

# 12 Water Resources

## Fastrack Revision

### ► Water Resource In India

- India makes up around 2.45% of the world's geographical area, 4% of the world's water resources and about 16% of the world's people.
- India gets water from 4000 cubic kilometres of yearly precipitation and 1869 cubic kilometres of surface and groundwater sources. However, only 60% (1122 cubic kilometres) of the water from these two sources is good and drinkable.

### ► Surface Water Resource

- The four main sources of surface water resources in India are rivers, lakes, ponds and tanks.
- There were about 10,360 rivers and tributaries here, with each tributary being more than 1.6 km long.
- The total yearly flow in India's river basins is estimated to be 1,869 cubic kilometres. Due to geographical, hydrological and other limits, only roughly 690 cubic kilometres (32%) of this water can be used.
- The flow of water in a river is controlled by the size of the catchment region/river basin and rainfall in that area. In India, river water availability is higher during the monsoon than during other seasons.
- The Ganga, Brahmaputra and Indus rivers in India have enormous catchment areas. The catchment areas of the Ganga, Brahmaputra and Barak rivers fall under the high rainfall receiving area, accounting for 60% of total water resources and only 33% of India's surface area, however the majority of the water is not used.
- On the other side, in the Peninsular rivers such as the Godavari, Krishna, Kaveri and others have a lower annual water flow, but much of their water resources have been depleted.

### ► Groundwater Resource

- In India, there are around 432 cubic kilometres of total replenishable groundwater resources. The Ganga and Brahmaputra basins contain over 46% of all replenishable groundwater supplies.
- Groundwater use is relatively high in the river basins of India's north-western and southern regions.
- Punjab, Haryana, Rajasthan and Tamil Nadu are among the states that use a lot of groundwater.
- Gujarat, Uttar Pradesh, Bihar, Tripura and Maharashtra are among the states with a moderate use of groundwater.
- Chhattisgarh, Odisha, Kerala and other states have low groundwater utilisation.
- It is assumed that if water use continues at its current rate, development will be limited and social upheaval will occur.

## Knowledge BOOSTER

- Some Indian states have indented coastlines, resulting in the formation of lagoons and lakes. Kerala, Odisha and West Bengal are examples of such states.
- These water resources are used for fishing and irrigating particular forms of rice crops, coconut and other crops due to brackish water bodies.



### ► Water Demand and Utilisation

- Agriculture alone uses 89% of surface water and 92% of groundwater in India, making it an essential part of the economy.
- The Bhakra-Nangal, Hirakud, Damodar Valley, Nagarjuna Sagar, Indira Gandhi Canal project and other river valley projects, as well as Five-Year Plans, were initiated to give water to the agricultural sector and enhance agricultural production.
- Aside from that, 90% and 3% of surface and groundwater are used for home uses, respectively, while 2% and 5% are used in the industrial sector.

### ► Demand of Water for Irrigation

- Because of the regional and temporal variations in rainfall, India has a significant demand for irrigation.
- In most parts of India, the winter and summer seasons are more or less dry. As a result, agriculture cannot be practised in these areas without irrigation.
- Water-intensive crops, such as rice, sugarcane, jute and others, require more water to flourish.
- Irrigation aids in the growth of different crops, increases agricultural output and when combined with HYV seeds, increases yield at a faster rate. Punjab, Haryana and Western Uttar Pradesh, for example, have more than 85% of their net sown area irrigated.
- Punjab has 76.1% of its net irrigated land under wells and tube wells, whereas Haryana has 51.3%. These states consume a huge portion of their groundwater resources, which is the primary cause of resource depletion.
- Aside from this, due to over-extraction of this resource in Rajasthan and Bihar, the concentration of fluoride in groundwater is also rising. The concentration of arsenic has increased in West Bengal and Bihar as a result of the same reason.

### ► Emerging Water Problems

- Rapid population expansion, as well as pollution from diverse sources such as industries, agriculture and residential sources, are the main causes of decreased potable water supplies.
- In India, the per capita availability of water is likewise dwindling.



### ► Deterioration of Water Quality

- Water quality refers to the absence of undesired foreign substances that pollute water, such as microorganisms, chemicals, industrial waste and other contaminants.
- By dissolving or remaining suspended in lakes, streams, rivers and seas, these harmful chemicals contribute to water pollution.
- Such pollutants can leak into the groundwater and poison it. The Ganga and Yamuna rivers in India are the most polluted.

### ► Water Conservation and Management

- After reducing the amount of freshwater and increasing demand due to population growth, water conservation and management become vital.
- The government should encourage people to use watershed development, rainwater harvesting, recycling and reuse of water and conjunctive use of water for long-term availability of quality water for sustainable development and quality of life.

### ► Prevention of Water Pollution

- Water resources are becoming scarcer at an increasing rate. It has been observed that hilly places have a lower population density and as a result, have better water quality in their rivers.
- Plains drain agricultural wastes (chemical fertilizers and insecticides), solid and residential wastes and industrial wastes, contaminating water sources considerably.
- The concentration of contaminants in rivers remains high during the summer due to a lack of water, which prevents these toxins from flowing.
- The Central Pollution Control Board (CPCB) has been monitoring the water quality of national aquatic resources at 507 stations with the help of State Pollution Control Boards.
- According to the data collected from these sites, India's major rivers are the most polluted by organic and microbiological pollution.
- Between Delhi and Etawah, the Yamuna River is the most polluted river in the country. The Sabarmati in Ahmedabad, the Gomti in Lucknow, the Kali, the Adyar, the Cooum (at entire sections), the Vaigai in Madurai, the Musi in Hyderabad and the Ganga in Kanpur and Varanasi are all extremely polluted rivers.
- Ground water is also polluted in certain sections of the country due to excessive concentrations of heavy toxic metals and fluoride nitrates.

### ► Legislative Prohibition and Laws to Prevent River Pollution

- The government has taken a number of steps to reduce river and water pollution, but these have proven to be ineffective due to a number of obstacles. For example, the Water Act (Prevention and Control of Pollution) of 1974 and the Environment Protection Act of 1986 were ineffective, as 251 polluting factories were established along rivers and lakes in 1997.
- The 1977 Water Cess Act, which was intended to reduce pollution, was equally ineffective. As a result, there is a pressing need to raise public awareness about the importance of water in daily life. As a result, pollution from agricultural operations and industrial discharge will be reduced.

### ► Recycle and Reuse of Water

- Recycling and reusing is the simplest and most effective approach to conserve fresh water and ensure that it is available to everybody.

- Water of low quality and wastewater can be used by industries for cooling and firefighting, lowering their water costs and conserving fresh water.
- Water collected after bathing, washing utensils, washing clothes and washing cars could be used for gardening.
- Water reuse and recycling is now confined to a small number of people, but there is huge potential for water replenishment through recycling.

### ► Watershed Management

Watershed management is the process of effectively managing and conserving surface water.

The following activities are included in watershed management:

- Preservation of groundwater resources.
- Surface runoff prevention.
- Storage and recharge of groundwater by different methods such as percolation tanks, recharge wells, etc.
- The conservation, regeneration and judicious use of all natural resources (land, water, plants and animals) and human resources.
- Build harmony in the natural world as well as in society.
- The effectiveness of a Watershed Development Programme is dependent on community engagement.

In India, both the Central and State Governments have launched many watershed development and management programmes at the national and state levels, including:

- The Central Government sponsors **Haryali**, which is carried out by Gram Panchayats in various communities with public participation. People were able to conserve water for a variety of purposes, including drinking, irrigation, fishing and afforestation, thanks to this method.
- State-led watershed development initiatives include Andhra Pradesh's **Neeru-Meeru (Water and You) Programme** and Rajasthan's **Arvary Pani Sansad**.
- With the cooperation of the people, countless percolation tanks, dugout ponds (Johad), check dams and other water collecting structures were built under these two programmes. Tamil Nadu is the only state that has made the installation of water harvesting systems in homes mandatory.
- It is forbidden to construct a building without a water harvesting structure. Despite the existence of such programmes, the majority of Indians are unaware of the benefits of watershed development and management. As a result, more people must be encouraged to engage in this initiative.

### ► Rainwater Harvesting

Rainwater harvesting is a low-cost, environmentally beneficial method of storing rainwater in bore wells, pits and recharging groundwater aquifers for various purposes. The following are some of the advantages of rainwater harvesting:

- It improves the availability of water.
  - Check the level of depleting groundwater.
  - It enhances groundwater quality by diluting pollutants like fluoride and nitrates.
  - It keeps the land from eroding and flooding.
  - If utilised to recharge aquifers, it can be used to prevent salt water intrusion in coastal locations.
- In India, there are a variety of ways to collect rainwater. Traditional rainwater harvesting techniques collect water in any surface water body in rural settings, such as lakes, ponds, irrigation tanks and so on. Another method is to use a Kund or Tanka, which is an underground storage tank that is covered.

### ▶ India's National Water Policy, 2002

- ▶ Drinking water, agriculture, hydropower, navigation, industrial and other uses are all prioritised in the National Water Policy, which was adopted in 2002. The policy calls for innovative new water management practices. The following are some of the highlights:
  - Where there is no other source of drinking water, irrigation and multi-purpose projects should always contain a drinking water component.
  - The main priority should be to provide drinking water to all humans and animals.

- Measures should be taken to limit and regulate groundwater exploitation.
- The quality of both surface and groundwater should be examined on a regular basis. To improve water quality, a staged approach should be implemented.
- The efficiency of water use in all of its various applications should be enhanced.
- It is important to promote awareness of water as a limited resource.
- Education, legislation, incentives and disincentives should be used to promote conservation awareness.



## Practice Exercise



### Multiple Choice Questions ↘

- Q 1. Which of the following states is the most likely to use groundwater?  
a. Punjab  
b. Chhattisgarh  
c. Bihar  
d. Kerala
- Q 2. In Punjab, what percentage of the net sown land is irrigated?  
a. 65%  
b. 75%  
c. 80%  
d. 82.20%
- Q 3. Which section of the river has good water quality?  
a. Mountain  
b. Plain  
c. Delta  
d. Valley
- Q 4. Which of the following types of resources best characterises water?  
a. Abiotic resource  
b. Non-renewable resource  
c. Biotic resource  
d. Cyclic resource
- Q 5. Which of the following rivers has the country's largest replenishable groundwater resource?  
a. The Indus  
b. The Brahmaputra  
c. The Ganga  
d. The Godavari
- Q 6. Which of the following sectors consumes the greatest amount of total water in the country?  
a. Irrigation  
b. Industries  
c. Domestic use  
d. None of these
- Q 7. Which of the following has nothing to do with the watershed development project?  
a. Haryali  
b. Neeru-Meeru  
c. Arwari Pani Sansad  
d. Van Mahotsava
- Q 8. Which of the following South Indian states uses the most groundwater (in percentage) of its overall groundwater potential?  
a. Tamil Nadu  
b. Karnataka  
c. Andhra Pradesh  
d. Kerala
- Q 9. Which of the following sectors has used the highest percentage of total water in India?  
(CBSE SQP 2021 Term-1)  
a. Domestic  
b. Commerce  
c. Agriculture  
d. Industry
- Q 10. Which of the following programmes sponsored by Central Government aims at enabling the rural population to conserve water for drinking, irrigation, fisheries and afforestation?  
(CBSE SQP 2021 Term-1)  
a. Arwari Pani Sansad  
b. Haryali  
c. Neeru-Meeru  
d. Narmada Bachao
- Q 11. Which of the following states has the highest percentage of irrigated area through wells and tubewells?  
(CBSE 2021 Term-1)  
a. Punjab  
b. Haryana  
c. Uttar Pradesh  
d. Madhya Pradesh
- Q 12. 'Haryali Watershed Development Project' is run by which of the following?  
(CBSE 2021 Term-1)  
a. Non-Governmental Organisation  
b. Local Self-Government  
c. State Government  
d. Central Government
- Q 13. In which one of the following states, Kund or Tanka is mainly used for rainwater harvesting?  
(CBSE 2021 Term-1)  
a. Rajasthan  
b. Maharashtra  
c. Andhra Pradesh  
d. Gujarat
- Q 14. Which of the following is not the benefit of rainwater harvesting?  
(CBSE SQP 2023-24)  
a. It increases water availability.  
b. It checks the declining groundwater table.  
c. It improves the quality of groundwater through dilution of contaminants like fluoride and nitrates.  
d. Helpful in production of hydroelectricity.
- Q 15. If you are asked to formulate the National Water Policy, what will be the utmost important priority for you.  
(CBSE SQP 2023-24)  
a. To provide water for generation of hydroelectricity.  
b. Availability of water for industries.  
c. To provide drinking water.  
d. Availability of water for navigation.
- Q 16. Given below are the steps to generate geothermal energy. Arrange the following in correct sequence.  
(CBSE SQP 2023-24)  
(i) It is so hot that when it rises to the earth's surface, it turns into steam.

- (ii) Groundwater in such areas (where the geothermal gradient is high) absorbs heat from the rocks and becomes hot.
  - (iii) This steam is used to drive turbines and generate electricity.
  - (iv) Geothermal energy exists because the earth grows progressively.
- a. (iv) (ii) (i) (iii)      b. (ii) (i) (iv) (iii)  
 c. (i) (iv) (iii) (ii)      d. (iii) (ii) (iv) (i)

Q 17. Which of the following statement is not true regarding Indira Gandhi Canal? (CBSE 2023)

- a. It was previously known as Rajasthan canal.
- b. It originates at Harika barrage in Punjab.
- c. The canal runs almost parallel to Pakistan border.
- d. Rajasthan is least benefited by this canal.

Q 18. Match the following:

Column I	Column II
A. Groundwater	1. Water conservation
B. Economic use of water	2. Drip Irrigation
C. Cause of water scarcity	3. Exhaustible renewable resource
D. Method of watering plants	4. Growth in population

Codes:

- |      |   |   |   |      |   |   |   |
|------|---|---|---|------|---|---|---|
| A    | B | C | D | A    | B | C | D |
| a. 1 | 2 | 3 | 4 | b. 4 | 3 | 2 | 1 |
| c. 3 | 1 | 4 | 2 | d. 2 | 4 | 1 | 3 |

Q 19. Consider the following statements and choose the correct answer with the help of given options:

Statement I: Water is a renewable resource.

Statement II: Freshwater is mainly obtained from surface run off and groundwater that is continually being renewed.

- a. Both the statements are true. statement II does not explain statement I correctly.
- b. Both the statements are true and statement II correctly explains the statement I.
- c. Both statements I and II are false.
- d. Statement I is true and statement II is false.



### Assertion & Reason Type Questions

Directions (Q. Nos. 20-24): In the questions given below, there are two statements marked as Assertion (A) and Reason (R). Read the statements and choose the correct option:

- a. Both (A) and (R) are true and (R) is the correct explanation of (A).
- b. Both (A) and (R) are true. but (R) is not the correct explanation of (A).
- c. (A) is true. but (R) is false.
- d. (A) is false. but (R) is true.

Q 20. Assertion (A): It is difficult to practice agriculture without assured irrigation during dry seasons.

Reason (R): Irrigation is needed because of spatio-temporal variability in rainfall in the country.

Q 21. Assertion (A): Water gets polluted by foreign matters, such as microorganisms, chemicals, industrial and other wastes.

Reason (R): When toxic substances enter lakes, streams, rivers, ocean and other water bodies, they don't get dissolved in water.

Q 22. Assertion (A): The need has arisen to conserve and effectively manage this precious life giving resource for sustainable development.

Reason (R): There is a declining availability of freshwater and increasing demand.

Q 23. Assertion (A): Available water resources are degrading rapidly.

Reason (R): The Yamuna river is the most polluted river in the country between Delhi and Etawah.

Q 24. Assertion (A): Intensive irrigation has led to tremendous rise in agricultural and livestock productivity in the Indira Gandhi Canal Command area.

Reason (R): Intensive Irrigation has led to excessive water logging and soil salinity.

### Answers

1. (a)    2. (d)    3. (a)    4. (d)    5. (c)  
 6. (a)    7. (d)    8. (a)    9. (c)    10. (b)  
 11. (c)    12. (d)    13. (a)    14. (d)    15. (c)  
 16. (a)    17. (d)    18. (c)    19. (b)    20. (b)  
 21. (c)    22. (a)    23. (b)    24. (b)



### Passage Based Questions

#### Passage 1

Read the passage given below and answer the questions that follow by choosing the most appropriate option:

The total replenishable groundwater resources in the country are about 432 cubic km. The level of groundwater utilisation is relatively high in the river basins lying in north-western region and parts of south India. The groundwater utilisation is very high in the states of Punjab, Haryana, Rajasthan and Tamil Nadu. However, there are states like Chhattisgarh, Odisha, Kerala, etc., which utilise only a small proportion of their groundwater potentials. States like Gujarat, Uttar Pradesh, Bihar, Tripura and Maharashtra are utilising their groundwater resources at a moderate rate. If the present trend continues, the demands for water would need the supplies. And such a situation, will be detrimental to development and can cause social upheaval and disruptions.

- Q 1. The total replenishable groundwater resources in the country are about ..... cubic km.  
 a. 433                                      b. 431  
 c. 432                                      d. 430
- Q 2. The level of groundwater utilisation is relatively high in the ..... lying in north-western region and parts of south India.  
 a. river basins                              b. valleys  
 c. mountains                                d. All of these
- Q 3. The groundwater utilisation is very high in the states of:  
 a. Tamil Nadu                                b. Punjab  
 c. Rajasthan and Haryana                d. All of these
- Q 4. Consider the following questions:  
**Statement I: There are states like Haryana, Rajasthan and Tamil Nadu which utilise only a small proportion of their groundwater potentials.**  
**Statement II: States like Gujarat, Uttar Pradesh, Bihar, Tripura and Maharashtra are utilising their groundwater resources at a moderate rate.**  
**Choose the correct answer among the given option:**  
 a. Both I and II are correct  
 b. Both I and II are incorrect  
 c. Only I is correct  
 d. Only II is correct

### Answers

1. (c)    2. (a)    3. (d)    4. (d)

## Passage 2

Read the passage given below and answer the questions that follow by choosing the most appropriate option:

Jhabua district is located in the westernmost agro-climatic zone in Madhya Pradesh. It is in fact, one of the five most backward districts of the country. It is characterised by high concentration of tribal population (mostly Bhils). The people suffer due to poverty which has been accentuated by the high rate of resource degradation, both forest and land. The watershed management programmes funded by both the Ministries of "Rural Development" and "Agriculture", Government of India, have been successfully implemented in Jhabua district which has gone a long way to preventing land degradation and improving soil quality. Watershed Management Programmes acknowledge the linkage between land, water and vegetation and attempts to improve livelihoods of people through natural resources management and community participation. In the past five years the programmes funded by the Ministry of Rural Development alone (implemented by Rajiv Gandhi Mission for Watershed Management) has treated 20 per cent of the total area under Jhabua district.

The Petlawad Development block of Jhabua is located in the northernmost part of the district and represents an interesting and successful case of Government-NGO partnership and community participation in managing watershed programmes. The Bhils in Patlawad Development block, for example, (Sat, Rundi hamlet of Karravat village) through their own efforts, have revitalised large parts of common property resources. Each household planted and maintained one tree on the common property. They also have planted fodder grass on the pasture land and adopted social-fencing of these lands for at least two years. Even after that, they say, their would be no open grazing on these lands, but stall freeing of cattle, and they are thus confident that the pastures they have developed would sustain their cattle in future. An interesting aspect of this experience is that before the community embarked upon the process of management of the pasture, there was encroachment on this land by a villager from an adjoining village. The villagers called the tehsildar to ascertain the rights of the common land. The ensuing conflict was tackled by the villagers by offering to make the defaulter encroaching on the CPR a member of their user group and sharing the benefits of greening the common land/pastures. (CBSE 2023)

- Q 1. Why did the people of Jhabua tribal community suffer from poverty? Choose the option which is not correct.  
 a. High rate of forests degradation  
 b. Land degradation  
 c. Illiteracy  
 d. Implementation of watershed management
- Q 2. How did people manage to develop pasture lands? Choose the correct option.  
 a. Use of barbed wire to protect pastures.  
 b. Pasture lands were not under any encroachment.  
 c. Pastures were common property resources, hence they developed it.  
 d. Government officials did not interfere in any work of the villagers.
- Q 3. How did the Bhils, through their own efforts revitalise the common property resources? Choose the correct option.  
 a. Common land was brought under cultivation.  
 b. They controlled open grazing on the common property resources.  
 c. No tree plantation was taken up.  
 d. They developed water resources.

### Answers

1. (d)    2. (c)    3. (b)

### Passage 3

Read the passage given below and answer the questions that follow:

In agriculture, water is mainly used for irrigation. Irrigation is needed because of spatio-temporal variability in rainfall in the country. The large tracts of the country are deficient in rainfall and are drought prone. North-western India and Deccan plateau constitute such areas. Winter and summer seasons are more or less dry in most parts of the country. Hence, it is difficult to practice agriculture without assured irrigation during dry seasons. Even in the areas of ample rainfall like West Bengal and Bihar, breaks in monsoon or its failure creates dry spells detrimental for agriculture. Water needs of certain crops also makes irrigation necessary. For instance, the water requirement of rice, sugarcane, jute, etc., is very high which can be met only through irrigation.

Provision of irrigation makes multiple cropping possible. It has also been found that irrigated lands have higher agricultural productivity than unirrigated land. Further, the high yielding varieties of crops need regular moisture supply, which is made possible only by developed irrigation systems. In fact, this is why that green revolution strategy of agriculture development in the country has largely been successful in Punjab, Haryana and Western Uttar Pradesh.

#### Q 1. Why is irrigation needed?

Ans. Irrigation is needed because of spatio-temporal variability in rainfall in the country.

#### Q 2. Which crops require an ample amount of water?

Ans. Crops like rice, sugarcane, jute, etc., require an ample amount of water.

#### Q 3. How has irrigation helped in the development of agriculture in our country?

Ans. Provision of irrigation makes multiple cropping possible. It has also been found that irrigated lands have higher agricultural productivity than unirrigated land. Further, the high yielding varieties of crops need regular moisture supply, which is made possible only by developed irrigation systems.



### Very Short Answer Type Questions

#### Q 1. Give three reasons why there is a scarcity of water and its availability is decreasing.

Ans. The main reasons of scarcity of water and reasons due to which its availability is decreasing are:

- (i) Increasing demand
- (ii) Over-utilisation
- (iii) Pollution

#### Q 2. Mention any two human-caused water pollution sources in India.

Ans. The two human-caused water pollution sources in India are:

- (i) Urban sources, such as sewage, municipal waste and household rubbish.
- (ii) The discharge of industrial waste into bodies of water.

#### Q 3. Define the concept of watershed management.

Ans. The proper management, use and conservation of surface and groundwater resources is referred to as watershed management. In the watershed, surface runoff is prevented and groundwater is stored and recharged using various technologies such as percolation tanks, recharge wells and so on.

#### Q 4. In India, what is the primary source of water-borne diseases?

Ans. Water contamination is one of the primary causes of water-borne diseases, including:

- (i) Diarrhoea
- (ii) Intestinal worms
- (iii) Hepatitis

#### Q 5. Which Indian river basin has the highest proportion of replenishable groundwater resource use?

Ans. The Ganga river basin has the highest proportion of replenishable groundwater resource utilisation.

#### Q 6. In India, which sector (economic activity) consumes the most surface and groundwater?

Ans. In India, agriculture consumes the majority of surface and groundwater.

#### Q 7. Name some cultural activities in India that are responsible for water contamination.

Ans. The following are examples of cultural activities:

- (i) Pilgrimage
- (ii) Religious fairs
- (iii) Tourism

#### Q 8. What is the primary cause of the deterioration of India's water quality?

Ans. The following are the primary causes of water quality decline in India:

- (i) Increased population causes domestic waste disposal and indiscriminate water consumption.
- (ii) Water quality has deteriorated as a result of industrial waste.

#### Q 9. What are the two contaminated Ganga zones in Uttar Pradesh and Bihar?

Ans. The Ganga river is contaminated from Kanpur to Varanasi in Uttar Pradesh and from Varanasi to Patna in Bihar.



### Short Answer Type Questions

#### Q 1. "There is high demand of water for irrigation in agricultural sector in India." Justify the statement.

OR

(CBSE 2023)

Explain the role of irrigation in India's agriculture.

Ans. India requires irrigation for the following reasons:

- (i) **To Reduce India's Reliance on Monsoon Rainfall:** Despite decades of independence, India's agriculture production remains reliant on monsoon rainfall. Only 33% of agricultural land is irrigated, with the rest relying on rainfall for moisture. Rainfall irrigation is required to reduce reliance on the monsoon.
- (ii) **To Increase Production:** Agricultural production and yield in rainfed areas are both low. Irrigation is required in India to boost agricultural production.
- (iii) **Maintaining Population and Food Production Balance:** Foodgrain production in India is extremely low and its growth rate is much lower when compared to population growth. An increase in foodgrain production is required to feed the world's growing population. As a result, irrigation is required.

Q 2. Describe India's groundwater resources.

Ans. India's groundwater resources are:

- (i) The country's total replenishable groundwater resources are around 432 cubic kilometres.
- (ii) About 46% of the total replenishable groundwater resources are found in the Ganga and Brahmaputra basins.
- (iii) The use of groundwater in the river basins of north western India and parts of southern India is relatively considerable.

Q 3. What are the advantages of irrigation?

Ans. The advantages of irrigation are:

- (i) Provision of irrigation makes multiple cropping possible.
- (ii) Irrigated fields are also reported to have higher agricultural production than unirrigated ones.
- (iii) Crops with high yields require consistent moisture delivery, which can only be provided by well-developed irrigation systems.
- (iv) This is why Punjab, Haryana and Western Uttar Pradesh have mostly benefitted from the country's green revolution agriculture development policy.

Q 4. How do human activities such as industrial and agricultural operations damage the water? Explain.

Ans. Industries produce a variety of unwelcome items that pollute waterways. Leather, pulp and paper, textiles and chemicals are all major water polluters. In running water, industrial pollutants, polluted wastewater, dangerous gases, chemicals and metal particles are disposed off. Poisonous materials enter rivers and water bodies, polluting the bio system of these bodies of water. India has long been an agrarian economy, with agriculture employing roughly two-third of the population. Irrigation is required due to the country's spatio-temporal variability in rainfall

and the pollution of water. Some contaminants leak into the groundwater and pollute it.

Q 5. The states of Punjab and Haryana have significant water supplies, however the groundwater table has dropped. What is the reason for this?

Ans. More than 85% of the net area sown in Punjab, Haryana and Western Uttar Pradesh is irrigated. In these states, irrigation is mostly used to cultivate wheat and rice. Wells and tubewells irrigate 76.1% of the total net irrigated land in Punjab and 51.3% in Haryana. This indicates that these states are using a considerable percentage of their groundwater potential, resulting in groundwater depletion.

Q 6. "In India, the indiscriminate use of water by an expanding population and industrial expansion has resulted in significant degradation of water quality." Explain the values that can aid in the preservation of water quality.

Ans. Water quality refers to the cleanliness of water. Water quality suffers from widespread contamination practically throughout the country. It is claimed that three-quarters of India's surface water is polluted. The procedures below are required for water resource conservation:

- (i) Water-saving technology and practices are being developed.
- (ii) Preventing water contamination.
- (iii) Watershed development, rainwater collecting, water recycling and reuse, and conjunctive water use are all encouraged for long-term water supply sustainability.



### Long Answer Type Questions

Q 1. "A declining availability of freshwater and increasing demand are the compelling reasons for conservation and effective management of water in India." Justify the statement. (CBSE 2023)

OR

Explain any three factors responsible for the depletion of water resources. Examine any two legislative measures in India that are aimed at reducing water pollution.

Ans. The following are the three elements that are causing India's water resources to be depleted:

- (i) **Increasing Population:** India's population is growing at a faster rate than the rest of the world. This expansion is causing a decrease in the amount of fresh water available and the amount of water available per population.
- (ii) **Industrialisation:** After independence, industrialisation exploded in leaps and bounds. Because industrial wastes are thrown in water sources, it has produced a serious problem of water pollution in India.



(iii) **Groundwater Overuse:** India is a predominantly agrarian country. As a result, irrigation in agriculture necessitates a large volume of water. Groundwater is used to maximise agriculture productivity in irrigated areas. The overuse of groundwater in certain places has resulted in a decrease in groundwater levels. The government has taken certain initiatives to prevent river and water pollution, although some have proven ineffective and others have failed to be implemented. The following are two legislative provisions:

(a) Water (Prevention and Control of Pollution) Act of 1974.

(b) Environment Protection Act (1986).

These efforts were ineffective, as 251 polluting factories were built beside rivers and lakes in 1997. The 1977 Water Cess Act proved ineffectual as well. The main reason was that they were unable to raise public awareness about the importance of water conservation. Generation of awareness in public about the importance of water in life and impacts of water pollution is necessary.

**Q 2. Describe India's National Water Policy's key aspects.**

**Ans.** India's National Water Policy, 2002:

Drinking water, agriculture, hydropower, navigation, industrial and other uses are all prioritised in the National Water Policy, which was adopted in 2002. The policy calls for innovative new water management practices. The following are some of the highlights:

- (i) Where there is no other source of drinking water, irrigation and multi-purpose projects should always contain a drinking water component.
- (ii) The main priority should be to provide drinking water to all humans and animals.
- (iii) Measures should be taken to limit and regulate groundwater exploitation.
- (iv) The quality of both surface and groundwater should be examined on a regular basis. To improve water quality, a staged approach should be implemented.
- (v) The efficiency of water use in all of its various applications should be enhanced.
- (vi) It is important to promote awareness of water as a limited resource.
- (vii) Education, legislation, incentives and disincentives should be used to promote conservation awareness.

**Q 3. "Rainwater harvesting has been practiced through various methods by different communities in the country." Justify the statement. (CBSE 2023)**

OR

**Describe the methods and effects of rainwater harvesting.**

**Ans.** Rainwater harvesting is a technique for collecting rainwater. Rainwater harvesting is a technique for catching and storing rainwater for use in a variety of

applications. It is also used to rehydrate underground aquifers.

- (i) It is a low-cost and environmentally friendly method of preserving every drop of water by directing rainwater to bore wells, pits and wells.
- (ii) Rainwater gathering expands the amount of water available.
- (iii) It prevents the groundwater table from eroding.
- (iv) Dilution of impurities such as fluoride and nitrates enhances the quality of groundwater.
- (v) When used to replenish aquifers, it avoids soil erosion, flooding and saltwater intrusion in coastal locations.

**Methods:** Rainwater collection has long been practised by many communities throughout the country using various ways. In rural areas, rainwater collection is traditionally done by using surface storage bodies such as lakes, ponds and irrigation tanks. Rainwater harvesting structures, commonly known as Kund or Tanka (a covered subterranean tank), are built near or in the house or hamlet in Rajasthan to store captured rainwater and to learn about different rainwater gathering methods.

**Effects:** Rainwater harvesting has a lot of potential for conserving vital water resources. Rainwater can be collected on rooftops and in open spaces. Rainwater harvesting also reduces the community's reliance on groundwater for household purposes. It can save energy to pump groundwater since recharge leads to a rise in the groundwater table. In addition to bridging the demand-supply gap, Rainwater harvesting is now being implemented on a large scale in various states across the country. Rainwater collection can be especially beneficial in urban settings, where water demand has already outstripped availability in most cities and towns.

**Q 4. "The Central and State Governments have initiated many watershed development and management programmes in the country." Justify the statement.**

(CBSE 2023)

**Ans.** The statement that the Central and State Governments have initiated many watershed development and management programmes in India can be justified by considering the following points:

- (i) **National Watershed Development Project for Rainfed Areas (NWDPA):** The Government of India has implemented the NWDPA, which is one of the largest watershed development programmes in the country. It aims to enhance the productivity of rainfed agriculture, increase the availability of water for various purposes, and mitigate soil erosion and land degradation.
- (ii) **Integrated Watershed Management Programme (IWMP):** The IWMP is a flagship programme of the Government of India, which promotes the sustainable development of rainfed areas. It focuses on soil and water conservation, afforestation, and livelihood improvement



activities. The programme is implemented in collaboration with state governments, and it has been instrumental in bringing about positive changes in watershed management practices.

- (iii) **Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA):** MGNREGA, a rural employment guarantee scheme, also plays a significant role in watershed development. Under this scheme, local communities are provided with wage employment opportunities for creating and maintaining water conservation structures like check dams, farm ponds, and percolation tanks. These structures contribute to better watershed management and water availability in rural areas.
- (iv) **State-level Initiatives:** In addition to the Central Government Programme, several State governments in India have also launched their own watershed development and management initiatives. These programmes are tailored to address the specific needs and challenges of each state, considering factors like topography, rainfall patterns, and agricultural practices.
- (v) **Collaborative Efforts:** The Central and State Governments often collaborate with various stakeholders, including Non-governmental Organisations (NGOs), research institutions, and local communities, to implement watershed development programmes effectively. These collaborations ensure the involvement of different expertise and resources, leading to comprehensive and sustainable watershed management practices.
- Overall, the initiation of multiple watershed development and management programmes by the Central and State Governments in India showcases their recognition of the importance of sustainable water resource management, agricultural productivity enhancement, and ecological restoration. These initiatives aim to mitigate the adverse effects of water scarcity, soil erosion, and land degradation, while promoting rural livelihoods and overall development in the country.

**Q 5. Formulate the guidelines to promote sustainability in the Indira Gandhi Canal command area.**

(CBSE SQP 2023-24)

**Ans.** To promote sustainability in the Indira Gandhi Canal command area, the following guidelines can be considered:

- (i) **Integrated Water Resources Management:** Implement an integrated approach to water resource management that takes into account the entire water cycle, including equitable allocation, efficient use, and conservation of water resources. This can be achieved through the development and enforcement of water use regulations, promotion of water-saving technologies and practices, and regular monitoring of water availability and quality.

- (ii) **Watershed Management:** Adopt watershed management practices to prevent soil erosion, conserve water, and recharge groundwater. Encourage the construction of check dams, farm ponds, and other water-harvesting structures to retain rainwater and enhance groundwater recharge. Promote afforestation and agroforestry practices to prevent land degradation and improve soil fertility.
- (iii) **Crop Diversification and Efficient Irrigation:** Promote crop diversification to reduce water-intensive crops and encourage the cultivation of drought-tolerant and climate resilient crops. Encourage farmers to adopt efficient irrigation techniques such as drip irrigation, sprinkler irrigation, and precision farming to minimise water wastage and improve water use efficiency.
- (iv) **Participatory Approach:** Involve local communities, farmers, and stakeholders in decision-making processes related to water management. Establish water user associations or committees to ensure community participation and ownership in managing water resources. Conduct awareness campaigns and capacity-building programmes to educate farmers about sustainable agricultural practices and efficient water use.
- (v) **Water Pricing and Economic Incentives:** Implement a fair and transparent water pricing mechanism that reflects the true value of water and encourages responsible water use. Provide economic incentives, subsidies, and support for farmers to adopt sustainable practices. Invest in water-saving technologies, and switch to less water-intensive crops. Promote market linkages and value addition to agricultural produce to enhance farmers' income and reduce dependence on water-intensive crops.
- (vi) **Research and Innovation:** Encourage research and development activities to identify and promote innovative solutions for sustainable water management in the canal command area. Support research institutions, universities, and organisations working on water-related issues to develop and disseminate best practices, technologies, and policies for sustainable water resource management.
- (vii) **Monitoring and Evaluation:** Establish a robust monitoring and evaluation system to assess the effectiveness of sustainability measures and identify areas for improvement. Regularly monitor water quality, groundwater level, soil health, and crop yields to gauge the impact of interventions. Use the collected data to inform evidence-based decision-making and adaptive management strategies.
- (viii) **Cross-sectoral Collaboration:** Foster collaboration and coordination among different sectors such as agriculture, water resources, environment, and rural development. Facilitate inter-departmental cooperation



to address the multidimensional aspects of sustainability in the canal command area. Promote public-private partnerships and encourage the involvement of civil society organisation and NGOs in implementing sustainable water management initiatives. By implementing these guidelines, the Indira

Gandhi Canal Command area can move towards a more sustainable and resilient water management system, ensuring the availability of water resources for future generations while supporting the livelihoods of local communities and fostering ecological balance.



## Chapter Test

### Multiple Choice Questions

- Q 1. Which of the following programmes sponsored by Central Government aims at enabling the rural population to conserve water for drinking, irrigation, fisheries and afforestation?
- a. Arwarl Panl Sansad      b. Haryali  
c. Neeru-Meeru          d. Narmada Bachao
- Q 2. In which one of the following states, Kund or Tanka is mainly used for rainwater harvesting?
- a. Rajasthan              b. Maharashtra  
c. Andhra Pradesh      d. Gujarat

### Assertion and Reason Type Question

- Q 3. In the question given below there, are two statements marked as Assertion (A) and Reason (R). Read the statements and choose the correct option:

**Assertion (A):** Intensive irrigation has led to tremendous rise in agricultural and livestock productivity in the Indira Gandhi Canal Command area.

**Reason (R):** Intensive irrigation has led to excessive water logging and soil salinity.

- a. Both (A) and (R) are true and (R) is the correct explanation of (A).  
b. Both (A) and (R) are true, but (R) is not the correct explanation of (A).  
c. (A) is true, but (R) is false.  
d. (A) is false, but (R) is true.

### Passage Based Question

- Q 4. Read the passage given below and answer the questions that follow:

In agriculture, water is mainly used for irrigation. Irrigation is needed because of spatio-temporal variability in rainfall in the country. The large tracts of the country are deficient in rainfall and are drought prone. North-western India and Deccan plateau constitute such areas. Winter and summer seasons are more or less dry in most parts of the country. Hence, it is difficult to practice agriculture without assured irrigation during dry seasons. Even in the areas of ample rainfall like West Bengal and Bihar, breaks in monsoon or its failure creates dry spells detrimental for agriculture. Water needs of certain crops also

makes irrigation necessary. For instance, the water requirement of rice, sugarcane, jute, etc., is very high which can be met only through irrigation.

Provision of irrigation makes multiple cropping possible. It has also been found that irrigated lands have higher agricultural productivity than unirrigated land. Further, the high yielding varieties of crops need regular moisture supply, which is made possible only by developed irrigation systems. In fact, this is why that green revolution strategy of agriculture development in the country has largely been successful in Punjab, Haryana and Western Uttar Pradesh.

- (i) Why is irrigation needed?  
(ii) Which crops require an ample amount of water?  
(iii) How has irrigation helped in the development of agriculture in our country?

### Very Short Answer Type Questions

- Q 5. Name some cultural activities in India that are responsible for water contamination.  
Q 6. What is the primary cause of the deterioration of India's water quality?

### Short Answer Type Questions

- Q 7. "In India, the indiscriminate use of water by an expanding population and industrial expansion has resulted in significant degradation of water quality." Explain the values that can aid in the preservation of water quality.  
Q 8. Describe any three essential aspects of India's National Water Policy, which was adopted in 2002.

### Long Answer Type Questions

- Q 9. Describe India's National Water Policy's key aspects.  
Q 10. Formulate the guidelines to promote sustainability in the Indira Gandhi Canal command area.