3. The Quad's Cancer Moonshot Initiative aims to reduce the high costs of cancer treatment through public-private partnerships.

    How many of the above statements is/are correct?
    a) Only one **b) Only two**
    c) All three d) None

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