

GROUPS MASTER

APPSC

GROUP-1 MAINS 2023

SCIENCE & TECHNOLOGY

SOLVED QUESTIONS

**YOUTUBE VIDEOS
PDF COMPILATION**

www.groupsmaster.com

APPSC

GROUP-1 MAINS 2023

SCIENCE & TECHNOLOGY

SOLVED QUESTIONS

Q.1. (A) Do you think the problem in India is "not so much knowledge creation, as knowledge consumption" and Scientific Social Responsibility (SSR) will go a long way in remedying this situation? Justify your stand. Discuss the challenges associated with the implementation of Scientific Social Responsibility. 5+5

- I agree with the statement that the problem in India is "not so much knowledge creation, as knowledge consumption". There are several factors that may contribute to India falling behind in terms of knowledge consumption.
- **Access to Education:** Despite significant improvements in recent years, access to quality education remains a challenge in many parts of India. Disparities in educational infrastructure, resources, and opportunities hinder knowledge acquisition and consumption, particularly among marginalized communities and rural areas.
- **Digital Divide:** Limited access to affordable internet services, lack of digital literacy, and inadequate technological infrastructure can hinder individuals' ability to access and consume knowledge resources available online.
- **Language Barriers:** India is a multilingual country, and many people do not speak English. This makes it difficult for them to access information that is published in English.
- **Awareness and Information Dissemination:** Inadequate awareness about available knowledge resources and limited efforts in disseminating research findings to the general public can hinder knowledge consumption.
- **Socioeconomic Factors:** Socioeconomic factors such as poverty, inequality, and lack of infrastructure can limit access to resources needed for knowledge consumption.
- Scientific Social Responsibility (SSR) refers to the ethical and moral obligations of scientists, researchers, and scientific institutions towards society. It emphasizes the responsibility of the scientific community to actively engage

with society, contribute to its well-being, and address societal challenges through their research and knowledge.

- SSR has the potential to go a long way in remedying the problem of knowledge consumption in India.
- By communicating their research to the public, scientists can help people to understand the benefits of knowledge consumption.
- By working with policymakers, scientists can help to ensure that knowledge is used to solve social problems.
- By using their knowledge to educate and empower people, scientists can help to create a society where everyone has the opportunity to benefit from knowledge.

Challenges associated with implementing SSR:

- Scientific Social Responsibility (SSR) can play a significant role in bridging the gap between the knowledge creation and knowledge consumption by promoting responsible engagement, collaboration, and the translation of research into tangible solutions.
- The implementation of SSR faces challenges such as awareness, funding, collaboration, and evaluation.
- Encouraging a culture of SSR requires raising awareness among scientists about their societal responsibilities and changing mindsets to prioritize societal impact alongside academic achievements.
- Inadequate dissemination of research findings, limited collaboration between researchers and stakeholders, and a lack of emphasis on translating research into practical solutions are affecting the implementation of SSR.
- Sometimes the lack of trust between scientists and the public. This can make it difficult for scientists to communicate their research to the public, and to build support for SSR initiatives.

Q.1. (B) Technology plays a key role in transforming healthcare sector and in addressing India's healthcare challenges — Discuss. 10

- The ways in which technology plays a key role in transforming healthcare sector and in addressing India's healthcare challenges are as follows:
- **Telemedicine:** Telemedicine allows patients to consult with doctors remotely, using video conferencing or other technologies. This can be especially beneficial for patients in rural areas who have difficulty accessing healthcare services. eSanjeevani is the telemedicine technology of Government of India.
- **Electronic health records (EHRs):** EHRs are electronic versions of a patient's medical record. They can be used to store and share patient data, which can improve the quality of care and make it easier for patients to manage their health. Ayushman Bharat Digital Mission which aims to create a unified digital health infrastructure for India will focus on developing electronic health records (EHRs).
- **Mobile health (mHealth):** mHealth refers to the use of mobile devices, such as smartphones and tablets, to deliver healthcare services. mHealth can be used to provide patients with access to information, education, and care, and to monitor their health remotely.
- **Wearable devices:** Wearable devices, such as fitness trackers and smartwatches, can be used to collect data about a person's health, such as their heart rate, sleep patterns, and activity levels. This data can be used to monitor a person's health and to identify potential health problems early on.
- **Health Awareness and Education:** Digital platforms, mobile applications, and online resources provide health awareness, education, and preventive care information to the public.
- **Remote Training and Continuing Medical Education:** Technology enables online training modules and webinars, expanding access to medical education and continuing professional development for healthcare professionals. This enhances their knowledge and skills, ultimately benefiting patient care.
- **Public Health Surveillance:** Technology supports disease surveillance systems, early outbreak detection, and monitoring of health trends.

- **Conclusion:** These are just a few of the ways in which technology is being used to improve healthcare in India. As technology continues to evolve, it is likely that we will see even more innovative and effective ways to use technology to improve healthcare in India.

Q.2. (A) Digital platforms dramatically improve the quality and accountability of public service and facilitate citizen centric governance — Elaborate. Explain various Technical, Economic and Social bottlenecks in the implementation of e-governance programmes in India. 10

- Digital platforms have indeed played a transformative role in improving the quality and accountability of public services and facilitating citizen-centric governance.
- **Accessibility and Convenience:** Digital platforms have made public services more accessible and convenient for citizens. Through online portals, mobile applications, and digital interfaces, citizens can access services anytime and anywhere, reducing the need for physical visits to government offices. This convenience enhances the overall quality of public service delivery.
- **Efficient Service Delivery:** Digital platforms streamline and automate various government processes, resulting in improved efficiency in service delivery. Through online systems, citizens can apply for services, submit documents, track progress, and receive notifications electronically. This reduces bureaucracy, eliminates paperwork, and minimizes delays, ensuring faster and more efficient service provision.
- **Transparency and Accountability:** Digital platforms promote transparency and accountability in public service delivery. Online platforms allow citizens to access information about government programs, policies, and expenditures. This transparency enables citizens to hold public officials accountable and helps in reducing corruption and malpractices.
- **Real-time Monitoring and Feedback:** Digital platforms enable real-time monitoring of public services. Government agencies can use data analytics and dashboards to monitor service performance. Citizens can also provide feedback and report issues through digital platforms, ensuring prompt action and resolution.

- **Enhanced Citizen Engagement:** Digital platforms facilitate greater citizen engagement in governance processes. Citizens can participate in online consultations, surveys, and feedback mechanisms, allowing them to contribute their opinions and suggestions for policy formulation and implementation.
- **Cost-effectiveness:** Digital platforms offer cost-effective solutions for public service delivery. Online systems reduce the need for physical infrastructure, paperwork, and manual processes, resulting in cost savings for both the government and citizens.
- **Integration of Services:** Digital platforms facilitate the integration of various government services, making it easier for citizens to access multiple services through a single interface.
- **Conclusion:** Digital platforms have revolutionized public service delivery by enhancing accessibility, efficiency, transparency, citizen engagement, and accountability. By leveraging technology, governments can create a citizen-centric governance ecosystem that empowers citizens and improves service quality.

Technical, economic, and social bottlenecks in the implementation of e-governance programs in India are:

Technical Bottlenecks

- Lack of adequate infrastructure, such as reliable internet connectivity and computers.
- Uneven access to technology and poor network coverage can hinder the effective delivery of digital services.
- Lack of skilled manpower to develop and maintain e-governance systems.
- Challenges in data sharing and integration can hinder the smooth functioning of e-governance initiatives.
- Cybersecurity threats, data breaches, and privacy concerns present significant challenges.
- Security and privacy concerns can also discourage people from using e-governance services.

Economic Bottlenecks

- The cost of developing and maintaining e-governance systems can be high.
- The cost of training people to use e-governance systems can also be high.
- The benefits of e-governance may not be immediately apparent, which can make it difficult to justify the investment.

Social Bottlenecks

- Lack of awareness about e-governance services.
- Affordability of internet access and digital devices can be a barrier for citizens, especially those from economically disadvantaged backgrounds.
- Illiteracy and language barriers can make it difficult for people to use e-governance services.
- Many citizens, especially in rural and marginalized communities, lack digital literacy and skills required to access and utilize e-governance services effectively.
- Resistance to change and traditional mindsets can hinder the adoption and acceptance of e-governance initiatives.

Q.2. (B) Explain how 'Atmanirbhar Bharat' initiative is bringing a big change in India's IT sector. Suggest the steps to be taken to make India a Global technology hub. 10

- The 'Atmanirbhar Bharat' (Self-Reliant India) initiative aims to **promote self-sufficiency and resilience** in various sectors, including the IT sector.
- The 'Atmanirbhar Bharat' initiative **emphasizes the development and manufacturing of indigenous hardware components**, including electronics, semiconductors, and telecom equipment. This push for local manufacturing reduces dependence on imports, creates employment opportunities, and strengthens the domestic IT industry.
- The 'Atmanirbhar Bharat' initiative **focuses on promoting domestic software development** and IT services. It encourages the growth of Indian software companies, startups, and entrepreneurs by providing support through policy reforms, incentives, and access to capital.

- This fosters innovation, enhances competitiveness, and contributes to the growth of the IT sector.
- The initiative aims to **expand digital connectivity in rural and remote areas**, bridge the digital divide, and improve internet access across the country. This infrastructure development facilitates the adoption of digital technologies and enhances the reach of IT services.
- The 'Atmanirbhar Bharat' initiative **emphasizes skill development and capacity building** in the IT sector. It focuses on enhancing the quality and relevance of technical education and training programs to meet the industry's needs. Skill development initiatives like 'Skill India' and 'Digital India' complement the 'Atmanirbhar Bharat' initiative by creating a skilled workforce to support the growth of the IT sector.
- 'Atmanirbhar Bharat' **encourages the establishment and growth of startups** and promotes innovation in the IT sector. It offers support through policies like Startup India, tax incentives, incubation facilities, and access to venture capital. This ecosystem fosters entrepreneurial spirit, fosters innovation-driven enterprises, and contributes to the overall development of the IT industry.
- The 'Atmanirbhar Bharat' initiative **emphasizes the importance of data localization and data security**. It encourages the storage and processing of sensitive data within India's borders, which enhances data security and promotes the growth of local data center infrastructure. This ensures that critical data remains within the country and helps protect national security interests.
- The 'Atmanirbhar Bharat' initiative is also **promoting the adoption of cloud-based solutions**. This is because cloud-based solutions are more scalable and cost-effective than traditional on-premises solutions.
- The 'Atmanirbhar Bharat' initiative **focuses on strengthening domestic companies** to compete effectively in the global market, attract foreign investments, and facilitate technology collaborations. This emphasis on global competitiveness contributes to the growth of India's IT exports.
- Conclusion: By increasing investment, promoting domestic manufacturing, and shifting to cloud-based solutions, 'Atmanirbhar Bharat' initiative can help to make India a global leader in the IT sector.

Steps to be taken to make India a Global technology hub:

- **Invest in research and development:** India needs to invest heavily in research and development (R&D) to develop new technologies and solutions. The government can provide financial incentives to companies that invest in R&D, and it can also set up research parks and incubators to support R&D activities.
- **Strengthen Digital Infrastructure:** Invest in robust and high-speed digital infrastructure, including internet connectivity, data centers, and cloud computing facilities. This infrastructure development should focus on bridging the urban-rural divide and ensuring seamless connectivity across the country.
- **Foster Startup Ecosystem:** Create a conducive environment for startups by simplifying regulations, providing tax incentives, and offering access to funding and mentorship. Establish incubation centers, accelerators, and innovation hubs that support entrepreneurship and facilitate knowledge sharing.
- **Encourage Foreign Investment:** Implement policies and reforms that attract foreign direct investment (FDI) in the technology sector. Offer incentives, ease regulatory procedures, and ensure a favorable business environment to encourage multinational companies to establish their presence in India.
- **Strengthen Intellectual Property Protection:** Enhance intellectual property rights protection mechanisms to safeguard innovations and encourage research and development.
- **Focus on Emerging Technologies:** Embrace and invest in emerging technologies such as artificial intelligence (AI), blockchain, Internet of Things (IoT), cybersecurity, and data analytics. Foster a supportive ecosystem for these technologies through policy support, infrastructure development, and talent acquisition.
- **Promote Global Collaboration:** Foster collaboration and partnerships with international technology organizations, research institutions, and industry leaders. Facilitate knowledge sharing, technology transfer, and joint projects to leverage global expertise and accelerate India's growth as a global technology hub.
- India can become a global technology hub if these steps should be implemented holistically, with continuous monitoring and evaluation.

Q.3. (A) What is Space Junk ? Discuss the challenges posed by increased space junk and the potential risk associated with it. What do you know about Project NETRA ?
10

- Space junk refers to **man-made objects orbiting the Earth** that no longer serve any useful purpose. This includes dead satellites, spent rocket stages, fragments from spacecraft collisions or explosions, and other debris resulting from human activities in space.
- **The accumulation of space junk poses following significant challenges and risks:**
- **Collision Risk:** Space junk travels at high velocities, and even small debris can cause catastrophic damage when colliding with operational satellites or crewed spacecraft. Collisions can generate more debris and could make certain orbits unusable.
- **Threat to Satellites and Spacecraft:** Space junk poses a threat to operational satellites, including communication, weather monitoring, navigation, and scientific research satellites. A collision can disrupt or destroy critical infrastructure, leading to service outages and financial losses.
- **Human Space Exploration:** As human space exploration expands, such as crewed missions to the Moon, Mars, or beyond, the risk posed by space junk becomes even more significant. The safety of astronauts is paramount, and even small debris can be hazardous to spacecraft or spacesuits.
- **International Space Station (ISS):** The ISS orbits within the low Earth orbit (LEO) where space junk is most concentrated. The station requires regular adjustments to its orbit to avoid collisions with debris. If the International Space Station is severely damaged, it could jeopardize the presence of humans in space and international collaboration in space exploration.
- **Long-Term Sustainability of Space Activities:** The increasing amount of space junk threatens the long-term sustainability of space activities. If left unaddressed, it could restrict future space missions and hinder the deployment of new satellites, potentially impacting various sectors relying on space-based services.

Project NETRA

- Network for space object TRacking and Analysis (NETRA) project of ISRO is an early warning system in space to detect debris and other hazards to Indian satellites.
- The primary objective of Project NETRA is to safeguard India's space assets by developing a reliable system for the detection and tracking of space debris. The project involves the establishment of a network of observatories or radars to track objects in space, particularly those in low Earth orbit (LEO) that pose a potential threat to operational satellites.
- NETRA seeks to improve space situational awareness (SSA) and enable early warning of potential collisions. The data gathered through this network would help in predicting and mitigating collision risks, facilitating timely maneuvers to avoid debris, and protecting valuable space assets.
- Project NETRA also aims to develop indigenous technologies and capabilities in the field of space debris monitoring, tracking, and analysis. It aligns with India's broader goals of space exploration and ensuring the safety and sustainability of its space assets.

Q.3. (B) Why is India's space industry looking for private sector investments even though ISRO is a successfully performing PSU ? 10

- The Indian Space Research Organisation (ISRO) has indeed been a successful and renowned government agency in the field of space exploration and satellite technology. However, there are several reasons why the Indian space industry is seeking private sector investments and involvement, even with ISRO's track record of success:
- **Increased Demand and Ambitious Goals:** The demand for satellite-based services, such as communication, remote sensing, weather forecasting, and navigation, is growing rapidly. Additionally, India has set ambitious goals for space exploration, including missions to the Moon, Mars, and beyond. To meet these expanding requirements and goals, the space industry needs increased resources and capabilities.
- **Cost and Resource Sharing:** Space missions and satellite launches require substantial financial resources. Partnering with the private sector allows for

cost-sharing and reduces the burden on the government budget. Private investments can provide the necessary capital and expertise to develop and launch satellites, reducing the financial strain on ISRO.

- **Technological Innovation:** Collaboration with the private sector brings in new perspectives, fresh ideas, and innovative technologies. Private companies often have a more agile and market-oriented approach, which can accelerate the development of new space technologies and services. By leveraging private sector capabilities, the space industry can stay competitive globally and foster technological advancements.
- **Commercialization and Economic Growth:** The space sector offers significant opportunities for commercialization and economic growth. By involving the private sector, India aims to tap into these opportunities, foster entrepreneurship, and create new business avenues. Private companies can develop satellite-based services, manufacture satellites and launch vehicles, and offer value-added services, thus contributing to economic development and job creation.
- **International Collaboration and Partnerships:** Private sector involvement enhances India's ability to collaborate with international partners in space exploration and satellite technology. Joint ventures, technology transfers, and collaborations with private entities from other countries can lead to knowledge exchange, sharing of resources, and mutually beneficial partnerships.
- It is important to note that while private sector involvement is being encouraged, ISRO continues to play a significant role in India's space industry. ISRO's expertise, infrastructure, and experience remain crucial for the success of the sector. The aim is to foster a symbiotic relationship between ISRO and the private sector to leverage their respective strengths and drive the growth and advancement of the Indian space industry.

Q.4. (A) Though circumstances are strongly insisting for India to overturn decades of 'No first use' nuclear doctrine, still India is committed to No first use of nuclear weapons — Comment. 10

- India has maintained a doctrine of "No First Use" (NFU) regarding nuclear weapons. The NFU doctrine means that India commits to using nuclear weapons solely as a deterrent and pledges not to be the first to use them in a conflict.
- The NFU policy has been a fundamental principle of India's nuclear doctrine since its official declaration in 1999. It serves as a signal of India's commitment to nuclear disarmament and non-proliferation, emphasizing its nuclear weapons as a defensive deterrent rather than an offensive tool. It can be seen as a way to reduce the risk of nuclear proliferation especially in the South Asia. India's no first use policy is a major factor in regional stability. It sends a clear signal to Pakistan that India will not initiate a nuclear war, and it helps to deter Pakistan from using nuclear weapons first. India's policy is seen as a way to uphold India's moral stance against nuclear weapons. By making it clear that India will only use nuclear weapons in retaliation, the doctrine deters its adversaries from using nuclear weapons against India in the first place. It also strengthen India's security.
- There are some who argue that India's no first use policy is outdated and no longer serves its interests. Some argue that the doctrine is no longer credible, given the growing nuclear arsenals of India's adversaries. They argue that the doctrine is too restrictive, and that it limits India's ability to respond to a conventional attack. They argue that India's no first use policy makes it more vulnerable to conventional attack, as enemy states knows that India will not retaliate with nuclear weapons. So they argue that India needs to be prepared to use nuclear weapons first in order to deter its adversaries.
- It is important to remember that India's no first use policy is not just about India's own security. It is also about the security of the entire region. If India were to abandon its no first use policy, it would have a destabilizing effect on the region and could increase the risk of nuclear war. Hence in my opinion, India is right to remain committed to its no first use policy. It is a policy that has served India well for many years, and it is a policy that is essential for regional stability. However, it is also important to be prepared to revisit the issue if the circumstances change.

Q.4. (B) What is Green Energy ? Discuss about the Green Energy corridors and their need in India.10

- Green energy is energy that is produced from renewable sources, such solar power, wind power, hydropower, geothermal energy, and bioenergy. It is a clean and sustainable form of energy that does not produce greenhouse gases or other pollutants.
- In India the Green energy corridors refer to the infrastructure and transmission systems developed to facilitate the integration and transmission of renewable energy generated from various sources to the national grid. These corridors ensure a smooth and efficient flow of green energy from generation sites to consumption centers.
- **Phase 1 of the Green Energy Corridor** is already under implementation in the States of Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu for grid integration and power evacuation of approx. 24 GW of RE power
- **Phase 2 of the Green Energy Corridor** will facilitate grid integration and power evacuation of approximately 20 GW of Renewable Energy (RE) power projects in seven States namely, Gujarat, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu and Uttar Pradesh. The transmission systems will be created over a period of five year from Financial Year 2021-22 to 2025-26.

Need for a Green Energy Corridor in India:

- Prime Minister has pledged to increase the country's non-fossil fuel power generation capacity to 500 GW and meet 50% of its energy requirements from renewable sources by the end of this decade. So there is a need for integration.
- India has set ambitious renewable energy targets, including the goal of achieving 450 gigawatts (GW) of renewable energy capacity by 2030. To realize this potential, there is a need to develop a robust infrastructure to transmit the electricity generated from renewable sources to demand centers across the country.
- It will also contribute to long-term energy security of the country and promote ecologically sustainable growth by reducing the carbon footprint.

- It will generate large direct & indirect employment opportunities for both skilled and unskilled personnel in power and other related sectors.

Q.5. (A) Climate change is a global concern which needs urgent intervention to combat it - Explain why. Discuss how climate smart agriculture mitigates the devastating effects of climate change.10

- Climate change has emerged as one of the most pressing global concerns of our time, demanding urgent and collective intervention from nations, communities, and individuals alike because of the following reasons -
- Climate change is causing significant environmental damage. Rising global temperatures lead to melting ice caps, resulting in sea-level rise and coastal flooding. This threatens low-lying areas, island nations, and densely populated coastal cities, displacing millions of people and leading to economic and humanitarian crises.
- Climate change contributes to the loss of biodiversity, as ecosystems struggle to adapt to rapidly changing conditions, leading to species extinction and disrupting entire food chains.
- Extreme weather events such as hurricanes, droughts, and heatwaves become more frequent and intense, resulting in increased mortality rates, injuries, and the spread of diseases. Heat-related illnesses and respiratory problems due to air pollution worsen as temperatures rise.
- Climate change poses significant economic risks. Extreme weather events cause billions of dollars in damages to infrastructure, homes, and agriculture. Businesses and industries that rely on stable climatic conditions face disruptions in production, supply chains, and transportation.
- Climate change exacerbates existing social inequalities and disproportionately affects vulnerable populations. The impacts of climate change, such as food and water insecurity, displacement, and health risks, tend to be more severe for disadvantaged communities.

Climate-smart agriculture (CSA) is an approach that aims to address the challenges of climate change while enhancing agricultural productivity, resilience, and sustainability. Climate smart agriculture mitigates the devastating effects of climate change:

- Climate-smart agriculture emphasizes adaptive strategies to help farmers and agricultural systems cope with changing climate conditions. This includes promoting climate-resilient crop varieties and livestock breeds that are better suited to withstand extreme weather events, drought, or heat stress.
- CSA encourages the adoption of practices such as agroforestry, conservation agriculture, and improved water management techniques to enhance resilience and adaptability in agricultural systems.
- Climate-smart agriculture emphasizes the sustainable management of natural resources, such as soil, water, and biodiversity. Practices like agroforestry, conservation tillage, and integrated pest management help improve soil health, reduce erosion, enhance water conservation, and minimize the use of synthetic inputs.
- Climate-smart agriculture actively promotes practices that enhance carbon sequestration, such as agroforestry, afforestation, and the use of cover crops. These practices capture and store carbon dioxide from the atmosphere, mitigating greenhouse gas emissions.
- Climate-smart agriculture focuses on increasing agricultural productivity in a sustainable manner. This involves adopting innovative and efficient technologies, such as precision agriculture, drip irrigation, and improved farming practices.
- Climate-smart agriculture emphasizes careful management of fertilizer application, improved livestock management to minimize methane emissions, and efficient energy use in farming operations.
- Climate-smart agriculture involves providing farmers, stakeholders, and policymakers with the necessary knowledge, skills, and resources to adopt climate-resilient and sustainable practices. This includes training programs, information sharing, and capacity-building initiatives to enable farmers to make informed decisions and adapt to changing climate conditions effectively.
- **Conclusion:** By integrating these principles and practices, climate-smart agriculture contributes to mitigating the devastating effects of climate change on agriculture and the environment.

Q.5. (B) What is meant by open cast mining? Discuss the impacts of open cast mining on environment and solutions to overcome them. Add a note on the importance of post mining reclamation. 10

- Open-cast mining is a mining technique where large-scale excavation is conducted on the surface of the Earth to extract valuable minerals or resources that are located in shallow deposits. It involves the removal of overlying soil, rocks, and vegetation to access the desired minerals.
- Open-cast mining is commonly used for the extraction of coal, copper, gold, iron, and other minerals.

Impacts of Open-Cast Mining on the Environment:

- **Habitat Destruction:** Open-cast mining involves clearing large areas of land, resulting in the destruction of ecosystems and habitats. The removal of vegetation and topsoil can lead to the loss of biodiversity, as well as disrupt the natural balance of flora and fauna in the area.
- **Soil Erosion:** The removal of topsoil and vegetation exposes the underlying soil to erosion by wind and water. This can lead to the degradation of fertile soil, loss of soil nutrients, and reduced capacity for vegetation regeneration.
- **Water Pollution:** Open-cast mining can result in water pollution through the release of contaminants into nearby water bodies. Mining activities often require the use of chemicals, such as cyanide and mercury, which can leach into rivers, lakes, and groundwater, posing risks to aquatic ecosystems and human health.
- **Air Pollution:** Dust and particulate matter generated during the mining process can contribute to air pollution, affecting air quality in the surrounding areas. Mining operations may also release pollutants such as sulfur dioxide and nitrogen oxides, leading to acid rain and respiratory health issues.
- **Landscape Alteration:** Open-cast mining can drastically alter the landscape, leaving behind large open pits and disturbed landforms. These altered landscapes can have long-lasting visual impacts and can disrupt natural drainage patterns, potentially leading to flooding and changes in groundwater levels.

Solutions to Overcome Environmental Impacts:

- **Environmental Planning and Regulation:** Effective environmental planning and regulation can help ensure that mining operations follow strict guidelines and minimize their impact on the environment. This includes conducting environmental impact assessments, implementing comprehensive monitoring programs, and enforcing stringent environmental standards.
- **Sustainable Mining Practices:** Promoting sustainable mining practices can minimize the environmental footprint of open-cast mining. This includes the efficient use of resources, reducing waste generation, and implementing advanced technologies to minimize pollution and energy consumption.
- **Rehabilitation and Reclamation:** Effective post-mining reclamation is crucial to restore the land and ecosystems affected by open-cast mining. This involves the restoration of topsoil, re-vegetation, and implementing measures to control erosion. Rehabilitated areas can provide habitat for wildlife, restore ecosystem functions, and support sustainable land use practices.

Importance of Post-Mining Reclamation:

- **Mine reclamation** is the process of modifying land that has been mined to ecologically functional or economically usable state.
- Post-mining reclamation is essential for mitigating the long-term environmental impacts of mining activities. It helps restore the ecological integrity of the land, promotes biodiversity, and supports sustainable land use options.
- Reclaimed land can be utilized for agriculture, forestry, recreational purposes, or as conservation areas, thus contributing to the overall sustainable development of the region.
- Post-mining reclamation also plays a vital role in community engagement and social responsibility. It can provide opportunities for local communities to participate in the restoration process, creating jobs and fostering a sense of ownership and stewardship over the rehabilitated land.
- **Conclusion:** Overall, open-cast mining has significant environmental impacts, but through careful planning, sustainable practices, and post-mining reclamation efforts, the negative effects can be minimized, and the land can be restored for future generations.

Q.6. (A) What are various mitigation activities by the Government of India to lower CO₂ emission for trading of carbon credits in the international market under Paris Agreement? 10

- In order to lower CO₂ emissions and meet its Nationally Determined Contribution (NDC) under the Paris Agreement, the Government of India has identified a number of mitigation activities that can be used to generate carbon credits. These activities include:
- **Renewable Energy Development:** India has been focusing on promoting renewable energy sources such as solar, wind, hydro, and biomass power. The government has set ambitious targets for renewable energy capacity installation and has introduced various incentives and subsidies to encourage investment in the sector.
- **Improving energy efficiency:** India is also working to improve energy efficiency in its buildings, industries, and transportation sector. This can help to reduce the amount of energy that is needed, and therefore the amount of CO₂ that is emitted.
- **Developing carbon capture and storage (CCS) technologies:** CCS technologies can capture CO₂ from power plants and other industrial facilities, and then store it underground. This can help to prevent CO₂ from entering the atmosphere and contributing to climate change.
- **Shifting to cleaner fuels:** India is shifting to cleaner fuels, such as natural gas and electricity, to power its economy. This is helping to reduce emissions from the transportation and power sectors.
- **Energy Efficiency Measures:** The government has implemented several energy efficiency initiatives, including the Perform, Achieve, and Trade (PAT) scheme, which sets energy consumption targets for designated industries. The scheme enables industries to trade energy-saving certificates, thereby encouraging energy efficiency improvements.
- **Afforestation and Forest Conservation:** India has emphasized afforestation and forest conservation as part of its climate change mitigation strategy. The government has launched initiatives like the Green India Mission and REDD+ (Reducing Emissions from Deforestation and Forest Degradation), aiming to

increase forest cover and reduce greenhouse gas emissions. Complying with the UNFCCC decisions on REDD+, India has prepared its National REDD+ Strategy.

- **National Action Plan on Climate Change (NAPCC):** The Indian government formulated the NAPCC, which consists of eight missions addressing various aspects of climate change mitigation and adaptation. The NAPCC includes the National Solar Mission, National Mission for Enhanced Energy Efficiency, and National Mission on Sustainable Habitat, among others.
- **Promotion of Electric Mobility:** The government has taken steps to promote electric vehicles (EVs) to reduce carbon emissions from the transport sector. Various incentives, tax benefits, and charging infrastructure development programs have been introduced to encourage the adoption of EVs.
- **International Solar Alliance (ISA):** India co-founded the ISA with France to facilitate the deployment of solar energy and to reduce dependence on fossil fuels and promote solar power generation.
- **Conclusion:** The government of India is committed to taking action on climate change, and these mitigation activities and participation in the carbon trading market are an important part of its strategy.

Q.6. (B) Explain various challenges associated with disposing of massive amounts of Municipal solid waste. Discuss action plan for municipal solid waste management in India for cities generating waste > 500 tonnes per day. 10

- Disposing of massive amounts of Municipal Solid Waste (MSW) presents several challenges. Some key challenges associated with MSW disposal are
- **Limited Land Availability:** Finding suitable land for waste disposal is a major challenge, particularly in densely populated areas. The scarcity of land and competing land-use demands make it difficult to establish new landfill sites or expand existing ones.
- **Environmental Impact:** Improper waste disposal can have detrimental effects on the environment. Landfills can contaminate soil and groundwater, leading to pollution and health hazards. The release of greenhouse gases, such as methane, from decomposing waste contributes to climate change. Incineration, if not properly regulated, can release toxic pollutants into the air.

- **Waste Composition and Hazardous Materials:** Municipal solid waste is a heterogeneous mix of different materials, including organic waste, plastics, metals, and hazardous substances. Managing the segregation of waste composition requires different disposal methods and poses challenges in terms of sorting, recycling, and treating hazardous waste to ensure environmental safety.
- **Inadequate Waste Management Infrastructure:** Many regions lack proper waste management infrastructure, including collection systems, recycling facilities, and waste treatment plants. Inadequate infrastructure hampers effective waste management practices, leading to increased reliance on unsustainable disposal methods like open dumping or uncontrolled burning.
- **Financial and Technological Constraints:** Establishing and maintaining advanced waste management systems requires substantial financial investments and access to appropriate technologies. Many municipalities and developing countries face budget constraints, making it challenging to upgrade waste management infrastructure and implement advanced waste treatment technologies.
- **Public Awareness and Participation:** Encouraging public participation and awareness about waste management practices is crucial. Educating communities about the importance of waste segregation, recycling, and responsible waste disposal can help reduce the burden on landfills and promote sustainable waste management. However, achieving widespread public engagement can be challenging.
- To address these challenges, the Indian government has devised an action plan for municipal solid waste management in cities generating more than 500 tonnes of waste per day. The plan includes the following key components:
 - **Segregation at Source:** Encouraging citizens to segregate waste at the source into categories like biodegradable, recyclable, and hazardous waste. This practice facilitates effective waste management and enables efficient resource recovery.
 - **Waste Processing and Treatment:** Implementing waste processing and treatment facilities such as composting plants, biomethanation plants, waste-to-energy plants, and material recovery facilities. These facilities help reduce

the volume of waste going to landfills while recovering resources for producing energy.

- **Sanitary Landfills:** Developing engineered sanitary landfills that adhere to environmental regulations and incorporate measures to prevent pollution, control emissions, and minimize the impact on the surrounding environment and communities.
- **Awareness and Education:** Conducting public awareness campaigns and educational programs to promote responsible waste management practices, including waste segregation, reducing waste generation, and promoting recycling.
- **Extended Producer Responsibility (EPR):** Enforcing the concept of EPR, which holds producers responsible for managing and recycling the waste generated by their products. This approach encourages manufacturers to design products with a focus on recyclability and provides incentives for proper waste management.
- **Technology Adoption:** Encourage innovative technologies and processes for waste management, such as advanced waste segregation systems, waste-to-energy conversion, and waste processing technologies, to enhance efficiency and minimize environmental impact.
- **Institutional Capacity Building:** Strengthening the institutional capacity of municipal bodies and waste management agencies through training, skill development, and improved governance mechanisms. This helps ensure effective planning, implementation, and monitoring of waste management initiatives.

Q.7. (A) Biotechnology has unlocked a vast potential for improving human life, but the risks it poses are now a concern - Discuss throwing light on blessing and curse of Biotechnology.10

- Biotechnology, with its advancements in genetic engineering, medical research, agriculture, and other fields, has indeed unlocked vast potential for improving human life. However, as with any powerful technology, it also comes with risks and ethical concerns. The blessings and curses associated with biotechnology:

Blessings of Biotechnology:

- Biotechnology has revolutionized medical research and healthcare. It has led to the development of new diagnostics, therapies, and treatments for various diseases, including genetic disorders, cancer, and infectious diseases. Biotechnology has also enabled the production of safer and more effective drugs and vaccines.
- Biotechnology has facilitated the development of genetically modified (GM) crops with enhanced traits such as pest resistance, disease resistance, and increased yields. These crops can help address food security challenges by increasing agricultural productivity and reducing crop losses.
- Biotechnology offers the potential to mitigate environmental issues. For example, bioremediation uses microorganisms to clean up pollution and toxic waste. Biotechnology can also contribute to the production of biofuels, which can reduce greenhouse gas emissions and dependence on fossil fuels.
- Biotechnology has applications in various industries, including manufacturing, energy, and waste management. It enables the production of bio-based materials, biofuels, and biodegradable plastics, reducing dependence on non-renewable resources and promoting sustainability.

Curses of Biotechnology:

- The ethical implications of biotechnology are a major concern. Genetic engineering raises ethical questions regarding human gene modification, cloning, and other interventions that manipulate the genetic makeup of organisms. These practices raise concerns about playing with nature and have potential social and moral implications.
- The release of genetically modified organisms (GMOs) into the environment poses potential risks. Cross-pollination between GM crops and their wild relatives may lead to the spread of modified genes, impacting biodiversity and natural ecosystems. Additionally, the unintended consequences of GMOs on non-target organisms are a cause for concern.
- The use of biotechnology, especially genetic engineering, raises safety concerns. There is a need for rigorous testing and regulation to ensure the safety of genetically modified organisms and products derived from biotechnological

processes. Contamination or unintended side effects could have unknown impacts on human health.

- Biotechnology can exacerbate economic disparities. Patents and intellectual property rights often restrict access to biotechnological innovations, making them more accessible to wealthier nations or corporations. This can hinder the equitable distribution of benefits and limit the access of developing countries and marginalized communities to important advancements.

Conclusion:

- To maximize the benefits and mitigate the risks of biotechnology, it is essential to establish robust regulatory frameworks and promote transparency. Ultimately, the potential of biotechnology to improve human life is immense, but it is crucial to approach its applications with caution, ethical awareness, and a comprehensive understanding of its long-term implications.

Q.7. (B) Why is Ecotourism considered as a tool for conservation of Natural heritage? Discuss challenges associated with Ecotourism.10

- Ecotourism refers to responsible travel to natural areas that conserves the environment, sustains the well-being of local communities, and provides educational and enriching experiences for visitors. It is a form of tourism that aims to minimize negative impacts on the environment while promoting conservation, community empowerment, and cultural understanding. Ecotourism considered as a tool for conservation of Natural heritage because of the following reasons -
- **Economic Incentives for Conservation:** Ecotourism generates revenue from nature-based tourism activities. By providing economic benefits to local communities and governments, it creates an incentive to protect and conserve natural areas. This financial support can fund conservation initiatives, habitat restoration, and wildlife protection efforts.
- **Awareness and Education:** Ecotourism provides an opportunity for visitors to engage with and appreciate natural environments. It promotes environmental awareness and educates tourists about the importance of conservation and sustainable practices. This increased awareness can lead to support for conservation efforts and the adoption of environmentally responsible behaviors.

- **Conservation of Biodiversity:** Ecotourism often focuses on areas with high biodiversity and sensitive ecosystems. By promoting responsible tourism practices, such as minimizing habitat disturbance and respecting wildlife, ecotourism can contribute to the preservation of biodiversity. It can also support research and monitoring programs that aid in understanding and protecting fragile ecosystems.
- **Community Engagement and Empowerment:** Ecotourism can involve local communities in conservation efforts by providing employment opportunities, encouraging community-based tourism initiatives, and promoting sustainable livelihoods. When communities benefit from the presence of tourists, they become stakeholders in preserving their natural heritage and are motivated to protect it.

Challenges Associated with Ecotourism:

- **Overcrowding and Environmental Degradation:** The popularity of ecotourism can lead to overcrowding in sensitive areas, causing environmental degradation and habitat disturbance. Inadequate infrastructure and visitor management can strain ecosystems, resulting in pollution, habitat destruction, and stress on wildlife.
- **Unsustainable Practices:** Some forms of ecotourism may not adhere to sustainable practices. Activities like off-road driving, unregulated hiking, or uncontrolled access to fragile habitats can cause significant harm to natural areas and wildlife populations.
- **Disruption of Local Communities:** Rapid growth in tourism can disrupt the social fabric and traditional livelihoods of local communities. It may lead to cultural erosion, loss of traditional practices, and inequalities in benefit-sharing.
- **Misleading Marketing:** Some operators may claim to be environmentally friendly without actually implementing sustainable practices. It is important to have proper certification, transparency, and regulation to ensure genuine ecotourism practices.
- **Climate Change Impact:** Ecotourism can contribute to greenhouse gas emissions through transportation, accommodation, and other tourist activities. Climate change can also directly impact ecotourism destinations, affecting ecosystems, wildlife, and the overall visitor experience.

- To address these challenges, responsible and sustainable tourism practices should be prioritized. By adopting a holistic approach, ecotourism can continue to play a significant role in the conservation of natural heritage while benefiting local communities and promoting sustainable development.

Q.8. (A) Why is antibiotic resistance getting worse in India? (Discuss the strategies and action plans in India to deal with this. 10

Antibiotic or Antimicrobial resistance happens when germs like bacteria and fungi develop the ability to defeat the drugs designed to kill them or inhibit their growth. It is a natural biological phenomenon that occurs when bacteria mutate or acquire genetic material that allows them to survive and reproduce even in the presence of antibiotics.

Reasons for antibiotic resistance getting worse in India include:

- The inappropriate use of antibiotics is widespread in India. This includes over-the-counter sales without prescriptions, inadequate dosage procedure, incorrect self-medication practices, and poor adherence to prescribed treatment courses. Such practices contribute to the emergence and spread of resistant bacteria.
- Inadequate infection control measures in hospitals and healthcare facilities contribute to the spread of resistant bacteria. Factors such as overcrowding, insufficient sanitation, and improper waste management create an environment where infections can thrive, leading to the increased use of antibiotics.

To address the issue of antibiotic resistance, the Indian government has implemented various strategies and action plans. These include:

- **National Action Plan on Antimicrobial Resistance (NAP-AMR):** The Indian government launched the NAP-AMR in 2017, which outlines a comprehensive approach to tackle antimicrobial resistance. It focuses on enhancing surveillance, improving infection prevention and control, promoting appropriate antibiotic use, and promoting research and innovation.
- **Strengthening surveillance systems:** India has been working on strengthening its surveillance systems to monitor the occurrence and spread of antibiotic resistance. This includes establishing the Indian Council of Medical Research's Antimicrobial Resistance Surveillance Network (AMRSN) to collect data on resistance patterns across the country.

- **AMR Research & International Collaboration:** ICMR has taken initiatives to develop new drugs /medicines through international collaborations in order to strengthen medical research in AMR. ICMR along with Research Council of Norway (RCN) initiated a joint call for research in antimicrobial resistance in 2017.
- **Public awareness campaigns:** The government has initiated awareness campaigns to educate the public, healthcare providers, and pharmacists about the responsible use of antibiotics. These campaigns aim to discourage self-medication, promote appropriate antibiotic use, and emphasize the importance of completing the full prescribed course of antibiotics.
- **Regulation of antibiotic sales:** The Indian government has taken steps to regulate the sale of antibiotics by introducing Schedule H1 drugs, which require a prescription for purchase. Efforts have also been made to strengthen regulatory frameworks to control the availability and quality of antibiotics.
- **Training healthcare professionals:** Training programs have been implemented to educate healthcare professionals about appropriate antibiotic prescribing practices, infection prevention and control measures, and the importance of antibiotic supervision. These programs aim to improve knowledge and promote evidence-based decision-making.
- **Research and innovation:** The government encourages research and innovation in the development of new antibiotics, alternative therapies, and rapid diagnostic tools. This supports the exploration of new treatment options and strategies to combat antibiotic resistance effectively.
- **Conclusion:** Addressing antibiotic resistance requires a concerted effort from multiple stakeholders, including government bodies, healthcare providers, pharmaceutical industry, and the general public.

Q.8. (B) Bio-pesticides are slower in action compared to conventional pesticides, with shorter persistence and susceptible to unfavourable environmental conditions, but still there is a need to shift towards Bio-pesticides - Explain why.10

- Bio-pesticides are naturally occurring substances or microorganisms that are used to control pests. Bio-pesticides are slower in action compared to conventional pesticides, with shorter persistence and susceptible to unfavourable environmental conditions, but because of following reasons there is a need to shift towards Bio-pesticides.
- **Environmental sustainability:** Bio-pesticides are derived from naturally occurring substances such as plants, microbes, and minerals. They are generally less harmful to the environment compared to conventional pesticides, which are often synthetic chemicals. Bio-pesticides typically have shorter persistence

and degrade more rapidly, reducing their impact on ecosystems. Shifting towards bio-pesticides can help mitigate the negative environmental consequences associated with conventional pesticide use.

- **Reduced chemical residues:** Conventional pesticides leave behind chemical residues on crops, soil, and water bodies. These residues can have adverse effects on human health when consumed through food or water. In contrast, bio-pesticides are often considered safer as they have minimal or no chemical residues. Shifting to bio-pesticides can contribute to reducing the risk of pesticide exposure and its potential health impacts.
- **Integrated Pest Management (IPM):** Bio-pesticides are a crucial component of Integrated Pest Management approaches. IPM aims to minimize reliance on pesticides and emphasizes the use of a combination of biological, cultural, and chemical control methods to manage pests effectively. Bio-pesticides play a vital role in IPM strategies by providing targeted control of pests while minimizing harm to beneficial organisms and the environment.
- **Resistance management:** Pests can develop resistance to conventional pesticides over time, rendering them ineffective. Bio-pesticides offer an alternative mode of action that can help manage pesticide resistance. By incorporating bio-pesticides into pest management programs, the reliance on a single class of pesticides can be reduced, slowing down the development of resistance in pest populations.
- **Sustainable agriculture:** Shifting towards bio-pesticides aligns with the principles of sustainable agriculture. It promotes practices that maintain or enhance soil health, conserve biodiversity, and protect the long-term productivity of agricultural systems. Bio-pesticides, along with other sustainable farming practices, can contribute to a more resilient and environmentally friendly agricultural system.
- **Market demand and regulatory trends:** There is an increasing demand for organic and sustainable food production globally. Consumers are becoming more conscious of the environmental and health impacts of conventional pesticide use. Consequently, regulatory agencies are implementing stricter guidelines on pesticide residues. Shifting towards bio-pesticides allows farmers to meet market demands, comply with regulations, and access niche markets that prioritize sustainable and environmentally friendly practices.
- **Conclusion:** While bio-pesticides may have limitations, continued research and development efforts can improve their effectiveness and shifting towards bio-pesticides is a crucial step towards achieving sustainable agriculture and reducing the negative impacts associated with conventional pesticide use.

Q.9. (A) Why is the number of patents granted in India still a fraction compared to China and US, even though India's global position in innovations has been rising over the years?10

- A patent is a legal protection granted by a government to an inventor or assignee for a new and useful invention. Patents are granted for inventions for a product, its process or a process which is novel, has inventive step and industrial applicability. A patent is valid for 20 years.
- The number of patents granted in a country is influenced by several factors, including the country's innovation ecosystem, policies and regulations, investment in research and development (R&D), and the level of industry-academia collaboration. While India's global position in innovation has been rising, there are several reasons why the number of patents granted in India is still relatively low compared to countries like China and the United States:
- Both China and the United States invest significantly more in R&D compared to India. Higher investment in research and innovation often leads to increased patent filings and grants.
- The culture of IP protection and awareness plays a crucial role in driving patent filings. In countries like the United States, there is a strong culture of protecting intellectual property, and there are more businesses and individuals actively seek patents to safeguard their innovations. India, on the other hand, has historically had lower IP awareness and a less robust IP culture, which can impact the number of patent applications.
- Commercialization of research outcomes is crucial for driving patent filings. Countries like the United States and China have made significant efforts to translate research findings into commercial products and services. India is also making progress in this area, but further emphasis on research commercialization is needed.
- The efficiency and effectiveness of the patent examination and approval process can influence the number of patents granted. The patent examination process in India has faced challenges in terms of backlogs, delays, and complexities, which can discourage patent filings. Efforts have been made to improve this process, but it is still a factor that affects the overall number of patents granted.

- There is a significant gap between industry and academia collaboration in india in bringing new innovative ideas and protecting intellectual property.
- It's worth noting that the number of patents granted alone does not fully capture the innovation landscape of a country. Other factors, such as the quality and impact of innovations, should also be considered. While India may have a lower number of patents granted, it has shown advancements in various sectors, including information technology, pharmaceuticals, and renewable energy.

Q.9. (B) What are the tools required for the successful commercialization of Intellectual Property Rights in India? Discuss the role of CIPAM in commercialization of Intellectual Property Rights. 10

- Intellectual Property is a type of intangible property and includes inventions, literary and artistic works, symbols, names and paintings. Intellectual Property Rights (IPRs) are the Rights granted to the creators of Intellectual Property (IP) by the Government. The following essential tools are required for successful IPR commercialization in India:
- **Intellectual Property (IP) Protection:** The first step is to protect the IP through registration with the relevant authorities for the successful commercialization of IP. Obtaining proper IP protection ensures legal rights and prevents unauthorized use.
- **Market Research:** Conduct thorough market research to identify potential markets, target audiences, competitors, and existing technologies or products in the field. This analysis helps in understanding the commercial viability and potential demand for the IP.
- **Business Plan:** Develop a comprehensive business plan that outlines the commercialization strategy, including marketing, sales, distribution, and financial projections.
- **Licensing:** Licensing the IP to other companies or individuals who can utilize it commercially can help leverage the expertise and resources of established market players.
- **Strategic Partnerships and Collaborations:** The potential strategic partners, investors, or collaborators can assist in commercializing the IP. These

partnerships can provide access to distribution networks, manufacturing facilities, marketing expertise, or funding.

- **Branding and Marketing:** Develop a strong brand identity for the IP and implement effective marketing strategies to create awareness and generate demand for commercialization.
- **Technology Transfer:** This involves transferring the know-how and technical specifications to the licensee for manufacturing, marketing, and distribution.
- **Legal Expertise:** Engage legal professionals specializing in intellectual property and commercial law to guide the aspects of licensing, contracts, negotiations, and dispute resolution.

Role of CIPAM in commercialization of Intellectual Property Rights:

- The Cell for IPR Promotion and Management (CIPAM) plays a crucial role in the commercialization of Intellectual Property Rights (IPR) in India. Its primary objective is to promote and manage IPR awareness, protection, and commercialization in the country.
- CIPAM plays a vital role in raising awareness about IPR among various stakeholders, including businesses, entrepreneurs, startups, and the general public.
- It conducts workshops, training programs, seminars, and awareness campaigns to educate people about the importance of IPR, its commercial value, and the steps involved in protecting and commercializing it.
- CIPAM actively participates in policy formulation related to IPR commercialization. It collaborates with government agencies, industry bodies, and international organizations to develop policies and guidelines that facilitate the commercialization of IPR.
- CIPAM recognizes the significance of startups in driving innovation and economic growth. It provides support and guidance to startups in leveraging their IP assets for commercialization. CIPAM facilitates the registration and management of IP for startups, assists in IP valuation, and helps them connect with investors, industry experts, and potential collaborators.

- CIPAM actively collaborates with industry associations, research institutions, educational institutions, and international organizations to foster an ecosystem conducive to IPR commercialization.
- CIPAM also facilitates international cooperation in the field of IPR to foster technology transfer and trade.

Q.10. (A) Inefficient farming and poor distribution are reasons for the world's food shortage and the genetically modified crops are a bad answer to the wrong problem

Comment. 10

- Inefficiencies in farming practices can limit agricultural productivity and reduce food output. Factors such as inadequate access to modern technologies, lack of knowledge or training in advanced agricultural techniques, and limited use of fertilizers or irrigation systems can all contribute to lower crop yields and overall agricultural productivity.
- Poor distribution systems hinder the effective movement of food from areas of surplus production to regions with food shortages. Inadequate infrastructure, such as roads, storage facilities, and transportation networks, can result in post-harvest losses and delays in delivering food to markets or areas in need. This can lead to food shortages, particularly in remote or underserved regions.
- Genetically modified crops have been developed to address these agricultural challenges. GM crops help in increasing crop yields, enhancing resistance to pests and diseases, improving nutritional content, and adapting to changing environmental conditions.
- GM crops have the potential to increase agricultural productivity and address food security concerns by providing higher yields, reducing crop losses, and improving nutritional content. GM crops can be an important tool in combating hunger and malnutrition, particularly in regions facing agricultural challenges.
- However, by improving farming techniques, implementing sustainable practices, and providing support to farmers, it is possible to enhance productivity and increase food production without relying solely on GM crops.
- By focusing on improving farming efficiency, implementing sustainable practices, and investing in infrastructure and distribution networks, it may be

possible to address the world's food shortage without relying solely on genetically modified crops.

- By addressing the logistical challenges and improving distribution systems can also help ensure that food reaches those in need more efficiently.
- GM crops may have a role to play in combatting global hunger, but merely increasing crop production or nutritional value will not solve the larger problem of inequity in access to food. GM crops are not the solution to poor countries and regions affected by the political unrest and economic recession.
- While genetically modified crops are not a standalone solution to food shortages, they can complement other approaches to addressing agricultural challenges. Efforts to improve farming practices, invest in infrastructure, enhance agricultural education, promote sustainable farming techniques, investments in agricultural infrastructure, and improvements in transportation and storage facilities are necessary alongside genetic modification of crops to create a more sustainable and resilient food system.

Q.10. (B) Why is monitoring and weather forecasting crucial? Discuss the role of ISRO in the weather prediction and capabilities in Disaster management. Add a note on Mission NISAR. 10

Monitoring and weather forecasting are crucial for following reasons:

- Weather monitoring and forecasting play a vital role in disaster preparedness and response efforts.
- Severe weather events such as hurricanes, tornadoes, floods, and heatwaves can pose significant risks to human safety. By monitoring weather patterns and providing timely forecasts, authorities can issue warnings, evacuate vulnerable areas, and take appropriate measures to minimize the impact of these events.
- Monitoring and weather forecasting provide essential information for farmers to plan their agricultural activities effectively.
- Weather fluctuations and extreme events can pose significant risks to agriculture. Monitoring and weather forecasting enable farmers to anticipate and prepare for potential risks such as droughts, floods, storms, or frost.

- Weather monitoring and forecasting play a critical role in water resource management. By tracking precipitation levels, evaporation rates, and soil moisture content, water availability and usage can be better managed.
- Airlines need precise weather information to make decisions about flight routes, takeoff, and landing. Monitoring severe weather events, turbulence, icing conditions, and visibility allows for safer and more efficient travel.
- Power generation from renewable sources like wind and solar is heavily dependent on weather conditions. Accurate forecasts help utilities plan for fluctuations in energy production and demand.
- Accurate weather forecasting allows businesses to anticipate and prepare for weather-related changes in consumer behavior, adjust their operations, and optimize resource allocation.

Role of ISRO in the weather prediction and capabilities in Disaster management:

- ISRO operates a series of satellites dedicated to meteorological observations, including INSAT/GSAT satellites for weather forecasting services.
- These satellites provide valuable data on cloud cover, rainfall patterns, sea surface temperatures, atmospheric profiles, and other meteorological parameters.
- ISRO collaborates with the India Meteorological Department (IMD) to provide weather forecasts and warnings to various sectors. This includes providing forecasts for cyclones, heavy rainfall, heatwaves, and other extreme weather events.
- ISRO employs remote sensing data to map and monitor flood-prone areas. This information helps in identifying vulnerable regions, assessing flood extent, and supporting rescue and relief operations.
- ISRO's satellite communication systems, such as GSAT, provide reliable and robust communication links during emergencies. These systems enable quick dissemination of information, coordination of rescue operations, and connectivity restoration in disaster-hit regions.
- After a disaster, ISRO's satellite imagery is used to assess the extent of damage to infrastructure, agriculture, and natural resources. This data aids in prioritizing relief efforts, estimating losses, and facilitating post-disaster recovery.

Mission NISAR (NASA-ISRO Synthetic Aperture Radar)

- NISAR is a joint Earth-Observation mission between ISRO and NASA for global observations over all land masses including Polar cryosphere and Indian Ocean region.
- The primary objective of Mission NISAR is to launch a dual-frequency synthetic aperture radar (SAR) satellite to observe and measure changes in the Earth's surface.
- It is a dual band (L-band and S-band) Radar imaging mission to observe minor changes in land, vegetation and cryosphere (frozen parts on earth).
- NASA is developing L-band SAR and associated systems and ISRO is developing S-band SAR, spacecraft bus, the launch vehicle and associated launch services.
- The major scientific objectives of the mission are to improve understanding of the impact of climate change on Earth's changing Ecosystems, land and coastal processes, land deformations and Cryosphere.

Q.11. (A) Discuss how Artificial Intelligence manipulated digital media can impact privacy, democracy and national security of a country. Suggest solutions to tackle this infodemic.10

- Artificial Intelligence (AI) refers to the development of computer systems or machines that can perform tasks that typically require human intelligence. AI enables machines to mimic cognitive functions. Artificial Intelligence (AI) manipulated digital media can have significant implications for privacy, democracy, and national security.

Privacy:

- AI can be used to generate deepfake videos or manipulate images, creating convincing and deceptive content that can compromise individuals' privacy.
- These manipulated media can be used for identity theft, blackmail, or spreading false information about individuals.
- AI can be utilized to create fake profiles or identities, which can be used for fraudulent activities.

- The data breaches and unauthorized access to personal information and the erosion of privacy can have serious consequences for individuals' personal and professional lives.
- AI-powered chatbots or virtual assistants can be programmed to manipulate individuals into revealing personal information or engaging in harmful actions. These deceptive tactics can compromise privacy by tricking people into sharing sensitive data or performing actions against their best interests.

Democracy:

- AI manipulated digital media can be used to spread misinformation, propaganda, and fake news, which can undermine trust in democratic institutions, can influence public opinion, manipulate elections, and disrupt democratic processes.
- Deepfakes can be used to spread false information, defame political candidates, or undermine the credibility of public figures, leading to confusion and distrust among voters.
- AI algorithms can use social media platforms and contribute to the amplification and radicalization of extremist views.
- AI-powered bots and algorithms can be employed to manipulate online discussions and shape public opinion.

National Security:

- AI manipulated media can be weaponized to spread disinformation and propaganda, creating social unrest or inciting violence. It can be used to fabricate evidence or generate misleading narratives that threaten national security.
- Manipulated media can also be employed in cyberattacks, phishing campaigns, or social engineering tactics to gain unauthorized access to sensitive information.
- AI-generated messages can deceive individuals into revealing sensitive information, compromising their personal or organizational security.
- AI-powered systems can amplify extremist views or promote harmful ideologies, potentially leading to social unrest and threatens national security.

Solutions:

- Promote digital literacy and media literacy programs to educate individuals about the existence and impact of AI manipulated media. Enhancing critical thinking skills and teaching media verification techniques can help people identify and discern manipulated content.
- Develop advanced AI technologies capable of detecting and flagging manipulated media. This could involve the use of machine learning algorithms to analyze patterns, identify inconsistencies, and verify the authenticity of digital content.
- Foster cooperation and information sharing between governments, technology companies, researchers, and civil society organizations to address the challenges associated with AI manipulated media. This collaboration can help develop policies, regulations, and guidelines to mitigate the risks and promote responsible use of AI.
- Encourage transparency in AI development and deployment. Promote ethical guidelines and standards that prioritize the protection of privacy, democratic processes, and national security.
- Hold technology companies accountable for the content they host and ensure they have robust systems in place to combat AI manipulated media.
- Foster international collaboration to address the global nature of AI manipulated media. Cooperation between countries can help share best practices, exchange information, and develop joint initiatives to combat the spread of manipulated content.
- **Conclusion:** Balancing technological advancements and protecting privacy, democracy, and national security requires a multi-faceted approach involving technological innovation, legal frameworks, public awareness, and international cooperation.

Q.11. (B) What is the current scenario of renewable power generation in India? Discuss the factors responsible for the growing focus and shift towards Renewable energy.10

- India has set an enhanced target at the COP26 of 500 GW of non-fossil fuel based energy by 2030.
- India's installed non-fossil fuel capacity has increased 396% in the last 8.5 years and stands at more than 178.79 Giga Watts (including large Hydro), which is about 43% of the country's total capacity (as on May 2023).
- India saw the highest year on year growth in renewable energy additions of 9.83% in 2022.
- The installed Renewable energy capacity (including large hydro) has seen an increase of around 128 % since 2014.
- As of Feb 2023, Renewable energy sources, including large hydropower, have a combined installed capacity of 178.79 GW.
- **The following is the installed capacity for Renewables:**
 - Solar Power: 66.7 GW
 - Wind power: 42.6 GW
 - Biomass/Co-generation: 10.2 GW
 - Small Hydro Power: 4.94 GW
 - Waste To Energy: 0.55 GW
 - Large Hydro: 46.85 GW

There are several factors contributing to the growing focus and shift towards renewable energy sources. These factors include:

- **Environmental concerns:** One of the primary drivers of the shift towards renewable energy is the growing recognition of the environmental impacts associated with traditional fossil fuel-based energy sources. Renewable energy technologies have significantly lower carbon emissions and do not contribute to air pollution or greenhouse gas emissions that cause climate change. The desire to mitigate climate change and reduce pollution is leading to increased adoption of renewable energy.

- **Energy security:** Dependence on fossil fuels for energy leaves countries vulnerable to price volatility, geopolitical tensions, and supply disruptions. By diversifying the energy mix and increasing reliance on renewable sources, countries can enhance their energy security. Renewable energy sources are typically domestic and abundant, reducing dependence on imports and increasing energy independence.
- **Economic opportunities:** The renewable energy sector offers significant economic opportunities. As the technology advances and economies of scale are achieved, the costs of renewable energy generation have been declining, making it increasingly competitive with fossil fuels. This has led to the growth of renewable energy industries, creating jobs and driving economic growth. Investments in renewable energy can stimulate local economies, attract foreign investment, and foster innovation and technological development.
- **Energy access and electrification:** In many parts of the world, especially in developing countries, there is a lack of access to reliable electricity. Renewable energy technologies provide a decentralized and scalable solution to meet energy needs in remote areas. Solar panels, wind turbines, and small-scale hydropower systems can be deployed to provide electricity to communities that are off-grid or have limited access to traditional energy infrastructure. Renewable energy can contribute to achieving universal energy access and improve the quality of life for millions of people.
- **International commitments:** International agreements like the Paris Agreement which set targets for reducing greenhouse gas emissions, driving countries to transition to cleaner energy sources.
- **Technological advancements:** Advances in renewable energy technologies, such as improvements in solar panel efficiency, wind turbine design, and energy storage systems, have made renewable energy more viable and cost-effective. Ongoing research and development efforts are further driving innovation, leading to continuous improvements and new breakthroughs in renewable energy generation, storage, and distribution.
- **Public awareness:** The growing public awareness about the environmental and economic benefits of renewable energy has helped to create demand for renewable energy products and services.

- The combination of these factors has contributed to the growing focus on renewable energy, as countries recognize the need to transition to sustainable and cleaner energy sources to address environmental concerns, enhance energy security, stimulate economic growth, and improve access to electricity.

Q.12. (A) What is coastal erosion? Discuss factors causing coastal erosion. Why is erosion dominant in the Eastern coast than the Western coast in India? 10

- Coastal erosion refers to the gradual wearing away and removal of coastal land and shoreline due to natural processes and human activities. It is a natural phenomenon that occurs as a result of various factors. The factors causing coastal erosion are:
- **Wave action:** The impact of waves on the shoreline, combined with their ability to transport sediment, can lead to the erosion of coastal land. The continuous wave action contributes to erosion of the coast over time.
- **Tides and currents:** Tides and currents can move sediment along the coastline, resulting in the loss of sand from one area and its deposition in another. These processes can lead to the gradual erosion of beaches and the alteration of coastal landforms.
- **Sea level rise:** As sea levels rise, waves and tidal currents reach further inland, increasing erosion rates. The loss of coastal land and the retreat of shorelines are more pronounced in areas where sea level rise is significant.
- **Climate change:** Climate change can alter weather patterns, leading to changes in storm intensity and frequency. Climate change can also impact sediment supply and transport, affecting the balance of erosion and deposition along coastlines.
- **Storms and extreme weather events:** Powerful storms, hurricanes, and cyclones can have a severe impact on coastal erosion. These events generate high-energy waves and storm surges that can result in rapid erosion, flooding, and the destruction of coastal infrastructure.
- **Human activities:** Human activities such as the construction of harbors, jetties, or breakwaters, can disrupt natural sediment transport processes and lead to erosion in adjacent areas. The extraction of sand and gravel from beaches and

coastal areas for construction purposes can deplete sediment sources and accelerate erosion.

- **Coastal Geology:** Soft or erodible rocks, such as sand, silt, or clay, are more susceptible to erosion than harder rocks.

The dominance of erosion in the Eastern coast of India compared to the Western coast can be attributed to several factors:

- The Eastern coast of India is more exposed to the open ocean and experiences higher wave energy compared to the Western coast.
- The Bay of Bengal receives strong monsoon winds and experiences cyclonic activity, which generates powerful waves that can cause significant erosion along the coast.
- The eastern coast receives more rainfall. The more rainfall a coast receives, the more sediment is washed into the ocean, which can contribute to erosion.
- The Eastern coast of India generally receives a higher sediment supply compared to the Western coast. Major rivers like the Ganges, Brahmaputra, and Godavari deposit large amounts of sediment into the Bay of Bengal. The excess sediment load can also lead to increased erosion when it exceeds the natural capacity of the coast to accommodate and retain it.
- The Eastern coast features low-lying coastal plains, deltas, and barrier islands. These landforms are more susceptible to erosion due to their lower elevation, relatively softer sediments, and vulnerability to storm surges and tidal action.
- **Conclusion:** While erosion may be more dominant on the eastern coast, the western coast of India is not entirely immune to erosion processes. The western coast experiences erosion in localized areas, particularly where coastal structures, urbanization, or natural factors contribute to erosion

Q.12. (B) Discuss how technology translated into a medium for the destruction of environment through human exploitation.10

- Technology, when misused or harnessed irresponsibly, can indeed become a medium for the destruction of the environment through human exploitation. The technology can contribute to environmental degradation in following ways:
- Technological advancements have led to increased production and consumption levels, resulting in greater demand for natural resources. Industries such as manufacturing, energy production, and agriculture require vast amounts of resources, including fossil fuels, minerals, water, and land. Unsustainable resource extraction and consumption patterns can lead to habitat destruction, deforestation, water pollution, and soil degradation.
- Many technological processes and products generate pollution and waste that harm the environment. Industrial activities, transportation systems, and energy production often release pollutants into the air, water, and soil, contributing to air pollution, water contamination, and soil degradation. Improper disposal of electronic waste, plastics, and other non-biodegradable materials adds to the problem of waste accumulation and pollution.
- The increasing use of technology, particularly in the form of electronic devices, data centers, and communication networks, consumes significant amounts of energy. The generation of energy from fossil fuels, such as coal and oil, releases greenhouse gases that contribute to climate change. Additionally, the manufacturing, transportation, and disposal of electronic devices contribute to their overall carbon footprint.
- Technology-driven activities, such as agriculture, logging, and urbanization, contribute to deforestation and habitat loss. The expansion of agricultural land, often driven by the demand for food and biofuel production, leads to the clearing of forests, resulting in the loss of biodiversity and disruption of ecosystems.
- Advanced fishing technologies, such as large-scale trawlers and fish finders, have enabled intensified fishing efforts that exceed sustainable levels. Overfishing leads to the depletion of fish populations, disruption of marine ecosystems, and the loss of livelihoods for coastal communities. Additionally,

marine pollution from technological activities, such as oil spills or chemical runoff, further degrades marine habitats.

- Urbanization and industrialization driven by technological advancements often result in land degradation and the loss of fertile agricultural land.
- The expansion of cities into surrounding natural areas, can destroy natural habitats and disrupt ecosystems.
- The production of technology devices and components often involves unethical labor practices, including low wages, poor working conditions, and the exploitation of workers' rights. Extractive industries that provide raw materials for technology, such as mining for rare earth metals, can also result in environmental destruction and human rights violations.
- Addressing these environmental challenges requires responsible and sustainable approaches to technology development, production, and consumption. We also need to be aware of the environmental impacts of our activities and to take steps to mitigate these impacts.

Q.13. (A) The most important climate goal is limiting the Earth's warming to 1.5° Celsius. What happens to the world if we pass the crucial 1.5° Celsius climate threshold ?10

Passing the crucial 1.5°C climate threshold and allowing Earth's warming to exceed this limit would have significant and wide-ranging consequences for the planet.

- With a global temperature increase of 1.5°C or more, the frequency and intensity of extreme weather events like heatwaves, droughts, hurricanes, and heavy rainfall events are expected to increase. These events can lead to widespread destruction of ecosystems, loss of life, and displacement of communities.
- Exceeding the 1.5°C threshold would accelerate melting of glaciers and ice sheets, leading to rising sea levels. Coastal areas would be at a higher risk of inundation, posing a threat to densely populated regions, low-lying islands, and coastal ecosystems. This would result in the loss of habitable land, displacement of populations, and increased vulnerability to storm surges and coastal erosion.
- Higher temperatures and associated climate changes would impact ecosystems and biodiversity. Many species, including coral reefs, tropical forests, and Arctic

wildlife, are particularly vulnerable to warming beyond 1.5°C. Ecosystem disruptions and species extinctions can have far-reaching consequences for ecosystem services, food security, and the overall health and functioning of the planet.

- A temperature increase beyond 1.5°C would pose significant challenges to global food and water security. Changing climatic conditions, including shifts in rainfall patterns and increased frequency of extreme events, would affect crop yields, livestock production, and freshwater availability. This could lead to food shortages, increased food prices, and water scarcity, particularly in vulnerable regions already struggling with these issues.
- Crossing the 1.5°C threshold could trigger the melting of permafrost and release of significant amounts of methane, a potent greenhouse gas. It further accelerates global warming.
- The consequences of exceeding the 1.5°C threshold would have significant social and economic implications. Disruptions to infrastructure, agriculture, and ecosystems would impact livelihoods, increase poverty, and create challenges for sustainable development. Increased migration and conflicts over resources could further strain social systems and create geopolitical tensions.
- **Conclusion:** Limiting global warming to 1.5°C, as outlined in the Paris Agreement, is a crucial goal to minimize these risks and protect the planet and its inhabitants from the worst impacts of climate change.

Q.13. (B) Block chain technology is the doorway to transforming the agriculture sector in India - Discuss. 10

- Blockchain technology has the potential to bring significant transformation to the agriculture sector in India in a number of ways. The blockchain can benefit the agriculture sector in following ways:
- Blockchain enables transparency and traceability throughout the agricultural supply chain. Each transaction or movement of goods can be recorded on the blockchain, creating an immutable and transparent ledger. This transparency helps to ensure the authenticity of products, track their origin, and verify the conditions under which they were produced.

- Blockchain can streamline the process of quality assurance and certification in the agriculture sector. Certificates related to organic farming, fair trade, or specific production practices can be stored on the blockchain, making them easily accessible and verifiable. This enhances trust and credibility in the market, allowing consumers to make informed choices and rewarding farmers who adhere to higher standards.
- Blockchain technology can enhance the efficiency of supply chain management in agriculture. By providing real-time visibility into the movement of goods, blockchain can help optimize logistics, reduce waste, and minimize delays.
- Smart contracts on the blockchain can automate and enforce contractual agreements, facilitating seamless transactions between various stakeholders in the supply chain, such as farmers, distributors, processors, and retailers.
- Blockchain can help address financial inclusion challenges faced by small-scale farmers. By recording farmers' transaction history, land ownership, and production data on the blockchain, financial institutions can have access to reliable and transparent information for assessing creditworthiness. This enables farmers to access loans and financial services more easily.
- Blockchain-based platforms can also facilitate direct transactions between farmers and buyers, eliminating intermediaries and ensuring fair pricing for farmers.
- Blockchain technology can empower farmers by providing them with more control over their data and connecting them directly with buyers. By eliminating intermediaries, farmers can negotiate better prices and access a broader market for their products.
- The use of blockchain in agriculture can enable better data management and analytics. Agricultural data, such as weather patterns, soil conditions, and crop yields, can be securely stored and shared on the blockchain. This data can be utilized for predictive analytics and evidence-based decision-making.
- Blockchain platforms can also enable peer-to-peer trading, fostering fair trade practices and creating opportunities for small-scale farmers to participate in the global economy.

- **Conclusion:** These are some of the ways in which blockchain technology can transform the agriculture sector in India. As the technology advances, we can expect to see even more innovative applications of blockchain in agriculture.

Q.14. (A) What are the reasons behind the India's opposition to sign the Non-Proliferation of nuclear weapons (NPT)? Discuss the impact of the civil nuclear agreement with the Nuclear Supplier Group (NSG) on nuclear power generation in India. 10

India has not signed the Treaty on Non-Proliferation of Nuclear Weapons (NPT) for a number of reasons. These reasons include:

- The NPT distinguishes between nuclear-weapon states and non-nuclear-weapon states. Nuclear-weapon states are allowed to keep their nuclear weapons, while non-nuclear-weapon states are not. India believes that this is discriminatory and that it does not promote nuclear disarmament.
- The NPT does not have any strong enforcement mechanisms to ensure that countries comply with its terms. India believes that this makes the NPT ineffective and that it does not provide adequate security guarantees to non-nuclear-weapon states.
- India has security concerns about its neighbors, Pakistan and China, both of which have nuclear weapons. India believes that the NPT does not adequately address these security concerns and that it does not provide India with the security guarantees it needs.
- India has a nuclear weapons program that it has developed independently. India believes that its nuclear program is essential for its security and that the NPT would limit its ability to develop and maintain its nuclear weapons program.
- Despite not being a signatory to the NPT, India has maintained a largely responsible record in terms of nuclear security, non-proliferation, and export controls. It adheres to a "No First Use" policy, emphasizing its commitment to use nuclear weapons only in response to a nuclear attack.

Impact of the agreement:

- The civil nuclear agreement between India and the Nuclear Suppliers Group (NSG) has had a significant impact on nuclear power generation in India. The agreement, which was reached in 2008, allowed India to access nuclear technology and fuel from countries that are members of the NSG. This has helped India to expand its nuclear power program and to meet its growing energy needs.
- Prior to the agreement, India was largely isolated from the global nuclear market. This was because the NSG had a rule that prohibited the export of nuclear technology to countries that had not signed the Nuclear Non-Proliferation Treaty (NPT). India is not a signatory to the NPT, so it was unable to access nuclear technology from countries that were members of the NSG.
- Since the agreement was reached in 2008, India has signed nuclear cooperation agreements with countries including US, France, Russia, Japan, Australia etc and it has started construction on several new nuclear power plants.
- The agreement granted India access to nuclear technology, equipment, and fuel from international suppliers. This opened up opportunities for India to import reactors, fuel, and other nuclear components, which were previously restricted due to international sanctions and the lack of formal nuclear cooperation.
- The availability of nuclear technology and fuel has contributed to the expansion of India's nuclear power capacity. India has been able to build and operate new nuclear power plants, increasing its electricity generation capacity from nuclear energy. Nuclear energy contributes to India's energy security by diversifying its energy mix and reducing dependence on fossil fuels.
- The civil nuclear agreement has fostered collaboration between India and international partners in nuclear research and development. It has facilitated joint projects, exchange of expertise, and cooperation in areas such as reactor design, safety measures, waste management etc.
- The agreement also encouraged India to align its nuclear safety and regulatory practices with international standards. As part of the agreement, India committed to separating its civil and military nuclear facilities, thereby enhancing transparency and safety measures.

- **Conclusion:** The civil nuclear agreement with the NSG has played a significant role in facilitating India's nuclear power generation capacity by providing access to technology, fuel, and international collaboration. It has contributed to India's efforts to expand its nuclear energy sector, improve safety practices, and enhance energy security.

Q.14. (B) What are e-waste recycling practices in India? Discuss the highlights of new e-waste management rules 2022 notified by the Government of India. 10

- Electronic waste or e-waste refers to discarded electrical or electronic devices. It includes a wide range of products, such as computers, televisions, mobile phones, refrigerators, and printers.

E-waste recycling practices:

- E-waste recycling practices in India vary depending on the scale of the operation.
- The management of e-waste is being carried out in India under the frame work of E-Waste (Management) Rules, 2016 and amendments there off.
- Under these Rules, the responsibility of disposal of e-waste in a scientific and environmentally sound manner has been assigned to Producers of notified Electrical & Electronic Equipment (EEE) under the principle of Extended Producer Responsibility (EPR).
- The e-waste recycling system in India involves the establishment of collection centers, authorized dismantlers, and recyclers across the country. These collection centers serve as drop-off points for individuals, businesses, and organizations to dispose of their e-waste in an environmentally responsible manner.
- Major recycling of e-waste is carried out in the non-formal sector using primitive and hazardous methods. Non-formal units generally follow the steps such as collection of the e-waste from the rag pickers, disassembly of the products for their useable parts, components, modules, which are having resell value. The rest of the material is chemically treated to recover precious metals.
- Few formal recyclers are operating in India. The processes followed in formal sector are mainly limited to the segregation, dismantling of e-waste till the size reduction stage of printed circuit boards (PCBs). A shredder is employed for

PCBs size reduction. The pre-processed PCB is exported to smelting refineries in developed countries for further recovery of precious metals like copper, silver, gold, aluminum, palladium etc. and also treating the slag byproduct in an eco-friendly manner.

- Land Filling is the another common method of electronic waste disposal.
- Efforts are continuously made to enhance e-waste recycling practices in India, promote sustainable methods, and create a circular economy for electronic products. The goal is to minimize the environmental impact of e-waste while maximizing resource recovery and reducing the need for raw materials extraction.

Ministry of Environment, Forest and Climate Change has notified the E-Waste (Management) Rules 2022 on 2nd November, 2022. These rules replaced E-waste (Management) Rules, 2016 and came into effective from 1st April, 2023.

Highlights of new e-waste management rules 2022 are:

- These rules are applicable to every manufacturer, producer, refurbisher, dismantler and recycler.
- All the manufacturer, producer, refurbisher and recycler are required to register on portal developed by Central Pollution Control Board (CPCB).
- No entity shall carry out any business without registration and also not deal with any unregistered entity.
- Authorization has now been replaced by Registration through online portal and only manufacturer, producer, refurbisher and recycler require Registration.
- Schedule-I expanded and now 106 EEE (electrical and electronic equipment) has been include under Extended Producer Responsibility (EPR) regime.
- Producers of notified EEE, have been given annual E-Waste Recycling targets based on the generation from the previously sold EEE or based on sales of EEE as the case may be.
- Management of solar PV modules /panels/ cells added in new rules.
- The quantity recycled will be computed on the basis of end products, so as to avoid any false claim.

- Provision for generation and transaction of EPR Certificate has been introduced.
- Provisions for environment compensation and verification & audit has been introduced.
- Provision for constitution of Steering Committee to oversee the overall implementation of these rules.

Q.15. (A) Discuss why India did not sign the COP26 pledge to stop deforestation and cut methane gas emission by 2030. 10

- During the COP26 global climate conference in Glasgow, Scotland in 2021, the world leaders made a commitment to halt deforestation by the end of the decade and reduce the emission of methane, a potent greenhouse gas, in order to mitigate the effects of climate change. This COP26 pledge commits countries to reduce methane emissions by 30% by 2030. India did not sign this COP26 pledge to stop deforestation and cut methane gas emissions by 2030 because of following reasons –
- India expressed apprehension about the potential economic and developmental impacts of stringent methane reduction measures.
- India argues that reducing methane emissions from agriculture would have a negative impact on food production.
- India emphasized the need for a comprehensive and accurate understanding of its own domestic emissions before committing to specific reduction targets.
- The government has also said that it is not clear how the pledge would be implemented, and that it would need more information before making a decision.
- India is also concerned about the availability of technology to reduce methane emissions from livestock. The Methane Pledge does not provide any financial assistance to help countries develop or implement methane reduction technologies.
- The pledge could lead to tariffs on Indian agricultural products, which would have a negative impact on the country's economy and its trade relations with other countries.

- India also argued that developed countries have a much higher historical responsibility for climate change, and that they should take the lead in reducing emissions.
- Carbon dioxide has hundreds of years of lifetime whereas methane has a much shorter atmospheric lifetime of just 12 years and India argued that focus should not be shifted to methane reduction which have shorter atmospheric lifetime than CO₂.
- India pointed out that India is a party to UNFCCC and its Paris Agreement but the Methane Pledge is outside the ambit of the UNFCCC and its Paris Agreement.
- **Conclusion:** India's decision is based on a number of factors, including economic, technological, and political concerns and the government is still considering the issue and not ruled out signing the pledge in the future.

Q.15. (B) What are Gene Sanctuaries? How do they protect the genetic diversity of plants in India?. 10

- Gene sanctuaries are areas or designated regions where the conservation and protection of genetic diversity and wild relatives of crops and other organisms are prioritized. These sanctuaries aim to safeguard the genetic resources that are crucial for maintaining biodiversity and supporting the resilience of ecosystems and agricultural systems.

Gene sanctuaries in India protect the genetic diversity of plants in a number of ways. These include:

- Gene sanctuaries identify and protect areas where wild relatives of cultivated plants are found. These wild species possess valuable genetic traits that can be utilized in breeding programs to enhance crop resilience.
- By safeguarding the natural habitats of wild plant species, gene sanctuaries help ensure the survival and diversity of wild plant populations.
- Gene sanctuaries often involve the collection and storage of seeds from diverse plant species. These seed banks serve as a safeguard against the loss of valuable plant traits due to habitat destruction, climate change, or other threats.
- Gene sanctuaries helps to prevent the introduction of invasive species that can outcompete and displace native plants.

- Gene sanctuaries often serve as centers for research, monitoring, and education and contribute to scientific studies on plant genetic diversity.
- Gene sanctuaries provides a safe haven for threatened and endangered plants.
- Gene sanctuaries are often located in areas with high levels of biodiversity. By protecting these areas, gene sanctuaries help to conserve the natural ecosystems of India.
- Government has established the National Gene Bank in the year 1996 to preserve the seeds of Plant Genetic Resources for future generations. Garo Hills Gene Sanctuary of Meghalaya and Nilgiri Biosphere Reserve are the gene sanctuaries in India.
- **Conclusion:** Through these efforts, gene sanctuaries in India play a crucial role in protecting and conserving the genetic diversity of plants. They contribute to the sustainability of agriculture and the continued availability of genetic resources for future generations.

Visit <https://groupsmaster.com> for more study materials.