

CONTENTS

1. A Line in the Sand: Understanding the India-China Border Conflict	1
2. Prelims Bits: Sohrai and Khovar Art	4
3. Secularism: Safeguarding Freedom of Thought and Expression”	5
4. Empowering India’s Space Economy: Rs. 1,000 Crore Venture Capital Fund Initiative for Innovation and Growth.....	9
5. The role of the non-ferrous metals industry in the Indian economy	12
6. “Transforming Waste into Power: India’s Approach to Waste-to-Energy Solutions”	16

A Line in the Sand: Understanding the India-China Border Conflict

Why in the news?

India and China will undertake “coordinated patrolling” in Depsang and Demchok along the Line of Actual Control (LAC) in Eastern Ladakh to avoid face-offs, as disengagement in both areas. They added that the patrols were set to resume by the “month-end”.

EVOLUTION OF INDIA-CHINA BILATERAL TIES (1950-1970 AND 2000-2020)

1. 1950: Diplomatic relations were established on April 1; India first non-socialist country to recognize the People's Republic of China. Catchphrase: “Hindi Chini Bhai Bhai.”
2. 1955: Both countries attended the Asian-African Conference in Bandung, promoting solidarity and cooperation and contributing to decolonization and the Non-Aligned Movement.
3. 1962: Border conflict leads to a serious setback in bilateral relations.
4. 1976: Restoration of ambassadorial relations; gradual improvement in ties.
5. 1988: Indian PM Rajiv Gandhi's visit initiates normalization, focusing on developing relations and resolving boundary issues.
6. 1992: President R. Venkataraman visits China, the first Indian President to do so post-independence.
7. 1996: Chinese President Jiang Zemin visits India; confidence-building measures in the military field signed.
8. 2000: President K. R. Narayanan visits China for the 50th anniversary of diplomatic ties.
9. 2008: Agreement on “A Shared Vision for the 21st Century.”
10. 2010: 60th anniversary of diplomatic ties; joint communiqué issued.
10. 2011: “China-India Exchange Year” with cultural activities and a joint encyclopedia project.

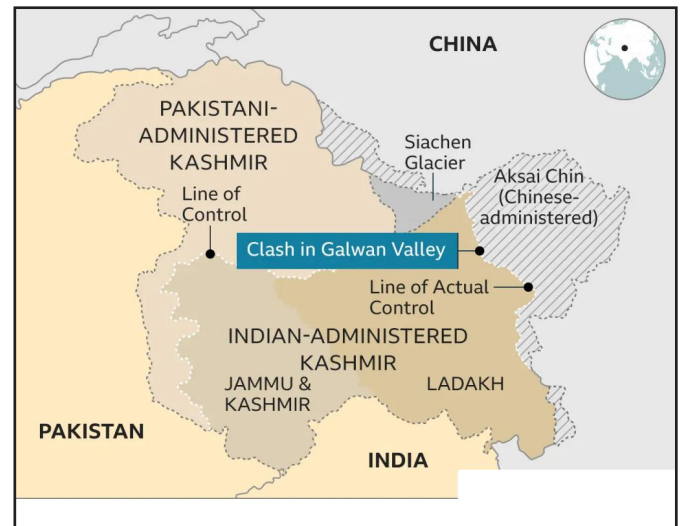
11. 2012: Designated “Year of China-India Friendship and Cooperation”; leaders meet during BRICS Summit.

12. 2015: Meetings on the sidelines of BRICS and East Asia Cooperation Summits; Nathu La Pass opened for Indian pilgrims.

13. 2018: Informal meeting in Wuhan establishes a new model for leader exchanges; meetings during SCO and G20 Summits.

14. 2019: Second informal meeting in Mamallapuram; reaffirmation of the Wuhan consensus and commitment to closer partnership.

15. 2020: Celebrates 70 years of diplomatic relations; Year of Cultural and People-to-People Exchanges with 70 celebratory activities planned



INDIA-CHINA DEEP ENTANGLEMENT:

1. Economic Relations

Trade Volume: India and China have significant trade ties, with China being one of India's largest trading partners. However, the trade imbalance remains a concern for India.

Dependency Issues: India's reliance on Chinese imports, particularly in electronics and pharmaceuticals, raises strategic concerns about dependency.

2. Cultural Exchange

Cultural Ties: Historical and cultural connections

exist, with initiatives promoting tourism, art, and educational exchanges.

Soft Power: Both nations use cultural diplomacy to enhance their global image, though cultural differences can also lead to misunderstandings.

3. Regional Forums

Shanghai Cooperation Organization (SCO): Both countries are members, focusing on security and economic cooperation in Central Asia, but differing priorities can lead to friction.

BRICS: India and China collaborate within BRICS to address global challenges, although competition in areas like economic influence often surfaces.

Russia-India-China (RIC): This trilateral forum addresses geopolitical issues, promoting multipolarity, but diverging interests can complicate cooperation.

4. Border Issues

Ongoing Disputes: The unresolved border conflict remains a significant point of tension, with periodic military standoffs and negotiations failing to yield lasting solutions.

Strategic Implications: Border tensions impact regional security dynamics, affecting both countries' defence postures and alliances.

5. Science and Technology

Collaboration Opportunities: There are areas for potential collaboration in technology and innovation, particularly in fields like space exploration and renewable energy.

Competition: Simultaneously, both nations are competing in high-tech industries, which can exacerbate tensions.

6. Climate Change

Common Challenges: Both countries face similar climate challenges and have opportunities for collaboration in sustainable development and renewable energy initiatives.

Global Responsibility: As major polluters, India and

China are under international scrutiny to fulfil commitments under climate agreements, impacting their bilateral dynamics.

7. WTO Platform

Trade Relations: Both nations engage in discussions within the World Trade Organization (WTO) regarding trade policies and practices.

Common Interests: They often align on issues such as agricultural subsidies and trade reforms, although competition can lead to conflicting positions.

IRRITANT IN BILATERAL RELATIONS:

1. Border Conflicts

Galwan Valley Incident (2020): A violent clash resulted in significant casualties, marking a severe escalation in tensions.

Standoff at Depsang Plains (2013): A prolonged standoff highlighted unresolved border issues and lack of trust.

Doklam Standoff (2018): Tensions flared over Chinese infrastructure development near a disputed tri-junction, leading to military confrontations.

2. China's Expansionist Policies

Tibet Autonomy: China's tight control over Tibet and repression of Tibetan culture create concerns for India regarding regional stability and autonomy.

3. Geographical Challenges

Brahmaputra River: Chinese dam projects on the Brahmaputra raise fears about water security and potential impacts on downstream states, particularly in India's northeast.

4. Regional Power Dynamics

Asian Giants: India and China are engaged in a regional power struggle, shaping the geopolitical landscape in Asia.

Support for Pakistan: China's strategic alliance with Pakistan, including military and economic assis-

tance, is viewed by India as a direct threat.

5. Economic Frictions

Trade Deficit: India has a significant trade deficit with China, raising concerns about economic dependency.

Predatory Pricing and Dumping: Allegations of unfair trade practices, including dumping of goods, create economic tensions.

Restrictions on Services: Non-tariff barriers in China limit Indian service exports, compounding trade imbalances.

6. Indo-Pacific Dynamics

Quad Alliance: India's involvement in the Quad (with the U.S., Japan, and Australia) is seen by China as a strategy to contain its influence in the Indo-Pacific region.

WAY FORWARD:

1. Diplomacy and Dialogue

Mutual Respect: Both nations should prioritize respect for sovereignty and territorial integrity to rebuild trust.

Disagreement Resolution Through Dialogue: Establishing regular diplomatic channels for open discussions on contentious issues, including border disputes, can help prevent misunderstandings and conflicts.

2. Economic Cooperation

Opening Economies: Promoting trade and investment by reducing tariffs and non-tariff barriers can enhance economic ties and reduce trade imbalances.

Fair Trade Practices: Both countries should commit to fair trade practices, addressing issues like predatory pricing and dumping to foster a more equitable economic relationship.

3. Climate Change Collaboration

Joint Initiatives: Collaborating on climate change

through joint research and development of renewable energy technologies can position both countries as leaders in global sustainability efforts.

Shared Goals: Aligning international climate agreements and commitments can enhance cooperation and demonstrate a united front in addressing global challenges.

4. Science and Technology

Cooperative Projects: Encouraging partnerships in scientific research and technological innovation can benefit both nations, particularly in areas like health, agriculture, and clean energy.

Exchange Programs: Promoting academic and research exchanges can facilitate knowledge transfer and strengthen ties in the science and technology sector.

CONCLUSION:

The relationship between India and China is characterized by a complex interplay of cooperation and competition, shaped by historical ties, economic interdependence, and ongoing tensions. The recent decision to undertake coordinated patrolling in Depsang and Demchok reflects an effort to manage border disputes and prevent face-offs, signalling a commitment to diplomacy despite past conflicts. Moving forward, both nations must prioritize dialogue and mutual respect to resolve outstanding issues, particularly concerning border disputes. Economic cooperation is crucial; by promoting fair trade practices and reducing barriers, India and China can address trade imbalances and enhance mutual prosperity.

Prelims Question:

Q. Consider the following statements regarding the India-China relationship:

1. India and China are based on the Panchsheel principles.
2. India and China are both members of the Nuclear Suppliers Group (NSG).

3. China has been the largest trade partner of India in the last five years.

How many of the statements given above are correct?

- A. Only one
- B. Only two
- C. All three
- D. None

Answer: A

Mains Question:

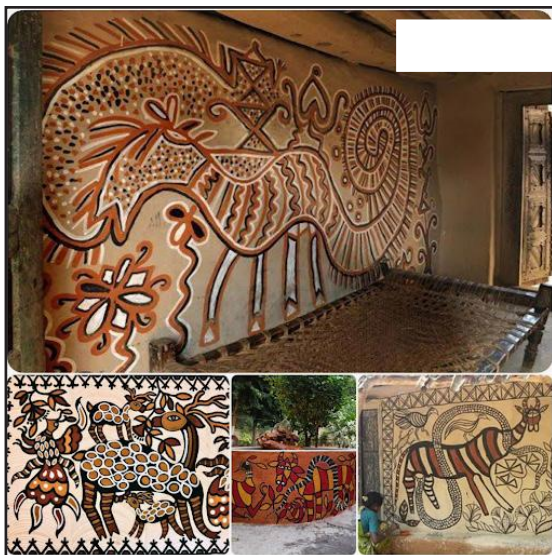
Q. Discuss the challenges posed by border disputes in India-China relations. How can sustained dialogue and negotiation frameworks help in resolving these conflicts?

(250 words, 15 marks)

Prelims Bits: Sohrai and Khovar Art

WHY IN THE NEWS?

PM Modi gifts Jharkhand's art to Russia's President Putin during BRICS summit



SOHRAI AND KHOVAR ART:

Region: Predominantly practiced in eastern India, especially in the Hazaribagh district of Jharkhand.

Cultural Significance:

1. Sohrai relates to the harvest festival following Diwali.
2. Khovar connects to marriage rituals, which are celebrated post-monsoon at the start of the paddy harvest.

Modern Adaptations

Art on Paper and Cloth: The traditional murals are now also created on paper and cloth for commercial sale.

HISTORICAL BACKGROUND

Origins: Dates back to the Paleolithic period (7000 – 400 BC) with cave paintings showing similar animal and floral motifs.

Revival Efforts: Environmentalist Bulu Imam brought attention to the art form's historical significance.

Etymology

Sohrai: Derives from the Mundari term "Soroi," meaning "to lash with a stick."

Khovar: "Kho" means house or room, and "Var" means groom.

CHARACTERISTICS

Sohrai:

1. Matriarchal art passed from mother to daughter.
2. Common motifs include pregnant figures, animals with young ones (e.g., hens and chicks), buffalo, rhinoceros, cows, tigers, wild pigs, and Nilgai.
3. Dedicated to Pashupati, the ruler of creatures.
4. Uses red (ancestors' blood) and black lines (eternal death/Shiva).

Khovar:

Matriarchal origins are similarly passed from mother to daughter.

Themes related to fertility and relationships; motifs include bamboo, elephants, turtles, peacocks, lotuses, and flowers.

ARTISTIC PROCESS

Base Coating: Wall surfaces are prepared with a mixture of soil and dung, followed by white clay.

Sohrai Process: Red lines depict fertility, black lines for Shiva, and white lines for food, reflecting the harvest festival.

Khovar Process:

Black earth (womb) layered with white clay (sperm).

Patterns are created with a comb, symbolizing a Mother Goddess.

Pregnant peacocks are drawn as an auspicious symbol in the marriage room.

PRESENT SITUATION

Popularization: Bulu Imam established the Sanskriti Museum & Art Gallery in 1992.

Government Initiatives:

Plans to adorn trains and government buildings with Sohrai murals (2018).

Geographical Indication (GI) Tag: Sohrai-Khovar received GI status in 2020.

PRELIMS QUESTION

Q. With reference to Sohrai and Khovar Art, consider the following statement:

1. The Sohrai Khoavar Art is a type of mural painting
2. This art is primarily predominant in the states of Kerala and Karnataka
3. The Sohrai Khovar art is unique in its features as it is a matriarchial art

How many of the above-given statements are correct?

- A. Only one
- B. Only two
- C. All three
- D. None

ANSWER: B

Secularism: Safeguarding Freedom of Thought and Expression"

WHY IN THE NEWS?

The Supreme Court on Monday said secularism is an indelible and core part of the Basic Structure of the Constitution. The court made the oral observation while hearing a batch of petitions led by former Rajya Sabha member Subramanian Swamy and others challenging the inclusion of the words "socialist" and "secular" in the Preamble of the Constitution.



WHAT IS SECULARISM?

Secularism is the principle of separating religion from political, social, and educational institutions. It advocates for a society where government and religious institutions operate independently, ensuring that public policies are based on reason, science, and universal human rights rather than religious beliefs.

Constitutional Provisions:

1. Preamble:

The Preamble of the Indian Constitution declares India as a “Sovereign Socialist Secular Democratic Republic.” This emphasizes the commitment to secularism as a core value of the state, ensuring freedom of religion and the separation of religion from government affairs.

2. Fundamental Rights (FR):

Article 25: Guarantees the right to freedom of religion, allowing individuals to practice, profess, and propagate their religion.

Article 26: Provides the right to manage religious affairs, including the establishment of institutions for religious purposes.

Article 27: Prohibits the government from compelling any citizen to pay taxes for the promotion or maintenance of any religion.

Article 28: Ensures that educational institutions maintained by the state cannot compel students to participate in religious instruction.

3. Directive Principles of State Policy (DPSP):

Article 44: Advocates for a uniform civil code for all citizens, promoting equality irrespective of religion.

Article 46: Directs the state to promote the educational and economic interests of Scheduled Castes, Scheduled Tribes, and other weaker sections, which includes protecting their rights against social injustice, including religious discrimination.

4. Fundamental Duties (FD):

Article 51A: Highlights the duty of every citizen to promote harmony and the spirit of common brotherhood among all people, transcending religious, linguistic, and regional diversities.

UNIQUENESS OF INDIAN SECULARISM:

1. Equality of All Religions: Indian secularism acknowledges the equal status of all religions rather than promoting a strict separation of religion and state. This recognition fosters an environment where multiple faiths coexist, allowing for a more

inclusive approach to governance.

2. State Intervention for Promoting Rights: Unlike some Western models where the state remains neutral, the Indian state may intervene in religious matters to promote fundamental rights and social justice. For instance, laws can be enacted to protect vulnerable groups within various religious communities, ensuring that practices do not infringe on individual rights.

3. Coexistence Since Time Immemorial: India’s history is marked by a long tradition of religious coexistence. Various faiths have interacted, adapted, and influenced each other over centuries, leading to a unique syncretism. This historical backdrop informs the contemporary understanding of secularism in India.

4. Fraternity and Brotherhood: The Indian Constitution emphasizes fraternity and brotherhood among citizens. This principle reinforces secularism by promoting unity and harmony across diverse religious communities, fostering a sense of belonging and mutual respect.

5. Protecting Essential Practices: Indian secularism protects the essential practices of different religions, acknowledging their significance while ensuring that they do not violate fundamental rights. This nuanced approach allows for the preservation of cultural and religious identities within a secular framework.

6. Cooperation with Religious Institutions: The Indian state often collaborates with religious institutions for social welfare initiatives and community development. This cooperative stance aims to harness the positive influence of religion in addressing societal issues while maintaining a secular ethos.

7. Harmonious Constitution: The Indian Constitution embodies a harmonious approach to secularism, integrating values of justice, liberty, equality, and fraternity. This holistic framework allows for a more contextual and pragmatic understanding of secularism that aligns with India’s diverse social fabric.

CHALLENGES TO INDIAN SECULARISM:

1. **Religious Fundamentalism:** The rise of religious fundamentalism poses a significant threat to secularism. Extremist views can lead to intolerance, communal violence, and discrimination against minority communities.

2. **Political Polarization:** Political parties sometimes exploit religious sentiments for electoral gains, leading to divisions among communities. This politicization of religion undermines the secular framework and can incite communal tensions.

3. **Caste Discrimination:** Caste-based identities and discrimination can overshadow religious pluralism, complicating the secular landscape. This entrenched social hierarchy can lead to exclusion and inequality within and across religious groups.

4. **Legal and Social Inequality:** Certain personal laws based on religion can perpetuate inequality, especially concerning women's rights. The lack of a uniform civil code is often cited as a challenge to true secularism in India.

5. **Communal Violence:** Instances of communal riots and violence disrupt social harmony and challenge the ideals of secularism. These events often stem from historical grievances, economic disparities, and political manipulation.

6. **Religious Political Parties:** The emergence of political parties that openly advocate for specific religious ideologies can blur the lines of secular governance. This can lead to policies that favor one religion over others.

7. **Social Media and Misinformation:** The spread of misinformation and hate speech on social media can exacerbate religious tensions, fostering a climate of distrust and animosity among communities.

8. **Educational Bias:** Curricula that reflect religious biases can influence young minds, promoting sectarian views rather than fostering an inclusive, secular outlook.

9. **Cultural Nationalism:** A growing trend of cultural nationalism may prioritize one religious identity

over others, undermining the inclusive nature of Indian secularism and alienating minority communities.

10. **Economic Disparities:** Economic inequalities often correlate with religious identities, leading to marginalization of certain communities. This can create resentment and further complicate the secular fabric.

WAY FORWARD:

1. Promoting Education and Awareness:

Curriculum Reforms: Integrate secular and pluralistic values into the education system to foster critical thinking and respect for diversity.

Awareness Campaigns: Launch initiatives to educate citizens about secularism, human rights, and the importance of coexistence.

2. Strengthening Legal Frameworks:

Uniform Civil Code: Consider implementing a uniform civil code to ensure equal rights for all citizens, regardless of religion.

Revising Personal Laws: Review and amend personal laws to eliminate gender discrimination and ensure they align with constitutional principles.

3. Encouraging Interfaith Dialogue:

Community Engagement: Promote interfaith dialogues and community programs to build understanding and solidarity among different religious groups.

Conflict Resolution Mechanisms: Establish forums for dialogue during times of tension to address grievances and prevent escalation.

4. Political Accountability:

Responsible Political Discourse: Encourage political parties to adopt responsible rhetoric that promotes unity rather than division.

Electoral Reforms: Implement reforms to reduce the influence of religion in politics, such as stricter regulations on campaign funding and

religious endorsements.

5. Combatting Misinformation:

Media Literacy Programs: Develop initiatives to enhance media literacy, helping citizens critically assess information and combat misinformation.

Regulating Hate Speech: Enforce laws against hate speech and incitement to violence, ensuring accountability for those who spread communal hatred.

6. Promoting Social Justice:

Economic Development Initiatives: Target economic programs to uplift marginalized communities, reducing economic disparities along religious lines.

Inclusive Policies: Design policies that promote social equity, focusing on education, healthcare, and employment opportunities for all.

7. Strengthening Civil Society:

Empowering NGOs: Support civil society organizations that work towards promoting secularism, human rights, and social harmony.

Grassroots Movements: Encourage grassroots movements that advocate for secular values and community cohesion.

8. Cultural Initiatives:

Cultural Exchange Programs: Promote cultural events that celebrate diversity and encourage interactions among different communities.

Art and Literature: Use art and literature as tools to promote messages of peace, tolerance, and secularism.

9. Engaging Youth:

Youth Programs: Develop programs to engage young people in discussions about secularism, diversity, and civic responsibility.

Volunteer Opportunities: Create opportunities for youth to participate in community service and interfaith initiatives.

CONCLUSION:

The recent affirmation by the Supreme Court regarding secularism as a core part of the Basic Structure of the Constitution underscores its critical importance in shaping India's identity as a diverse and inclusive nation. Indian secularism, with its unique characteristics that embrace equality, coexistence, and cooperation among different religions, is vital for maintaining social harmony and fostering a sense of unity among citizens.

Prelims Question:

Q. Consider the following constitutional provisions:

1. Fundamental Rights
2. Fundamental Duties
3. Directive Principles of State Policy (DPSP)
4. Preamble

How many of the given provisions are related to secularism in India?

- A. Only one
- B. Only two
- C. Only three
- D. All four

Answer: D

Mains Question:

Q. Analyze the challenges faced by Indian secularism in the context of rising religious fundamentalism and political polarization. What measures can be implemented to address these challenges?

(250 words, 15 marks)

Empowering India's Space Economy: Rs. 1,000 Crore Venture Capital Fund Initiative for Innovation and Growth

WHY IN THE NEWS?

The Union Cabinet, led by Prime Minister Narendra Modi, has approved the establishment of a Rs.1,000 crore Venture Capital (VC) Fund dedicated to supporting India's space sector. This pioneering initiative, developed under the aegis of IN-SPACE (Indian National Space Promotion and Authorization Center), aims to propel the growth of space startups, strengthen India's space economy, and position the country as a global leader in space technology. The establishment of this fund aligns with the government's broader vision of promoting innovation, ensuring economic growth, and fostering self-reliance in high-tech industries, thus supporting the goals of Atmanirbhar Bharat.



OBJECTIVES AND STRATEGIC VISION OF THE FUND:

The Rs. 1,000 crore VC Fund is structured to align with India's strategic vision for the space sector and supports the goals set forth in the 2020 space reforms. The fund is designed to address the unique needs of private companies operating in the high-risk, high-reward field of space technology. The fund aims to achieve the following objectives:

1. **Capital Infusion:** The capital fund is expected to encourage additional funding for later-stage development, instilling market confidence and providing

early-stage financial support critical for growth.

2. **Talent Retention and Domestic Development:** Many Indian startups relocate abroad due to better financial opportunities. The fund will work to retain talent within India, preventing brain drain and fostering the growth of homegrown space companies.

3. **Five-Fold Expansion of Space Economy:** The government aims to grow India's space economy by five times over the next decade, supporting the establishment of India as a major global player in space technology.

4. **Technological Advancements:** Investment in innovation will help advance space technology, supporting the development of sophisticated solutions for both domestic and international markets.

5. **Boosting Global Competitiveness:** Enabling Indian companies to develop unique space-based solutions will reduce dependency on foreign technology and allow for stronger competition on a global scale.

6. **Supporting Atmanirbhar Bharat:** By investing in indigenous startups, the fund underscores India's commitment to self-reliance, fostering a robust domestic space economy with fewer dependencies on external technology.

7. **Creating a Vibrant Innovation Ecosystem:** The fund seeks to foster a dynamic space innovation ecosystem by nurturing startups and fostering collaborations between various sectors. This environment encourages the development of new ideas, products, and technologies, stimulating a continuous cycle of innovation in the Indian space industry.

8. **Driving Economic Growth and Job Creation:** By supporting startups and entrepreneurs in the space sector, the fund is expected to boost economic activity, leading to the creation of thousands of direct and indirect jobs. It will enable companies across the supply chain to scale operations, thus enhancing India's competitive position in the global space economy.

FINANCIAL IMPLICATIONS AND DEPLOYMENT STRUCTURE:

The Rs. 1,000 crore VC Fund will be deployed strategically over five years, supporting startups in various stages of growth. The annual investment range is projected to be between Rs.150 crore and Rs. 250 crore, depending on the industry’s needs and growth opportunities. The proposed break-up financial year-wise is as follows:

Financial Year	Estimate (In Rs. Crore)
2025-26	150.00
2026-27	250.00
2027-28	250.00
2028-29	250.00
2029-30	100.00
Total	1000.00

Deployment is structured in two tiers, based on the company’s growth stage and the projected impact on India’s space capabilities:

Growth Stage: Investments will range from Rs. 10 crore to Rs. 30 crore, depending on the startup’s development trajectory and long-term potential.

Later Growth Stage: Investments will range from Rs. 30 crore to Rs. 60 crore, supporting more established companies that have shown significant progress and have a strong growth trajectory.

Based on these funding ranges, the VC Fund aims to support around 40 startups, providing the necessary financial foundation to stimulate growth and innovation across India’s space industry.

EXPECTED IMPACT ON EMPLOYMENT AND ECONOMIC GROWTH:

One of the primary goals of the fund is to create a robust ecosystem that promotes job creation and enhances India’s standing in the space technology sector.

- 1. Generate Direct Employment: Jobs in engineering, data analysis, software development, manufacturing, and other technical fields are expected to increase. Each investment could potentially generate hundreds of direct job opportunities within these high-skill areas.
- 2. Indirect Employment Opportunities: Additional employment will also be generated in fields associated with logistics, professional services, and supply chain management. These jobs will arise from the increased demand created by scaling businesses and manufacturing units.
- 3. Strengthening India’s Space Workforce: By fostering a skilled workforce in the space sector, the fund aims to build a sustainable talent pool, enhancing India’s global standing and driving innovation through skilled professionals.

The fund will not only create jobs but also drive economic growth by expanding the space ecosystem and building an innovation-centric economy that supports self-reliance and sustainable development.

POSITIONING INDIA AS A GLOBAL SPACE ECONOMY LEADER:

1 . Current Market Overview:

Indian space economy is valued at approximately USD 8.4 billion.

Represents a 2% share of the global space market.

2. Future Vision:

The government aims to scale the space economy to USD 44 billion by 2033.

Target includes USD 11 billion in exports, aiming for a 7-8% global market share.

3. Private Sector Participation:

Strong growth is expected from the increased involvement of private companies.

Approximately 250 startups are currently operating in various segments of the space economy.

4. Global Trends in Space Investment:

Many countries recognize the strategic importance of space, establishing VC funds.

Examples of such funds include:

UK: GBP 30 million Seraphim Space Fund

Italy: EUR 86 million Primo Space Fund

Japan: USD 6.7 billion Space Strategic Fund

Saudi Arabia: Neo Space Group by Public Investment Fund (PIF)

5. India's VC Fund Initiative:

India plans to create a dedicated VC fund to support space startups.

Focus on fostering innovation and strengthening national capabilities in space technology.

6. Ecosystem Development:

Aims to create a robust space innovation ecosystem.

Encourages local development of space technologies and related services.

7. Strategic Importance:

Enhancing India's position in the global space race.

Building partnerships and collaborations for technological advancements.

WHAT ARE THE CHALLENGES IN INDIA'S SPACE SECTOR :

1. Access to Capital: Many space startups struggle to secure funding from traditional financial institutions due to the high-risk nature of space technol-

ogy investments. The perception of long payback periods further deters investment.

2. Talent Shortage: While there is a growing interest in space technology, there is a limited pool of skilled professionals. The need for specialized training programs and educational initiatives is critical to nurture talent in fields such as engineering, software development, and data analysis.

3. Regulatory Hurdles: Complex regulatory frameworks can hinder the rapid development and deployment of space technologies. Streamlining regulations and ensuring clear guidelines for private participation is essential for fostering innovation.

4. Infrastructure Limitations: Adequate infrastructure is vital for the growth of the space sector. Investment in testing facilities, launch pads, and research institutions is needed to support the increasing number of startups.

5. Market Competition: With many countries investing heavily in their space sectors, Indian companies face stiff competition. They need to develop unique technologies and solutions to carve out a niche in the global market.

6. Intellectual Property Issues: Protecting intellectual property rights in a rapidly evolving tech landscape is crucial for startups. Ensuring that innovators can safeguard their inventions will encourage more private investment.

7. Dependency on Global Supply Chains: A significant portion of space-related components is imported. Strengthening domestic manufacturing capabilities is essential for self-reliance and reducing vulnerability to global supply chain disruptions.

WAY FORWARD:

1. Enhanced Funding Mechanisms: Establish innovative funding models that include grants, equity, and convertible notes, making it easier for startups to access diverse capital sources.

2. Skill Development Initiatives: Launch training programs and partnerships with academic institutions to develop a skilled workforce. Collaborations

with international space agencies can also enhance knowledge transfer.

3. **Regulatory Simplification:** Work with IN-SPACE and other regulatory bodies to create a conducive environment for startups, ensuring that policies are transparent and supportive of innovation.

4. **Investment in Infrastructure:** Allocate resources towards developing testing and launch facilities, research centres, and collaborative workspaces that foster innovation and partnership.

5. **Focus on R&D:** Encourage startups to invest in research and development through tax incentives and grants, promoting the creation of proprietary technologies.

6. **Strengthen IP Protection:** Create awareness and provide resources for startups on intellectual property rights, ensuring they can protect their innovations.

7. **Encourage Domestic Supply Chains:** Promote initiatives that incentivize the local manufacturing of components and technologies, reducing reliance on imports and enhancing self-sufficiency.

CONCLUSION:

The Rs. 1,000 crore VC Fund under IN-SPACE signifies a milestone in India's space sector evolution, demonstrating the government's commitment to achieving self-reliance and establishing India as a global leader in space. By providing risk capital, creating jobs, fostering innovation, and encouraging private sector participation, the fund aligns with national priorities to strengthen India's capabilities in the high-tech domain. It is not only a financial commitment but also a long-term strategic investment in building a vibrant, innovative, and sustainable space economy that aligns with the goals of Atmanirbhar Bharat.

Prelims Question:

Q. Which of the following is NOT one of the stated objectives of the Rs. 1,000 crore VC Fund?

- A. Boosting global competitiveness
- B. Encouraging brain drain
- C. Supporting Atmanirbhar Bharat
- D. Driving economic growth and job creation

Answer: B

Mains Question:

Q. Evaluate the role of IN-SPACE in facilitating private sector participation in the space industry. How can this organization further enhance its effectiveness in promoting innovation and investment?

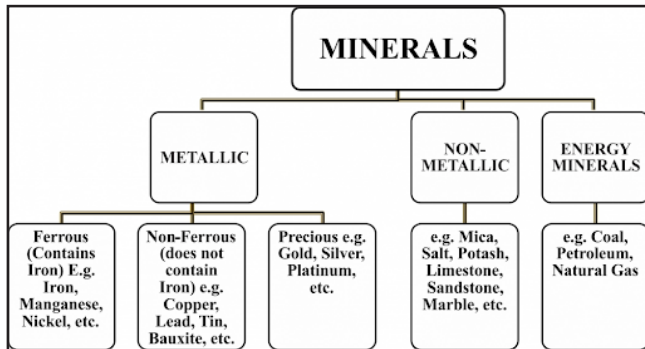
(250 words, 15 marks)

The role of the non-ferrous metals industry in the Indian economy

WHY IN THE NEWS?

In FY 2024-25 (April-September), India's non-ferrous metals sector saw steady growth. Primary aluminum production rose by 1.2%, reaching 20.90 lakh tons (LT), up from 20.66 LT in the same period last year. Refined copper production also increased by 4.6%, from 2.39 LT to 2.50 LT.



MINERAL CLASSIFICATION:**NON-FERROUS METALS:**

Non-ferrous metals are metallic elements or alloys that do not contain iron as a primary component.

CHARACTERISTICS OF THE NON-FERROUS METALS:

Corrosion Resistance: Non-ferrous metals are less likely to rust or corrode compared to ferrous metals, making them suitable for a wide range of applications.

Conductivity: Many non-ferrous metals, such as copper and aluminum, have excellent electrical and thermal conductivity, which is essential in electrical and electronic applications.

Malleability: These metals can be easily shaped and formed without breaking, allowing for versatile manufacturing processes.

COMMON EXAMPLES OF NON-FERROUS METALS:

Aluminum: Lightweight and used in construction, automotive, and packaging. It is extracted from bauxite ore through the Bayer process, which involves refining the ore to obtain alumina, followed by electrolysis to produce aluminum metal.

Copper: Highly conductive, widely used in electrical wiring and plumbing. Copper is primarily extracted from chalcopyrite and malachite ores through methods like smelting and hydrometallurgical processing, which includes solvent extraction and electro-winning.

Zinc: Primarily used for galvanizing steel to prevent corrosion. Zinc is extracted from sphalerite ore through roasting and hydrometallurgical processes, including leaching and electrowinning.

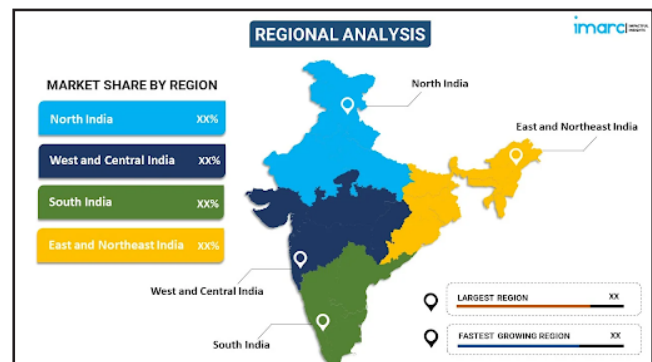
Lead: Used in batteries and radiation shielding. Lead is obtained from galena ore through a process of crushing, grinding, and then smelting to separate the metal from sulfur and other impurities.

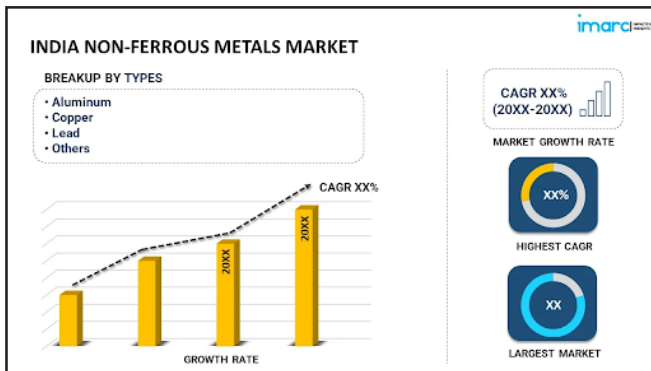
Precious Metals: Such as gold and silver, are valued for their rarity and used in jewelry, electronics, and investment. Gold is extracted from auriferous ores via cyanidation or the Miller process, while silver is often obtained from argentite and can be extracted through both cyanidation and electrolysis methods.

NON-FERROUS METAL SCENARIO IN INDIA:

Non-ferrous metals, which include aluminum, copper, lead, nickel, tin, and zinc, are essential for various industries due to their unique properties such as corrosion resistance and conductivity.

Statistics: The Indian non-ferrous metals market was valued at USD 17.7 billion in 2023 and is projected to grow significantly, reaching USD 28.78 billion by 2032, reflecting a compound annual growth rate (CAGR) of 5.50% from 2024 to 2032, according to the IMARC Group. India ranks as the second-largest aluminium producer and is among the top 10 in refined copper.





KEY DEMAND DRIVERS FOR NON-FERROUS METALS IN INDIAN ECONOMY:

Automotive Sector Growth: Rising vehicle production and a shift toward lightweight materials drive significant demand for non-ferrous metals like aluminium and lead.

Expanding Infrastructure and Construction Industry: Increased infrastructure projects, urbanization, and government-led initiatives such as 'Smart Cities' spur demand for non-ferrous metals, particularly aluminium, zinc, and copper.

Electrical and Electronics Demand: High demand for conductors, wiring, and electronic components boosts the need for copper and aluminium in the growing electronics sector.

Consumer Durables Market Expansion: Growth in household appliances and electronics increases consumption of aluminum and copper in this sector.

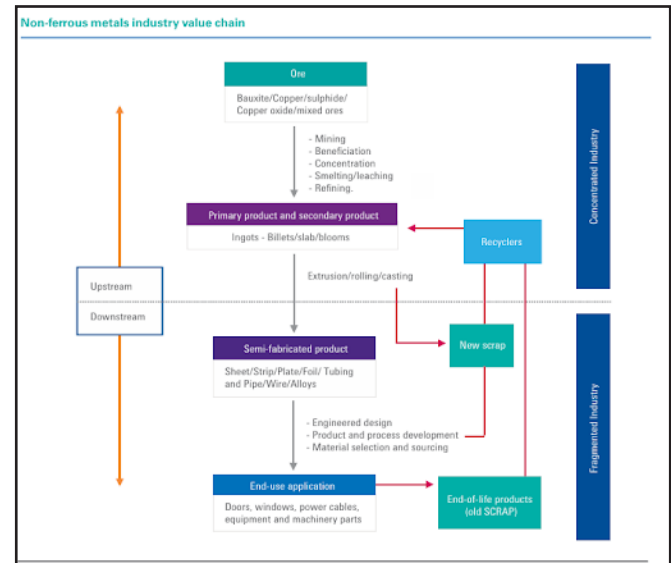
Renewable Energy Development: The expansion of solar and wind power infrastructure drives demand for non-ferrous metals, especially aluminium, and copper, essential for efficient energy systems.

Steel Industry Requirements: Zinc demand is strongly linked to steel galvanization, which is vital for corrosion resistance in construction and industrial applications.

Domestic Aluminium Supply and Capacity Expansion: India meets primary aluminium demand through local production, and significant capacity expansions over recent years have strengthened

supply, reducing import dependency.

Lead Demand from Battery Sector: The automotive and industrial battery sectors, which consume 70-75% of lead, contribute to steady demand growth, with secondary lead production covering around 85% of this need.



CHALLENGES IN THE NON-FERROUS METALS SECTOR IN INDIA:

High Imports of Downstream Aluminium Products: Due to limited domestic processing capabilities, significant imports from China and the Middle East affect local market competitiveness.

Infrastructure and Technology Gaps in the Aluminium Downstream Sector: Inadequate infrastructure and outdated technology hinder the efficient processing and production of high-quality aluminum products.

Dependence on Copper Downstream Imports: Despite being a net exporter of copper, India imports large volumes of downstream copper products due to technological limitations and high production costs.

Outdated Technology in Copper Processing: Insufficient technological advancements in the copper downstream sector reduce productivity and efficiency, impacting competitiveness.

Net Importer Status of Lead: Although lead production has increased, India still imports significant quantities to meet domestic demand.

High Resource Intensity for Lead Recycling: Secondary production of lead, which meets a majority of demand, requires substantial resources, making recycling inefficient and costly.

Surge in Imports of Galvanized Steel: Increased imports of galvanized steel dampen zinc demand growth domestically, as galvanized steel is a primary consumer of zinc for corrosion protection.

Regulatory Challenges in the Zinc Sector: Despite anti-dumping measures and import duties, high imports of galvanized steel continue to affect local zinc demand.

Complex Regulations Affecting Ease of Doing Business: Lengthy bureaucratic processes and complex regulatory requirements add to operational costs and discourage investment in the non-ferrous metals sector.

Skill Gaps in Manufacturing and Processing: A shortage of skilled labor and limited training facilities restricts the ability of the non-ferrous metals industry to adopt advanced production techniques and maintain high-quality standards.

WAY FORWARD TO ADDRESS HIGH NON-FERROUS METALS DEMAND:

Streamline Business Operations: Enhance the ease of doing business by simplifying registration processes and tax laws to attract new investments in the non-ferrous metals sector.

Boost Infrastructure Investment: Accelerate infrastructure development in railways, roads, and ports, allowing 100% FDI to improve logistics and transportation efficiency for non-ferrous metal supply chains.

Implement Dedicated Freight Corridors: Expedite the implementation of dedicated freight corridors to facilitate quicker and more efficient movement of non-ferrous metals across the country.

Revive Stalled Projects: Focus on reviving stalled infrastructure projects to enhance connectivity, ensuring timely delivery of raw materials and products.

Enhance Recycling and Sustainable Practices: Promote recycling initiatives and sustainable practices in the non-ferrous metals sector to meet increasing demand while minimizing environmental impact.

Develop Skilled Workforce: Invest in skill development programs, such as the Skill India initiative, to ensure a workforce equipped to handle advanced technologies and processes in non-ferrous metal production.

Encourage Technological Innovation: Foster technological advancements in processing and production techniques to improve efficiency and quality in the non-ferrous metals industry.

Strengthen Regulatory Framework: Create a more favorable investment climate through clear and supportive regulations, encouraging both domestic and foreign investment in the non-ferrous metals sector.

CONCLUSION:

Hence, the non-ferrous metals industry is essential for India's economic development, as it supports various sectors and drives technological innovation. So, by addressing the challenges faced by this industry and focusing on emerging demands, such as electronic batteries, India can enhance its manufacturing capabilities. With strategic investments and regulatory support, this sector has the potential to become the backbone of India's economy.

Prelims Question:

Q. With reference to the Minerals in India, Consider the following statement:

1. In the last five years, India has been the top producer of non-ferrous metal aluminum.
2. In the last decade India has been the largest exporter of copper metal.

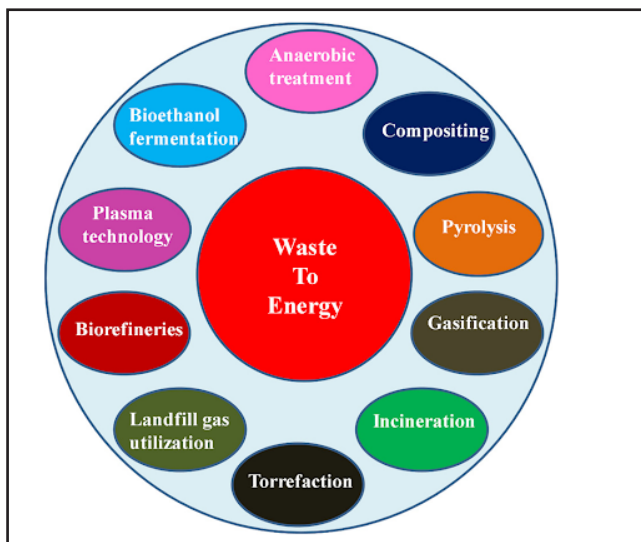
to generate heat, electricity, or as a natural gas substitute, while the digestate is often used as fertilizer.

Landfill Gas Recovery: Methane and other gases generated by decomposing organic waste in landfills are captured through wells and used to produce electricity, and heat, or upgraded to renewable natural gas. This process reduces greenhouse gas emissions from landfills.

Plasma Arc Gasification: High-temperature plasma torches break down waste materials into syngas and molten slag in an oxygen-starved environment. Plasma gasification is efficient and can handle a variety of waste, though it is costly and less widely adopted.

Biomass-to-Energy (BTE): Biomass waste, such as wood chips, agricultural residue, or organic industrial waste, is combusted or converted into biofuels. The resulting energy can generate electricity, provide heat, or be converted to biofuels like biodiesel or ethanol.

Membrane Filtration: This method involves using semi-permeable membranes to separate and filter contaminants from wastewater or other waste streams. In waste-to-energy applications, membrane filters can purify biogas or liquid waste, removing impurities and increasing the efficiency of anaerobic digestion or other bioconversion processes. This technology also enhances water reclamation and nutrient recovery, supporting sustainable waste management and energy production.



ADVANTAGES OF WASTE-TO-ENERGY METHODS:

Environmental Viability and Sustainability: Waste-to-energy (WTE) plants offer sustainable waste management solutions, reducing the volume of waste sent to landfills and lowering greenhouse gas emissions.

Reduction in Air Pollution: By diverting waste from incineration, WTE plants help decrease air pollution, as waste is processed in a more controlled environment.

Enhancement of Soil Fertility: Organic waste can be processed into bio-compost, which enriches soil fertility, supporting agricultural sustainability.

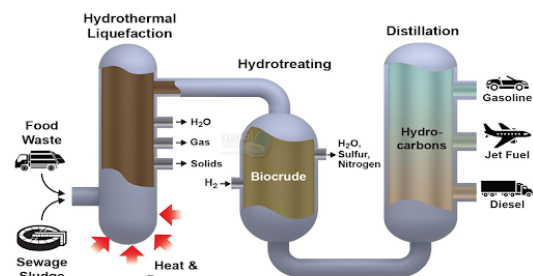
Sustainable Energy for Rural Areas: WTE facilities provide renewable energy to rural areas, promoting sustainable energy access across regions.

Supporting Nationally Determined Contributions (NDCs): WTE contributes to India's goals under its NDCs by promoting renewable energy and lowering overall carbon emissions.

Improving Safety and Health for Children: Reduced pollution levels around waste sites contribute to a safer environment, particularly benefiting children's health.

Boosting Renewable Energy Targets: Increasing renewable energy from WTE contributes toward India's 40% renewable energy target, enhancing the country's clean energy mix.

Membrane Filtration: Membrane filters are used in WTE processes to purify wastewater and remove impurities from biogas, improving efficiency in biogas production and enabling safe water reclamation for various uses.



Efficient Waste to Energy Conversion Processes for Effluent Treatment

CHALLENGES TO WASTE-TO-ENERGY PRODUCTION IN INDIA:

Resource Limitations in Urban Bodies: Many local urban bodies lack the resources needed to implement waste-to-energy projects effectively.

Issues with Collection and Segregation: Inconsistent garbage collection and inadequate segregation of waste hinder effective waste management.

High Use of Non-Biodegradable Plastics: The widespread use of non-biodegradable plastics complicates waste-to-energy processes.

Limited Use in Urban Centres: Only a few urban centres effectively utilize waste-to-energy techniques for waste management.

Manpower Shortage: There is a shortage of skilled manpower dedicated to waste-to-energy projects.

Reliance on Conventional Dumping: Many major cities still rely on traditional waste dumping, as seen in Delhi, Chennai, and Mumbai.

Neglect of Tier 2 and Tier 3 Cities: Smaller cities often receive less attention for waste-to-energy initiatives.

Low Public Participation: There is limited public participation in adopting eco-friendly waste management practices.

High Initial Costs: The high initial cost of setting up waste-to-energy plants poses a financial barrier.

Lack of Access in Rural Areas: Many rural and panchayat areas are yet to benefit from waste-to-energy technology.

WAY FORWARD:

Support via Smart City and National Rural Missions: Increased support through these missions can enhance waste-to-energy adoption in urban and rural areas.

Development of New Biopolicies: Biopolicies should focus on increasing the production and use of biodegradable waste.

Expand Swachh Bharat Mission to Remote Areas: Extending Swachh Bharat Mission efforts to remote areas can improve waste management.

Promote Public-Private Partnerships: Successful partnerships, like the Ahmedabad model, can reduce initial setup costs for waste-to-energy plants.

Raise Public Awareness: Campaigns by entities like the Kakinada Municipal Corporation can boost public engagement in waste management.

Amend Plastic Regulation Rules: Strengthening plastic regulations, as suggested by a parliamentary panel, could enforce stricter plastic usage controls.

Encourage Eco-Friendly Bags: Promoting alternatives like jute bags can help reduce plastic waste.

Mission LiFE for Household Waste Reduction: The Mission LiFE initiative can reduce household waste and promote sustainable living practices.

Adopt Advanced Technologies: Using algae and other innovative technologies can aid in degrading plastics and reducing waste.

Utilize Biopolymers: Incorporating biopolymers can significantly help in minimizing non-biodegradable plastic waste.

Ensure Medical Waste Segregation: Proper disposal and segregation of medical waste are essential for maintaining hygiene and safety.

CONCLUSION:

Waste-to-energy methods provide a transformative solution for energy generation by converting waste into usable energy, thereby reducing landfill use and greenhouse gas emissions. To fully harness this potential, it is crucial to invest in partnerships with private players and raise public awareness of the benefits. These combined efforts can lead to a new era of sustainable energy solutions.

Prelims question:

Q. Which of the following are typically a product of waste-to-energy processes?

1. Electricity
2. Heat
3. Digestate (fertilizer)
4. Plastic

Select the correct answer using the code given below:

- A. Only one
- B. Only two
- C. Only three
- D. All four

ANSWER: C

Mains questions:

Q. What are the key benefits and challenges of implementing waste-to-energy methods in India, and how can these challenges be effectively addressed?

(Answer in 250 words)