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*Academy for Civil Services Pvt. Ltd.*

CREATING CIVIL SERVANTS FOR THE NATION



**ANSWER OF OCS (2021)  
MAINS EXAMINATION (GS - II)**

## OPSC OAS MAINS DETAILED EXPLANATION OF GS-II OCS- 2021

### 1. Justify India's neutrality over the Ukraine invasion by Soviet Russia.

Approach:

Introduction: Provide a context for India's neutrality on the Ukraine invasion.

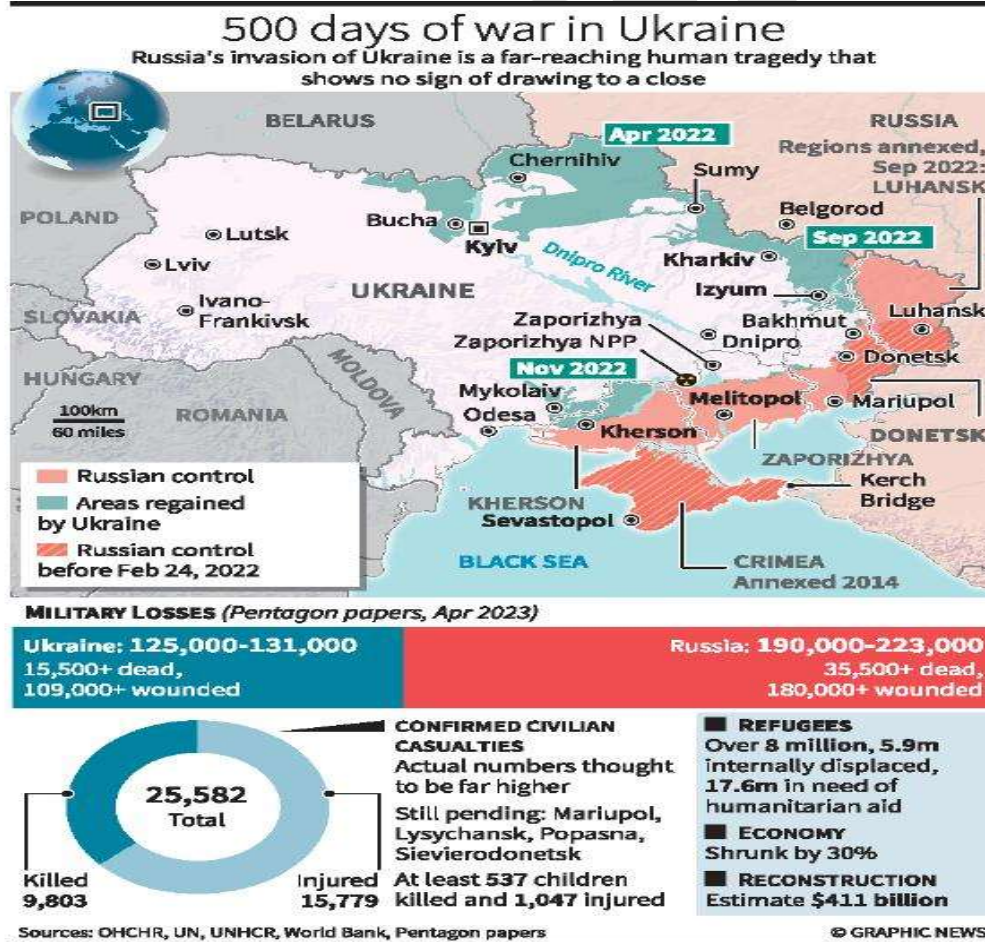
Body: Explore diplomatic, economic, and geopolitical factors shaping India's stance with examples in respective sections.

Conclusion: Summarize the multifaceted considerations influencing India's neutral position in the Ukraine-Russia conflict.

**Answer:**

**Introduction:**

India's historical approach to international crises, marked by cautious neutrality and a focus on problem-solving rather than condemnation, has shaped its responses to conflicts involving its partners. From the Soviet interventions in Hungary, Czechoslovakia, and Afghanistan to the American invasion of Iraq, India has maintained a non-condemnatory stance. The recent Russia-Ukraine war presents a complex scenario where India's strategic autonomy and historical neutrality are being tested, leading to scrutiny and pressure from the West.



### India's Stand on Russia-Ukraine War:

- India's response to Russia's invasion of Ukraine reflects its historically cautious neutrality. The condemnation of civilian killings without name-calling and the abstention from UN votes align with India's approach to conflicts involving its partners.

- The abstention from UNSC and UNGA resolutions and the IAEA resolution highlights India's reluctance to take sides in the global crisis. Notably, other democracies like South Africa and the United Arab Emirates have also abstained, emphasizing a shared approach to neutrality.

**Reasons for Selective Targeting:**

- India's selective targeting by Western countries can be attributed to political, economic, and strategic factors. Politically, the West constructs a narrative of a united front against Russian aggression, and India's neutrality challenges this narrative.
- Economically, India's trade with Russia, if sustained, could dilute the impact of Western sanctions on the Russian economy.
- Strategically, India's nuanced foreign policy, balancing partnerships with the U.S. and Russia, presents a challenge to the West's expectation of unequivocal support.

**Way Forward for India:**

- **Self-Reliance in Arms:**
  - India needs both the U.S. and Russia to counter Chinese expansionism.
  - Self-reliance in arms is key to navigating conflicts between major powers.
- **Balanced Approach:**
  - The India-Russia partnership is crucial on land, while alliances like the QUAD are imperative for countering maritime expansionism.
  - A balanced approach aligns with India's core national interests and strategic autonomy.
- **Realizing West's Interests:**
  - India's neutrality doesn't mean support for the war; it reflects pragmatic realism.
  - The West, seeking partners to contain China, may find India's markets and democratic influence indispensable.

**Conclusion:**

India's response to the Russia-Ukraine war underscores its commitment to strategic autonomy and pragmatic realism. Amid scrutiny and pressure, India maintains a neutral stance, rooted in historical principles and a recognition of its core national interests. The evolving geopolitical landscape necessitates a delicate balance between partnerships with the West and Russia, emphasizing the importance of self-reliance and a nuanced approach to navigating complex international crises.

**2. Examine the Nuclear Energy Policy of India.**

Approach:

Introduction: Define the Nuclear Energy Policy and its significance.

Body: Examine key aspects, such as policy goals, technology, safety measures, and international collaborations, to understand India's stance on nuclear energy.

Conclusion: Summarize India's Nuclear Energy Policy's strengths and challenges, highlighting its role in the country's energy landscape.

**Answer:**

**Introduction:**

India's Nuclear Energy Policy has evolved over the years, marked by significant milestones and strategic decisions. Initiated in the 1950s by Homi Bhabha, the three-stage nuclear power program aimed at harnessing nuclear energy for power generation has been a cornerstone of India's energy strategy. The recent developments, including the approval for constructing Pressurized Heavy Water Reactors (PHWRs) and the ambitious project in Jaitapur, Maharashtra, underscore India's commitment to nuclear power. However, this policy faces various challenges, requiring a nuanced examination.



Body:

- **Benefits and Rationale:**
  - The utilization of Thorium, a promising nuclear fuel, positions India as a leader in the quest for fossil fuel-free energy.
  - Nuclear energy offers a solution to reduce the hefty import bills incurred due to petroleum and coal, contributing to economic stability.
  - The stability and reliability of nuclear power make it a consistent and efficient source, distinguishing it from weather-dependent renewable sources.
- **Challenges to Adoption:**
  - The capital-intensive nature of nuclear power plants poses a hurdle, evident in instances like the V.C. Summer nuclear project's cost overruns.
  - India's nuclear-installed capacity lags significantly behind projections, raising questions about the feasibility of meeting future energy targets.
  - The lack of substantial public funding and subsidies puts nuclear power at a disadvantage compared to fossil fuels and renewables.
- **Environmental Concerns and Climate Change:**
  - Climate change amplifies the risks associated with nuclear power, as extreme weather events can lead to temporary shutdowns and affect water sources for cooling reactors.
  - The deployment of nuclear energy at the necessary scale for carbon emission mitigation may pose challenges.
- **Nuclear Waste and Safety:**
  - The production of nuclear waste and its potential health hazards raises ethical and practical concerns, especially in densely populated regions like India.
  - Addressing safety concerns is crucial for public acceptance, emphasizing the need for a Nuclear Safety Regulatory Authority to ensure adherence to the highest safety standards.
- **Potential Solutions:**
  - Subsidies on nuclear electricity could make it more competitive, aligning with the low costs of solar and wind power.

- Pre-project issues, including land acquisition and clearances, must be efficiently addressed, alongside efforts to reduce the capital cost of nuclear power plants.
- Technological advancements in reprocessing and enrichment capacity are essential for maximizing the potential of nuclear energy.

**Conclusion:**

India stands at a critical juncture in its pursuit of nuclear energy as a cornerstone of its power generation strategy. While the benefits are evident, challenges such as high capital investment, safety concerns, and environmental considerations demand careful attention.

The nation must strike a balance between harnessing its abundant Thorium resources and addressing the shortcomings in the current nuclear energy policy. With strategic reforms, subsidies, and a commitment to safety, India has the potential to emerge as a global leader in nuclear energy, contributing to a sustainable and energy-efficient future.

**3. Discuss the structure and functions of the World Trade Organisation (WTO). What is the dispute settlement mechanism under WTO?**

Approach:

Introduction: Define the World Trade Organisation (WTO) and its role in international trade.

Body: Explore the structure and functions of the WTO, highlighting key mechanisms. Dedicate a section to explain the dispute settlement mechanism.

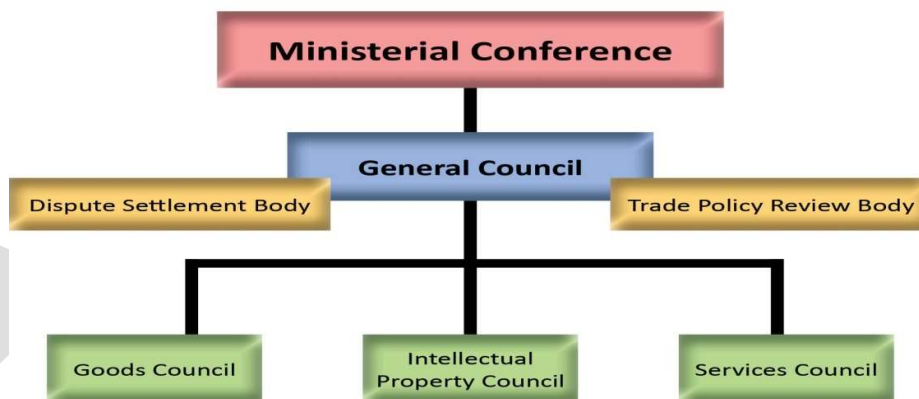
Conclusion: Summarize the importance of the WTO in facilitating global trade and resolving disputes.

**Answer:**

**Introduction:**

The World Trade Organization (WTO) serves as the global governing body for international trade, providing a framework for negotiating and formalizing trade agreements among its member nations. Established in 1995, the WTO replaced the General Agreement on Tariffs and Trade (GATT) and has since played a pivotal role in shaping the rules and regulations that govern global trade.

**Structures of WTO**



**Body:**

● **Structure and Functions:**

- The WTO operates on the principle of consensus among its member countries, currently numbering over 160. Its primary components include the Ministerial Conference, General Council, and various subsidiary bodies.
- The Ministerial Conference, the highest decision-making body, meets biennially to address key issues and provide guidance on the organization's overall direction.
- The General Council, responsible for day-to-day operations, oversees the functioning of various committees and councils that focus on specific aspects of trade, such as agriculture, services, and intellectual property.

● **Dispute Settlement Mechanism:**

- The Dispute Settlement Body (DSB) is a central component of the WTO's dispute resolution mechanism. It comprises all WTO members and is responsible for overseeing the settlement of disputes between member countries.
- The dispute settlement process typically involves consultations between the parties involved, aiming to reach a mutually agreed solution. If consultations fail, a panel is established to examine the case and deliver a ruling.
- The Appellate Body, a standing body of seven members, reviews appeals against panel decisions, providing an additional layer of impartiality and expertise.
- WTO members are obligated to comply with the dispute settlement rulings, ensuring a rules-based approach to resolving trade disputes and maintaining the integrity of the global trading system.

**Conclusion:**

The World Trade Organization, with its intricate structure and multifaceted functions, stands as a linchpin in fostering cooperation and regulating international trade. Through mechanisms like the Dispute Settlement Body, the WTO ensures that trade conflicts are addressed methodically and impartially, promoting a rules-based system that benefits all member nations.

As the global economy continues to evolve, the role of the WTO remains vital in facilitating fair, transparent, and mutually beneficial trade relationships among nations.

**4. Justify the replacement of the erstwhile Planning Commission by the NITI Aayog by the government of India. To what extent has the NITI Aayog been successful?**

Approach:

Introduction: Define the erstwhile Planning Commission and introduce the rationale behind its replacement by NITI Aayog.

Body: Examine the reasons for the shift, evaluating NITI Aayog's successes and challenges. Discuss its impact on policy formulation and implementation.

Conclusion: Summarize the key achievements and limitations of NITI Aayog in steering India's development agenda.

**Answer:**

**Introduction:**

The transition from the Planning Commission to the National Institution for Transforming India (NITI Aayog) marked a significant shift in India's approach to economic planning and policy formulation. The decision to replace the Planning Commission was driven by the need for a more flexible and dynamic institution that could adapt to the evolving socio-economic landscape.

The NITI Aayog, established in 2015, aimed to foster cooperative federalism, encourage innovation, and provide a platform for inclusive and sustainable development. This move reflected the government's commitment to modernize the planning process and align it with the complexities of a rapidly changing global economy.

**Body:**

● **Rationale for Replacement:**

- The erstwhile Planning Commission, with its centralized planning approach, faced criticism for being rigid and bureaucratic.
- The decision to replace it with the NITI Aayog was rooted in the recognition of the need for a more decentralized, participative, and adaptable planning body.
- The shift from a top-down planning model to a collaborative and cooperative federal structure aimed to involve states in the decision-making process, fostering a sense of ownership and accountability.

● **Key Objectives of NITI Aayog:**

- The NITI Aayog was envisioned to act as a think tank, providing strategic and directional inputs across sectors.
- It aimed to encourage cooperative federalism by involving states in the policy formulation process, promoting competitive and cooperative federalism for holistic development.
- The emphasis on innovation and technology-driven solutions reflected the changing dynamics of the global economy.
- **Successes of NITI Aayog:**
  - The NITI Aayog facilitated the formulation of key policy initiatives such as the Goods and Services Tax (GST), promoting a unified tax structure across states.
  - It played a pivotal role in identifying and addressing bottlenecks in various sectors through initiatives like the Ease of Doing Business rankings, fostering a business-friendly environment.
  - The institution actively engaged with states, promoting collaborative initiatives and providing a platform for sharing best practices.
- **Challenges and Criticisms:**
  - Despite its successes, the NITI Aayog faced challenges such as resource constraints and the need for greater statutory backing to enhance its effectiveness.
  - Critics argue that the shift to a more decentralized model has led to a dilution of the planning process, with some suggesting the need for a more structured and accountable approach.

**Conclusion:**

The replacement of the Planning Commission by the NITI Aayog was a strategic move to modernize India's planning framework, aligning it with the principles of cooperative federalism and innovation. The successes of the NITI Aayog in fostering policy initiatives, engaging with states, and addressing bottlenecks are commendable.

However, challenges persist, and ongoing efforts are required to strengthen its institutional framework. As India continues its journey towards sustainable and inclusive development, the role of the NITI Aayog remains pivotal in providing dynamic and forward-looking policy inputs.

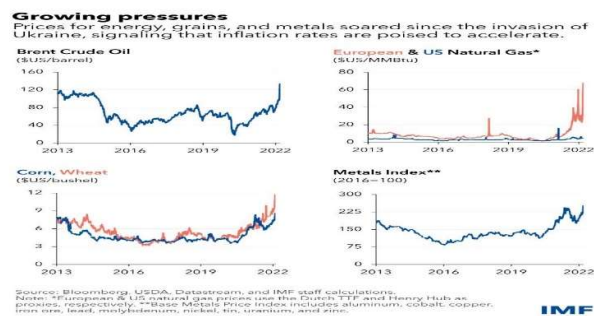
**5. Examine the consequences of the Russian-Ukraine war on the worldwide economy.**

**Approach:**  
**Introduction:** Outline the significance of the Russian-Ukraine war's impact on the global economy.  
**Body:** Analyze economic consequences, such as trade disruptions, energy market fluctuations, and geopolitical effects.  
**Conclusion:** Summarize the overarching economic implications and potential future scenarios arising from the conflict.

**Answer:**

**Introduction:**

The ongoing conflict between Russia and Ukraine has far-reaching implications, extending beyond the borders of these two nations. In the interconnected world of globalization, the consequences of this war reverberate across various dimensions, with a profound impact on the worldwide economy.



**Body:**

- **Inflation in the Global Economy:**
  - The economic repercussions of the conflict are felt globally, with a significant impact on the world's economy. The unrest in financial markets, coupled with the imposition of sanctions, has contributed to inflationary pressures.

- European countries, highly dependent on Russian oil and gas, face challenges in replacing these supplies immediately, leading to an estimated additional 1.5 percentage points of inflation in 2022.
- Inflationary trends, particularly in Europe, can erode household consumption, dampen business investment, and lower GDP growth, potentially pushing some economies into recession.
- **Displacement and Humanitarian Crisis:**
  - The war has triggered a massive humanitarian crisis, with millions of Ukrainians displaced and seeking refuge in neighboring countries. The influx of refugees places a strain on resources and infrastructure, affecting not only regional stability but also sparking a need for international humanitarian assistance.
  - Countries hosting large numbers of refugees may experience economic challenges as they allocate resources to provide shelter, medical aid, and other essential services, impacting their economic dynamics.
- **Environmental Consequences:**
  - The environmental dimensions of the conflict add another layer of complexity. The war, particularly in industrialized areas like Ukraine, poses risks of toxic contamination due to the concentration of power stations, chemical plants, and other industrial facilities.
  - The takeover of Chernobyl by Russian forces raises concerns about potential environmental disasters, as any strike near a nuclear power plant could lead to severe consequences for both human health and the environment.
  - The long-term environmental impact may take time to manifest fully, but the presence of environmental damage is evident, necessitating global attention and potential ramifications for future climate policies.

**Conclusion:**

The Russian-Ukraine war transcends geopolitical boundaries, leaving an indelible mark on the worldwide economy. From inflationary pressures to a burgeoning humanitarian crisis and environmental concerns, the consequences are vast and interconnected.

As the conflict unfolds, nations globally must navigate the economic shocks, collaborate on humanitarian aid, and address the environmental fallout. The lasting impact of this war on the global stage underscores the need for collective strength and international cooperation to mitigate its far-reaching effects on economies, societies, and the planet.

**6. Discuss the conventional and advisory jurisdictions of the International Court of Justice (ICJ).**

Approach:

Introduction: Define the International Court of Justice (ICJ) and its significance in international law.

Body: Examine the conventional and advisory jurisdictions of the ICJ, citing examples for clarity.

Conclusion: Summarize the dual roles of the ICJ, emphasizing its importance in resolving international disputes and providing legal guidance.

**Answer:**

**Introduction:**

The International Court of Justice (ICJ), established under the United Nations Charter, serves as the principal judicial organ for resolving legal disputes between states. The ICJ operates within two distinct jurisdictions - conventional and advisory. Understanding the scope and functions of these jurisdictions is crucial for appreciating the role of the ICJ in promoting international justice and maintaining peace.

**Body:**

● **Conventional Jurisdiction:**

- Conventional jurisdiction refers to the primary role of the ICJ in adjudicating disputes based on treaties, conventions, and agreements between states. When parties willingly submit their disputes to the ICJ, they engage in the court's conventional jurisdiction.



- The ICJ has the authority to hear cases related to legal disputes arising from treaties, diplomatic conventions, and customary international law. States voluntarily accepting the ICJ's jurisdiction through declarations or specific agreements bring their cases before the court.
- **Notable examples include the Nicaragua v. United States case**, where the ICJ ruled on issues related to the use of force and intervention, demonstrating the court's pivotal role in settling contentious matters between states.
- **Advisory Jurisdiction:**
  - Advisory jurisdiction pertains to the ICJ's function of providing legal opinions and advice on questions referred to it by UN organs, specialized agencies, and other authorized entities. Unlike conventional jurisdiction, advisory jurisdiction does not involve resolving disputes between states but rather offering legal guidance on specific issues.
  - The General Assembly, the Security Council, and other UN bodies may seek the ICJ's advisory opinions to clarify legal questions or interpret international law. While these opinions are not binding, they hold considerable weight in shaping legal norms and informing the decisions of international actors.
  - The ICJ's advisory jurisdiction has been instrumental in addressing complex legal issues, such as the Legality of the Threat or Use of Nuclear Weapons advisory opinion, which contributed to the discourse on the legality and ethical considerations of nuclear arms.

**Conclusion:**

The International Court of Justice operates within two distinct yet interconnected jurisdictions, namely conventional and advisory. Conventional jurisdiction involves the court's role in settling legal disputes between states based on treaties and agreements. In contrast, the advisory jurisdiction focuses on providing legal opinions to guide UN organs and agencies on matters of international law. Together, these jurisdictions empower the ICJ to play a pivotal role in fostering international justice, promoting the rule of law, and contributing to the peaceful resolution of disputes on the global stage.

**7. What do you mean by Stealth Technology? How it can support our defense system?**

**Approach:**  
**Introduction:** Define Stealth Technology as a design approach to make military aircraft, ships, and missiles less detectable by radar, infrared, and other detection methods.  
**Body:** Explore how Stealth Technology enhances national defense by enabling covert operations, minimizing enemy detection, and improving overall strategic advantage.  
**Conclusion:** Summarize the pivotal role of Stealth Technology in fortifying and modernizing defense capabilities, ensuring a tactical edge in contemporary warfare.

**Answer:**

**Introduction:**

Stealth technology, also known as stealth design or low observable technology, refers to a set of techniques and materials employed to reduce the detectability of an aircraft, ship, or other military assets by radar, infrared, and other detection methods. The primary objective is to make these platforms less visible or indistinguishable from the enemy's surveillance systems, providing a strategic advantage in terms of defense and offensive capabilities.

**Body:**

- **Principles of Stealth Technology:**
  - **Radar Cross Section (RCS) Reduction:** Stealth technology focuses on minimizing the radar cross-section of an object, making it appear smaller or less reflective on enemy radar screens. This involves designing surfaces and angles that deflect or absorb radar signals rather than reflecting them to the source.
  - **Infrared Signature Reduction:** In addition to radar invisibility, stealth technology aims to decrease the infrared signature emitted by military assets. This involves using special

- materials and coatings to dissipate or absorb heat generated by engines and other heat-emitting components.
- **Noise Reduction:** Stealth platforms incorporate measures to minimize acoustic and electromagnetic emissions, reducing the chances of detection by listening devices and electronic surveillance.
  - **Support to Defense Systems:**
    - **Increased Survivability:** Stealth technology enhances the survivability of military assets by allowing them to operate in contested environments with reduced risks of detection and targeting. This is particularly crucial in modern warfare scenarios where adversaries possess advanced radar and missile systems.
    - **Strategic Surprise and Offensive Capabilities:** Stealth enables the element of surprise, allowing military forces to conduct covert operations and strike deep into enemy territory without prior detection. This offensive capability is especially valuable in preemptive strikes and strategic military planning.
    - **Effective Penetration of Enemy Air Defenses:** Stealth aircraft can penetrate sophisticated enemy air defenses, such as anti-aircraft missile systems, by evading radar detection. This allows for more effective reconnaissance, surveillance, and target engagement without being intercepted.
    - **Force Multiplier:** Integrating stealth technology into defense systems serves as a force multiplier, amplifying the effectiveness of military operations. Stealth platforms can operate with reduced support and protection, increasing the flexibility and agility of defense strategies.

**Conclusion:**

Stealth technology stands as a cornerstone in modern defense systems, offering a tactical advantage by reducing the visibility and detectability of military assets. Its application across various platforms, including aircraft, ships, and ground vehicles, enhances the survivability, offensive capabilities, and strategic surprise of defense forces. As technology continues to advance, the integration of stealth features remains pivotal in maintaining a robust and effective defense posture on the global stage.

**8. With a significant description of Nanofluid, mention why it is used as a heat exchanger for new technologies to enhance heat transfer.**

Approach:

Introduction: Define Nanofluid as a suspension of nanoparticles in a base fluid, emphasizing its unique properties.

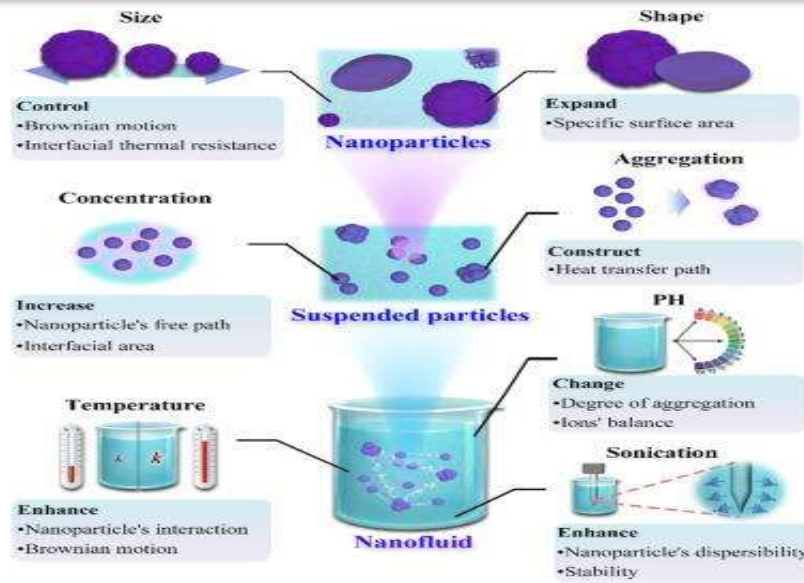
Body: Explore the reasons why Nanofluid is employed in heat exchangers for new technologies, highlighting enhanced heat transfer capabilities and applications.

Conclusion: Summarize the crucial role of Nanofluid in optimizing heat exchange for emerging technologies.

**Answer:**

**Introduction:**

Nanofluid refers to a type of fluid that incorporates nanometer-sized particles, typically metallic or non-metallic, into a base fluid such as water, oil, or ethylene glycol. These nanoparticles enhance the thermal conductivity and heat transfer properties of the fluid. Nanofluids have gained prominence in various industries, particularly in heat exchangers for new technologies, due to their ability to significantly improve heat transfer efficiency.



**Body:**

- **Enhanced Thermal Conductivity:**
  - Nano fluids exhibit higher thermal conductivity compared to traditional heat transfer fluids. The addition of nanoparticles increases the ability of the fluid to conduct heat, allowing for more efficient heat transfer in various applications.
  - The increased thermal conductivity of nanofluids is attributed to the high surface area and unique properties of nanoscale particles, which promote better heat conduction within the fluid.
- **Improved Heat Transfer Performance:**
  - In heat exchangers, the primary function is to transfer heat between two fluids or between a fluid and a solid surface. Nanofluids, with their enhanced thermal conductivity, significantly improve the efficiency of heat transfer in these systems.
  - The nanoparticles suspended in the fluid help in breaking down the thermal boundary layers, facilitating faster and more effective heat exchange between the fluid and the surfaces involved in the process.
- **Reduced Thermal Resistance:**
  - Nano fluids contribute to a reduction in thermal resistance within heat exchangers. The nanoparticles act as heat carriers, enhancing the overall heat transfer coefficient and minimizing the resistance to heat flow.
  - This reduction in thermal resistance translates to improved performance in cooling systems, electronic devices, and other technologies relying on efficient heat dissipation.
- **Applications in New Technologies:**
  - Nano fluids find extensive use in new technologies, such as electronic cooling, solar thermal systems, and advanced manufacturing processes. In electronic devices, nano fluid-based cooling systems help dissipate heat generated by high-performance components, ensuring optimal functioning and preventing overheating.
  - In solar thermal systems, nanofluids enhance heat absorption and transfer, leading to increased energy efficiency. The use of nanofluids in advanced manufacturing processes, such as additive manufacturing and laser cutting, contributes to better temperature control and thermal management.
- **Compatibility with Emerging Materials:**

- Nano fluids exhibit compatibility with emerging materials and advanced manufacturing techniques. This makes them suitable for integration into new technologies that utilize materials with specific thermal properties.
- The versatility of nanofluids allows for their application in a wide range of materials, from traditional metals to advanced composites, supporting the evolving landscape of materials used in emerging technologies.

**Conclusion:**

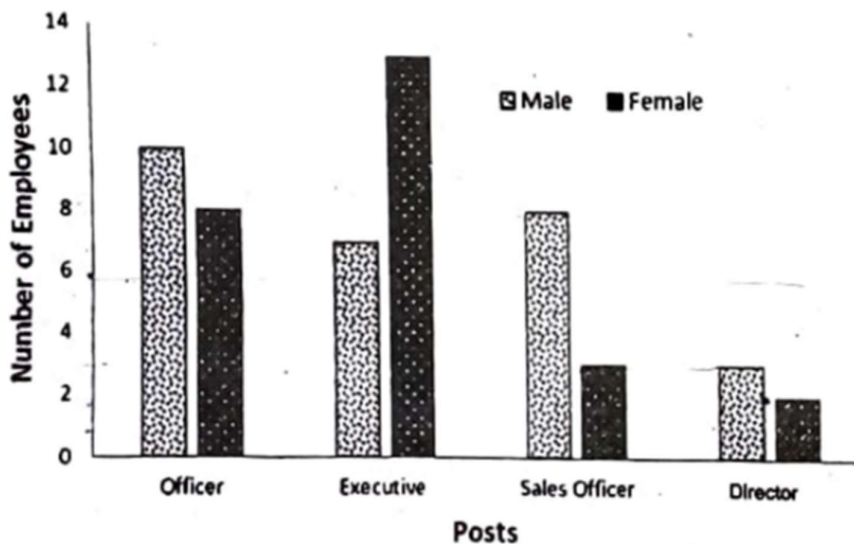
Nanofluids have emerged as a revolutionary solution in the realm of heat transfer and thermal management. Their enhanced thermal conductivity and improved heat transfer properties make them valuable components in heat exchangers for new technologies. By efficiently dissipating heat, nano fluid-based systems contribute to the reliability and performance of electronic devices, solar thermal systems, and various cutting-edge technologies, marking a significant advancement in the field of heat transfer and thermal engineering.

9. In a sample study about the coffee habits in two towns, the following data are observed:  
Town A: 55% of people are males, 40% are coffee drinkers and 28% are male coffee drinkers.  
Town B: 65% of people are males, 45% are coffee drinkers and 35% are male coffee drinkers.  
Tabulate the above observations.

Answer:

Town	Gender Distribution	Coffee Drinkers	Male Coffee Drinkers
A	55%	40%	28%
B	65%	45%	35%

10. Look at the graph provided below. It pertains to the number of males and females working in a company in different posts.



Try to answer the following questions based on the graph drawn above  $1 \times 10 = 10$

- What is the name of this diagram?
- In which post the number of females are more than the males?
- Which are the posts in which more than six males are working?

- (d) In which post the females are more than 50 percent of the corresponding males?
- (e) What is the number of female officers?
- (f) How many sales officers are there in all?
- (g) The number of directors in the company are ?
- (h) What is the Y-axis title of the graph?
- (i) What is the Y-axis title of the graph? ( In which post the number of males is more than double that of the females?
- (j) Exactly 10 number of employees are in which post and for which gender?

**Answer:**

- (a) The diagram given above is a bar graph. A bar graph is a visual representation of data, commonly used to compare categories or show the distribution of a dataset.
- (b) As from the diagram, the female employees from Executive is more than male.
- (c) Officers (10), Executive (7), Sales officers (8) are the posts in which more than six males are working.
- (d) In the Executive post females are more than 50% of corresponding males.
- (e) The number of female officers is 8.
- (f) The total number of sales officers are 11 (8 male and 3 female).
- (g) The number of directors in the company are 5 ( 3 male and 2 female)
- (h) The Y-axis title of the graph is 'Number of employees'.
- (i) The number of female employees in sales is 3 Safari and the number of male employees in sales is 8.
- (j) Male employees from the officer post are exactly 10.

**11. Discuss the challenges faced by India to its territorial integrity.**

**Approach:**  
**Introduction:** Outline the significance of territorial integrity for a nation's stability and security.  
**Body:** Analyze specific challenges faced by India to its territorial integrity, including border disputes and internal conflicts.  
**Conclusion:** Summarize the complexity of safeguarding territorial boundaries and the need for strategic measures to address these challenges.

**Answer:**

**Introduction:**

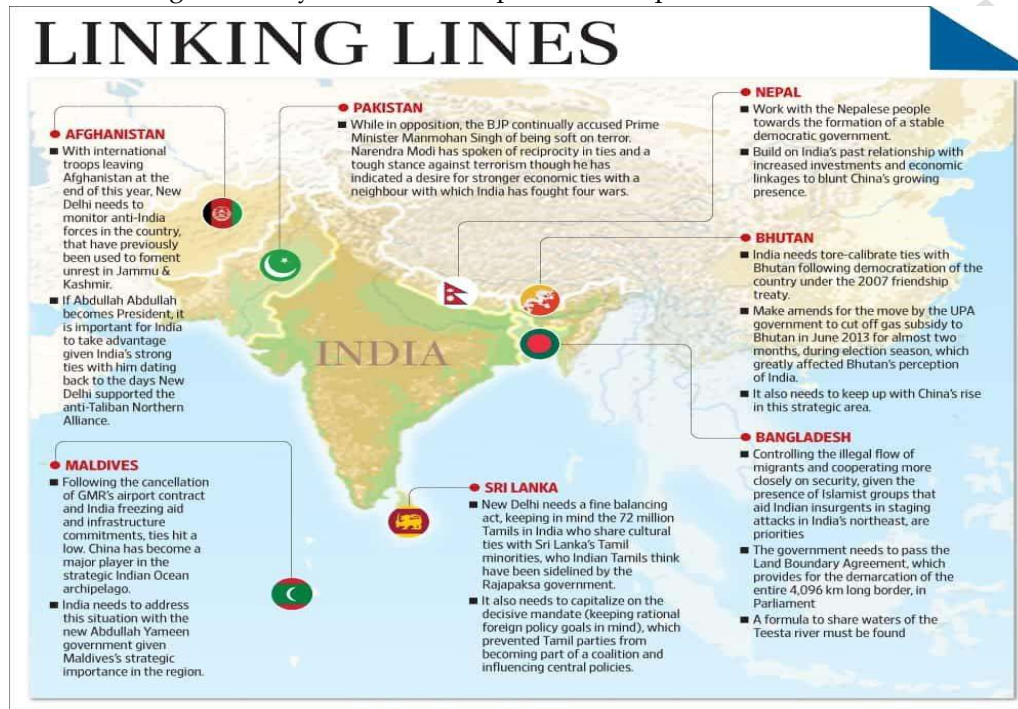
India, with its diverse geography and complex geopolitical landscape, faces numerous challenges to its territorial integrity. These challenges encompass a range of issues, from border disputes and insurgencies to geopolitical rivalries. Examining these challenges provides insights into the complexities that India confronts in safeguarding its territorial boundaries and maintaining national unity.



**Body:**

● **Border Disputes:**

- India shares long and contested borders with neighboring countries, leading to ongoing disputes. The Line of Actual Control (LAC) with China and the Line of Control (LoC) with Pakistan are focal points of contention.
- The unresolved border issues, such as the Doklam standoff with China and the Kashmir dispute with Pakistan, pose continuous challenges to India's territorial integrity, often resulting in military tensions and diplomatic complexities.



● **Insurgencies and Internal Conflicts:**

- Certain regions within India grapple with insurgencies and internal conflicts, challenging the government's control and authority. States like Jammu and Kashmir, parts of the Northeast, and areas affected by left-wing extremism experience internal unrest.
- Insurgent groups, fueled by ethnic, religious, or political grievances, pose threats to India's territorial integrity by seeking autonomy or independence from the Indian state.

● **Geopolitical Rivalries:**

- India's strategic location in South Asia exposes it to geopolitical rivalries, with global powers seeking influence in the region. The competition between major powers like China and the United States can impact India's territorial interests and security dynamics.
- The evolving geopolitical landscape, including the influence of external actors in India's neighborhood, adds complexity to the challenge of safeguarding territorial integrity.

● **Cross-Border Terrorism:**

- India faces the menace of cross-border terrorism, particularly emanating from non-state actors based in Pakistan. Terrorist attacks, such as those on Indian soil and against military installations, pose threats to national security and territorial integrity.
- The use of asymmetric warfare tactics by terrorist groups further complicates efforts to secure borders and maintain territorial control.

● **Water Disputes:**

- Water-sharing disputes among states within India, as well as with neighboring countries, pose challenges to territorial integrity. The distribution and management of river waters, such as the sharing of the Indus and Brahmaputra rivers, can lead to regional tensions.

- The impact of climate change on water resources adds a layer of complexity to these disputes, requiring comprehensive and collaborative solutions.

**Conclusion:**

India's efforts to preserve its territorial integrity are multi-faceted, involving diplomatic, military, and governance strategies. Addressing the challenges posed by border disputes, internal conflicts, geopolitical rivalries, terrorism, and water disputes requires a nuanced and holistic approach. By navigating these complexities, India can secure its territorial boundaries, promote national unity, and contribute to regional stability in South Asia.

**12. Explain the opportunities before India as leader of G-20.**

**Approach:**

**Introduction:** Define G-20 and its significance in global economic governance.

**Body:** Explore key opportunities for India's leadership, including economic reforms, diplomatic influence, and addressing global challenges.

**Conclusion:** Summarize the potential positive impact of India's leadership in the G-20, highlighting the country's role in shaping global policies and fostering international cooperation.

**Answer:**

**Introduction:**

As a leader of the G-20, India has a unique position to influence global economic policies and foster international cooperation. The G-20, comprising major economies, provides India with significant opportunities to address pressing global challenges and contribute to shaping the future of the world economy.

**Body:**

- **Economic Leadership:**

- India, as a G-20 leader, can play a pivotal role in shaping global economic policies. The opportunity to lead discussions on sustainable economic growth, financial stability, and inclusive development positions India as a key player in fostering a more balanced and equitable global economy.

- **Climate Change Mitigation:**

- G-20 leadership offers India a platform to advocate for sustainable development and climate change mitigation. As a major emerging economy, India can contribute to global efforts in transitioning to clean energy, implementing environmentally friendly policies, and promoting resilience against climate-related challenges.

- **Global Health Initiatives:**

- India's leadership in the G-20 enables it to spearhead global health initiatives, especially in the wake of global health crises. By promoting international cooperation, sharing expertise, and facilitating equitable access to healthcare resources, India can enhance global preparedness for pandemics and health emergencies.

- **Trade and Investment Facilitation:**

- India can use its position to foster international trade and investment. By advocating for fair trade practices, reducing trade barriers, and encouraging investment flows, India can contribute to a more open and interconnected global economy, benefiting both developed and developing nations.

- **Digital Transformation and Innovation:**

- G-20 leadership provides India with the opportunity to shape discussions on digital transformation and innovation. India, as a technology hub, can advocate for policies that promote digital inclusivity, address cyber threats, and harness the benefits of technological advancements for global development.

- **Social Inclusion and Poverty Alleviation:**

- India can use its leadership role to emphasize social inclusion and poverty alleviation on the global stage. By sharing its experiences and implementing inclusive policies, India can contribute to G-20 initiatives aimed at reducing inequality, eradicating poverty, and fostering sustainable development.

- **Collaboration on Global Governance:**

- India's leadership in the G-20 allows it to advocate for reforms in global governance structures. By working collaboratively with other member nations, India can push for more inclusive and representative international institutions that reflect the evolving dynamics of the global economy.

**Conclusion:**

India's leadership in the G-20 presents a multitude of opportunities to shape global economic policies, address shared challenges, and contribute to a more inclusive and sustainable world. By leveraging its unique position, India can play a proactive role in fostering international cooperation, driving economic growth, and addressing pressing global issues for the benefit of the entire G-20 community and beyond.

**13. Give a brief outline of Odisha's macroeconomic performance in terms of the growth of GSDP in the post-reform period. Comment on the distributional aspect of the growth across regions.**

**Approach:**

**Introduction:** Provide a brief overview of Odisha's macroeconomic performance post-reforms, focusing on the growth of Gross State Domestic Product (GSDP).

**Body:** Analyze the distributional aspect of this growth across regions in Odisha, considering factors such as disparities in development, infrastructure, and economic opportunities.

**Conclusion:** Summarize the key findings, highlighting the regional variations in Odisha's economic growth post-reforms.

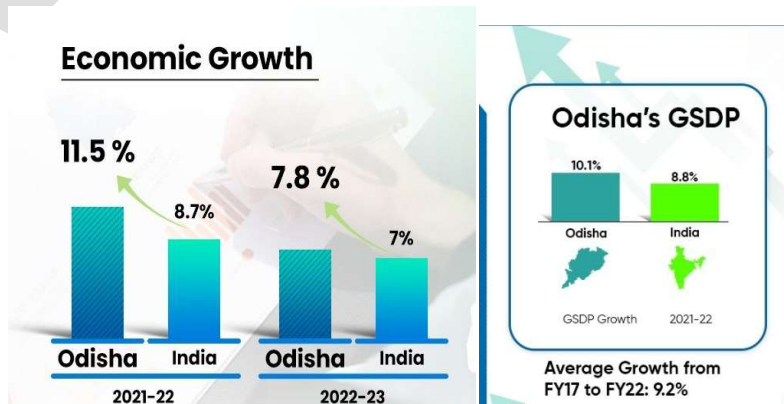
**Answer:**

**Introduction:**

Odisha, a state in eastern India, has undergone significant economic transformations in the post-reform period. Analyzing its macroeconomic performance, particularly the growth of Gross State Domestic Product (GSDP), provides insights into the state's economic trajectory. Additionally, understanding the distributional aspects of this growth across regions within Odisha sheds light on the inclusivity and disparities within the state.

*The economy grew at 7.82 percent in 2022-23 which is higher than pre-COVID average growth of 7.1 percent (2012-13 to 2019-20). Industry and service sectors have been the major engines of economic growth in the State in recent years.*

**Body:**



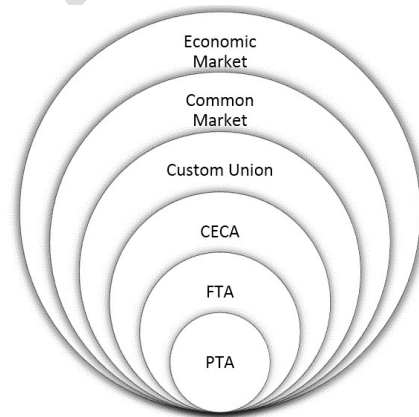
- **GSDP Growth in Post-Reform Period:**



- Odisha's macroeconomic performance, especially GSDP growth, reflects the impact of economic reforms initiated in the early 1990s. The state has witnessed a notable expansion in its economic output, driven by factors such as industrialization, infrastructure development, and a focus on key sectors.
- Sectoral contributions, including agriculture, industry, and services, play a crucial role in shaping Odisha's GSDP growth. Assessing the trends and contributions of these sectors provides a comprehensive view of the state's economic dynamics.
- **Distributional Aspects of Growth Across Regions:**
  - Examining the distributional aspects of economic growth across regions within Odisha reveals the inclusivity and disparities in development. Coastal regions, with strategic ports and industrial hubs, often experience accelerated growth due to better connectivity and infrastructure.
  - In contrast, the interior and tribal-dominated regions may face challenges in accessing the benefits of economic growth. Disparities in infrastructure, education, and healthcare may contribute to uneven development, posing a need for targeted policy interventions to address regional imbalances.
- **Inclusive Growth Strategies:**
  - Ensuring inclusive growth requires strategic policies that address regional disparities. Investments in infrastructure, education, and healthcare in underdeveloped regions can enhance their economic potential and contribute to overall state growth.
  - Fostering industries and employment opportunities in interior areas can mitigate migration pressures and promote balanced development. Special attention to sectors like agriculture, which often dominates rural economies, is crucial for inclusive growth.

**Conclusion:**

Odisha's macroeconomic performance in the post-reform period signifies both progress and challenges. The growth of GSDP showcases the state's economic resilience and adaptability to reform measures. However, the distributional aspects of this growth highlight the imperative of addressing regional disparities for a more inclusive development trajectory. By implementing targeted policies, Odisha has the opportunity to ensure that the benefits of economic growth permeate across all regions, fostering a balanced and sustainable economic landscape.



**14. What is a Free Trade Agreement (FTA)? How many FTAs is India part of and who are the partners? Discuss the major issues relating to India's FTAs.**

**Approach:**  
**Introduction:** Define the Free Trade Agreement (FTA) and its economic significance.  
**Body:** Explore the number of FTAs India is engaged in, list partner countries, and delve into key issues surrounding India's FTAs such as trade imbalances, tariff concerns, and socio-economic impacts.  
**Conclusion:** Summarize the complexities and challenges in India's FTA landscape, highlighting the need for strategic negotiations.

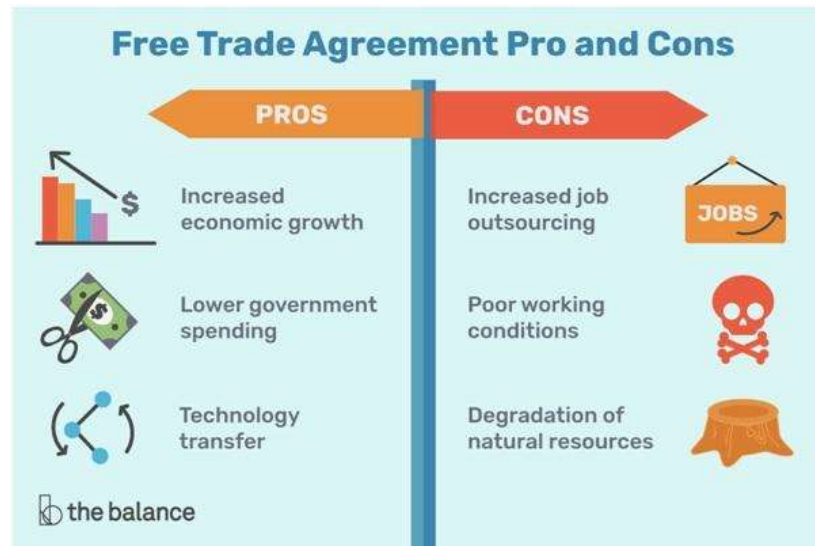
**Answer:**

**Introduction:**

A Free Trade Agreement (FTA) is a pact between two or more countries to facilitate trade by reducing or eliminating tariffs, quotas, and other restrictions on goods and services. The primary objective of an FTA is to promote economic integration and foster smoother trade relations between participating nations. India, as a part of its economic strategy, has engaged in several FTAs with various countries and regional blocs.

However, these agreements have not been without challenges and concerns.

**Body:**



- **India's Participation in FTAs:**

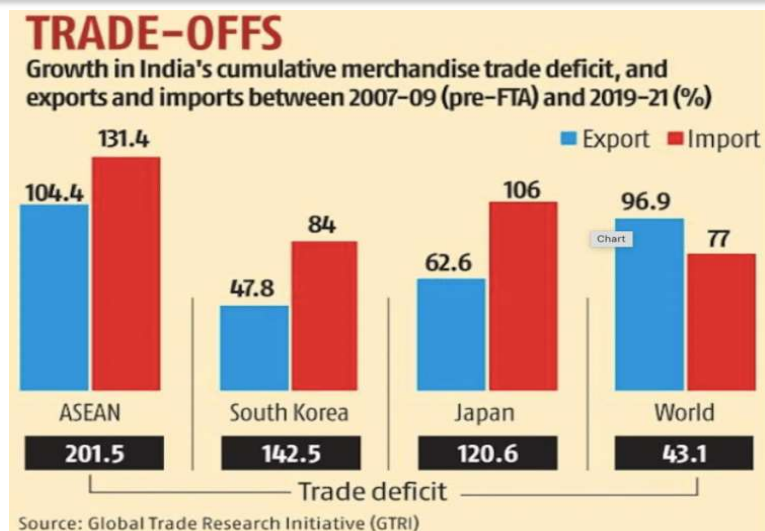
- India has actively pursued FTAs as part of its trade policy to enhance economic cooperation and strengthen diplomatic ties.
- Key FTAs involving India include agreements with ASEAN (Association of Southeast Asian Nations), South Korea, Japan, and more recently, the Regional Comprehensive Economic Partnership (RCEP), which includes 15 Asia-Pacific nations.

- **India's FTA Partners:**



- ASEAN-India FTA: India's FTA with ASEAN, implemented in 2010, aimed at fostering economic integration with Southeast Asian nations.
- India-Korea Comprehensive Economic Partnership Agreement (CEPA): This agreement, in force since 2010, focuses on reducing tariffs and promoting trade in goods and services between India and South Korea.
- India-Japan CEPA: The FTA with Japan, operational since 2011, aims to boost economic ties and promote investments between the two nations.
- RCEP: India was initially part of the RCEP, a mega FTA involving ASEAN and its six FTA partners. However, India opted out of the agreement in 2019, citing concerns about its impact on domestic industries.

- **Major Issues Relating to India's FTAs:**



- **Trade Imbalances:** India has faced persistent trade imbalances with some FTA partners, leading to concerns about the impact on domestic industries, particularly in sectors like manufacturing and agriculture.
- **Safeguard Measures:** The surge in imports following FTAs has prompted the use of safeguard measures, such as anti-dumping duties, to protect domestic industries from unfair competition.
- **Rules of Origin:** Determining the origin of products and establishing eligibility for preferential tariffs has been a complex issue, impacting the effectiveness of FTAs.
- **Non-Tariff Barriers:** Non-tariff barriers, including technical standards and sanitary measures, pose challenges to Indian exports in FTA partner countries.
- **Services and Investments:** While FTAs often focus on goods, addressing barriers in services and investments remains a crucial aspect for India to fully leverage the benefits of economic integration.

**Conclusion:**

India's participation in FTAs reflects its commitment to global economic engagement. However, challenges such as trade imbalances, safeguard measures, and non-tariff barriers require strategic solutions to ensure that these agreements contribute positively to India's economic growth. Balancing the interests of domestic industries while fostering international trade relations will be essential for India to navigate the complexities of the global economic landscape in the context of FTAs.

**15. Highlight the Indo-US relations in the changing geo-political scenario. Discuss the nuances between the relations of the two countries.**

Approach:

Introduction: Outline the historical context of Indo-US relations, highlighting their evolution.

Body: Examine the current geopolitical dynamics shaping Indo-US relations, emphasizing key aspects such as strategic partnerships, economic ties, and shared interests.

Conclusion: Summarize the nuanced nature of the relationship, acknowledging both cooperative efforts and potential challenges in the evolving global landscape.

**Answer:**

**Introduction:**

The geopolitical landscape has witnessed a transformative shift, challenging the established world order that emerged after the collapse of the Soviet Union. The rise of multipolarity, characterized by an assertive China and the resurgence of other global powers, has prompted a reassessment of international alliances. In this dynamic scenario, the Indo-US partnership assumes increased significance as both nations navigate the complexities of a changing world.

## INDIA-US RELATIONSHIP OVERVIEW

*The confluence of common factors like democratic values, Shared areas of Interests, Stand against terrorism makes India and US enjoy a comprehensive strategic partnership.*



### Body:

- **Cooperation between India & USA:**
  - Indo-US collaboration extends across various multilateral forums, reflecting shared interests in promoting global stability and prosperity.
  - Both nations actively engage in organizations such as the United Nations, G-20, ASEAN Regional Forum, and more, showcasing a commitment to shaping a collective global agenda.
  - The Quad, comprising India, the United States, Australia, and Japan, exemplifies collaborative efforts to ensure a free and open Indo-Pacific, addressing regional challenges and fostering economic growth.
  - The inclusion of India in the UN Security Council for a two-year term underscores the recognition of its pivotal role in international affairs.
- **Nuances of Indo-US Relations:**
  - Despite the strong Indo-US ties, nuances exist in their relationship, particularly in dealings with other global players.
  - India's historically strong relationship with Russia, demonstrated through increased crude oil imports and defense cooperation, adds complexity to the Indo-US dynamic.
  - The purchase of the S-400 Triumf missile defense system from Russia has triggered discussions around the CAATSA law, revealing divergent priorities in defense partnerships.
  - India's stance on global issues, such as the Ukraine crisis, has prompted a recalibration of perspectives in Beijing, showcasing the intricacies of India's interactions with key players.

### Conclusion:

The Indo-US relationship stands as a crucial pillar in the evolving geopolitical landscape. The partnership reflects a mature alliance that navigates both convergences and divergences, acknowledging the complexities of a multipolar world. As India emerges as a prominent global player, its strategic collaboration with the United States will continue to be a linchpin for navigating the challenges and opportunities that define the contemporary geopolitical scenario. The nuances in their relations highlight the need for a nuanced, dialogical approach that allows both nations to manage differences and leverage their respective strengths for mutual benefit.

**16. How does India see its place in the economic space of rising natural resource-rich Africa? Discuss.**

Approach:

Introduction: Provide an overview of India's engagement with resource-rich Africa in the evolving economic landscape.

Body: Explore India's economic ties with Africa, emphasizing strategic partnerships and investments. Discuss the nuances, including collaborative projects and diplomatic relations, to highlight the multifaceted nature of their engagement.

Conclusion: Summarize India's position in Africa's economic space, underlining its contributions, challenges, and the potential for future growth in the region.

**Answer:**

**Introduction:**

Africa, with its vast natural resources, stands as a reservoir of immense potential, making up 30% of the world's mineral reserves, including significant deposits of oil, gas, gold, and other valuable minerals. Recognizing the economic significance, India envisions a strategic role in the rising natural resource-rich Africa. This engagement holds promise for both continents, given India's increasing demand for resources and Africa's underdeveloped yet resource-abundant landscape.

**Body:**

● **Trade Relations:**

- Africa has emerged as India's fourth-largest trading partner, with a diverse range of exports and imports. India's trade with Africa, valued at \$40 billion in exports and \$49 billion in imports in FY22, reflects a mutually beneficial relationship.
- A substantial portion of India's exports to Africa comprises petroleum products and pharmaceuticals. Strengthening trade ties through agreements can facilitate the smooth movement of these products, fostering economic growth on both sides.

● **Potential Benefits to India:**

- Africa's vast mineral wealth, producing nearly 1 billion tonnes of minerals worth \$406 billion in 2019, presents an attractive opportunity for India. Indian companies can leverage these resources, contributing to employment generation and wealth creation in Africa.
- The resource-rich continent aligns with India's needs, offering a reliable source of raw materials and reinforcing India's economic resilience.

● **Government Initiatives:**

- India's comprehensive engagement with Africa is evident through initiatives like the Comprehensive Economic Cooperation and Partnership Agreement (CECPA) with Mauritius, the India-Japan Asia-Africa Growth Corridor, Pan Africa e-network, and the Vaccine Maitri program.
- Collaborative efforts, such as the African Continental Free Trade Area (AfCFTA), provide a platform for Indian firms to tap into a unified African market, fostering economic cooperation and growth.

● **India-Africa Collaborative Projects:**

- India's commitment to Africa extends beyond trade to collaborative projects. Completed and ongoing ventures in countries like Gambia, Zambia, and Mauritius demonstrate India's involvement in diverse sectors, from infrastructure to healthcare and agriculture.
- These collaborative projects underscore India's commitment to fostering sustainable development in Africa, contributing to the continent's growth trajectory.

**Conclusion:**

India envisions its role in the economic space of rising natural resource-rich Africa as a strategic partnership that goes beyond mere resource extraction. The trade relations, government initiatives, and collaborative projects reflect India's commitment to fostering a symbiotic relationship.

As Africa strives for development, India aims to be a reliable partner, contributing to the continent's

economic prosperity while securing its own resource needs. This mutually beneficial engagement holds the potential to redefine economic dynamics and diplomatic ties between India and Africa in the years to come.

**17. How biogas energy source alleviate two major environmental problems simultaneously? With a short note, describe the working of a biogas plant mentioning various steps followed for generation of the electricity.**

Approach:

Introduction: Introduce the dual benefits of biogas as an energy source addressing environmental issues.

Body: Discuss how biogas mitigates environmental problems, highlighting the steps in a biogas plant for electricity generation.

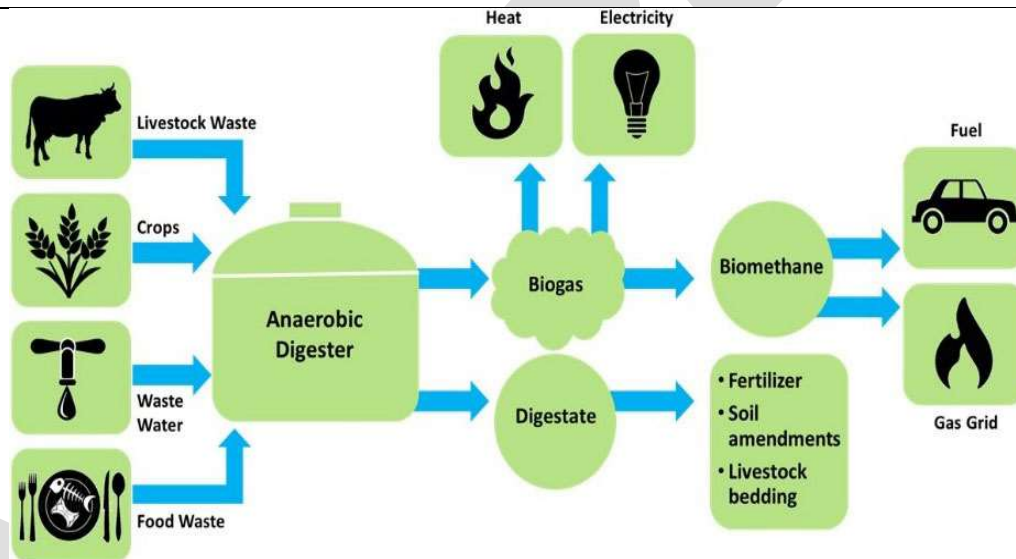
Conclusion: Summarize the eco-friendly attributes of biogas, emphasizing its role in sustainable energy and environmental conservation.

**Answer:**

**Introduction:**

Biogas, as an energy source, serves as a sustainable solution that effectively addresses two pressing environmental challenges concurrently – waste management and greenhouse gas emissions. By harnessing the power of organic materials through anaerobic digestion, biogas not only offers a cleaner alternative to traditional energy sources but also contributes to a more environmentally resilient future.

*Every year, India generates almost 62 million tonnes of Municipal Solid Waste (MSW), roughly half of which is organic.*



**Body:**

- **Waste Management:**

- Biogas production begins with the anaerobic digestion of organic waste, including agricultural residues, animal manure, and food waste. This process not only facilitates the efficient disposal of organic materials but also minimizes the environmental impact associated with their decomposition.
- By utilizing organic waste in biogas plants, the technology aids in reducing the volume of waste and mitigating potential soil and water pollution, thus contributing to comprehensive waste management.

- **Greenhouse Gas Emissions Reduction:**

- One of the remarkable environmental benefits of biogas is its role in curbing greenhouse gas emissions. Anaerobic digestion in biogas plants prevents the release of methane—a potent greenhouse gas—into the atmosphere. Methane emissions, commonly associated with

organic decomposition in landfills, are significantly mitigated through the controlled digestion process in biogas plants.

- By capturing and utilizing methane as biogas, this renewable energy source actively addresses climate change concerns by reducing the carbon footprint associated with organic waste decomposition.

**Working of a Biogas Plant:**

- **Feedstock Collection:**
  - The process begins with the collection of organic materials, such as agricultural residues, crop waste, animal manure, or food waste, which serve as the feedstock for the biogas plant.
- **Anaerobic Digestion:**
  - The collected organic materials are introduced into an anaerobic digester, a sealed container where bacteria break down the organic matter in the absence of oxygen.
  - This anaerobic digestion process produces biogas, predominantly composed of methane and carbon dioxide.
- **Gas Storage:**
  - The generated biogas is stored in a gas holder or storage tank, allowing for consistent availability for energy production.
- **Electricity Generation:**
  - The stored biogas is utilized in a combined heat and power (CHP) unit or a generator to produce electricity.
  - The electricity generated can be integrated into the local power grid or used for on-site energy needs.

**Conclusion:**

Biogas emerges as a dual-purpose environmental solution, addressing waste management challenges and mitigating greenhouse gas emissions. Through its intricate working mechanism, biogas plants exemplify the potential of sustainable energy sources in promoting a circular economy while contributing to a cleaner and more resilient environment. As the world seeks alternatives to traditional energy, biogas stands out not only as an eco-friendly power source but as a comprehensive environmental solution.

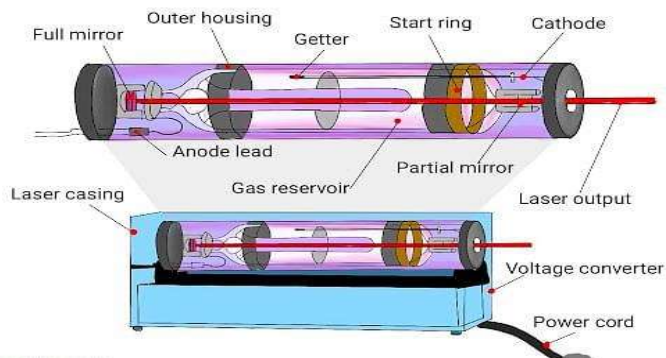
**18. With unique inheritance characteristics and general working of a laser, enumerate its application in communication technology for the present digital era.**

**Approach:**  
**Introduction:** Define the fundamental principles of lasers and their unique characteristics.  
**Body:** Explore diverse applications of lasers in communication technology, emphasizing their role in the current digital era, from optical fiber communication to data transmission.  
**Conclusion:** Summarize the pivotal contributions of laser technology to advancing communication in the contemporary digital landscape.

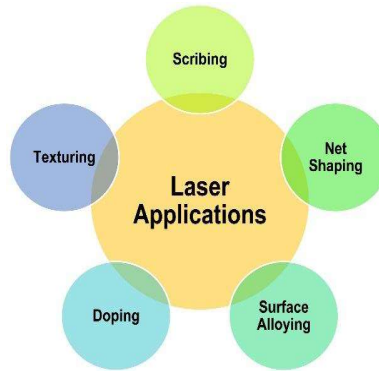
**Answer:**

**Introduction:**

The laser, with its distinctive properties of coherence, monochromaticity, and directionality, has revolutionized various technological domains. In the realm of communication technology, its unique inheritance characteristics find multifaceted applications, playing a pivotal role in shaping the landscape of the present digital era.



Body:



- **Inheritance Characteristics of Laser:**
  - Lasers exhibit coherence, wherein the emitted light waves have a consistent phase relationship, enabling them to travel in a concentrated beam.
  - The monochromatic nature of laser light ensures a single wavelength, contributing to its precision and efficiency in various applications.
  - Laser light can be focused on a tiny spot, enhancing its ability to carry information over long distances with minimal dispersion.
- **Applications in Communication Technology:**
  - **Fiber Optic Communication:**
    - Lasers are integral to fiber optic communication systems, where information is transmitted through optical fibers. The coherent and focused laser beam allows for high-capacity data transmission over long distances.
    - The use of lasers in fiber optics enables the efficient and rapid transfer of vast amounts of digital data, forming the backbone of modern communication networks.
  - **Optical Data Storage:**
    - Laser technology is employed in optical data storage devices, such as CDs, DVDs, and Blu-ray discs. The focused laser beam reads and writes information on these storage media with exceptional precision.
    - This application facilitates the storage and retrieval of large volumes of digital data, catering to the escalating demands of the digital era.
  - **Laser Printing:**
    - Laser printers utilize lasers to create high-resolution images on paper. The laser beam forms an electrostatic image on a photosensitive drum, which is then transferred and fused onto the printing surface.
    - Laser printing has become a cornerstone in digital document reproduction, offering fast and high-quality printing for various applications.
  - **Laser Diodes in Telecommunications:**
    - Laser diodes, semiconductor devices that emit coherent light, are extensively used in telecommunications for signal transmission in optical fibers.
    - These laser diodes enable the conversion of electronic signals into optical signals for efficient and high-speed communication, supporting the backbone of digital connectivity.

**Conclusion:**

The unique inheritance characteristics of lasers, including coherence, monochromaticity, and focus, have positioned them as indispensable tools in communication technology for the present digital era. From fiber optic communication networks to optical data storage and laser printing, the applications of lasers have reshaped the landscape of information transmission, offering speed, precision, and efficiency. As we navigate the complexities of the digital age, lasers continue to illuminate the path for seamless and advanced communication technologies.



19. Consider the data provided below. Construct the frequency table for the data and find the number of observations in the data set that is less than 50. Also, draw the frequency polygon of the frequency table (use graph paper)

76, 96, 26, 97, 88, 89, 27, 15, 17, 29, 66, 43, 89, 56, 20, 80, 94, 86, 26, 24, 85, 94, 20, 29, 71, 33, 84, 15, 25, 52, 46, 43, 29, 93, 66, 36, 83, 98, 27, 94, 15, 35, 23, 89, 70, 57, 75, 73, 57, 89, 98, 85, 25, 19, 27, 96, 76, 30, 89, 84, 28, 57, 93.

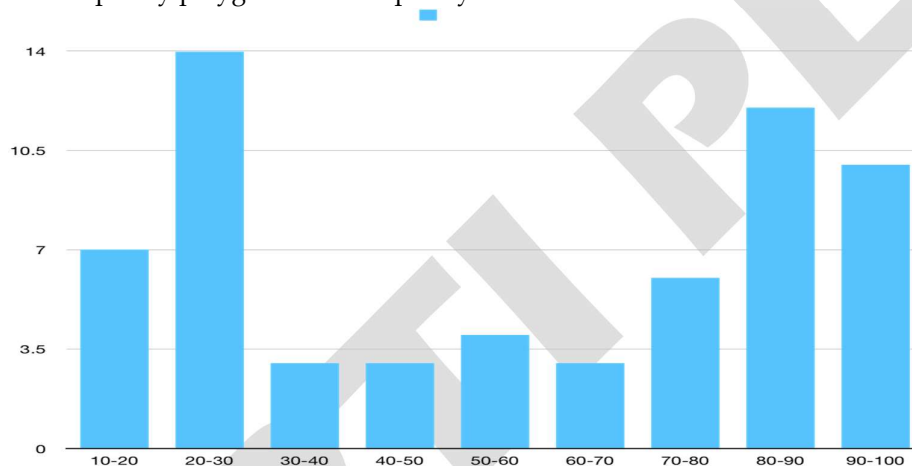
Answer:

The frequency table for the given data with class interval of 10:

Class Interval	Frequency
10-20	7
20-30	14
30-40	3
40-50	3
50-60	4
60-70	3
70-80	6
80-90	12
90-100	10

The number of observations in the data set that is less than 50 is 27.

The frequency polygon of the frequency table:



20. In calculating the premium payable for life insurance policies, the insurance company uses the following mortality table:

Age in years	No. of persons surviving
0	1000
25	958
45	905
65	608
75	550

Find the probability that a person of age 25 will

- Attain the age of 45 years
- Not attain the age of 75 years
- Die before completion of 45 years
- Live more than 65 years
- Shall die between 65 to 75 years

Answer:

The mortality table provided indicates the number of people surviving at different ages. Using this table, we can calculate the probability of different events. Here are the probabilities for each event:

Probability = (Number of persons surviving at the older age)/(Number of persons surviving at the younger age)

- (a) Probability that a person of age 25 will attain the age of 45 years:  
 $P(25 \text{ to } 45) = (\text{Number of persons surviving at age 45})/(\text{Number of persons surviving at age 25}) = 905/958 = 0.947.$
- (b) Probability that a person of age 25 will not attain the age of 75 years:  
 $P(25 \text{ to } 75) = (\text{Number of persons surviving at age 75})/(\text{Number of persons surviving at age 25}) = 550/958 = 0.427$
- (c) Probability that a person of age 25 will die before completion of 45 years:  
 $P(\text{Death before 45}) = 1 - P(25 \text{ to } 45)$   
 $(\text{Number of people surviving at age 45} - \text{Number of people surviving at age 25})/(\text{Number of people surviving at age 25})$   
 $(958 - 905)/958 = 0.053.$
- (d) Probability that a person of age 25 will live more than 65 years:  
 $P(\text{Survive beyond 65}) = (\text{Number of persons surviving at age 65})/(\text{Number of persons surviving at age 25}) = 608/958 = 0.634.$
- (e) Probability that a person of age 25 will die between 65 to 75 years:  
 $P(65 \text{ to } 75) = (\text{Number of persons surviving at age 75} - \text{Number of persons surviving at age 65})/(\text{Number of persons surviving at age 25})$   
 $(608 - 550)/958 = 0.186$