1. Discuss the natural resource endowment of Russia. How does it shape Russia's worldview? Examine.

Approach:

Question is asking you to discuss, it requires you to write a debate where one has to use your skill at reasoning, backed up by deliberately selected evidence to make a case for and against an argument. Also, you have to examine (dig deep) how natural resource endowment of Russia shape Russia's worldview.

Introduction:

Russia is the largest country in the world; it covers a vast amount of topographically varied territory, including much that is inaccessible by conventional modes of transportation. Natural resources remain a crucial part of Russia's economy and play a role in its projection of power abroad and account 10.7% of India's GDP.

Body:

THE NATURAL RESOURCE ENDOWMENT OF RUSSIA

- Russia is probably richer in natural resources than any other country in the world. It has abundant supplies of oil, natural gas, timber and valuable minerals, such as copper, diamonds, lead, zinc, bauxite, nickel, tin, mercury, gold and silver— most of which are located in Siberia and the Far East. The value of Russia's resources is huge.
- Russia's resources are not just oil and gas. Russia also has major deposits of metals and minerals, timber supplies, and vast amounts of land.Many of Russia's natural resources are located far from industrial processing centers.
- The fuel resources that supported development of industrial centres in European Russia have been depleted, necessitating reliance on coal, natural gas, and petroleum from Siberian deposits. However, Russia still has an estimated 6 percent of the world's oil deposits and one-third of the world's natural gas deposits, making it a major exporter of both commodities.
- Russia possesses rich reserves of iron ore, manganese, chromium, nickel, platinum, titanium, copper, tin, lead, tungsten, diamonds, phosphates and gold. Its diverse mineral resources have given many of its products a strong position in world markets.
- There is a large uranium mine near Krasnokamensk, in the Altai region about 25 miles from where the Russian, Mongolian and Chinese borders all come together. It is a gigantic hole, nearly mile long, three quarters of a mile wide and 330 yards deep. are-earth producing countries include Russia, Malaysia, Kyrgyzstan and Kazakhstan. As of the mid 2000s, ninety-five percent of the world's rare earths came from China.

HOW DOES IT SHAPE RUSSIA'S WORLDVIEW?

- Russia's raw materials provide significant inputs for an industrial economy. The abundance of oil and natural gas has made Russia virtually self-sufficient in energy and a large-scale exporter of fuels. Oil and gas were primary hard-currency earners for the Soviet Union, and they remain so for the Russian Federation.
- Russia also is self-sufficient in nearly all major industrial raw materials and has at least some reserves of every industrially valuable nonfuel mineral--even after the productive mines of Ukraine, Kazakstan, and Uzbekistan no longer were directly accessible.
- Tin, tungsten, bauxite, and mercury were among the few natural materials imported in the Soviet period. The forests of Siberia contain an estimated one-fifth of the world's timber, mainly conifers.
- Russia's reliance on its resources have made them an obvious target for US sanctions. New deposits have indeed been slow to develop within Russia and sanctions have been cited as a possible cause.

Conclusion:

Russia's role in the global economic system today, and the Soviet Union's in the past, is dominated by the export of natural resources, particularly oil and gas. The rents earned from these exports are both a source of strength and weakness, as they link the fortunes of Russia's domestic economy to the volatility of global resource markets.

2. What are the emerging frontiers in the field of conventional energy resources? Discuss the key issues surrounding those.

Approach:

The question has two parts students are expected to address each part equally, also it is important to understand the demand of the question in each part and write answer accordingly.

Introduction:

Conventional sources of energy are the natural energy resources which are present in a limited quantity and are being used for a long time. They are called non-renewable sources as once they are depleted; they cannot be generated at the speed which can sustain its consumption rate. They are formed from decaying matter over hundreds of millions of years. These resources have been depleted to a great extent due to their continuous exploitation. It is believed that the deposits of petroleum in our country will be exhausted within few decades and the coal reserves can last for a hundred more years. Some common examples of conventional sources of energy include coal, petroleum, natural gas and electricity.

Body:

Emerging frontiers in the field of conventional energy resource-

- The hydrogen industry and the energy industry brushed shoulders at multiple points throughout their history. The first demonstrations of water electrolysis to produce carbon-free hydrogen fuel and fuel cells to convert hydrogen to electricity were engineered in the 1800s. Hydrogen was used to fuel the first internal combustion engines. Green Hydrogen is currently enjoying unprecedented political and corporate interest, at least 24 countries have now drafted policies or are setting up strategies for the hydrogen economy.
- Hydrogen is versatile. Hydrogen can be used as a chemical feedstock, fuel, or energy carrier and storage, and has many possible applications across industries, heavy-duty transport, power, and buildings sectors. Multi-sectoral applications provide a conducive environment towards an exponential rise in demand and subsequent benefits of scale.
- Hydrogen is uniquely clean. The USP of hydrogen is that it can help to decarbonise industrial processes and economic sectors, where reducing carbon emissions is both urgent and hard to achieve. Fertilisers, oil-refining, heavy industry like steel and heavy-duty transport are some examples of hard sectors that likely will need hydrogen to decarbonise.
- Biofuel is the other frontier in the field of conventional energy resource which has been extensively researched over a period of time Biofuels in India are of strategic importance as it augers well with the ongoing initiatives of

the Government such as Make in India, Swachh Bharat Abhiyan, Skill Development and offers great opportunity to integrate with the ambitious targets of doubling of Farmers Income, Import Reduction, Employment Generation, Waste to Wealth Creation.

- The Government approved the National Policy on Biofuels-2018 in June 2018. The policy has the objective of reaching 20% ethanol-blending and 5% biodiesel-blending by the year 2030. Among other things, the policy expands the scope of feedstock for ethanol production and has provided for incentives for production of advanced biofuels.
- Molten salt reactors are the new phenomena in the field of nuclear energy. Nevertheless, advocates say one emerging technology, the molten salt reactor, could provide carbon-free electricity with fewer radiation risks than traditional nuclear.

Issues surrounding these new frontiers-

- Research in these technologies is still in initial phase barring biofuels it is going to take a long time to get these technologies to show their impact at global level.
- making ethanol from grains is the worst possible solution, not only because of its impact on food production, but mostly because of its poor energy yield. In fact, between fertilizers, seeds, harvesting, transportation, and treatment, the amount of energy contained in a litter of ethanol is barely more than that required to obtain it from cereals. Therefore, from an energy standpoint, it is unreasonable to use this type of raw material.
- Also, the cost of energy through these new systems is quite high which makes these technologies ineffective in the long run.
- Environmental concerns are the other issues that need to be looked into, transition into renewable sources of energy has been in focus from quite a long time now there has been a significant shift from non-renewable to renewable sources of energy throughout the globe.

Conclusion:

Coal will continue to be an abundant, though potentially highly contaminating source, and it is necessary to make advances in its use with the capture and storage of CO_2 but at this time, the most important challenge may well be to encourage renewable energies in order to make them a significant percentage of the total supply. Solar energy is more abundant, but has the problem of dispersion. At some point in the near future, it will have to become the dominant and truly massive, sustainable and unlimited renewable energy source. That will call for the solution of technological problems that limit its spread and affect its current high price, and will require decisive public support.

3. What are the key issues related to the extraction and processing of rare earth elements? Discuss.

Approach

The candidate needs to discuss what rare earth elements are, in the initial part and then elaborate upon the key issues related to the extraction and processing of rare earth elements.

Introduction

Rare earth elements are obtained from a group of 15 elements referred to as the lanthanide series in the periodic table of elements. Scandium and yttrium, while not true rare earth elements, are also included. REEs are key components in many electronic devices that we use in our daily lives, as well as in a variety of industrial application.

Body

Rare earth metals comprise seventeen chemical elements — anthanum, cerium, praseodymium, neodymium, promethium, etc. Despite their classification, most of these elements are not really “rare”. One of the Rare Earths, promethium, is radioactive. As essential and functional materials, rare earth elements have been named "The Vitamins of Modern Industry".

According to the Rare Earth Technology Alliance (RETA), the estimated size of the Rare Earth sector is between $10 billion and $15 billion. But at the same time, there are some issues with regards to their extraction and processing, some of which can be seen from the following points –

- **Low Concentration:** Global rare-earth reserves are at more than 130 million metric tons. However, most of those reserves either are too low in concentration to be extracted economically, or they are not readily accessible, such as metals locked away in deep-sea manganese-based nodules or hydrothermal deposits.
- **Extraction Costs:** REMs are found in a variety of minerals, but not all are equally suitable for economic development. REMs are generally found in concentrations below what is economically viable for extraction at current prices using available technology.
- **Environmental factors:** Extraction and mining of rare earth metals involves similar land-use exploitation, environmental damage and ecological burden as any other mining operation. They are mined using extremely energy-intensive processes, spewing carbon emissions into the atmosphere and toxins into the ground.

- **Recycling:** Less than 1% of rare earth elements are currently recycled given the difficulty of separating these elements from existing alloys. This should be seen in the context of skyrocketing demand, which will limit the ability of recycled rare earths to meet the expected short and medium-term needs.
- **Geopolitical Issues:** China is the world's largest producer of REEs, accounting for over 60% of global annual production, estimated at 132,000 tonnes for 2019. It withheld the supply of Rare Earths to Japan after their dispute over Senakaku Islands, which alerted the world to use of rare earths for geopolitical purposes.
- **Supply Monopoly:** China remains virtually the only producer of the valued heavy REMs. China imposed export restrictions on REE between 2010 and 2014, resulting in dramatic increases in REE prices during those years. This leads to uneconomical trends in other countries for rare earth extraction.
- **China Factor:** China's intents of hegemony, non-solidarity with other nations does not augur well for the environment in general, as well as for geo-politics and global renewable energy usage and scenarios. Its intents on doing the same with its vast rare earth reserves will be detrimental.
- The high vulnerability of the EV industry could raise doubts over the feasibility of decarbonisation efforts given the envisaged role of electric vehicles in carbon reduction.
- Beyond EVs and wind turbines, these metals are used in strategic sectors such as defence (drones for instance) and digital technologies. The omnipresence of digital technologies could make the world economy even more dependent on these critical metals. Addressing this is a challenge as big as sourcing sustainable energy for the transition to net zero.

Way Forward –

- Replacing, reducing or recycling rare earth metals can lower the impact of using these elements. E.g. - Alternatives exist in the wind industry.
- Diversifying the supply chain of Rare Earth Metals around the world, especially focusing on the same in India.
- Recycling of these rare earth metals for continuous usage for various technologies is a good option that can be considered.

Conclusion

Rare earths have become indispensable and, in many cases, irreplaceable components of materials that are essential in modern life. Thus the usage of these metals, which form a critical part of the renewable energy revolution should be handled with careful, sincere and cleaner measures if the way forward has to be greener and environment-friendly.

4. What are the major areas of dispute related to water resources between India and its neighbours? Analyse.

Approach

Candidates are expected to first to write about disputes of India over water resources with neighbouring countries. And try to analyse on major areas of disputes related to it.

Introduction

Water dispute is a term describing a conflict between countries, states, or groups over the rights to access water resources. The United Nations recognises that water disputes result from opposing interests of water users, public or private. A wide range of water conflicts appear throughout history, though rarely are traditional wars waged over water alone.

Body

Water dispute in South Asia:

- Water remains a politically contested issue in much of South Asia. The region is facing water shortage it will continue to face increasing demands on energy and water with rapid industrialisation. UN reports that by 2030, water demand in India will grow to almost 1.5 trillion cubic situation is further aggravated by the India's water disputes with its neighbours and inter-state river water disputes in India.
- Combine these factors with the impact of climate change that's reducing the amount of water in the Brahmaputra and many other basin also changing the patterns of water flow.

Water resources disputes between India and its neighbour:

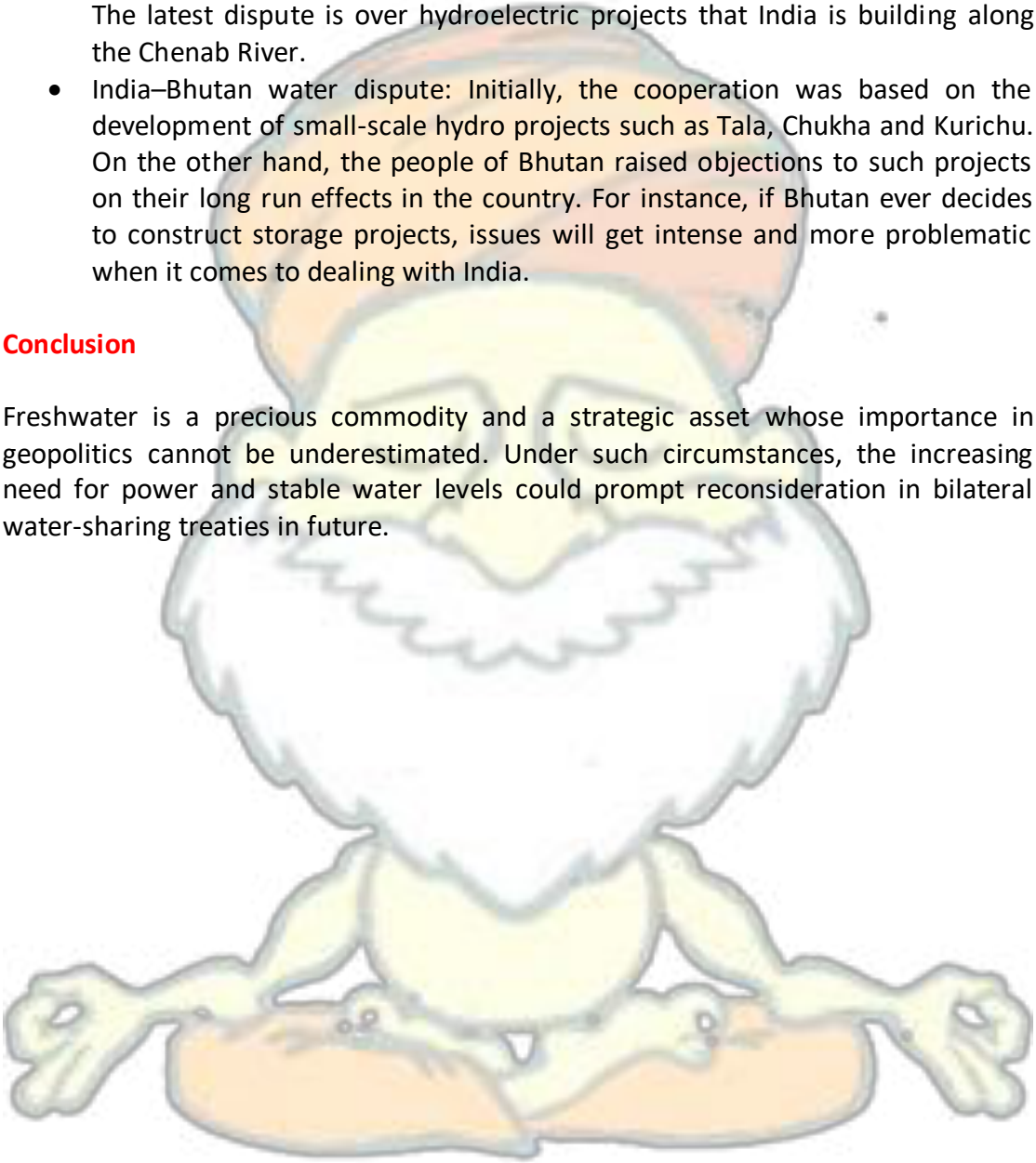
- India-China Water Dispute: As an upstream riparian region, China maintains an advantageous position and can build infrastructure to intentionally prevent water from flowing downstream. China's dam-building and water division plans along the Brahmaputra (called Yarlung Zangbo in China) is a source of tension between the two neighbours, despite the two having signed several MoUs on strengthening communication and strategic trust.
- India–Bangladesh water issue: Sharing the waters of the Teesta river, which originates in the Himalayas and flows through Sikkim and West Bengal to merge with the Brahmaputra in Assam and (Jamuna in Bangladesh), is perhaps the most contentious issue between two friendly neighbours, India and Bangladesh.
- India–Nepal water issues: Since 1954, when the Kosi Agreement was signed between India and Nepal, talks between the two governments have stalled and water rights issues have not been addressed. The dispute between India

and Nepal might seem minor but it gains strategic importance, because the disputed area lies near the Sino-Indian border. Also delimitation of the boundary along the Maha Kali River is matter of dispute.

- India–Pakistan Water Dispute: Accord called the Indus Waters Treaty in 1960 was carried forward. The Indian Government has more than 40 projects that are either already completed or in the proposal stage on the western rivers. The carrying of such activities within the western rivers has irked Pakistan. The latest dispute is over hydroelectric projects that India is building along the Chenab River.
- India–Bhutan water dispute: Initially, the cooperation was based on the development of small-scale hydro projects such as Tala, Chukha and Kurichu. On the other hand, the people of Bhutan raised objections to such projects on their long run effects in the country. For instance, if Bhutan ever decides to construct storage projects, issues will get intense and more problematic when it comes to dealing with India.

Conclusion

Freshwater is a precious commodity and a strategic asset whose importance in geopolitics cannot be underestimated. Under such circumstances, the increasing need for power and stable water levels could prompt reconsideration in bilateral water-sharing treaties in future.



5. The South China Sea conflict is essentially a manifestation of energy skirmishes. Comment.

Approach- Candidate can explain the geography of the South china sea. With the help of some data and analysis importance of the region for the energy security of the south east Asia can be shown while drawing attention to insecurities of China.

Introduction

South China Sea is an arm of western Pacific Ocean in Southeast Asia. It is south of China, east & south of Vietnam, west of the Philippines and north of the island of Borneo. It is connected by Taiwan Strait with the East China Sea and by Luzon Strait with the Philippine Sea. It contains numerous shoals, reefs, atolls and islands. The Paracel Islands, the Spratly Islands and the Scarborough Shoal are the most important.

Body

South china sea and energy security

- The dispute over the South China Sea is a reflection of increased nationalist sentiment throughout the region, but by virtue of the resources in the disputed area, it also has an important role to play with regards to regional energy security.
- The U.S. Energy Information Administration estimates that there are "11 billion barrels (bbl) of oil reserves and 190 trillion cubic feet (Tcf) of natural gas reserves in the South China Sea.
- On top of these known and accessible deposits, the U.S. Geological Survey (USGS) estimates that there may be between "5 and 22 billion barrels and between 70 and 290 trillion cubic feet of gas in as-yet undiscovered resources.
- These hydrocarbon reserves are not distributed equally across the South China Sea, and there is some uncertainty about how they are distributed. Paracel island territory does not have significant discovered conventional oil and gas fields and thus has no proved or probable reserves.
- Spratly islandmay contain significant deposits of undiscovered hydrocarbons…anywhere between 0.8 and 5.4 (mean 2.5) billion barrels of oil and between 7.6 and 55.1 (mean 25.5) Tcf of natural gas in undiscovered resources."
- The second way in which the South China Sea is important to regional energy security is as a point of transit. In 2013, China and Japan imported 4.5 and 3.2 million barrels of crude oil per day (MMbbl/d); more than half of the roughly 14 million barrels of crude oil from the Middle East that passed through the South China Sea daily, with much of the remainder going to South Korea.

- Of the 6 trillion cubic feet of liquefied natural gas (LNG) that passed through the South China Sea in 2011, roughly 56% went to Japan, 24% went to South Korea, and 19% went to China.
- Speaking more generally, roughly 33% of the world's seaborne oil travels through the Strait of Malacca, making it a chokepoint for energy imports, trade, and other shipping headed towards East Asia.
- The Asia-Pacific region between 2005 and 2030, energy demand is expected to grow at a rate of 2.4% (as compared to a world average of 1.5%), net imports of fossil fuels are expected to double, and "the region's oil dependency will increase from 57.5% to 66.4%."
- This means that countries in East/Southeast Asia will only become more dependent on the sea lines of communication (SLOC) that are responsible for bringing in their energy imports. Japan, for example, already buys "nearly 90% of its oil from the Middle East, making it vulnerable to disruptions of even a few days in the Strait of Hormuz.
- Massive energy consumption has allowed for China's sustained economic growth, which in turn has ensured some measure of social stability. Although the Chinese economy has in many ways liberalized, energy is still very much controlled by the central government.
- The true importance of the South China Sea with regards to China's energy security comes down to its role as a sea line of communication. China is disproportionately dependent on the South China Sea; it is "the only major power with a vital strategic interest in Freedom of Navigation in the South China Sea."

Energy skirmishes

- China's local rivals are undertaking major military modernization projects, they too could potentially pose a threat to China's sea lines of communication. The Spratlys and Paracels sit astride the most direct route between the Strait of Malacca and the port cities on China's eastern coast.
- If the Philippines, Vietnam, or the United States were to take commanding positions atop this sea line, it would be a Sword of Damocles hanging over China's maritime trade routes.
- China has sought to reduce its dependency on sea-borne imports via pipeline projects across Eurasia as part of its "One Belt, One Road" initiative, but these projects have met with significant delays.
- This is not to say that any of these countries has an interest in doing so, but from the perspective of Chinese strategic planners, the potential risks are very high. Hence the control of south china sea.

Conclusion

South china sea plays major role in ensuring steady flow of oil to the region. Overdependence on the sea routes is causing insecurity dilemma in the minds of strategic thinkers of China. The rise of china has not been peaceful, and the

posturing in the SCS is the result of the same and is arising nothing out of but the energy insecurity.